EXPLORING EARNINGS DIFFERENCES HIDDEN BEHIND THE GENDER PAY GAP[1]

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1. Foreword

Gender equality is one of the fundamental values of the European Union (Article 3(2) of the EC Treaty). Anyway, it is not jet a reality in the labour market. Regarding wages and salary in particular, the gap between women and men continues to exist and there is little evidence of improvement in some countries and in some areas. Reducing possible discrimination in earnings between men and women remains one of the major objectives within the overarching goal of achieving gender equality according to the Sustainable Development Goals of the UN 2030 Agenda, and of the European Pillar of Social Rights.

A large literature (economic, sociological and psychological theories) is available aiming to explain the persistence and the determinants of the salary differences between men and women. Several theories claim that differential gender roles unconsciously adopted early in life influence much of what happens in personal relationships, family life and employment (Ochsenfeld, 2014). Following different paths in education and employment is expected lead to overall differences in pay. Some studies consider the growth in women's education a major driver of the decline in the gender pay gap (Goldin, 2002), while Olsen *et al*. (2010) show that education explains little of the gap, and its impact is also declining.

In this framework, the necessity to investigate the multiple content of that measure of gender inequalities is a growing need. One of the key indicators used to monitor imbalances in earnings between women and men is the structural indicator Gender Pay Gap (GPG), but the GPG is not exactly a measure of the incidence of discrimination in the labour market. Furthermore, it is defined 'unadjusted' since it is sensitive to composition effects (sector of economic activity, size of company, occupation, level of education, age of the employee, seniority in the company, etc.). For this reason, the main institutions (e.g., Eurostat, International Labour Office)

[1] The article is the result of the joint work of the authors. §1, 2, 6 are attributed to Marilena Ciarallo, §3 and 4 are attributed to Paola Conigliaro and §5 to Francesca Ceccato.

conducted experiments in order to develop a methodology to calculate an indicator more suitable for measuring pay differentials by controlling the composition effects.

This report presents the main characteristics of gender pay differentials in Italy in 2018, measured using the unadjusted GPG and an application of the decomposition approach (i.e., Oaxaca decomposition), used in Eurostat experiments.

2. The GPG and its main data source: the structure of earnings survey

The unadjusted GPG used in EU area to monitor possible discrimination in earnings between men and women, expressed as a percentage, is defined as follows:

$$\frac{\textit{Mean (gross) hourly earnings of men - Mean (gross) hourly earnings of women}}{\textit{Mean (gross) hourly earnings of men}} \quad (1)$$

According to Eurostat Methodology, all European Countries use the Structure of Earnings Survey (SES)[2] micro data, at employee level, to calculate the indicator. The SES allows to produce comparable information on relationships between the level of remuneration, individual characteristics of employees (sex, age, occupation, length of service, highest educational level attained, etc.) and of their employer (economic activity and geographic location of the local unit; size of the enterprise).

As the SES results are available only every four years (the last is 2018 edition), the EU countries update the indicator every year, using annual information from other sources. In the case of Italy, up to 2016 data from EU-SILC survey and since 2017 data from the Italian Labour Register based on administrative data were used. According to GPG methodology, the annual GPG estimates have to be aligned with the (*4*-yearly) SES. For this reason, estimates related to years backwards the year *t+4* have been updated distributing equally over the period the differences between the initial GPG for the year *t+4* calculated using national annual data and the SES data benchmark for the year *t+4*.

$$GPG_t \textit{ updated} = GPG_{t\,annual} + 1/4 * (GPG_{t+4\,SES} - GPG_{t+4annual}) \quad (2)$$

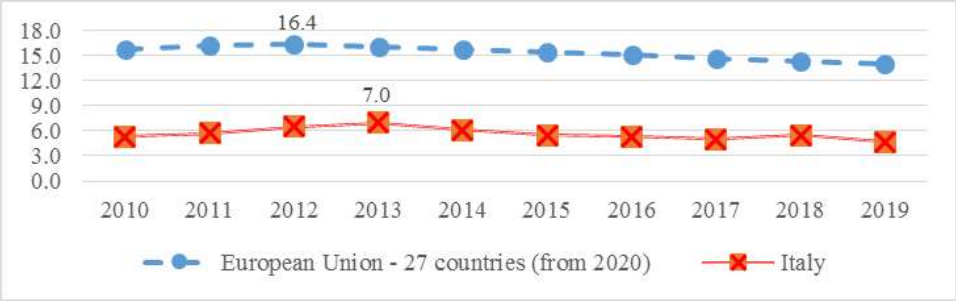
Figure 1 displays the GPG values in Italy and at EU 27 level since 2010. The Italian GPG is one of the lowest in EU: in 2018, it is 5.5%[3] and provisional data for

[2] The Structure of earnings survey is conducted every four years in the Member States and it is based on the Council Regulation (EC) No 530/1999 concerning structural statistics on earnings and on labour costs. All the enterprises and institutions belonging to Private and Public sectors with at least 10 employees compose the target population. The employees covered are those who received remuneration for the reference month (October 2018).

[3] In EU comparison, values do not consider Nace Section O (Public administration, Defence, Compulsory social security) as it is not mandatory. In the following analyses, Section O is included. In that case, the Italian GPG is 6.2% in 2018.

2019 show a further decrease. The indicator has always been many points below the EU average value (15.3% in 2018) and, as for almost all EU countries, it smoothly decreases every year. The next paragraphs deal with a closer analysis of the complexity of the indicator and of its possible interpretations.

Figure 1 – *Gender pay gap in unadjusted form EU 27 – Italy (2010-2019).*



Data source: Eurostat- Dataset Gender pay gap in unadjusted form. At 24/02/2021 update, data for 2016, 2017 and 2019 are provisional

3. What the GPG indicates and what it does not. The need of adjusting or integrating the indicator.

As defined, the GPG does not consider the earnings of employed in micro-enterprises, self-employed, professionals and agricultural workers and all workers in undeclared and informal employment relationships. Furthermore, even within the observation domain, the indicator presents some information gaps, recognized and described in much of the literature.

The ILO (2018) aiming to better understand what lies behind the GPG figure, examines a set of 80 countries very different in term of labour legislation, level of collective bargain, and methods to collect data. Most of the countries register a positive GPG (20 points on average). Considering the median, many countries manifest a wider gap. This should indicate that men record higher frequencies in the high tail of earnings distribution, while women in the low tail. As concerning the distribution of average yearly earnings, the gap widens in most of countries. The report identifies many factors of inequality hidden in the GPG measure and proposes two complementary measures to better approximate the assessment of unequal pay for equal work. The first is the factor-weighted GPG, the second is the decomposition of GPG into an "explained" and an "unexplained" part. To calculate the factor-weighted GPG the authors have: selected a set of factors that they believe affect the earning structure (e.g. education, age, working hours, private or public

sector employment); clustered women and men into subgroups defined by these main factors; estimated the GPG for each subgroup; multiplied the GPG of each subgroup by the weight of the subgroup with respect to the employee population. As concerning the decomposition procedure carried out in ILO's report, it is very near to that applied by Eurostat to calculate the "*adjusted*" GPG, described in detail in Section 5.

4. Descriptive analysis on composition effects on Italian GPG [4]

There is a broad consensus among scholars that low GPG can result even under conditions that do not support equity in earnings. For example, in Italy the higher hourly remuneration of teachers in public schools lowers the national GPG, but this information hides the fact that monthly wages of teachers are quite low, because of the low number of contractual hours. Teaching in schools is a low-paying profession, although the workers' educational level is higher than in other sectors. It is then no so attractive. The sector is highly feminized (76.8%), and despite this, the number of male employees in management positions is 1.4 times the number of females in that role. It follows that even in this sector the GPG is positive (7.9%), and assume a negative value (-8.4%) just for employees with a secondary qualification.

One of the characteristics that influences the GPG value is the form of economic and financial control of the enterprises. Data show that this factor has effect on GPG in many EU countries (Eurostat 2021). In Italy, in 2018, the GPG in the private control sector was 17.7%, while it dropped to 2% in the public sector. The GPG varies also according to the NACE section (sector of economic activity). Scholars attribute this to the "horizontal segregation", as women "choose" (i.e. have more job opportunities in) those sectors where workers receive lower wages. Another factor that affects earnings is the educational level of employees. Employees with lower educational attainment have a greater probability to work for a lower remuneration (12.1 euros on average), but women earn less than man at any educational level. However, GPG is lower among employees with a secondary educational level (10.4%) and higher for employees with basic (15%) and tertiary (18%) educational attainment. A further factor influencing both wages and GPG is age. Young employees earn 11.1 euros per hour on average, those between 30 and 49 years old 15 euros and the older ones 18.2 euros. The GPG raises with the increasing age, but the average wages of men and women do not present the same growth curves in

[4] This session presents some descriptive analyses on Italian data from the SES 2018. Figures and percentages are the results of calculations applied directly to the SES 2018 micro data. For further data and methodological information see ISTAT (2021).

relation to the age class. Hourly earnings for women increase particularly in the transition from 20-24 to 25-29 years of length of service in the enterprise (+14.2%), while the greatest improvement observed for males occurs between the first two classes (0-4 and 5-9 years) of seniority (+22.4%). The number of men in management or supervisory positions significantly exceeds the number of women, both in absolute terms (2.4 times) and in relation to the gender composition of employees (1.9 times). Furthermore, the GPG is 11.9% between employees covering those positions.[5] These differences in career paths and opportunities determine the so called "vertical occupational segregation".

Table 1 presents the results of a focus on the 45-54 age group of employees and the main NACE sections[6], splitting data according to educational attainment, sex, and section.

Table 1 – *Employees in age class 45-54, by section, educational attainment and sex; supervisory positions, average earnings and gender differences in earnings.*

Section		Educational attainment	Employees (% on total 45-54) *(a)*		Supervisory positions (% on the corresponding group) *(b)*		Average hourly earnings	GPG	Mean annual earnings ratio *(c)*
			F	M	F	M			
C	Manufacturing	Basic	2.59	7.67	2.29	6.26	12.89	17.74	1.38
		Secondary	2.75	7.57	8.87	16.49	16.10	16.72	1.30
		Tertiary	0.70	1.72	35.83	48.84	26.89	25.93	1.47
G	Wholesale and retail trade; Repair of motor vehicles and motorcycle	Basic	1.34	2.35	3.01	7.19	12.13	11.93	1.41
		Secondary	2.39	2.46	7.68	18.48	14.90	24.95	1.60
		Tertiary	0.46	0.58	25.55	41.78	24.71	35.20	1.63
N	Administrative and support service activities	Basic	1.90	1.78	1.97	1.82	9.49	10.41	1.71
		Secondary	1.31	1.30	4.77	6.85	11.56	15.16	1.44
		Tertiary	0.31	0.28	11.70	20.55	17.06	20.55	1.30
O	Public administration and Defence; Compulsory social security	Basic	0.42	2.15	0.00	0.62	16.44	26.73	1.62
		Secondary	2.33	4.50	0.10	2.27	16.97	19.84	1.42
		Tertiary	1.87	1.93	6.95	17.35	21.95	19.85	1.34
P	Education	Basic	0.66	0.25	0.36	0.78	12.33	-0.41	1.05
		Secondary	3.68	0.69	0.26	0.92	17.46	-10.46	0.98
		Tertiary	5.14	1.56	4.78	20.09	24.38	6.01	1.17
Q	Human health and social work activities	Basic	1.57	0.53	2.08	2.64	11.73	8.22	1.18
		Secondary	3.70	1.00	2.57	4.01	14.65	4.90	1.12
		Tertiary	2.71	1.20	19.89	35.36	20.35	18.88	1.30

Notes: Columns (a) percentage of employees of the cell on total employees of 45-54 age class;
Columns (b) percentage of employees in supervisory position on total employees of the correspondent cell;
Column (c) ratio between the average annual earnings for men and women

[5] Employees indicated to hold a management/supervisory positions in the enterprise. It does not necessarily correspond to employees with a managerial occupation.
[6] Chosen sections represent 75.4% of employees in 45-54 age group.

Figures show that for the same educational level and sector of activity, women generally earn a lower hourly wage than men. In addition, they are less likely to hold positions of responsibility, with evident disparity effects on both hourly and annual wages. Earnings gap is in favour of women only in the education sector. However, even there, the situation reverses if we consider employees with a tertiary educational level.
Furthermore, in this subgroup, the presence of management/supervisory personnel among men is considerably higher than among women. Although women account for 3/4 of the employees, male managers are even more numerous than female ones (1.3 times). These are some examples of the information enhancement resulting from a multidimensional data description. They confirm the need for tools capable of highlighting the share of inequality "hidden" beyond the GPG.

5. Hourly wages for personal and job characteristics and Gender Gaps

As before declared, the unadjusted GPG is rather a complex indicator. Eurostat proposed an experimental method[7] to adjust the GPG indicator based on the Oaxaca decomposition[8] and to estimate the unexplained (adjusted) GPG with the Structure of Earnings Survey (SES) as the data source, aimed to better compare the indicators among the European labour markets (Leythienne *et al.*, 2018). This paragraph presents the Oaxaca decomposition that consists of two stages - a regression analysis and a decomposition analysis - based on the SES data on 2018.

5.1. The variables that affect the mean hourly wages

The ordinary linear regression analysis is carried out separately for the earnings structure of men and the earnings structure of women.
In formula, the implementation:

$$\overline{\ln y}^M = \hat{\beta}_0^M + \sum_{k=1}^K \bar{x}_k^M \hat{\beta}_k^M \quad (3)$$

$$\overline{\ln y}^W = \hat{\beta}_0^W + \sum_{k=1}^K \bar{x}_k^W \hat{\beta}_k^W \quad (4)$$

[7] The method and results were discussed with Working Group on Labour Market Statistics (LAMAS) in October 2017 that includes delegates from national statistical institutes in EU Member States and EFTA countries.
[8] Also Called Blinder-Oaxaca decomposition (Oaxaca, 1973).

where: $\overline{\ln y}$ represents the natural log of mean of hourly earnings of men (M) and women (W); $\bar{x}_k$, from k=1 to k=K, are the means of the variables covering the observed personal, job and enterprise characteristics for men (M) and women (W); $\hat{\beta}_0$ is a costant and $\hat{\beta}_k$, from k=1 to k=K, are the parameters for the corresponding variables covering the observed characteristics for men (M) and women (W). The regression equations provide insights into the male and female earnings structures by showing the relationship between log hourly earnings and observed characteristics (personal, job and enterprise characteristics) for men and women, separately[9]. For the categorical characteristics, all categories without one (omitted category) are expressed as dummy variables. The results of the analysis should be interpreted as differentials with respect to the missing dummy. In the case analysed, the set of missing dummies that constitutes the basic profile is made up of man with primary education, clerical support worker, hired with permanent and full-time job-arrangement, working in an enterprise under private control, belonging to the class 10-49 employees and operating in manufacturing activities. Table 2 shows the results in terms of regression coefficients and percentage differences in earnings due to a unit variation of each variable, calculated as $(exp(\beta) - 1) * 100$. The performance of work experience, represented by age and job experience in the current enterprise, on remuneration is positive for men and women but while it is similar for job experience (1% for men and 0.9% for women for each year), it is very different for age (1.1% for men and 0.2% for women). As expected, looking at personal and job characteristics, higher education level than primary school leads to higher hourly wages. Among occupations, the return on earnings compared to clerical support workers is almost always worse for women (except Professionals), although it is very positive for Managers, Professionals, Armed forces and Technicians and Associate Professionals. Percentage differences in earnings are of opposite sign for Services and sales workers (-4.1% for women and +3.5% for men). The part-time working arrangements has a relevant impact on wages, reducing it by 11% among men and by 6.1% among women. The dummies associated to employment contract not permanent (fixed-term and seasonal, apprenticeship) are significantly different from zero and exhibit expected effects but in this case they are worse for men. Looking at the enterprise characteristics, the percentage effect on earnings, compared to manufacturing activities, is discriminatory for women in the enterprises of each economic sectors with few exceptions (Wholesale and retail trade-repair of motor vehicles and motorcycles, Accommodation and food service activities, and Information and communication). In particular, higher wages by 26.9% are paid to men in Financial and insurance activities, while earnings' reduction of 20.5% is observed among female employees working in Public Administration, Defence,

[9] It is a result of adjusting and expanding the standard Mincer (1974) earnings equation.

Compulsory social security. The women disadvantage in Public Administration, Defence, Compulsory social security is balanced by the determinant of Public enterprise control that leads to wages greater by 18.4% among women, comparing to 3.8 among men. Higher salaries are paid to employees who work in enterprises belonging to size classes greater than 49 employees. Even in this case, however, female workers earn less money than male colleagues.

Table 2 – *Estimate of the variables affecting the hourly earnings in Industry and Services for gender – 2018 (% effect of a unit variation of the independent variable)*[10].

INDEPENDENT VARIABLE	Men	Women	Total
PERSONAL AND JOB CHARACTERISTICS (%)			
Female			-9.9
Age (year)	1.1	0.2	0.9
Age squared	0.0	0.0	0.0
Job experience in the current enterprise (year)	1.0	0.9	1.0
Job experience squared	0.0	0.0	0.0
EDUCATION *(b)*			
Secondary education (G2)	6.4	6.2	6.5
Bachelor's degree (G3)	10.6	11.1	11.5
Beyond Bachelor's degree (G4)	29.5	25.3	27.4
OCCUPATION (ISCO-08) *(b)*			
Armed Forces (0)	34.9	24.2	33.5
Managers (1)	145.9	101.9	132.7
Professionals (2)	48.9	49.2	49.3
Technicians and Associate Professionals (3)	20.8	13.0	17.7
Services and Sales Worker (5)	3.5	-4.1	0.3 *(a)*
Skilled Agricultural, Forestry and Fishery Worker (6)	-8.4	0.2 *(a)*	-6.3
Craft and Related Trades Worker (7)	-1.6	-10.7	-4.5
Plant and Machine Operators and Assemblers (8)	0.5 *(a)*	-5.9	-1.5
Elementary Occupations (9)	-10.1	-14.1	-11.9
Part-time (c)	-11.0	-6.1	-8.3
EMPLOYMENT CONTRACT *(b)*			
Fixed-term and seasonal (B)	-4.0	-3.8	-3.8
Apprentice (C)	-16.5	-15.3	-16.2
ENTERPRISE CHARACTERISTICS (%)			
ECONOMIC ACTIVITY (NACE REV2 SECTION) *(b)*			
Mining and quarrying (B)	14.6	9.0	12.1
Electricity, gas, steam and air conditioning supply (D)	9.3	-1.1 *(a)*	5.2
Water supply; sewerage, waste management and remediation activities (E)	-4.9	-7.0	-6.3
Construction (F)	1.2	-1.3 *(a)*	1.5
Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	-6.6	-2.6	-5.0
Transportation and storage (H)	-5.7	-14.2	-8.2
Accommodation and food service activities (I)	-10.3	-8.6	-9.9
Information and communication (J)	-8.1	-6.1	-7.4
Financial and insurance activities (K)	26.9	26.4	26.5
Real estate activities (L)	-8.8	-11.1	-9.8
Professional, scientific and technical activities (M)	-2.0	-5.0	-3.3

[10] The regression R-squared is 0.536 for men, 0.626 for women and 0.569 for total. The coefficients of the regression are available on request.

***Table 2** - continued*

Administrative and support service activities (N)	-13.7	-11.5	-12.9
Public administration, Defence, Compulsory social security (O)	-9.0	-20.5	-14.2
Education (P)	-3.4	-11.6	-6.4
Human health and social work activities (Q)	-9.6	-13.7	-12.0
Arts, entertainment and recreation (R)	3.7	-15.7	-5.2
Other service activities (S)	-15.2	-15.1	-15.3
Public enterprise control *(b)*	3.8	18.4	10.1
ENTERPRISE SIZE *(b)*			
1000-high employee	13.4	9.4	11.7
250-499 employee	9.5	6.2	8.2
500-999 employee	11.7	7.0	9.9
50-249 employee	6.4	4.6	5.9
ABSOLUTE OBSERVATION NUMBER	117,493	131,290	248,783

Notes: (a) Calculated on coefficient not statistically significant. (b) For the categorical characteristics, all categories without one (omitted category) are expressed as dummy variables.

5.2. GPG and its decomposition

After fitting separate regression models for men and women, a decomposition analysis of the difference between the means of log hourly earnings of men and women is carried out: $\Delta = \overline{\ln y}^{M} - \overline{\ln y}^{W}$. Within the decomposition approach, it must be decided which earnings structure constitutes the nondiscriminatory benchmark against which to decompose the difference (Bazen, 2011). For this analysis, it has been chosen the male one in accordance with the definition of unadjusted GPG[11]. As the estimated constant and coefficients in the men's equation are treated as the non-discriminatory benchmarks for the financial returns to characteristics of employees, a counterfactual equation is constructed where the constant and coefficients in the women's equation are replaced by those of the men's equation ($\overline{\ln y}^{W*}$). This equation can be interpreted as what the average female worker would have earned if she had been paid on the same basis as an equivalent male worker. The difference between the means of log hourly earnings of men and women can then be decomposed into two shares as follows:

$$\Delta = \left(\overline{\ln y}^{M} - \overline{\ln y}^{W*}\right) + \left(\overline{\ln y}^{W*} - \overline{\ln y}^{W}\right) \quad (5)$$

The first parenthesis represents the composition effects (explained GPG) caused by different average characteristics by gender, and the second (unexplained GPG) measures the difference between what a female worker with average characteristics

[11] The following other options are possible: - the female earnings structure constituting a non-discriminatory benchmark (Oaxaca 1973); - both the female and male earnings structures constituting non-discriminatory benchmarks with some weighted average applied (Cotton, 1988); - the whole population earnings structure constituting a non-discriminatory benchmark (Neumark, 1988).

would have earned if she had been treated in the same way as a typical male worker and what she actually earns (Bazen, 2011).

After a few steps, the final decomposition equation for the difference between the means of log hourly earnings of men (M) and women (W) can be written as follows:

$$\Delta = \left(\hat{\beta}_0^M - \hat{\beta}_0^W\right) + \sum_{K=1}^{k} \bar{x}_k^W \left(\hat{\beta}_k^M - \hat{\beta}_k^W\right) + \sum_{K=1}^{k} \hat{\beta}_k^M \left(\bar{x}_k^M - \bar{x}_k^W\right) \quad (6)$$

The first two component on the right side of the equation represent the Unexplained part of the difference (U), and the latter represents the Explained part (E). An interpretation of the part U as discrimination is not recommended as some other explanatory factors that were not observed in the data could change the results.

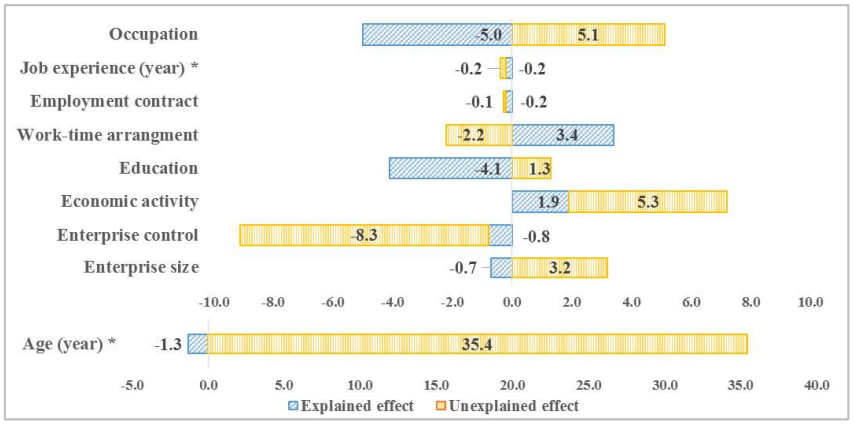
Finally, the explained and unexplained GPGs can be calculated by applying the decomposition results to the unadjusted GPG as follows:

$$GPG_{expl} = GPG_{unadj} * \frac{E}{\Delta}, \quad (7)$$

$$GPG_{unexpl} = GPG_{unadj} * \frac{U}{\Delta} \quad (8)$$

The percentages of the overall explained part and unexplained part of the difference (ln scale) are multiplied to the unadjusted GPG, using a proportional scaling, to derive the values of the two components. The values attributable to the job's characteristics are calculated as part of the total. A negative gap means that women are expected to earn more than men as possessing on average higher levels of a given characteristic than men. On the contrary, the positive signs indicate the factors that contribute to increasing inequality in favour of men. The results of the decomposition return a negative value for the explained GPG (-7%) and a positive value for unexplained (adjusted) GPG (+13.2%) given the unadjusted GPG equal to 6.2%. Figure 2 presents the results of the explained GPG for each characteristic.

Figure 2 – *Decomposition of the unadjusted GPG (in % of male hourly earnings), 2018.*



* *included the variable and the variable squared.*

The overall explained GPG is mostly driven by three characteristics: occupation, education and age. The remuneration effect of the age on total unexplained GPG is prevalent (+35.4 percentage points) as consequence of the differences of observed age return shown in Table 2. The economic activities and the occupation follow (+5.3 and +5.1 percentage points).

6. Conclusions

The aim of this report was to investigate the unadjusted gender pay gap, an indicator with a simple definition but a very complex interpretation. As shown in the first part of the paper, the unadjusted GPG is extremely sensitive to composition effects arising from the different characteristics of the male and female workers, of the jobs and of the enterprise. In Italy the indicator is influenced by the value in the public economic and financial control sector while is more in line with the EU mean in the private one. On the wave of the international discussion about the opportunity to find an indicator suitable to monitor imbalances in earnings between women and men, the paper applies an experimental method, proposed by Eurostat, estimating the part of the earnings gap explained by differences in the average characteristics of male and female and the 'unexplained GPG' that come from different financial returns for the same characteristics. In Italy, results show that the explained GPG is negative, this turns into the unexplained (adjusted) GPG being higher than the unadjusted GPG. However, it is necessary to be cautions also in the interpretation of this results: it is not possible to conclude that the unexplained part measures earnings discrimination, nor that the part explained is exempt from it. Furthermore, these results are strictly related to the variables considered in the regression analysis and every change in that choice may substantially change the results. More in general characteristics included in the model are those available from SES. The discussion around the indicator is still ongoing at EU level and the necessity to find indicators able to grasp the core of the information demand to support public policies, persists.

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SUMMARY

Exploring earnings differences hidden behind the Gender Pay Gap

This paper deals with the issues underlying the measurement of hourly wage differentials between men and women. It introduces the GPG indicator, currently disseminated by Eurostat, on whose remodelling an international debate is underway aimed at improving its measurement. Furthermore, to understand what the GPG hides, it proposes an application on the Italian SES 2018 data of the Eurostat methodology based on the Oaxaca decomposition to adjust the indicator and evaluate how much of the differential is explained by the different discrimination factors.

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