Wages determinants in the European Union

UPDATED RESULTS FROM STRUCTURE OF EARNINGS SURVEY (SES 2018) DATA

2021 edition

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Foreword

Since the turn of the millennium, the European Commission (Eurostat) has published detailed and harmonized information on the nominal wages paid by the employers to their employees. This information, collected with the support of the European Statistical System, provides important insights into the labour market situation of the different Member States of the European Union. For employers, wages represent an important part of the production costs and determine to some extent their cost competitiveness. For most employees, wages make-up the main part of their income thereby contributing to their economic welfare. The importance of ensuring fair and transparent wages was highlighted in the European pillar of social rights (Commission, 2017) that was fully endorsed by the von der Leyen Commission.

It is therefore important to monitor the levels and developments of wages and total labour costs at a macroeconomic level, as done by Eurostat through a complete set of annual and quarterly releases[1]. It is equally useful to analyse how the individual job profiles and characteristics of the employer determine wage patterns in the different EU countries. This provides information on how labour markets reward the different characteristics of the job holder and how the different types of businesses compete in terms of wages offered to their employees. By crossing job characteristics with sex, such analyses also shed light on possible gaps between the financial returns on education, part-time work etc. offered to men versus women.

The study presented in this document uses the detailed information collected through the latest Structure of Earnings Survey (SES 2018) that records the gross wages received and the individual characteristics of more than 500 000 enterprises and nearly 11 million employees throughout the EU.

This statistical working paper should help users to better understand the determinants of wages in the different EU countries thus contributing to the public debate and policy actions in the labour market domain.

Keywords: labour market statistics, wages, structure or earnings

Authors: Javier Alcántara-Ortega, Thibaut Henrion, Marina Pérez-Julián

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Eurostat, Unit F-3: Labour market statistics and lifelong learning

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[1] See in particular:
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Labour_cost_structural_statistics_-_levels
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Labour_cost_structural_statistics_-_changes
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Labour_cost_index_-_recent_trends

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1 | **Introduction**

1.1 Background

Every four years Eurostat collects detailed information on the gross wages earned by a large sample of employees working in enterprises of different sizes and economic activities. This data collection, named 'Structure of Earnings Survey' (SES), is a unique source of comparable information regarding the level and determinants of wages in the European Union.

The latest SES edition, for reference year 2018, has now been validated by Eurostat and the main aggregate results published online (see: earn_ses2018). In this study, we have used this information to update a previous publication that was based on SES2014.

As in the previous study, the analytical framework was taken from the publication: "*Schooling, experience and earnings*" (Mincer, 1974) where Jacob Mincer modelled the earnings as a function of schooling and experience. In the original work of Mincer, the logarithm of earnings was described as a function of both the sum of years of education and a quadratic function of years of potential experience. The introduction of the variable 'experience' with both a linear and a quadratic factor was due to the typical concave shape that the actual data from earnings displayed as the age variable increases: a larger increase inearnings at the beginning of the working life with a flattened pattern towards the end of the working life.

In this study, the original Mincer equation was adapted, as the Structure of Earnings Survey (SES) does not collect the years of potential experience but the age of the employee and their tenure (number of years) with the latest employer.

Moreover, additional variables collected through SES were included in the model, such as the effect of part-time work and of indefinite versus fixed term contracts as well as the main characteristics of the employing firm (NACE activity, size). Some individual characteristics of the employees have been crossed with sex to estimate the interaction between gender and other wage determinants such as age, education and part-time work.

Finally, this edition includes a regional dimension, making it possible to estimate and analyse the earnings gap among broad regions (NUTS I level), taking the capital region as the benchmark.

1.2 Aim of the study

The aim of the study is to explain how earnings are determined in the different Member States, using the same regression model across countries and applying it to a harmonized source (SES). By analysing gross earnings, and comparing their determinants across countries, we can understand better the functioning of labour markets in Europe. In addition, by crossing the explanatory variables with the gender dimension, we can also identify, measure and possibly interpret any differences in the gross wages earned by men versus women in EU labour markets.

The coefficients obtained from the regression represent the financial returns of a given characteristic, such as holding a Bachelor's degree or equivalent, to the expected earnings of the job holder.

When the financial returns significantly differ for a category of employees, e.g. working part-time or under fixed term contracts, this can point to a possible segmentation in the labour market concerned.

Moreover, by comparing financial returns across countries, it is possible in some cases to isolate groups of countries with similar outcomes with respect to the variable studied.

In the next part (§ 2.1) of this document, we will first introduce the data source used in this study, namely the Structure of Earnings Survey.

In part 2.2, we will then describe the regression model used and detail the explanatory (exogenous) variables.

The coefficients obtained from the regression are interpreted, with a cross country perspective, in part 3 whereas the main conclusions are drawn in part 4.

2 | Data source and methodology

2.1 The Structure of Earnings Survey

The Structure of Earnings Survey (SES) is a large business survey that provides comparable micro data on the link between the level of earnings and the individual characteristics of employees (sex, age, occupation, educational level) and of their employer (economic activity, size of the enterprise, etc.).

This survey is run every four years by the European Statistical System, in accordance with Council Regulation 530/1999. The data analysed in this study refer to reference year 2018 (SES 2018).

The gross hourly earnings collected by the SES refer to the wages and salaries earned by full-time and part-time employees, per hour paid, in the reference month (generally October 2018 for the SES 2018 exercise) before any tax and social security contributions are deducted. Wages and salaries include any overtime pay, shift premiums, allowances, bonuses, commission, etc.

In all Member States, SES data are collected for enterprises with at least 10 employees operating in all areas of the economy except public administration (Section O of the Statistical classification of economic activities in the European Community). Information on public administration as well as enterprises with less than 10 employees is also available for some countries which provide it on a voluntary basis.

The National Statistical Institutes are responsible for selecting the sample, preparing the questionnaires, conducting the survey and forwarding the results to Eurostat in accordance with the common coding scheme as stipulated by the implementing arrangements prepared by Eurostat. The data are centrally processed by Eurostat.

The SES is also used to compile other structural indicators such as the gender pay gap or the proportion of low wage earners.

2.2 Method

We have carried out a regression on gross earnings collected from SES with the explanatory variables collected through the same survey. The regression coefficients are estimated using the SES detailed information on individual earnings (endogenous variable), which are matched with the individual characteristics of the employee and his/her employer (exogenous). In addition, an enterprise-level random effect is included to take into account the unobserved characteristics, at the enterprise level. Finally, the regression model is the following:

$$y_{ij} = x'_{ij}\beta + \mu_j + \varepsilon_{ij}$$

Where:

- y_{ij} is the natural logarithm of hourly (gross) wages of an individual i working in enterprise j. Wages do not include bonuses or irregular payments;

- The vector x_{ij} of explanatory variables consists of personal characteristics, job characteristics and enterprise characteristics (see table below); interactions of several variables with the gender dummy were used where statistically significant;

- μ_j is the enterprise-level random effect, modelled through a cluster variable, which allows for different earnings within a given enterprise, irrespective of the characteristics of its labour force.

- ε_{ij} is the error term for the individual employee *i* working in the enterprise *j*.

The analysis is constrained by the different effects that personal and job characteristics may have on wages in the different Member States, as well as the differences in sample sizes and coverage. In line with the relevant scientific literature, persons below the age of 23, above the age of 65, those working less than 16 hours per week and apprentices were excluded from the analysis, as well as any cases with incomplete information in the variables of interest. The individuals with the lowest and highest 0.5% of hourly wage were also excluded in order to avoid a bias in the results due to outliers. Some industries and occupations (e.g. fishing industry, armed forces) are not included in SES data. In this case, no indication for the average salary for these particular industries and occupations can be given.

Regression models

It was decided to use four ISCED categories, splitting tertiary education into lower tertiary (ISCED levels 5 and 6) and upper tertiary levels (ISCED levels 7 and 8). The 2-digit level of the ISCO-08 classification has been used. Finally, a binary variable for part / full-time work has been used. Indeed, the relation between earnings and the number of hours worked is generally not linear, with part-time workers earnings generally less, per hour worked, than full-timers. We selected in the regression model those SES variables that had a significant effect on wages in a majority of Member States, as listed in table 1.

Table 1: List of SES variables selected in the regression model

VARIABLE	VALUES	NOTES
Gross hourly wages	natural logarithm	Dependent variable; the lowest and highest 0.5% of wages were excluded from the sample.
Personal and job characteristics:		
Gender	male (reference category) / female	Interactions between female and age, age squared and education are included.
Age	age, age squared	Individuals aged 23 - 65 are included. Proxy for experience; the age squared term is necessary to capture changing returns to experience.
Education	ISCED level 1+2 (basic education up to lower secondary), 3+4 (upper secondary), 5+6 (lower tertiary up to Bachelor's and equivalent), 7+8 (upper tertiary up to Master's and Doctoral)	The category used as reference (coefficient = 0) is ISCED level 1+2.
Occupation	2-digit ISCO-08 code	The category used as reference (coefficient = 0) is ISCO code 9.3 (Elementary occupations - subgroup "Labourers in Mining, Construction, Manufacturing and Transport"); ISCO code 6 (skilled agricultural and fishery workers) are not available for all Member States.
Job experience ("tenure")	Number of years with the current employer	Only the experience in the current job is taken into account in this variable.
Type of contract	permanent (reference category) / fixed term	Apprentices were excluded
Working time	full-time (reference category) / part-time	

Enterprise characteristics:		
Industry	NACE rev. 2 sections	The category used as reference (coefficient = 0) is NACE Rev. 2 section F ("Construction") Information for section "Public administration and defence; compulsory social security" is not available for all Member States.
Enterprise size	1-9; 10-49; 50-249; 250-499; 500-999; 1000+	Information for enterprises with less than 10 employees is not available for all Member States.
Region	NUTS 1 regions in the EU	Some countries consist of one single NUTS1 region. For countries with several NUTS I regions, the category used as reference (coefficient = 0) is the NUTS I region where the capital city is located

Source: Eurostat, Structure or Earnings Survey 2018

There are no cut-offs for the variable "tenure in the current firm", but if the amount of years entered exceeds "age-14" it will not be accepted, as it would imply the individual started to work at the age of 13 or younger. Individuals working less than 16, or more than 60 hours per week were excluded from the regression analysis.

Plausibility checks

The plausibility of the earnings estimated according to the above-described model were tested through a large number of cases. The simulation generated plausible results except for some countries: Czechia, Germany, Denmark, Hungary, the Netherlands and Poland in which the coefficients for one of the variables (age × sex) or (age^2 × sex) were not significant. In those cases, it was necessary to withdraw both variables from the model to obtain plausible results, in particular for older employees.

Coefficient of determination

The coefficient of determination (R^2) indicates which share of the variation in earnings, as measured by the variance, is explained by the model and which part remains unexplained.

The results for the coefficient of determination of the regression are displayed in table 2.

Table 2: Coefficient of determination (%)

BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV
85%	53%	54%	50%	63%	44%	59%	58%	56%	55%	50%	61%	69%	41%
LT	**LU**	**HU**	**MT**	**NL**	**AT**	**PL**	**PT**	**RO**	**SI**	**SK**	**FI**	**SE**	
46%	70%	64%	45%	59%	62%	56%	69%	58%	53%	46%	62%	54%	

Source: Eurostat, Structure or Earnings Survey 2018

The share of the variance in the logarithm of the earnings which is determined by the SES-based model described in part 2.2 varies between 41% in Latvia to 85% in Belgium. This means that earnings are explained in Belgium, to a large extent, by the characteristics of the employer and the employees. This is less the case in Latvia where a large part of the earnings is left unexplained being due to other variables (e.g. total work experience) that are not collected in SES or due to the individual performance of each employee irrespective of its objective characteristics.

3 Results and analysis

In this part of the document, we present the regression coefficients obtained for each explanatory variable, across EU countries, and discuss possible interpretations. These coefficients can be interpreted, for categorical variables, as the percentage difference in the average wages of a given class of workers compared to a reference category (all other SES variables being equal). For continuous variables such as age, it measures the marginal wage increase (in percent) when the explanatory variable increases by one unit (e.g. for an employee becoming 1 year older).

3.1 Age

Figure 1: Effect of age on earnings
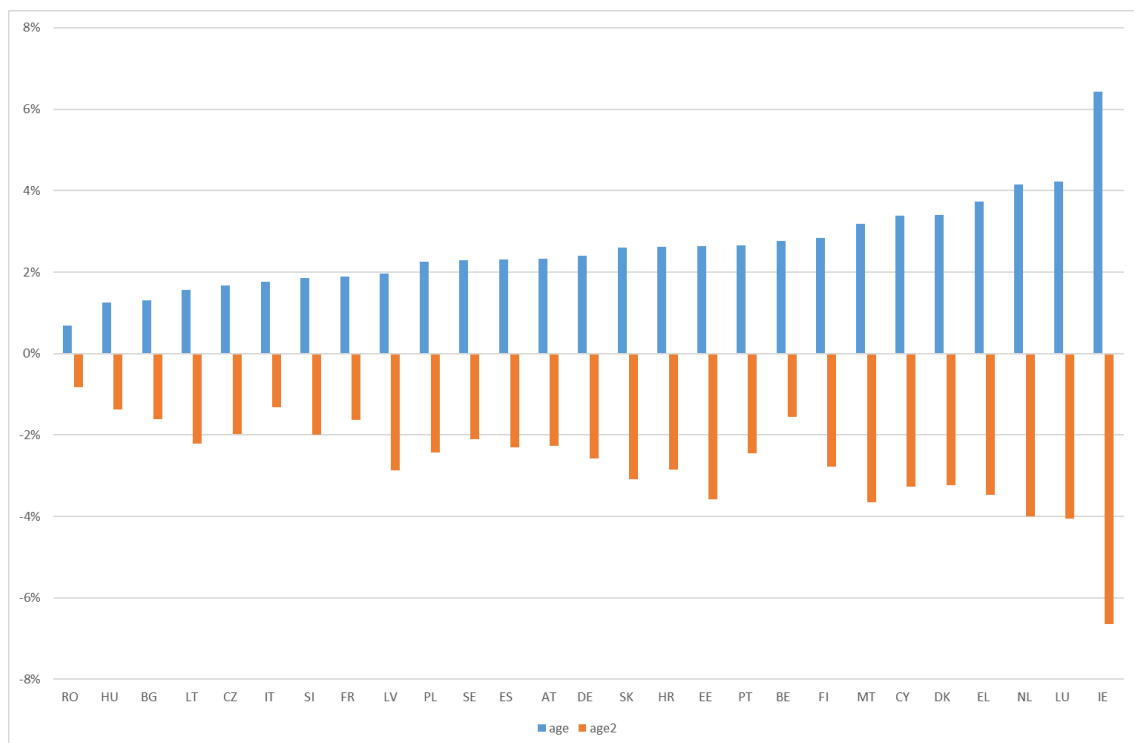
Source: Eurostat, Structure or Earnings Survey 2018

The chart in the previous page shows that salaries increase with age (positive coefficient for variable "age") with the highest marginal return observed for Ireland (+ 6.4%). This relationship is generally non-linear, as if there were a cap on the average salaries that translates into a negative coefficient for age-squared (age^2).

The following chart shows the effect of age on the earnings of women compared with men, except for countries where any of the variables (age × sex) or (age^2 × sex) were not significant[2]. When significant, the coefficient for the variable (age × female) is generally negative showing that the financial return on age is smaller for women than for men, with the exception of Romania. This could be due to the fact that some women are penalised in the first stage of their careers when they stop working (or work part-time), for instance to bring up their children, slowing down their professional development and accumulation of work experience. The correlation coefficient for age-squared is generally positive, which could be interpreted as a catching-up effect for women who were penalised at the start of their careers, leaving room for wage increases until the salary cap has been reached. Countries that display a large negative coefficient for age × female generally display another equally large coefficient for (age^2 × female) that mitigates the impact of the first coefficient for older workers. Finally, it must be noted that Belgium, Ireland, Cyprus, Lithuania, Luxembourg and Austria show equal financial returns on age for men and women.

Figure 2: Effect of age and sex on earnings
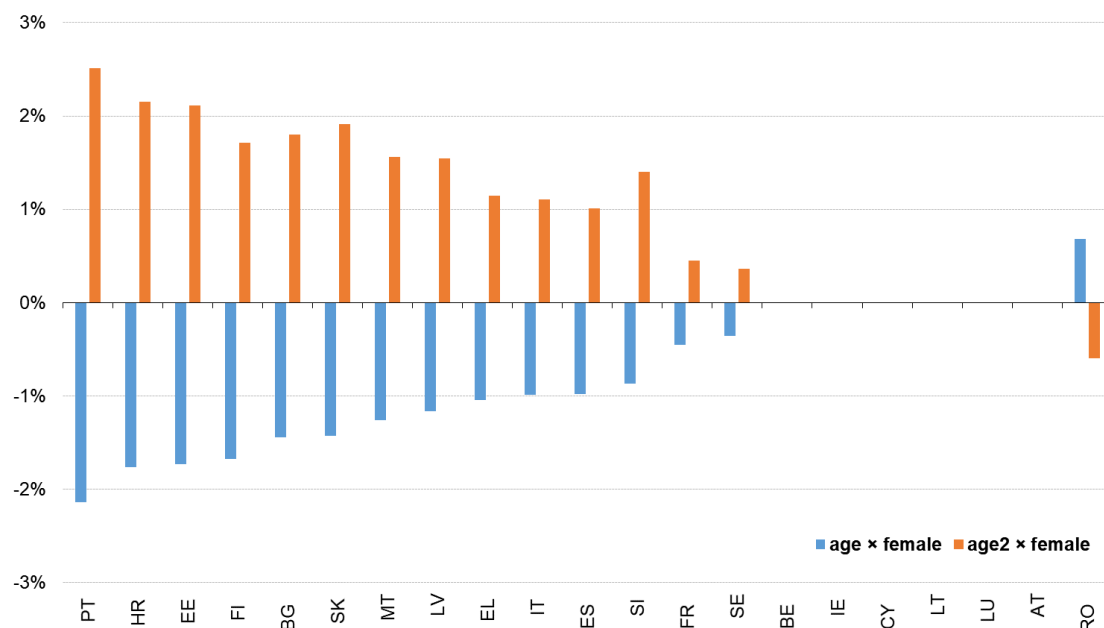
Czechia (CZ), Germany (DE), Denmark (DK), Hungary (HU), The Netherlands (NL) and Poland (PL) are not included in the figure as their coefficients for either (age × sex) or (age^2 × sex) were not significant.

Source: Eurostat, Structure or Earnings Survey 2018

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[2] This was the case for: Czechia (CZ), Germany (DE), Denmark (DK), Hungary (HU), The Netherlands (NL) and Poland (PL).

3.2 Education

The next chart shows the impact of education on earnings. The first stack in each column reflects the impact on earnings of completing upper secondary education compared to completing lower secondary education (school-leaving certificate). The second stack reflects the impact on earnings of completing lower tertiary education (Bachelor's degrees and other lower tertiary qualifications) compared to completing upper secondary education. The third stack reflects the impact of completing upper tertiary education (Masters and Doctoral degrees) when compared to completing lower tertiary education.

Figure 3: Effect of education on earnings
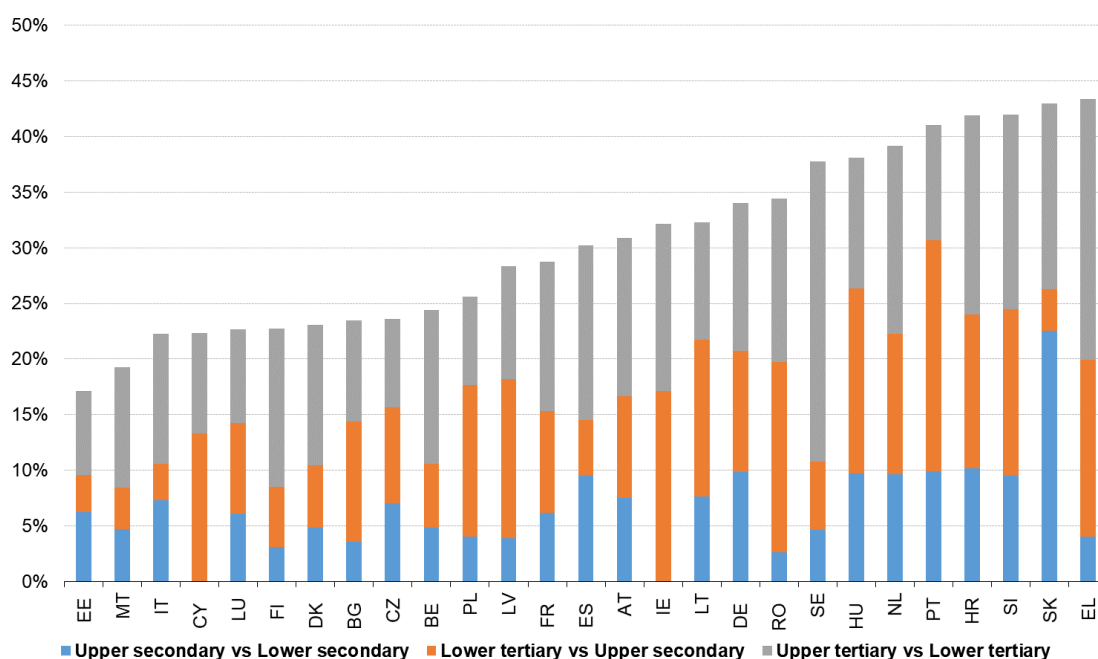
Source: Eurostat, Structure or Earnings Survey 2018

Firstly, all stacks are positive or null, showing that higher levels of education always yield higher average earnings (when compared to the education level immediately below). The impact of education (all levels combined) on earnings is highest in Greece, Slovakia, Slovenia, Croatia and Portugal.

Completing upper secondary is rewarded the most in Slovakia (+22.5%) and the least in Cyprus and Ireland where the average wages are the same as for employees with lower secondary level. In all Member States except five (Slovakia, Spain, Italy, Estonia and Malta), completing lower tertiary (compared to upper secondary) brings a larger increase in average earnings than completing upper tertiary (compared to lower secondary).

In 17 out of 27 countries, completing upper tertiary (compared to lower tertiary) brings a larger increase in average earnings compared to completing lower tertiary (compared to upper secondary). This is most noticeable in Sweden, Slovakia and Spain. On the contrary, in the other 10 countries, the increase in earnings is higher when moving from upper secondary to lower tertiary than from lower tertiary to upper tertiary. This is most noticeable in Portugal, where the financial return for completing upper tertiary is only +10% compared with +21% for completing lower tertiary.

The next chart shows the financial return of education levels for women, compared with men, ranked according to the results obtained for lower tertiary education. Three groups can be distinguished. A first group: Slovakia, Czechia, Austria, Finland, Poland, Spain, Germany, Belgium and Sweden includes countries where women receive lower financial returns for education compared with men, at least for some education levels. A second group, made up of Malta, Luxembourg, Portugal and the Netherlands, gathers countries where women receive a higher financial return than men from their educational achievements. Finally, a middle group covers countries with limited or no impact of gender on the financial returns of education, except for very specific education levels (e.g. Croatia for upper tertiary). This group consists of Bulgaria, Cyprus, Denmark, Estonia, France, Croatia, Hungary, Ireland, Greece, Lithuania, Latvia, Romania, Slovenia and Italy.

Figure 4: Effect of education and sex on earnings

■ Secondary education, vocational training×female ■ Lower tertiary education×female ■ Upper tertiary education×female
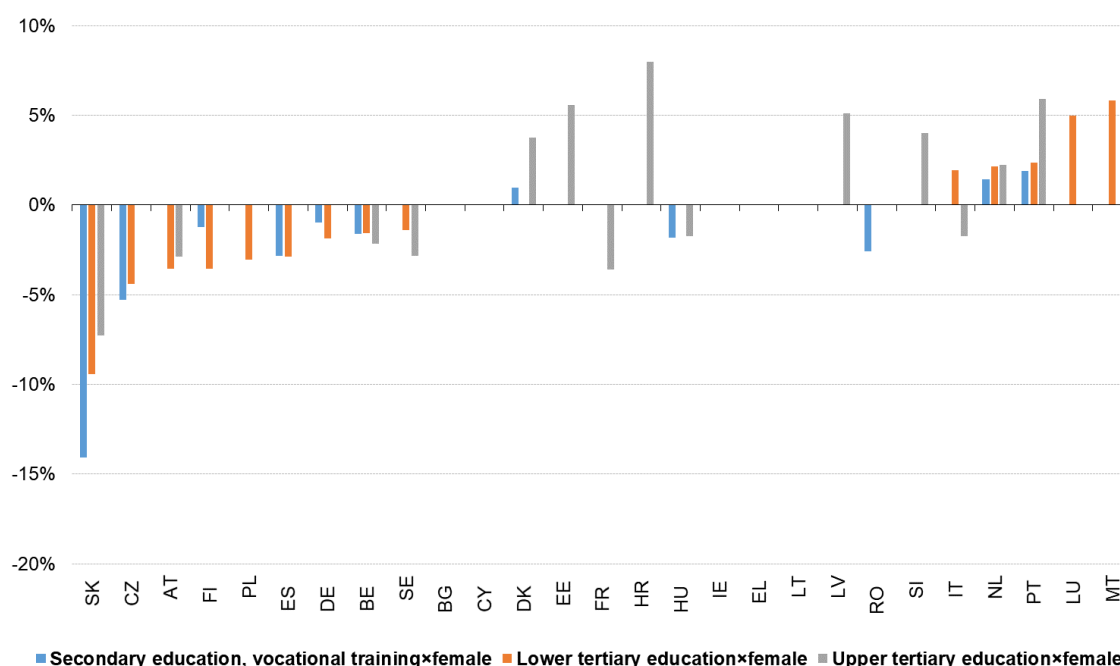
Source: Eurostat, Structure or Earnings Survey 2018

3.3 Other characteristics of the employee

Duration of the contract

As shown in figure 5, the average salaries are generally lower for fixed-term workers, compared with the reference category which consists of employees with indefinite contracts, especially in Hungary and Luxembourg.

This could reflect a dual labour market, with a marked difference in the wages offered under indefinite versus fixed-term contracts. However, this is not systematic and some Member States (Belgium, Bulgaria, Denmark, Estonia, Cyprus, Latvia and Lithuania) do not exhibit significant differences according to the duration of the contract. In the case of Greece, fixed-term contracts are even better paid on average than indefinite contracts.

Figure 5: Effect of fixed term contracts on earnings
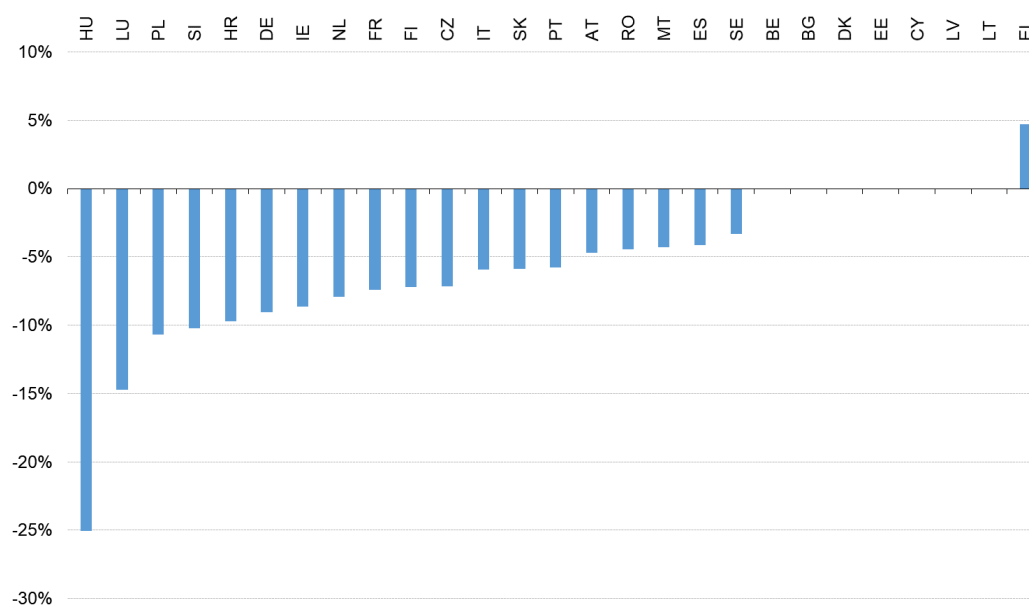
Source: Eurostat, Structure or Earnings Survey 2018

Part-time work

The reference level being full-time workers, working part-time has a negative impact on hourly wages in most EU countries, in particular Belgium, Greece, Italy and Cyprus (see figure 6). The reverse situation is observed in Malta, Latvia, Lithuania, Denmark and Luxembourg.

Finally, some countries do not record significant differences between the average earnings of full-time versus part-time workers. This is the case for Estonia, Ireland, Croatia, Poland, Portugal and Romania.

Figure 6: Effect of part-time work on earnings
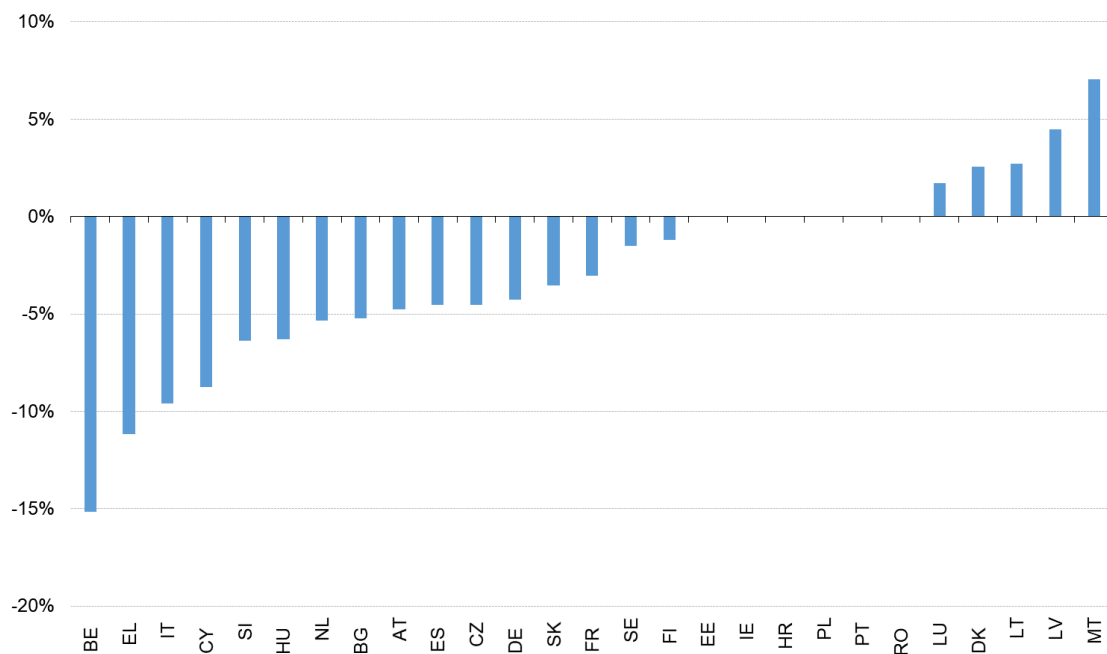
Source: Eurostat, Structure or Earnings Survey 2018

Job tenure

This chart shows that salaries increase with the number of years spent *in the firm* (positive coefficient for variable "tenure") used as a proxy to the "total number of years of employment" which is not collected in the Structure of Earnings Survey. It must be noted that these financial returns on experience in the same firm cumulate with the effect of age analysed in part 3.1.

The effect of tenure is highest in Greece, Cyprus and Ireland, meaning that workers have higher incentives to stay longer in the same firm. They are lowest in Belgium (no significant effect), Estonia, Finland and Sweden where firms may have less difficulties to retain their employees.

Figure 7: Effect of job tenure on earnings
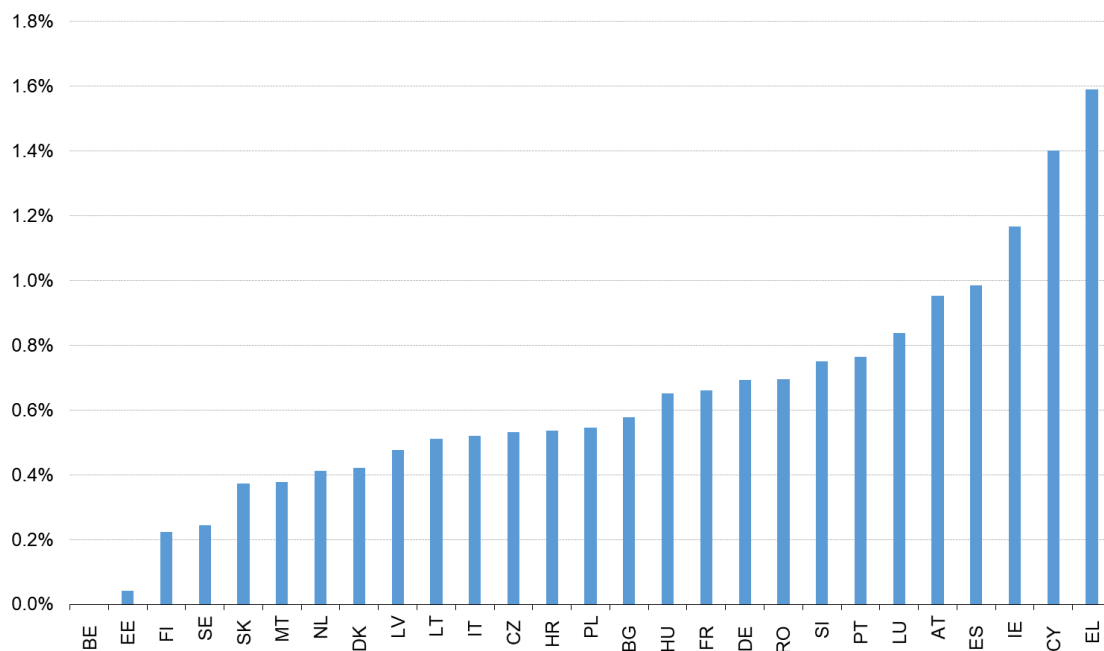
Source: Eurostat, Structure or Earnings Survey 2018

Occupation

Given the numerous occupations used in the regression, the results are displayed in annex (table A.2) followed by a short analysis.

3.4 Size of the enterprise

The next chart shows the effect of the enterprise size on hourly wages, the reference category being employees working in very large enterprises of more than 1000 employees. Countries are ranked according to the results obtained for enterprises with 50 to 249 employees. In general, the smaller the enterprise, the lower the average hourly salary. This could point to higher competitive pressure on smaller firms, with a higher number of market players, and to the higher productivity of larger companies. This difference is most visible in Bulgaria, Germany and Romania. The only exceptions are Denmark (all size classes except 10-49 employees), Finland and Lithuania (for some size classes) although the effect is very limited.

Figure 8: Effect of the enterprise size on earnings
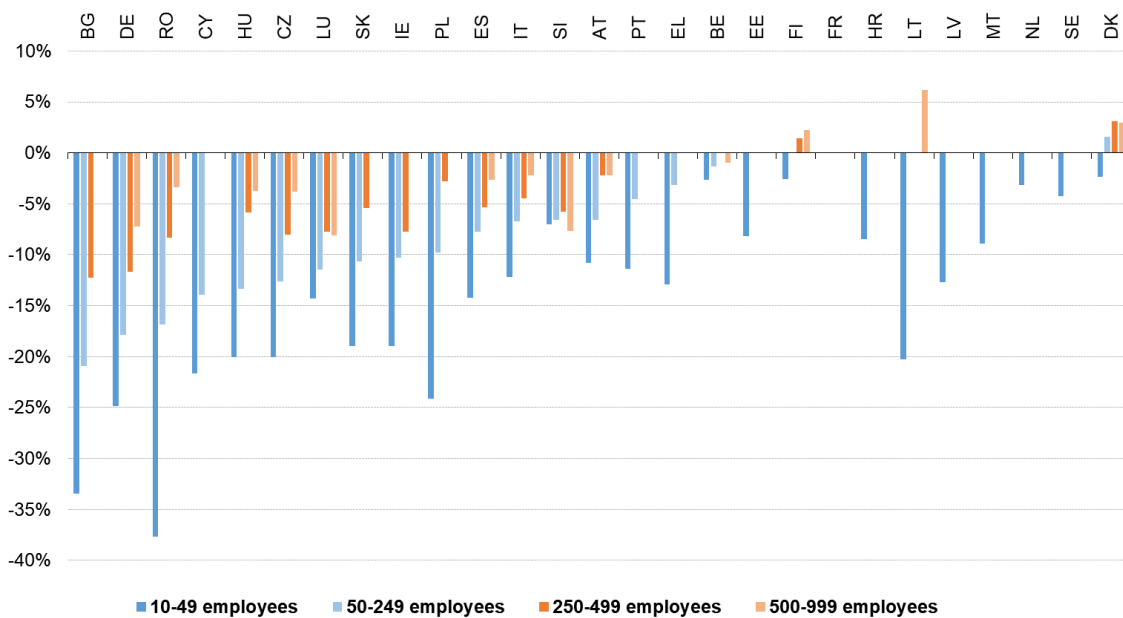
Source: Eurostat, Structure or Earnings Survey 2018

3.5 NACE activity

Given the numerous NACE activities, the results are displayed in the annex (table A.1) followed by a short analysis. It must be noted that all the results are considered against "Construction" as the reference sector.

In addition to the general overview of all NACE activities, three activities have been analysed separately as they are often dominated by public or quasi-public entities and may not be regulated by market forces. These include NACE sections O ("Public Administration and Defence, Compulsory Social Security"), P ("Education") and Q ("Health").

For each of them, the standard model used in this study has been adapted to compare the average earnings in the activity concerned against the rest of the economy.

Public administration

The analysis has been performed for the countries that collect SES information on NACE Rev. 2 section O: "Public Administration and Defence, Compulsory Social Security" that is all Member States except Belgium, Austria, Greece and Portugal.

For the majority of countries, the average wages earned in public administration are lower than in the rest of the economy. This is particularly noticeable in Bulgaria (- 34%) and Germany (- 26%) Employees in public administration are better paid than in other sectors - all other SES variables being equal - in four Member States, namely: Spain and the Netherlands (+4% for both), Romania (+22%) and Luxembourg (+44%).

For BE,AT,EL,PT information for NACE_O is not available
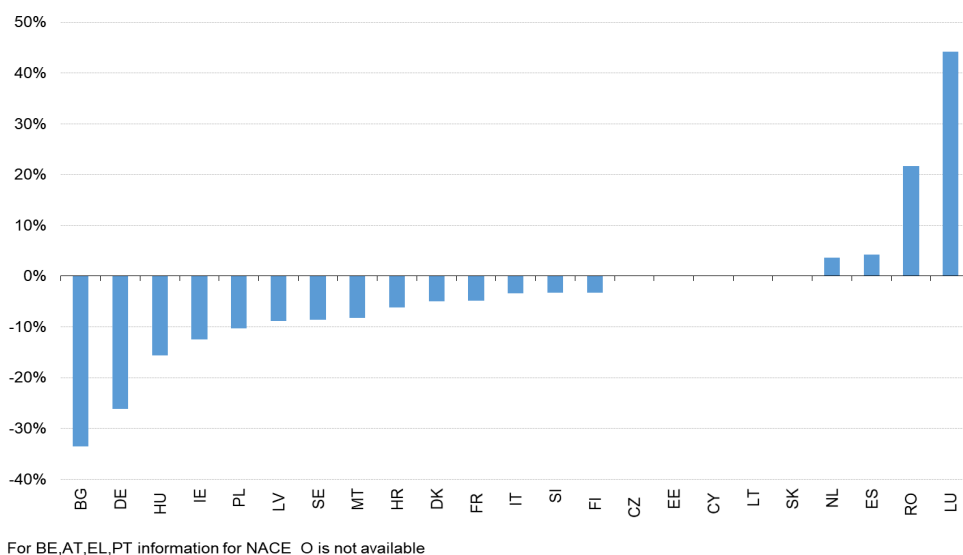
Source: Eurostat, Structure or Earnings Survey 2018

Table 3: financial returns for working in public administration versus other activities

BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV
n.a.	-34%	0%	-5%	-26%	0%	-12%	n.a.	4%	-5%	-6%	-3%	0%	-9%

LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE
0%	44%	-16%	-8%	4%	n.a.	-10%	n.a.	22%	-3%	0%	-3%	-9%

Source: Eurostat, Structure or Earnings Survey 2018

Education

As shown in the chart, the average salaries in education are generally lower than those in the rest of the economy. This is particularly visible in Latvia (-24%), Romania (-20%), Lithuania (-19%), Estonia (-17%), Slovenia (-14%) and Slovakia (-12%).

Only three countries stand out for paying employees working in the education sector better than in the rest of the economy: Luxembourg (+25%), Greece (+7%) and Denmark (+3%).
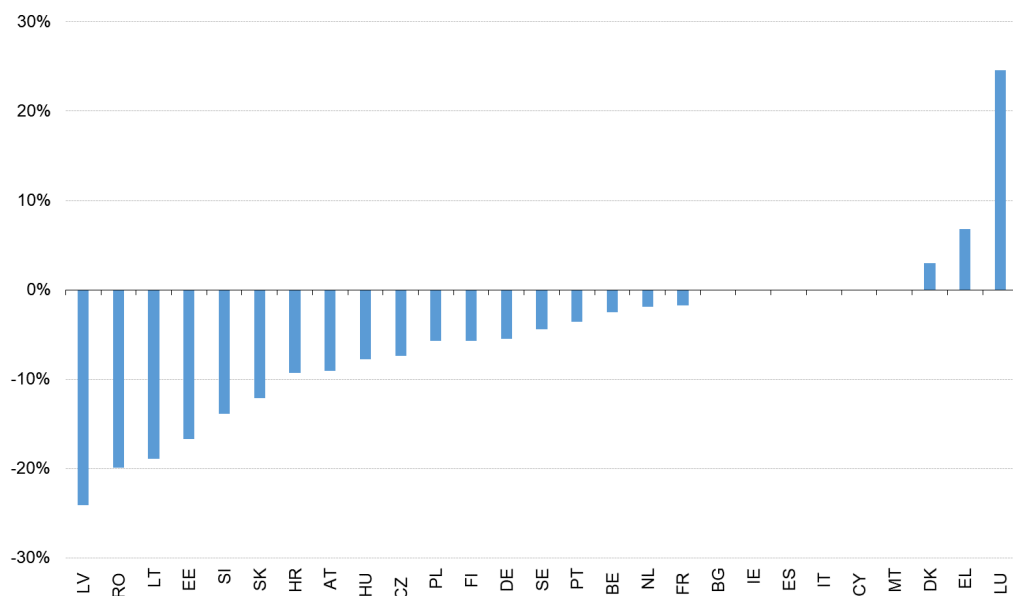
Source: Eurostat, Structure or Earnings Survey 2018

Table 4: financial returns for working in education versus other activities

BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV
-3%	0%	-7%	3%	-6%	-17%	0%	7%	0%	-2%	-9%	0%	0%	-24%

LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE
-19%	25%	-8%	0%	-2%	-9%	-6%	-4%	-20%	-14%	-12%	-6%	-4%

Source: Eurostat, Structure or Earnings Survey 2018

Health

In 15 out of 27 Member States, the average salaries are lower in the health sector than in the rest of the economy. This is particularly the case in Greece (-14%), Portugal (-12%), Denmark and Poland (-10% in both cases).

Whereas 10 countries record no gap, two countries record a positive earnings gap in favour of health workers, namely: Romania (+14%) and the Netherlands (+5%).
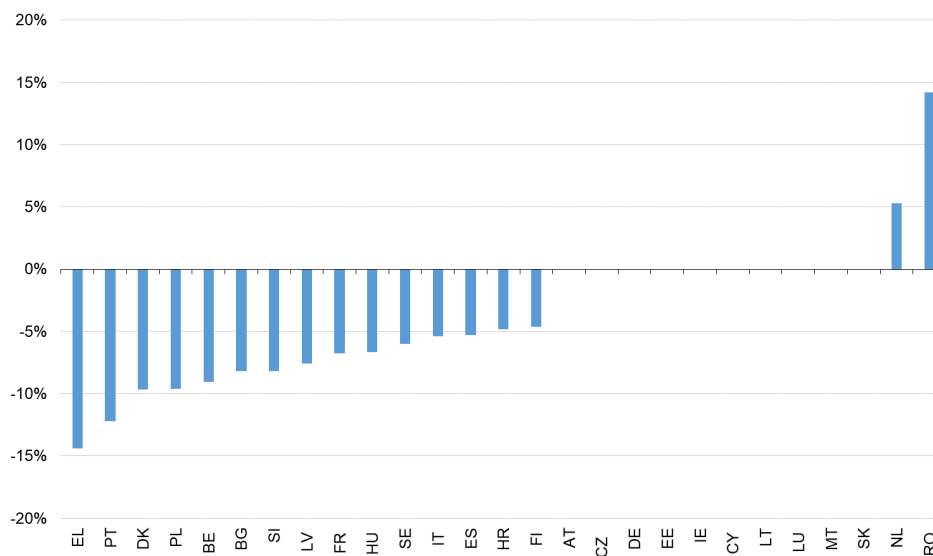
Source: Eurostat, Structure or Earnings Survey 2018

Table 5: financial returns for working in the health sector versus other activities

BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV
-9%	-8%	0%	-10%	0%	0%	0%	-14%	-5%	-7%	-5%	-5%	0%	-8%

LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	
0%	0%	-7%	0%	5%	0%	-10%	-12%	14%	-8%	0%	-5%	-6%	

Source: Eurostat, Structure or Earnings Survey 2018

3.6 Region

In this section we analyse the impact of the region (NUTS I) where the enterprise is located on the expected earnings of its employees. Given the numerous NUTS1 regions, the results are displayed in annex (Table A.3). The analysis was performed on EU countries that consist of several NUTS I regions, taking the region with the capital city as the reference.

Among the analysed countries, Belgium, Portugal and Finland record no significant differences among NUTS I regions. In other countries, employees generally earn as much or more in the capital region than in other parts of the country, with the largest gap (-16%) recorded in the macro region of Wschodni, in Poland. There are a few exceptions though, such as Austria where "Westösterreich" records higher average wages (+ 3%) than "Ostösterreich" where Vienna is located.

In France, higher average wages are paid in Ile-de-France whereas most other regions record a gap ranging from -6% in "Provence-Alpes-Côte d'Azur" to -10% in both "Bretagne" and "Nouvelle Aquitaine". The exceptions are: "Corse" (no gap) and "Régions Ultrapériphériques Françaises" (+ 3%).

The situation is more contrasted in Germany, Spain and Italy.

In Germany, the average wages in the NUTS I regions of "Hamburg" and "Baden-Württemberg" are more than 10% higher than in the capital region. "Bayern", "Bremen" and "Hessen" also record sizeable positive gaps (+ 8% for all of them). Conversely, several "Länder" located in the Eastern part of the country show negative differences in their average earnings compared to the Berlin region. This is the case in particular for: "Sachsen" (-13%), "Mecklenburg-Vorpommern" and "Thüringen" (both -11%), "Sachsen-Anhalt" (- 9%) and "Brandenburg" (- 8%).

In Spain, the "Noreste" region records a positive gap of +6% compared to the capital region. The largest negative gaps are recorded in the NUTS I regions of "Centro" and "Canarias" (both -7%) and "Noroeste" (- 6%).

In Italy, the Northern regions have higher average wages than the capital region: +5% for "Nord-Ovest" and +3% for "Nord-Est". The "Sud" region records a negative – but limited – gap (- 2%) compared to the Capital region.

4 | Conclusions

In this study, we have used the latest Structure of Earning Survey data (SES2018) to examine the relation between the individual characteristics of the employees and their employers and their gross wages. We have estimated the impact of each variable collected in SES on the expected earnings of employees and compared them across countries highlighting those with similar patterns.

Although SES does not include all relevant variables that would explain earnings, in particular the total working experience, the regression model selected for this analysis could generally explain more than 50% of the total variance and up to 85% in one case.

As in the previous study of wage determinants in the European Union [Eurostat, 2020A], the main drivers of earnings are: the age of the employee (which is a cumulative factor for every year of age), his/her level of education and occupation. The characteristics of the employer, namely the size and sector of activity of the employer also play a major role in the expected earnings of employees.

Moreover, the study confirmed the generally negative impact of working part-time or with a fixed-term contract (as opposed to an indefinite contract) on the expected wages received by employees. However, this is not systematic and some Member States (e.g. Estonia) do not exhibit such a segmentation between higher paid jobs, with full-time and permanent contracts, and lower paid employees under more precarious conditions.

In most cases, different financial returns for age were observed for men versus women. Whereas the latter are generally less rewarded for the factor age at the beginning of their careers, this effect is partly mitigated with positive returns (in comparison to men) when they get closer to retirement.

The financial returns on education are sometimes smaller for women than for men although the reverse might be true in some countries. For most Member States, the difference was found negligible or limited to specific education levels.

The above findings confirm the conclusions of the previous study based on SES2014 data. In this edition, additional analyses have been carried out on activities where the public sector is predominant and on regional disparities.

Concerning "Public administration, defence and social security", the study showed large negative gaps compared to the rest of the economy in Bulgaria and Germany and positive ones in Romania and Luxembourg.

In the case of "Education", the Baltic countries as well as Romania recorded large negative gaps whereas Luxembourg showed a strong positive difference in earnings compared with the other sectors.

Finally, in the "Health" sector, large negative gaps were observed in Greece, Portugal, Denmark and Poland. By contrast, the average wages were comparatively higher in this sector in Romania and the Netherlands.

Turning to regional disparities, the analysis could quantify the impact of the (NUTS I) region of location of the employer on the average earnings of its employees. This confirmed geo-economic features such as the 'Paris/Ile de France' exception in France, the East-West divide in Germany and the South-North gap in Italy.

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Appendix: Sector, occupation and region

In the following tables, we show the impact of the sector of activity of the employer (table A1) and the impact of the occupation of the employee on the expected salaries (table A2).

Table A1 shows the impact of the sector of activity of the employer on the expected wages of their employees, all other SES variables being equal, compared with the 'Construction' sector. According to their regression coefficients, the high-paying sectors are: "Mining and quarrying", "Electricity and gas", "Information and communication" and "Financial insurance activities".

Sectors that generally pay lower than construction are: "Accommodation and food services", "Administrative and support services activities", "Public administration and defence; social security", "Education", "Human health and social work", "Arts, entertainment and recreation" and the sector "Other service activities". This is not the case of Luxembourg, partly because the construction sector, used as reference category, record lower average wages than most other activities. The other notable exceptions are: Malta (for "Arts, entertainment and recreation") and Romania (for "Public administration and defence; social security", and "Human health and social work").

Table A2 shows the impact of the occupation of the employee on its expected salaries, compared with ISCO code 9.3 (elementary occupations - subgroup "Labourers in Mining, Construction, Manufacturing and Transport").

The well-paying occupations are as expected "Managers" then "Professionals", "Technicians and associate professionals". Occupations paying less well can be found in "Elementary occupations" with the exception of "Street and related Sales and Services workers" in some countries (Estonia, Greece, Cyprus, Latvia, Hungary and the Netherlands).

Table A3 records, for each NUTS I region, the difference between the expected earnings in that region and the reference value measured in the region where the capital city is located.

Table A1: Impact of the sector of activity (NACE section) on the expected wages

Parameter/Country	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE
Mining and quarrying	-6%	38%	9%	18%	6%	24%	0%	21%	13%	0%	0%	17%	21%	14%	22%	9%	0%	0%	0%	0%	30%	0%	26%	29%	0%	0%	13%
Manufacturing	7%	0%	6%	-3%	5%	5%	0%	0%	0%	-7%	0%	0%	0%	-7%	7%	0%	9%	17%	-9%	-5%	0%	4%	0%	0%	7%	-2%	-7%
Electricity, gas, steam and air-conditioning supply	13%	33%	18%	0%	17%	10%	18%	17%	23%	0%	22%	10%	0%	-9%	0%	31%	25%	55%	0%	4%	15%	53%	11%	16%	18%	7%	-4%
Water supply, sewerage, waste management and remediation	9%	0%	0%	-6%	0%	6%	0%	0%	0%	-10%	0%	-2%	20%	-10%	0%	19%	0%	11%	-5%	-12%	0%	0%	0%	0%	0%	-4%	-7%
Construction	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wholesale and retail trade, repair of motor vehicles and motorcycles	5%	13%	5%	-9%	-5%	0%	-12%	0%	-10%	-14%	0%	-4%	0%	-8%	0%	0%	0%	10%	-15%	-11%	0%	0%	0%	0%	6%	0%	-7%
Transportation and storage	6%	0%	0%	0%	-11%	0%	0%	14%	0%	-8%	0%	-8%	0%	0%	0%	12%	0%	26%	-6%	-14%	0%	16%	0%	0%	0%	0%	-8%
Accommodation and food service activities	0%	0%	-7%	-13%	-14%	0%	-23%	0%	-4%	-13%	12%	-9%	0%	-13%	0%	0%	-4%	0%	-23%	-25%	-4%	0%	0%	0%	0%	-8%	-12%
Information and communication	4%	32%	15%	-5%	5%	15%	11%	0%	-5%	-9%	11%	0%	0%	14%	19%	16%	9%	25%	-8%	-3%	15%	14%	21%	0%	15%	0%	0%
Financial and insurance activities	13%	8%	9%	3%	11%	22%	11%	19%	9%	-7%	12%	20%	18%	17%	22%	26%	13%	28%	0%	0%	17%	42%	0%	10%	15%	5%	0%
Real estate activities	7%	0%	9%	-7%	3%	0%	0%	10%	-14%	-15%	0%	-5%	0%	0%	0%	13%	0%	18%	0%	0%	0%	13%	0%	0%	5%	-6%	-9%
Professional, scientific and technical activities	11%	11%	8%	-6%	2%	6%	0%	0%	-13%	-10%	0%	0%	7%	0%	9%	10%	5%	20%	-8%	-6%	9%	8%	17%	0%	12%	-6%	-6%
Administrative and support service activities	3%	0%	-11%	-10%	-15%	0%	-10%	-15%	-18%	-14%	0%	-15%	0%	0%	0%	0%	0%	0%	-17%	-12%	-12%	0%	0%	0%	0%	-14%	-17%
Public administration and defence; compulsory social security	n.a.	-27%	0%	-15%	-29%	0%	-14%	n.a.	-4%	-18%	0%	-8%	7%	-17%	0%	58%	-16%	0%	-5%	n.a.	-11%	n.a.	28%	0%	0%	-11%	-22%
Education	0%	0%	-7%	-13%	-16%	-16%	-11%	0%	-9%	-17%	-8%	-5%	0%	-35%	-20%	46%	-13%	0%	-10%	-19%	-10%	0%	-11%	-16%	-12%	-17%	-24%
Human health and social work activities	-6%	-7%	0%	-20%	-9%	0%	0%	-15%	-12%	-21%	0%	-11%	0%	-22%	-8%	20%	-12%	0%	-5%	-14%	-13%	-8%	23%	-10%	0%	-16%	-24%
Arts, entertainment and recreation	-14%	0%	0%	-19%	-11%	-11%	-10%	0%	-8%	-14%	0%	-8%	0%	-24%	-14%	26%	-10%	34%	-17%	-17%	-12%	7%	0%	0%	0%	-18%	-17%
Other service activities	4%	0%	-6%	-10%	-5%	-10%	0%	-16%	-18%	-23%	0%	-15%	0%	0%	0%	18%	0%	0%	-11%	-19%	-8%	0%	-9%	0%	-18%	-16%	-16%

Table A2: Impact of occupation on the expected wages

	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE
1. Managers																											
Chief Executives, Senior Officials and Legislators	70%	80%	73%	48%	77%	65%	101%	71%	68%	91%	72%	90%	133%	37%	62%	81%	69%	78%	60%	77%	77%	82%	69%	70%	61%	86%	61%
Administrative and Commercial Managers	64%	93%	74%	48%	74%	53%	80%	76%	63%	56%	42%	105%	111%	53%	63%	78%	84%	67%	58%	64%	61%	81%	68%	48%	56%	78%	56%
Production and Specialized Services Managers	62%	75%	68%	38%	61%	51%	59%	67%	59%	49%	58%	90%	87%	57%	58%	56%	67%	66%	51%	57%	52%	71%	62%	39%	52%	68%	49%
Hospitality, Retail and Other Services Managers	42%	72%	48%	20%	58%	33%	27%	54%	39%	48%	52%	47%	72%	34%	46%	49%	44%	56%	37%	41%	30%	60%	52%	34%	33%	71%	27%
2. Professionals																											
Science and Engineering Professionals	44%	51%	46%	29%	43%	37%	33%	48%	38%	47%	42%	36%	35%	35%	41%	33%	57%	44%	33%	39%	29%	50%	40%	39%	30%	42%	28%
Health Professionals	55%	49%	57%	27%	56%	64%	39%	40%	55%	51%	52%	87%	41%	54%	51%	68%	60%	67%	42%	63%	49%	63%	66%	57%	38%	73%	40%
Teaching Professionals	73%	44%	43%	15%	38%	52%	70%	56%	40%	32%	23%	59%	58%	39%	52%	35%	47%	50%	36%	39%	71%	75%	46%	41%	32%	33%	20%
Business and Administration Professionals	49%	59%	55%	30%	50%	51%	42%	41%	39%	53%	40%	32%	55%	47%	44%	33%	62%	45%	39%	42%	32%	48%	49%	42%	41%	48%	33%
Information and Communications Technology Professionals	50%	95%	58%	32%	44%	59%	47%	43%	35%	49%	42%	28%	55%	65%	67%	29%	65%	53%	37%	40%	56%	47%	82%	43%	42%	43%	30%
Legal, Social and Cultural Professionals	47%	37%	30%	21%	38%	33%	45%	30%	31%	41%	31%	51%	41%	29%	33%	44%	54%	26%	34%	38%	41%	50%	43%	36%	15%	38%	27%
3. Technicians and associate professionals																											
Science and Engineering Associate Professionals	29%	39%	34%	18%	32%	29%	23%	43%	25%	27%	22%	21%	33%	35%	33%	21%	38%	34%	32%	32%	22%	29%	35%	31%	26%	27%	20%
Health Associate Professionals	41%	37%	44%	14%	32%	42%	0%	28%	17%	31%	35%	24%	20%	34%	25%	50%	39%	48%	27%	32%	17%	30%	39%	35%	23%	30%	11%
Business and Administration Associate Professionals	31%	43%	36%	19%	37%	31%	18%	23%	27%	26%	35%	27%	30%	28%	23%	19%	39%	35%	30%	33%	20%	39%	26%	29%	28%	29%	18%
Legal, Social, Cultural and Related Associate Professionals	36%	32%	26%	12%	37%	16%	0%	18%	14%	21%	23%	6%	31%	17%	18%	19%	40%	36%	22%	27%	13%	34%	33%	19%	8%	22%	11%
Information and Communications Technicians	31%	31%	36%	18%	39%	29%	0%	37%	19%	23%	26%	17%	23%	14%	10%	17%	41%	41%	22%	33%	25%	33%	35%	29%	22%	28%	13%

	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE
4. Clerical support workers																											
General and Keyboard Clerks	15%	15%	21%	9%	23%	16%	0%	21%	8%	9%	19%	8%	8%	9%	11%	15%	25%	17%	15%	21%	10%	19%	17%	18%	20%	15%	5%
Customer Services Clerks	8%	18%	18%	0%	19%	18%	0%	17%	7%	8%	15%	8%	0%	15%	16%	10%	28%	17%	14%	20%	8%	10%	17%	15%	12%	11%	0%
Numerical and Material Recording Clerks	23%	21%	26%	4%	16%	15%	0%	13%	14%	7%	16%	10%	10%	19%	24%	10%	33%	25%	20%	21%	8%	7%	21%	13%	15%	15%	0%
Other Clerical Support Workers	2%	22%	15%	0%	18%	0%	0%	21%	0%	11%	18%	0%	0%	0%	0%	17%	29%	21%	9%	5%	0%	14%	0%	12%	0%	0%	0%
5. Service and sales workers																											
Personal Services Workers	4%	9%	10%	0%	8%	0%	0%	12%	6%	12%	7%	4%	9%	11%	17%	0%	19%	14%	11%	7%	0%	5%	5%	12%	6%	7%	0%
Sales Workers	-2%	0%	8%	-4%	7%	-7%	0%	12%	0%	6%	0%	0%	0%	0%	10%	0%	16%	18%	8%	6%	0%	9%	6%	4%	0%	6%	0%
Personal Care Workers	10%	13%	21%	5%	14%	0%	0%	18%	0%	16%	19%	0%	0%	0%	8%	13%	29%	22%	21%	17%	3%	3%	-20%	14%	0%	14%	10%
Protective Services Workers	38%	-17%	0%	16%	20%	0%	0%	0%	18%	22%	0%	21%	0%	0%	0%	0%	10%	16%	21%	0%	-15%	-7%	-14%	12%	0%	18%	9%
6. Skilled agricultural, forestry and fishery workers																											
Market-oriented Skilled Agricultural Workers	n.a.	0%	0%	2%	18%	0%	0%	n.a.	7%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	n.a.	0%	0%	0%	0%	-12%	0%	0%
Market-oriented Skilled Forestry, Fishery and Hunting Workers	n.a.	0%	0%	0%	20%	0%	-17%	n.a.	15%	0%	0%	25%	n.a.	0%	n.a.	0%	0%	n.a.	0%	n.a.	0%	0%	-8%	0%	0%	0%	0%
Subsistence Farmers, Fishers, Hunters and Gatherers	n.a.	n.a.	17%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
7. Craft and related trades workers																											
Building and Related Trades Workers (excluding Electricians)	8%	24%	10%	11%	17%	11%	0%	17%	8%	5%	0%	7%	20%	16%	14%	11%	14%	12%	15%	14%	5%	5%	8%	6%	11%	12%	7%
Metal, Machinery and Related Trades Workers	14%	28%	18%	10%	19%	19%	0%	22%	17%	11%	13%	5%	26%	20%	24%	13%	26%	26%	16%	16%	15%	16%	20%	13%	19%	7%	0%
Handicraft and Printing Workers	8%	15%	9%	8%	12%	9%	0%	14%	3%	0%	6%	0%	0%	20%	13%	0%	16%	28%	13%	18%	8%	0%	13%	13%	9%	0%	0%
Electrical and Electronic Trades Workers	17%	22%	21%	14%	21%	20%	16%	22%	12%	12%	16%	6%	20%	21%	29%	13%	27%	22%	13%	19%	15%	18%	16%	16%	16%	13%	10%
Food Processing, Woodworking, Garment and Other Craft and Related Trades Workers	8%	7%	4%	2%	5%	0%	-15%	10%	0%	7%	-7%	-5%	0%	0%	13%	8%	14%	0%	9%	0%	-5%	0%	6%	0%	0%	7%	0%

	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE
8. Plant and machine operators and assemblers																											
Stationary Plant and Machine Operators	11%	12%	12%	6%	8%	6%	0%	0%	11%	4%	9%	6%	0%	0%	26%	0%	21%	12%	17%	9%	9%	0%	12%	11%	14%	12%	8%
Assemblers	14%	18%	12%	0%	15%	0%	0%	16%	13%	12%	0%	0%	21%	0%	19%	6%	11%	16%	6%	10%	5%	11%	8%	0%	8%	0%	0%
Drivers and Mobile Plant Operators	8%	15%	11%	0%	6%	0%	0%	14%	10%	7%	8%	8%	16%	17%	14%	0%	17%	13%	9%	3%	4%	0%	7%	6%	10%	8%	0%
9. Elementary occupations																											
Cleaners and Helpers	-5%	3%	-10%	-7%	-2%	-19%	0%	9%	0%	3%	-9%	-10%	0%	-13%	-8%	-14%	2%	0%	0%	-11%	-6%	0%	-6%	0%	-10%	-6%	-10%
Agricultural, Forestry and Fishery Labourers	n.a.	0%	0%	-8%	5%	0%	0%	0%	0%	0%	0%	-8%	8%	-11%	0%	0%	-16%	22%	-7%	0%	0%	-10%	-6%	0%	0%	-13%	-13%
Labourers in Mining, Construction, Manufacturing and Transport	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Food Preparation Assistants	-4%	0%	0%	-8%	0%	-16%	0%	0%	0%	0%	0%	0%	-8%	-9%	0%	-9%	7%	0%	0%	-6%	0%	0%	0%	0%	-11%	-8%	-6%
Street and Related Sales and Services Workers	n.a.	0%	0%	-10%	-9%	26%	n.a.	21%	-20%	n.a.	-16%	-13%	32%	29%	n.a.	-8%	17%	0%	68%	n.a.	0%	0%	0%	0%	0%	0%	n.a.
Refuse Workers and Other Elementary Workers	5%	0%	-6%	0%	4%	-18%	0%	0%	0%	-11%	0%	0%	0%	-16%	-6%	-13%	-15%	0%	0%	-8%	-5%	0%	-7%	0%	-4%	-11%	-11%

Source: Eurostat, Structure or Earnings Survey 2018

Table A3: Impact of the location of the employer (NUTS I region) on the expected wages

(The reference region is indicated in red fonts)

NUTS1	Name of the NUTS1 Region	Coefficient
BE1	Région de Bruxelles-Capitale/Brussels Hoofdstedelijk Gewest	0%
BE2	Vlaams Gewest	0%
BE3	Région wallonne	0%
BG3	Severna i Yugoiztochna Bulgaria	-5%
BG4	Yugozapadna i Yuzhna tsentralna Bulgaria	0%
CZ0	Česko	0%
DK0	Danmark	0%
DE1	Baden-Württemberg	10%
DE2	Bayern	8%
DE3	Berlin	0%
DE4	Brandenburg	-8%
DE5	Bremen	8%
DE6	Hamburg	11%
DE7	Hessen	8%
DE8	Mecklenburg-Vorpommern	-11%
DE9	Niedersachsen	4%
DEA	Nordrhein-Westfalen	5%
DEB	Rheinland-Pfalz	5%
DEC	Saarland	4%
DED	Sachsen	-13%
DEE	Sachsen-Anhalt	-9%
DEF	Schleswig-Holstein	4%
DEG	Thüringen	-11%
EE0	Eesti	0%
IE0	Ireland	0%
EL3	Attiki	0%
EL4	Nisia Aigaiou, Kriti	0%
EL5	Voreia Ellada	-6%
EL6	Kentriki Ellada	-5%
ES1	Noroeste	-6%
ES2	Noreste	6%
ES3	Comunidad de Madrid	0%
ES4	Centro (ES)	-7%
ES5	Este	3%
ES6	Sur	-4%
ES7	Canarias	-7%

Source: Eurostat, Structure or Earnings Survey 2018

FR1	Ile-de-France	0%
FRB	Centre - Val de Loire	-9%
FRC	Bourgogne-Franche-Comté	-9%
FRD	Normandie	-8%
FRE	Hauts-de-France	-9%
FRF	Grand Est	-9%
FRG	Pays de la Loire	-9%
FRH	Bretagne	-10%
FRI	Nouvelle-Aquitaine	-10%
FRJ	Occitanie	-9%
FRK	Auvergne-Rhône-Alpes	-8%
FRL	Provence-Alpes-Côte d'Azur	-6%
FRM	Corse	0%
FRY	RUP FR - Régions Ultrapériphériques Françaises	3%
HR0	Hrvatska	0%
ITC	Nord-Ovest	5%
ITF	Sud	-2%
ITG	Isole	0%
ITH	Nord-Est	3%
ITI	Centro (IT)	0%
CY0	Kypros	0%
LV0	Latvija	0%
LT0	Lietuva	0%
LU0	Luxembourg	0%
HU1	Közép-Magyarország	0%
HU2	Dunántúl	-7%
HU3	Alföld és Észak	-10%
MT0	Malta	0%
NL1	Noord-Nederland	-6%
NL2	Oost-Nederland	-4%
NL3	West-Nederland	0%
NL4	Zuid-Nederland	-3%
AT1	Ostösterreich	0%
AT2	Südösterreich	-2%
AT3	Westösterreich	3%
PL2	Makroregion południowy	-8%
PL4	Makroregion północno-zachodni	-7%
PL5	Makroregion południowo-zachodni	-6%
PL6	Makroregion północny	-9%
PL7	Makroregion centralny	-12%
PL8	Makroregion wschodni	-16%
PL9	Makroregion województwo mazowieckie	0%
PT1	Continente	0%
PT2	Região Autónoma dos Açores	0%
PT3	Região Autónoma da Madeira	0%
RO1	Macroregiunea Unu	-5%
RO2	Macroregiunea Doi	-10%
RO3	Macroregiunea Trei	0%
RO4	Macroregiunea Patru	-7%
SI0	Slovenija	0%
SK0	Slovensko	0%
FI1	Manner-Suomi	0%
FI2	Åland	0%
SE1	Östra Sverige	0%
SE2	Södra Sverige	-2%
SE3	Norra Sverige	-4%

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Wages determinants
in the European Union

UPDATED RESULTS FROM STRUCTURE OF
EARNINGS SURVEY (SES 2018) DATA

This publication analyses the impact of the different characteristics of the employee (age, occupation, etc.) and of its employer (industry, size, region) on wages, throughout the European Union.

The study is based on regression techniques applied on microdata taken from the Structure of Earnings Survey 2018, which gathers harmonized information from about 500 000 enterprises and almost 11 million employees working across the 27 Member States.

Regression coefficients provide information on how the different labour markets reward the different characteristics of the job tenant and how the different types of businesses compete in terms of wages offered to their employees.

By crossing job characteristics with sex, this analysis also sheds light on possible gaps between the financial returns on education, part-time work etc. offered to men versus women

For more information
https://ec.europa.eu/eurostat/

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