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The Case of an Italian University

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Abstract

Despite persistent progress in gender equality, the gender wage gap remains a salient feature of academic labour markets. While existing indicators for Research Performing Organizations routinely capture horizontal and vertical gender segregation, they rarely address gender pay gaps and their decomposition into differences in characteristics and returns, largely due to data and methodological constraints. To fill this gap, this work aims to verify the existence and size of the gender pay gap in the academic context and to measure its components. To this end, administrative personal and earnings data in 2019 and in 2023 of a large public university in Northern Italy were analysed by means of OLS regression and Oaxaca-Blinder (1973) wage decomposition analyses. As a result, the gender wage gap was found to have decreased over the course of four years, from 14.5% in 2019 to 12.8% in 2023. However, investigating the differential decomposition, one can observe a sharp change in the weight of the different components contributing to it, as while in 2019 the endowments (i.e., the explained component of the decomposition) accounted for 83%—with the academic rank and having additional emoluments being relevant in explaining the gap—and the unexplained component (reflecting the difference in the returns to characteristics between the male and female individuals) accounted for the remaining 17% of the differential, in 2023 the unexplained part of the differential increased to 45% while the explained one dropped to 55%, with a larger weight in the unexplained part to be found in increased inequalities within medical departments.

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Introduction

Among the many economic and societal advances of recent decades, the substantial bridging—and eventually its reversal—of the gender gap in education is one of the most prominent. Indeed, over the years women have progressed from being outnumbered to overtaking men in educational attainment. According to OECD (2024), girls and women generally tend to get higher scores on standardised assessments and are 28% less likely to repeat a grade at primary and lower secondary level. At upper secondary and tertiary level, they are more likely to successfully complete their degree programmes with gender gaps to their advantage often exceeding 10 percentage points. Female students (54% of young women) are also more likely to enter tertiary education than male students (41% of young men), and the proportion of women aged 25-34 with a tertiary qualification is substantially higher across the OECD. In 2023, there were 1.4 female graduates for every male graduate at bachelor's and master's level (OECD, 2023). Despite the improvements made, gender inequalities persist across the fields of education, as women are strongly under-represented in STEM fields while men are under-represented in fields such as education or health and welfare: on average, only 15% of women who enroll in university choose a STEM field, compared to 41% of men (OECD, 2024), while only 4% of male new entrants are enrolled in the field of education.

As far as Italy is concerned, a country which performs below the European average in terms of overall gender equality, women make up more than half of all university graduates, accounting for 60.0% of the total in 2023, a share that has been stable over the last ten years (Almalaurea, 2024a). Interestingly, women also come more frequently from less favoured family backgrounds, a fact that can lead to the assumption that the improvement in educational levels within the family is mainly attributable to women (Almalaurea, 2022). Nevertheless, gender differences within the chosen field of study still persist, showing gender segregation in humanities subjects (to the disadvantage of male students) and STEM subjects (to the disadvantage of female students). In the bachelor's degree courses, indeed, Italian women represent a clear majority in the education (94.4%), linguistics (85.3%), psychology (81.1%), healthcare (76.0%) and art and design (71.2%) groups. On the contrary, they represent a stark minority in the computer science and ICT (14.0%), industrial and information engineering (27.2%) groups (Almalaurea, 2024a).

Notwithstanding these premises, even graduated women continue to be disadvantaged once they enter the labour market: 84% of women with a tertiary degree are employed at the OECD level, which is 6 percentage points lower than the employment rate of men with similar qualifications. In addition, young women also earn less than young men, with average earnings 15% lower for those without an upper secondary qualification and 17% lower for those with a tertiary qualification (OECD, 2024). In Italy, according to Almalaurea data (2024b), male graduates have better outcomes

in the labour market (15.2% more likely to be employed than women) and, *ceteris paribus*, receive €73 per month more than women one year after graduation.

At the European level, in 2022 women's gross hourly earnings were on average 12.7% below those of men in the EU. Considering the Italian unadjusted pay gap (the difference between average gross hourly earnings of male and female employees as percentage of male gross earnings), it was 4.3% in 2022 according to Eurostat, a much lower result than the European average, but it has to be taken into account the low proportion of women participating in the labour market, so the non-random selection and labour-force selection phenomena (Card, 1999; Heckman et al. 2005), as employed women have, on average, characteristics that lead to higher labour market returns (Olivetti and Petrongolo, 2008; Addabbo and Favaro, 2007).

The Italian data on the population of university graduates in terms of the gender gap are substantially in line with the more general data on the Italian labour market. According to the National Institute of Statistics, ISTAT (2024), the employment rate of the Italian population aged 15-64 years in 2023 reached 61.5%, but it has to be noted a severe gender gap at the disadvantage of women: while the male employment rate is 70.4%, the female employment rate is almost 20 percentage points lower (52.5%). In this regard, comparing Italy with other leading European countries, the Italian labour market still lags far behind in terms of participation: in 2023, the inactivity rate of the population aged 15-64 (33.3%) remained the highest of the average of the EU27 countries (25.0 per cent) with a gap of about 13 percentage points for women. Women (17.7%) are also more employed with fixed-term contracts than male employees (14.8% of total employees aged 15-64 years).

The considerable increase in the number of women who have completed university education can result into an increase in female graduates entering the labour market or an increase in women continuing their education through a Ph.D., and one of the possible careers to be pursued may be academia, which has as a prerequisite a successful completion of degree courses. According to the European Commission (2021), the EU has almost achieved gender parity among Ph.D. graduates, with women accounting for 48.1 per cent of Ph.D. graduates at European level. Gender parity in the Ph.D. graduate pool is crucial to sustaining a gender-balanced research workforce. Despite this progress, however, also in this case important gender gaps still persist in fields of study. At European and national level, women graduates are over-represented in education and under-represented in the fields of information and communication technology (ICT) and engineering, manufacturing and construction. The substantial gender parity at Ph.D. graduate level is variously reflected once embarking on an academic career. Data at European level (European Commission, 2021) show that women account for more than 40% of academic staff overall, but while women account for almost half of grade C and D staff (46.6% of grade C staff and 47.1% of grade D staff) and more than 40

per cent of B grade staff (40.3 per cent), they for only about a quarter of grade A staff positions (26.2%) – equivalent to a full professorship – pointing out the existence of phenomena such as the 'leaky pipeline' (Alper, 1993; Blickenstaff, 2005) the 'glass ceiling' and the 'sticky floor' (Booth et al., 2003; Bjerk, 2008; Christofides et al., 2013; Cohen and Huffman, 2007). The 'glass ceiling' is a metaphorical term used to describe the invisible barriers that prevent women from advancing to the highest levels of professional career, despite the lack of differences in qualifications or skills. In contrast, the 'sticky floor' metaphor describes a scenario where women have fewer opportunities to move up the hierarchical ladder and become entangled in low-paid entry-level positions for a longer time, despite having similar endowments to men (Booth et al., 2003). The metaphor of the leaky pipeline suggests that as women move through the ranks of the academic career path and finally faculty positions, many 'leaks' may occur along the way, causing promising talent to be lost or diverted away from academic careers. The 'leaky pipeline' effectively captures how structural and cultural barriers disproportionately prevent women from advancing in academic careers, ultimately contributing to their under-representation in the highest ranks of academia, especially in traditionally male-dominated fields.

In this introduction, gender inequalities such as occupational segregation or wage differentials can already be noted. In this work, we decided to focus on gender inequalities—and specifically on wage differentials—in a particular labour market: the academic one. The objective of this work is to find out the existence of a gender wage gap within an academic institution and to measure it. In order to do so, we collected and analysed administrative data from a large university located in Northern Italy for 2019, the pre-pandemic year and when its Gender Equality Plan was not drafted yet, and 2023, the most recent year and after the implementation of the Gender Equality Plan actions. To fulfil our purpose, OLS regression and Oaxaca-Blinder (1973) decomposition analyses were performed. This work is structured as it follows: in Section 1 a theorical framing of labour market discrimination and the gender wage gap is proposed, while in Section 2 evidence from the literature about the gender wage gap in the academic wages and in the career advancements is outlined. Section 3 presents descriptive statistics of the dataset and the employed methodology, while in the fourth Section the results from both the regression and the wage decomposition analyses are disclosed. Conclusions and possible further developments follow last.

1. Labour market discrimination and the gender wage gap

Labour market discrimination refers to the differential treatment of individuals based on their gender, sex, race, religion, sexual orientation and other visible attributes, which results in unequal

opportunities, earnings, or status in employment settings. Gender discrimination is typically rooted in social norms, stereotypes and structural inequalities that influence how individuals experience the labour market. This discrimination can manifest in various forms, including wage disparities, unequal access to job opportunities, promotions, or training, and biased recruiting processes. It occurs when individuals of the disadvantaged gender (historically women) receive fewer benefits or face greater disadvantages than their counterparts of the other gender (historically men), despite possessing similar qualifications, experience or skills (Becker, 1971; Arrow, 1973).

The concept of gender discrimination in the labour market is often explored through several theoretical frameworks. Becker (1971) conceptualised the taste discrimination theory distinguishing three possible scenarios of discrimination: taste discrimination perpetrated by the employer, co-workers or customers. Such discrimination may result in a wage differential between men and women.

Furthermore, statistical discrimination models (Phelps, 1972) were introduced, and they assume uncertainty and imperfect information; consequently, differences between groups in the expected productivity or in the reliability with which productivity can be predicted may lead to differential treatment of group members. As a result, firms may pay women lower wages or prevent them career advancements (Lazear and Rosen, 1990). However, the model proposed by Phelps has been debated as well (Aigner and Cain, 1977), by discussing how this model was not as compelling in explaining the persistence of discrimination as the taste discrimination theory.

Human capital theory posits that wage differences between men and women are due to disparities in education, skills, and experience. Becker (1964) argued that women historically tended to have shorter careers or to be more involved in family care, especially because of motherhood, resulting in less investment in human capital. Mincer and Polacheck (1974) argued that the discontinuity in women's labor market participation can help explain a significant portion of the gender wage gap, as human capital is more valuable the longer the period during which the returns on investments can be realized. Men are not expected to have discontinuous labor market participation due to caregiving and family responsibilities, in contrast to women, whose human capital may decrease (Sandell and Shapiro, 1978; Corcoran and Duncan, 1979; Cox, 1984). According to Polacheck (1981) in this perspective women are also likely to choose occupations where investment in human capital is less prominent and where the depreciation of skills that occurs during the time spent outside the labour market is minimal. Nevertheless, it has been debated how this theory neglects the role of gender biases, structural inequalities and social factors that may influence both human capital investments and the returns on those investments. In this regard, even when women and men invest similarly in education and training, the former may still face wage disparities due to discrimination or societal expectations regarding gender roles in the workplace (Blau and Kahn,

2017). Goldin (2014) argues that the wage penalties related to temporal flexibility are best understood through personnel economics, rather than human capital theory, and attributes the gender wage gap to differences in the valuation of long hours and temporal flexibility across jobs and firms. Women's greater demand for flexibility leads them to sort into occupations with lower rewards for long hours, leading to a compensating differential equilibrium, as described by Rosen (1986).

The persistence of gender discrimination can be further explained by the concept of implicit discrimination, introduced by Bertrand et al. (2005). Drawing on social psychology, this idea suggests that discriminatory attitudes and stereotypes may operate unconsciously (Fiske, 1998), implying that they are not easily eradicated. As overt gender discrimination has become less socially acceptable, it has likely shifted to more subtle, unconscious forms. Moreover, such biases can undermine women's human capital development and labor force attachment by diminishing the returns to their investments in education and work, creating negative feedback effects (Weiss and Gronau, 1981).

Other perspectives, such as the theory of gendered organizations (Acker, 1990)—providing a critical framework for understanding how gender inequalities are embedded within organizational structures and practices—highlight how workplace structures and cultures systematically disadvantage women by reinforcing traditional gender roles and norms and reveals the existence of structural, organizational, and cultural processes that produce and reproduce gendered practices. Stemming from Acker (1990), Poggio (2006) argues that gender is continually redefined and negotiated through the everyday interactions in which individuals engage, with both men and women 'doing gender' and contributing to the construction of gender identities through a process of reciprocal positioning. In this light, only by means of genuinely transformative practices a different relational order can be produced.

1.1 The gender wage gap: a literature review

The gender wage gap remains one of the most persistent forms of inequality in the labor market, and it has been deeply investigated by both the economic and sociological literature (Blau and Kahn, 1997, 2003, 2006, 2017; Goldin, 1990, 2006 2014; Eveline and Todd, 2009; Huffman and Cohen, 2004) and subject of empirical analysis (Altonji and Blank, 1999; Goldin and Rouse, 2000). Notwithstanding the considerable progress in female employment in recent decades, a persistent wage gap remains in many economically developed countries. At the European level, in 2022 women's gross hourly earnings were on average 12.7% below those of men in the EU, highlighting the lasting of the gender wage gap. In most developed economies and the United States, the long-term trend has shown a significant bridging of the gender wage gap (Blau and Kahn, 2006). Indeed, by analysing

the gender wage gap using PSID microdata from 1980 to 2010, Blau and Kahn (2017) showed that improvements in women's education, work experience, occupational representation and union coverage contributed significantly to the reduction of the gender pay gap. But gender differences in job location—occupation and industry distribution—remained an important factor in explaining the remaining gap. The study highlights also traditional factors, like education and experience, while still relevant, now explain only a small part of the wage gap, especially since women have surpassed men in educational attainment and reduced the experience gap. Work interruptions and shorter hours, particularly in high-skilled occupations, emerged as key factors in explaining the wage gap for women. This aligns with studies (Goldin, 2014) suggesting compensating wage penalties for temporal flexibility, rather than purely human-capital factors, as mentioned above. The authors also emphasized the ongoing importance of traditional explanations, such as gender roles and the motherhood penalty (see, for example, Sigle-Rushton and Waldfogel, 2007) in addition to labor market discrimination, which may still play a role.

Building on the insights of Oaxaca (1973) and Blinder (1973), the economic literature has made significant progress in understanding the gender wage gap. The unexplained component in wage differentials has been commonly interpreted as reflecting discrimination against women, with its effects being more pronounced at the top and, to some extent, at the bottom of the wage distribution—phenomena typically referred to as the 'glass ceiling' and 'sticky floor', respectively (Booth et al., 2003; Bjerk, 2008; Christofides et al., 2013; Cohen and Huffman, 2007). The former refers to an invisible barrier that limits women's access to top positions and promotions, while the latter describes a scenario where women face limited opportunities for upward mobility and remain stuck in low-paid, entry-level jobs for longer periods, despite having qualifications similar to those of male counterparts (Booth et al., 2003). Eventually moving beyond the Oaxaca-Blinder approach, Albrecht et al. (2003) conducted one of the first studies on gender wage gaps across the distribution, using quantile regression analysis along with an early version of the Machado and Mata (2005) methodology to estimate the marginal distributions of predicted and counterfactual wages for women. Examining the evolution of the gender wage gap in Sweden, the authors found evidence supporting the presence of a glass ceiling effect and demonstrate that the wage gap at the top of the distribution emerged as a notable phenomenon during the 1990s. Furthermore, they showed that the significant wage differentials at the upper end of the female wage distribution are primarily driven by variations in the returns to different productive characteristics. By analysing the gender wage gap in the Netherlands using a sample of full-time workers and extending the quantile regression and decomposition methodology to account for the selection of women into full-time employment, Albrecht et al. (2009) found results confirming the presence of a glass ceiling effect in the Netherlands

as well, along with a substantial gender disparity in wage returns. Moreover, they revealed that after adjusting for selection into full-time employment, the wage gap increases, indicating a strong positive selection of women into full-time work in the Netherlands. García et al. (2001) found that the wage gap widens as the pay scale increases, and their decomposition of the wage gap shows that the unexplained portion becomes larger, both in absolute and relative terms, advancing in the wage distribution. Examining the wage gap with quantile regressions separately in the private and in the public sector and comparing 11 European countries, Arulampalam et al. (2007) found evidence of an unequal distribution of the gender wage gap, with wider differentials at the top end of the female wage distribution, demonstrating the existence of glass ceilings in 9 countries and sticky floor effects only in Italy and Spain. Using quantile regression analysis and the Machado and Mata (2005) procedure, Addabbo and Favaro (2011) examined gender wage differentials in Italy, focusing on the role of education. Their results show that the wage gap between women and men in Italy is strongly influenced by educational attainment, as highly educated women experience smaller wage gaps (ranging from 4.8% to 11.3%) compared to low-educated women (ranging from 11.7% to 16.1%) across all wage levels and identify a persistent glass ceiling effect for the former. Another research regarding the gender pay gap component arising from differences in characteristics' rewards in Italy revealed that the portion of the pay gap attributable to differences in the rewards for productive characteristics between Italian men and women is not evenly distributed across workers with varying educational backgrounds and other human capital attributes (Addabbo et al., 2012). Predictably, women with higher levels of education face smaller pay gaps compared to their lower-educated counterparts. Picchio and Mussida (2011) observed that the notable gender wage gap across the Italian wage distribution remained quite stable over time, while the driving factors changed, as women's improved qualifications helped narrowing the gap, but changes in the reward to those qualifications led to widening in the gap, especially at the top of the wage distribution (Mussida and Picchio, 2014). Piazzalunga and Di Tommaso (2019) found that the gender pay gap in Italy increased from 3.8 to 8.6 per cent between 2008 and 2012, mainly due to the public sector wage freeze, with a disproportionate impact on women. Furthermore, the authors noted the emergence of a glass ceiling after 2010, besides the sticky floor. Other studies highlighted the role of influential factors such as low labour market participation (Olivetti and Petrongolo, 2008), labour mobility (Del Bono and Vuri, 2011), the field of study (Piazzalunga 2018; Black et al. 2008) and industry distribution. Another stream of economic literature stresses the role played by psychological attributes, personality traits and preferences, also influenced by social factors. It has been found that women are generally less willing than men to negotiate or compete and tend to be more risk-averse (Bertrand, 2011; Croson and Gneezy, 2009). Furthermore, leadership is often associated with traditionally masculine traits, such as competence

and the ability to influence (Schein, 2001), which can lead to the perception that female leaders lack these qualities (Eagly et al., 1992; Fiske et al., 1999). Research on gender differences and stereotypes in competitive settings supports the idea that stereotype threat (e.g. Spencer, Steele, and Quinn, 1999; Steele and Aronson, 1995; Spencer, Logel and Davies, 2016) contributes to women's tendency to avoid competition with men (Günther et al., 2010). Likewise, Reuben et al. (2012) note that women are often under-selected for competitive tasks.

2. Measuring gender inequalities in academia

Over the last decades, women closed and eventually surpassed men in educational attainment, a phenomenon that Goldin et al. (2006) defined as an 'homecoming' of gender parity in education. Indeed, Blau et al. (2014) found that in 2011, women in the US accounted for 61% of master's degrees and 51% of PhDs. However, gender differences are still traceable in the choice of the fields of study, as women continue to be underrepresented in STEM (Science, Technology, Engineering, and Mathematics) fields, particularly in disciplines that are mathematically intensive (Ceci et al., 2014). This may affect labour market outcomes in tangible ways, since gender disparities in college major choice have been identified as a significant factor contributing to the wage gap between college-educated men and women (Black et al., 2008). The same scenario can be found in the European Union. Although women outnumber men among university graduates in the EU, they remain underrepresented in STEM fields: while men accounted for around 46% of all tertiary graduates over the past decade, they made up more than 80% of ICT graduates. In contrast, female ICT graduates constituted less than 2% of all female graduates, with a modest increase of only 0.6 percentage points between 2013 and 2021[1].

This result not only has an impact on the labour market but also influences the pool of talent that can pursue a path of research and an academic career. Consistently with the findings already mentioned, horizontal gender segregation still persists, with an under-representation of women among Doctoral graduates in fields such as Physical Sciences (38.4%), Mathematics and Statistics (32.5%), ICT (20.8%) and Engineering and Engineering trades (European Commission, 2021). Moreover, a further form of discrimination affecting female researchers occurs once they enter an academic career: although representing more 42% of the overall Italian academic staff in 2023, 50.5% of grade C staff and 45.6% of grade C staff, women account for 42.7% of grade B staff and 30% of grade A staff,

[1] Source: Eurostat, Students enrolled in tertiary education by education level, programme orientation, sex and field of education https://doi.org/10.2908/EDUC_UOE_ENRT03

equivalent to full professorship[2]. Looking at the European context, female researchers represent more than 40% of the European academic staff, as well, but gender differences begin to emerge while moving up the academic ranks, as while women represent 46.6% of grade C staff and 47.1% of grade D staff, they account for 40.3% of grade B and represent only 26.2% of grade A staff positions, equivalent to full professorship (European Commission, 2021). Also in this case, it is possible to detect a difference according to the field of study, since female grade A staff are relatively well represented in the field of Humanities (35%) but represent a minimal occurrence in the field of Engineering and Technology (17.9%). Furthermore, proportion of female heads of institutions in the higher education sector amounts to only 23.6%, once again displaying the under-representation of women in leadership positions. Given this data, it is unsurprising that at the European level, the Glass Ceiling Index (GCI)[3] was approximately 1.5 in 2021, suggesting the persistence of a glass ceiling effect for female academics, although it has slightly diminished over time (European Commission, 2021). The 'glass ceiling' represents a widely used notion to measure and compare women's challenges in reaching top positions, serving as a key indicator of gender inequality in academia across different contexts and over time. Recently, another index measuring the 'invisible' obstacles that women face in the academic environment has been introduced, namely the 'Glass Door Index' (GDI) (Picardi, 2019a, 2019b), which measures gender asymmetries at the entry stage of an academic career, i.e. given the relative presence of women in temporary research and academic entry positions, the GDI measures the fraction who have achieved tenure, highlighting the occurrence of a selection process in academic recruitment that disadvantages women. The presence of these indexes and the need to introduce them point to the persistence of gender inequalities throughout academic careers, from recruitment to advancement and eventually to achievement of full professorship positions.

2.1 The gender gap in the career advancement in academia

The collection of evidence previously presented creates a need for a deeper insight into the mechanisms of career advancement in academia and the obstacles that female staff encounter. The

[2] Source: MUR-USTAT data, last accessed in October 2024, available at: https://dati-ustat.mur.gov.it/dataset/a60a221d-1c0d-4abb-bc8b-2199f61c205d/resource/ddd84a09-8410-4dd7-b5d4-425a45ff5a6c/download/tracciatorecord_serieacademicstaff.xlsx

[3] The Glass Ceiling Index (GCI) is an index comparing the proportion of women in academia (grades A, B, and C) to the proportion of women in top academic positions (grade A positions, equivalent to full professorships in most countries) in a given year. The index can range from 0 to infinity, and a GCI of 1 indicates that there is no difference between women and men for being promoted, while a score of less than 1 means that women are over-represented at grade A level and a GCI score of more than 1 points towards a glass ceiling effect, meaning that women are under-represented in grade A positions.

main phenomena to be tackled can be summarised and described by referring again to the well-recognised metaphors of the 'glass ceiling' and the 'leaky pipeline' (Alper, 1993; Blickenstaff, 2005).

The literature has extensively explored gender and discrimination in academic recruitment and promotion dynamics: several studies have found that women are less likely to be promoted to tenure than men, with these disparities not fully accounted for by observable productivity differences (Kahn, 1993; Broder, 1993; McDowell et al., 1999, 2001). Ooms et al. (2018) found that in Germany, male researchers are more likely to secure early career positions than female researchers, although no gender differences were observed in the transition to assistant professor. However, gender disparities re-emerged at the transition to full professorship. According to the literature, the traditional factors which can explain the gender gap are mainly the women's reluctance to apply for promotion and the difference in productivity between male and female researchers. But it has also emerged how the different tasks assigned to men and women due to the persistence of gender roles, gender stereotypes and homophily can play a crucial role in preventing women advancing in their careers, revealing a structural gender bias. In a broader sense, it should also be borne in mind that the literature has highlighted how scientific excellence and quality are a gendered social construction (Benschop and Brouns 2003; O'Connor and O'Hagan 2016; Van den Brink and Benschop 2012; Nielsen 2016, 2018) and the persistence of 'gender practices' (Poggio, 2006) at the base of the construction and evaluation of academic excellence, systematically generate disadvantages for women (Van den Brink and Benschop 2011, 2012). Many scholars, when examining the impact of recent neoliberal reforms in university systems on gender inequality in academia, argue that the market-driven culture, which emphasizes individual competition and a gender-blind notion of 'excellence' is likely to precisely exacerbate existing gender disparities (Rees, 2011; Van den Brink and Benschop, 2012; Murgia and Poggio, 2018). This dynamic, where those with existing advantages continue to receive greater benefits, can be described by the 'Matthew Effect', a concept from the sociology of knowledge work (Merton, 1968).

Taking into account indicators of scholar productivity such as the number of publications, citations and citations indexes, female researchers have been found less productive than their male colleagues (Abramo and D'Angelo, 2015; Abramo et al., 2009; Jappelli et al. 2017; Mairesse and Pezzoni, 2015). However, Fox et al. (2011) and Mairesse and Pezzoni (2015) explain that the disparity in productivity can be attributed to women's family responsibilities, particularly for those with children. In this regard, due to their domestic and care responsibilities, still largely borne by the female components of a family, female academics tend to have fewer collaborations (Vazquez-Cupeiro and Elston, 2006) and are less likely to engage in international networks (Beaudry and Larivière, 2016; Uhly et al., 2017). Anyways, De Paola et al. (2017) found that, even after controlling

for scholarly productivity, female assistant and associate professors in Italy are around 4 percentage points less likely to apply for National Scientific Qualification (NSQ)[4] accreditation compared to their male peers. This finding is consistent with what Gonzales Ramos *et al.* (2020) found in Spain, where the process for accreditation is similar to the Italian NSQ.

The lower productivity of female university researchers is partly due also to the greater allocation of teaching and administrative tasks to women. Data show that men typically dedicate more time to research, while women spend more time on mentoring activities and service duties (Beaudry and Larivière, 2016; Misra et al., 2012). It has been pointed out that women are often assigned more administrative tasks and teaching, to the extent that it has been suggested that female professors are 'taking care of the academic family' (Guarino and Borden, 2017), indeed reducing the time that can be effectively devoted to research (Marini and Meschitti, 2018; Babcock et al. 2017).

Furthermore, recent studies (Sierminska and Oaxaca, 2021) suggest that gender discrimination in academia can result from gender segregation within specialized fields, even within the same discipline.

To conclude, research has shown that the gender gap in academia is not due to the fact that men are better researchers than women. Taking into account Italian universities, Filandri and Pasqua (2019) found that even after controlling for individual productivity, women are less likely than men to advance in their careers, but the gender gap narrows when the percentage of female full professors in the field where the competition was held is higher.

2.2 The gender wage gap in academia

The gender wage gap remains a persistent issue concerning the labour market, and academia is no exception, with significant disparities in compensation between male and female staff. As seen, a number of studies have focused on the career advancement gap, an issue tightly intertwined with the gender wage gap, given the persistent pattern of vertical and horizontal gender segregation in the labour market, more broadly, and in the academic context, specifically. Much of the existing research focuses on promotion as a key factor in gender wage inequality, particularly in the humanities. Differences in promotion rates between men and women contribute to wage gaps, with women often spending more years in lower academic ranks compared to their male counterparts, exacerbating wage discrepancies (Ginther and Hayes, 2003; Ginther and Kahn, 2004). According to a study on 323 US universities by using Academic Analytics data base that contains also data on faculty productivity,

[4] National Scientific Qualification (NSQ) accreditation is a pre-condition for career advancement in Italian universities: assistant professors seeking promotion to associate professor and associate professors aiming for full professorship must apply for NSQ accreditation.

differences occur amongst universities according to their research-intensity level, with the higher research intensive universities being about to reach gender parity in promotion to associate professor while the gender gap in promotion persists for lower research intensity institutions (Ginther and Kahn, 2021).

Another stream of research has focused on investigating the existence of a gender wage gap within the academic institutions, finding women in academic settings still earn less than their male counterparts, even after controlling for factors such as education, experience, and job type. A study concerning a sample of academic economists (Blackaby et al. 2005) revealed significant within-rank pay gap, with men receiving more outside offers than women, even when controlling for productivity and other characteristics. Additionally, for men, receiving more outside offers is linked to higher earnings, an effect which is not observed for women. In 2014, male full professors in the US earned 15% more than their female counterparts (Hatch, 2017) while a Canadian case study, by Smith-Carrier et al. (2021) found both an entry gender pay gap and gender gaps in faculty's total career earnings, in addition to a gender gap in pension earnings. Similarly, Chen and Crown (2019), by estimating the gender wage gap for the faculty at The Ohio State University for a period of ten years (2006–2016) across 23,000 observations, identified a 5.26% gender pay gap, after controlling for year, work experience, appointment type, rank and department, which is likely a conservative estimate, assuming parity in promotion and tenure. The analysis of Oaxaca-Blinder decomposition employed by the authors shows that 27% of the gender wage gap cannot be explained by differences in observable characteristics, suggesting discrimination. By examining the gender wage gap in Turkish academia, Ucal et al. (2015) highlighted a paradox where Turkey has one of the lowest female labor force participation rates among OECD countries (28%), yet the highest percentage of female full professors in Europe (28%). Despite this, women report ongoing discrimination, as the study finds a gender wage gap favoring men, particularly at private universities, where salaries are less regulated and more influenced by market forces and individual bargaining power. Kaszubowski and Wolszczak-Derlacz (2014) conducted a similar analysis of the gender wage gap in the Polish academic environment, analysing both salary and reservation wages (which means additional work, that is common in Poland due to low average income levels, as noted in the literature). Two key findings emerged, similar to the results Ucal et al. (2015) obtained: First, differences in faculty rank contributed most significantly to the gender gaps in both salary and reservation wage. Second, both the raw salary and reservation wage gaps between men and women were more pronounced at the top of the distribution, reflecting a 'glass ceiling' effect. Ward (2001) analysed a 1996 survey of academic staff in five Scottish universities, finding the highest gender pay gap in medicine, followed by science and social sciences. Regarding the US, Ceci et al. (2014) used the 2010 Survey of Doctorate Recipients and found that

the gender pay gap among economics professors was larger than in engineering, geoscience, and physical sciences, and among associate professors in life sciences. Tao (2018) analysed National Science Foundation data from 2003 to 2013, showing that women earn about 5% less than men after controlling for demographic, educational, productivity, and employment-related factors. Kim et al. (2023) examined the gender pay gap in economics and agricultural/applied economics among graduate tenure-track faculty, finding 8.3% pay gap in economics and a 4.1% gap in agricultural/applied economics, after controlling for rank, experience, and university affiliation. The smaller gap in agricultural/applied economics obtained is partly due to a higher proportion of women in assistant and associate professor roles. Their results show also that the gap increases with rank and varies across institutions, and despite productivity influences wages, it explains little of the gender pay gap. Gamage et al. (2020) investigating the UK academic context found women earning less than men across all subject groups and ranks, with the gender pay gap being most pronounced at the professorial level, especially in high-paying fields like economics and business management. Their results are consistent with previous findings of gender pay gaps in academia, even when comparing similar individuals. The gender pay gap in economics Gamage et al. (2020) found is smaller than the 12.7% reported by Mumford and Sechel (2019), who accounted for demographic, productivity, workplace, and labor market characteristics in their study of 367 academic staff in UK economics departments. Currie and Hill (2013) investigated the University of Western Australia, where a pay equity audit revealed a gender pay gap of 15% for academics, with discretionary allowances further exposed pay disparities, as male academics earned, on average, $8,744 more than their female counterparts, and male professionals earned $1,987 more than female professionals.

A promising issue concerns the impact of pay transparency on gender pay gap and on the performance basis of pay: in this regard Obloj and Zenger (2022) detected a positive impact of pay transparency on the reduction of the gender pay gap and a reduced impact of individually measured performance on pay, while Lyons and Zhang (2023) found that salary transparency improves average gender pay equality especially within the most visible organizations that likely anticipate high levels of public scrutiny. This would suggest implementing measures able to reduce the cost of public monitoring to improve transparency by easing the reduction of the pay gap.

3. Data and Methodologies

We believe academia can offer a unique context to investigate gender wage inequality, as academics are a quite homogeneous group in terms of education, training, and job tasks. Notwithstanding differences exist amongst fields and institutions, it can be stated that most Italian

professors are Ph.D. graduates and share similar responsibilities, such as teaching, researching and carrying out service duties. This results in the academic context being an ideal environment to examine gender wage inequalities. Taking into account the background we presented in the previous sections, and the relevance of using the academy as a setting to analyse the presence of gender gaps, we decided to investigate the presence of a gender wage gap in an Italian university and eventually measuring it. In order to do so, we selected a large Italian university located in Northern Italy and collected administrative data referring to personnel records from the analysed university's Human Resources office. We decided to focus on an Italian university given the poor results Italy has achieved in terms of gender equality in European reports such as the Gender Equality Index by the European Institute for Gender Equality (EIGE), specifically regarding the labour dimension, where Italy ranks last. In addition, since in Italy public academic jobs are governed by public sector labor rules, which limit flexibility in wage setting, one might assume that academia may offer some protection against the gender wage gap. Furthermore, we would like to contribute to the growing body of literature on this topic through an original study, as, to our knowledge, the current literature does not include a study on the existence of a gender wage gap in an Italian university and its measurement.

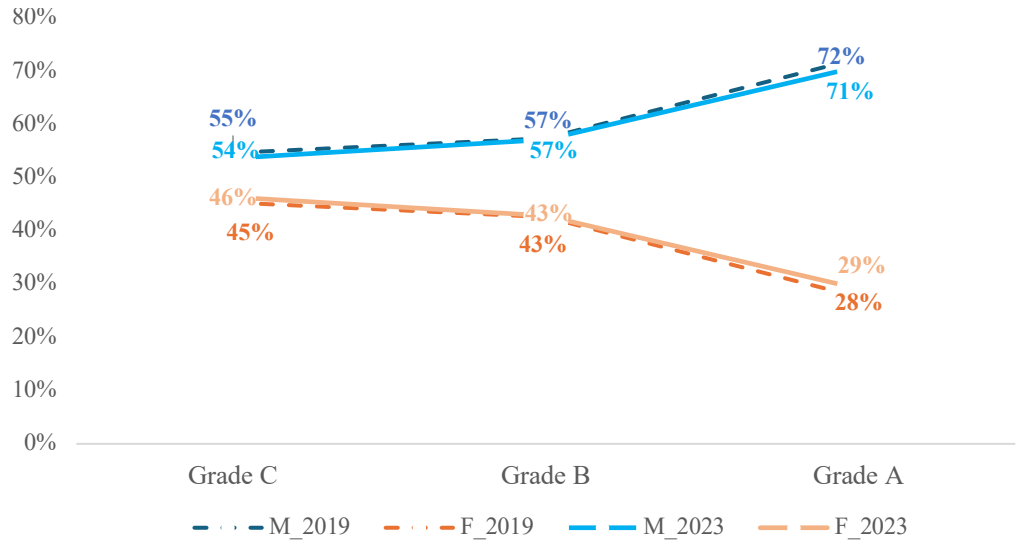
3.1 Data pre-processing and preliminary analysis

To pursue our work, we had to collect administrative data concerning university staff, and thanks to the collaboration of the University's Human Resources Office this was made possible. We decided to analyse data from two time points, i.e. the 2019 data (pre-pandemic year and before the approval of the Gender Equality Plan) and the most recent available data, from 2023 (after the implementation of the Gender Equality Plan). We treated the data from these two years separately and performed the same analysis for each year individually, in order to see how the state of the gender wage gap has changed over a four-year period. Considering the purpose of investigating the gender wage gap within a very homogeneous group with similar characteristics, we decided to focus only on university teaching and research staff, excluding technical-administrative staff in this analysis. We therefore took into account only grade A (equivalent to full professor), grade B (equivalent to associate professor) and grade C (equivalent to assistant professor[5]) staff.

[5] In Italy, following the last overhaul of the system under Law 240/2010, assistant professors are hired exclusively on temporary contracts, and the previous permanent assistant professor ('Ricercatore Universitario') position has not been renewed, resulting in the fact that all current permanent assistant professors were hired prior to 2010. After the reform, a distinction between non-tenured positions (Fixed-time Researcher, Type-A) and tenure-track positions (Fixed-time Researcher, Type-B) was introduced.

The preliminary data preparation process consisted of two key steps, identical for the two datasets (the one from 2019 and the one from 2023): initially, for each grade (A, B, and C), it was combined demographic and salary data originating from two separate spreadsheets into a single data set for each category (grade A, B, and C). Then, each dataset was merged together, resulting into a unique dataset collecting every personal record. It was therefore obtained a preliminary sample consisting of 1,002 observations of faculty members (i.e., 244 grade A, 423 grade B and 345 grade C) for the year 2019 and 1,087 observations (i.e., 275 grade A, 473 grade B, 339 grade C) for 2023. For each faculty member it was available demographic data (e.g., gender, age, nationality, country of residence, marital status, degree, role, type of contract, date of termination of the contract, affiliated department, area related to the teaching subject, first date of activity) and salary records, which we grouped according to the macro-classification of the wage categorisation made by the organization itself in five categories: freelance hospital emoluments ('*hospital_freelance*'), hospital emoluments ('*hospital_emol*'), additional emoluments from consultancy ('*consultancy*'), indemnities (broken down into additional lecturing activities and allowances due to a variety of appointments, such as committee tokens) and fixed salary. Then, for each group, the subtotals were computed, and the overall total was finally determined, representing the annual salary of each faculty member. Having personal data concerning the months in which a salary was received and the date of termination of the contract, if present, we were able to discard the observations of staff who were not effectively active in 2019 and in 2023 (i.e., who did not receive at least one month's fixed salary in 2019 and in 2023) and those with contracts expiring in 2019 and in 2023, considering that those with a contract ending in the reference years could be less engaged in activities beyond those remunerated by the fixed salary. In the final dataset, we thus obtained 791 observations of members of faculty for 2019 (i.e., 214 faculty members belonging to grade A, 352 belonging to grade B and 225 belonging to grade C) and 970 observations for 2023 (i.e., 254 belonging to grade A, 429 belonging to grade B and 287 belonging to grade C) who were active for at least one month in 2019 and in 2023 and had an active contract by the end of the year. By this data, we could observe the existence of a strong gender gap in female faculty participation in grade A and slightly in grade B as well, without significant variation in the four-year period considered. This data allowed us to plot the so-called career scissor graph (Figure 1), an effective graph highlighting the leaky pipeline and the glass ceiling phenomena, which result in a loss of the female-pool talent along the ranks within the academia, with the sharpest gap in grade A.

Figure 1. The career-scissor graph for the investigated university



Personal elaboration

Once the complete dataset had been created, as previously explained, all string variables were converted into binary or categorical variables and generated a series of dummy variables a step necessary for the following analysis on the gender wage gap. Specifically, we created a dummy variable regarding the gender (1 if female), dummy variables for each grade (A, B or C), a dummy variable related to the type of employment (full-time or part-time), and a dummy variable for each department to indicate whether a faculty member belongs to that department[6]. In this way we were able to examine the different departments and, as shown in Tables 1.a and 1.b, we can observe that the Department of Law (‘*law’*) (93.3%), the Department of Maternal, Child and Adult Medical and Surgical Sciences (‘*matsurg*’) (92.9%), the Department of Engineering Sciences and Methods (‘*engmet’*) (84.2%) and Department of Physical, Computer and Mathematical Sciences (‘*phys’*) (81.3%) present the largest gender gap in grade A positions in 2019, while the Department of Law (‘*law’*) (81.3%), the Department of Maternal, Child and Adult Medical and Surgical Sciences (‘*matsurg’*) (81.3%), the Department of Engineering (‘*engin’*) (79.1%) and the Department of Engineering Sciences and Methods (‘*engmet’*) (79.2%) have the widest gender gap in grade A positions in 2023. It can thus be noted that although a strong gender gap persists in these departments,

[6] The departments took into account are (department abbreviation in brackets): Department of Surgery, Medicine, Dentistry and Morphological Sciences with interest in Transplantology (‘surgmed’), Department of Communication and Economics (‘comunic’), Department of Economics (‘econ’), Department of Law (‘law’), Department of Engineering (‘engin’), Department of Biomedical, Metabolic and Neuroscience (‘biomed’), Department of Chemical and Geological Sciences (‘geochem’), Department of Life Sciences (‘lifescien’), Department of Engineering Sciences and Methods (‘engmet’), Department of Physical, Computer and Mathematical Sciences (‘phys’), Department of Maternal, Child and Adult Medical and Surgical Sciences (‘matsurg’), Department of Linguistic and Cultural Studies (‘lingcul’), Department of Education and Human Sciences (‘eduscien’).

in 2023 the gap narrowed slightly in some of them (‘*law’*, ‘*matsurg’* and ‘*engmet’*), but the overall gender gap in the grade position narrowed by only one percentage point in the period 2019-2023. The analysis of these data clearly shows a vertical segregation by gender in the different departments, particularly for departments within the STEM area. However, it can be noted how an improvement occurred in grade C over four years in some of the departments which presented the widest gaps. Indeed, two medical departments, the Department of Maternal, Child and Adult Medical and Surgical Sciences (‘*matsurg’*) and the Department of Biomedical, Metabolic and Neuroscience (‘*biomed*’), and the Department of Engineering Sciences and Methods (‘*engmet’*) improved the share of female faculty in grade C, probably as a consequence of a large-scale recruitment plan following the implementation of the National Recovery and Resilience Plan (PNRR). It should be noted, however, that grade C also contains a position characterised by precariousness and lower wages (i.e., ‘Fixed-time Researcher, Type-A’). In this regard, the recruitment of women for this position may accentuate the already existing inequalities in the distribution of salaries within these departments.

Table 1.a Distribution by gender and rank in departments (2019)

	Grade A		Grade B		Grade C	
Department	M	F	M	F	M	F
surgmed	53.33	46.67	78.57	21.43	52.63	47.37
comunic	60.00	40.00	47.83	52.17	66.67	33.33
econ	72.00	28.00	50.00	50.00	61.54	38.46
law	93.33	6.67	64.29	35.71	57.14	42.86
engin	80.00	20.00	76.60	23.40	75.86	24.14
biomed	68.75	31.25	34.48	65.52	50.00	50.00
geochem	66.67	33.33	60.71	39.29	60.00	40.00
lifescien	52.17	47.83	48.78	51.22	33.33	66.67
engmet	84.21	15.79	57.89	42.11	75.00	25.00
phys	81.25	18.75	48.15	51.85	70.59	29.41
matsurg	92.86	7.14	78.57	21.43	33.33	66.67
lingcul	53.85	46.15	54.55	45.45	40.00	60.00
eduscien	77.78	22.22	33.33	66.67	66.67	33.33
Total	72.43	27.57	57.51	42.49	54.67	45.33

Personal elaboration

Table 1. b Distribution by gender and rank in departments (2023)

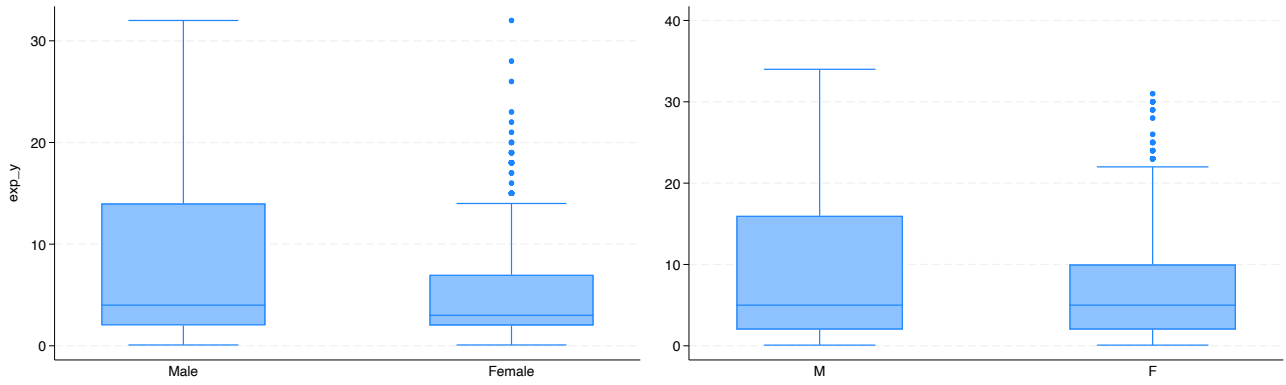
	Grade A		Grade B		Grade C	
Department	M	F	M	F	M	F
surgmed	68.75	31.25	67.65	32.35	54.55	45.45
comunic	66.67	33.33	39.13	60.87	80.00	20.00
econ	69.23	30.77	46.67	53.33	64.71	35.29
law	81.25	18.75	76.92	23.08	46.15	53.85
engin	79.07	20.93	75.93	24.07	81.82	18.18
biomed	66.67	33.33	40.00	60.00	34.62	65.38
geochem	75.00	25.00	62.86	37.14	82.35	17.65
lifescien	56.00	44.00	49.02	50.98	37.50	62.50
engmet	79.17	20.83	68.00	32.00	70.83	29.17
phys	75.00	25.00	61.11	38.89	70.83	29.17
matsurg	81.25	18.75	66.67	33.33	21.74	78.26
lingcul	46.15	53.85	34.62	65.38	20.00	80.00
eduscien	63.64	36.36	47.83	52.17	26.67	73.33
Total	70.87	29.13	57.11	42.89	53.66	46.34

Personal elaboration

Furthermore, other variables useful for the analysis were generated. Specifically, a variable indicating the years of experience in the role, considering the variable 'first date of activity' available from the demographic dataset and converted it to the number of years from the date to 2019 and 2023 was introduced. Starting from this variable, we were able to generate a new variable indicating years of experience in proportion to months of experience, in order to be able to observe new recruits as well. Although this does not necessarily represent the total academic experience of each researcher, if previous experience was at other universities, we assumed this as the complete information on available experience. Furthermore, as we were provided with the annual total salary and the individual components for each record, along with information on the number of months worked in 2019 and 2023, a variable concerning the monthly salary (obtained by dividing the annual total salary by the number of months worked) was generated. No variable relating to scientific productivity has been included, as this is not relevant for remuneration purposes, but only for the purposes of obtaining NSQ and therefore promotion from one rank to another (a parameter already included in the variable concerning the rank itself). Finally, in order to have a homogeneous sample, it was decided to carry out the analysis only on full-time working faculty, excluding individuals employed with part-time contracts, and obtaining the latest version of the dataset containing 752 observations for the year 2019 and 929 observations for 2023.

In Figure 2 the variable expressing the years of experience ('*exp_y*') is graphically represented. The average value is equal to 6.50 for 2019 and 7.90 for 2023, and the average for women is slightly lower than for men (5.58 against 7.13 years in 2019 and 7.54 against 8.15). However, it can be noted that years of experience of the female faculty increased over time, narrowing the gap. Both female boxplots present several upper outliers and are thinner, indicating that the overall distributions are centered on smaller values, in contrast to the male boxplot.

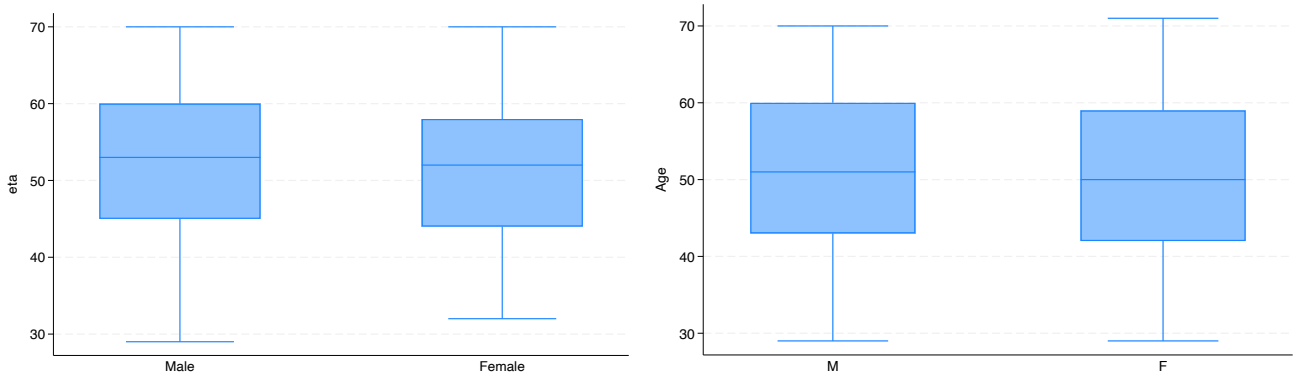
Figure 2. Boxplots on years of experience by gender for 2019 (on the left) and 2023 (on the right)



Personal elaboration

The same representations are given for the variable indicating the age in Figure 3 for 2019 and 2023, respectively. The average value for 2019 is 51.91 and 50.58 for 2023. It can be noticed that the average is slightly lower for women for both years, but in general, no differences in the age distribution between the two genders are observed.

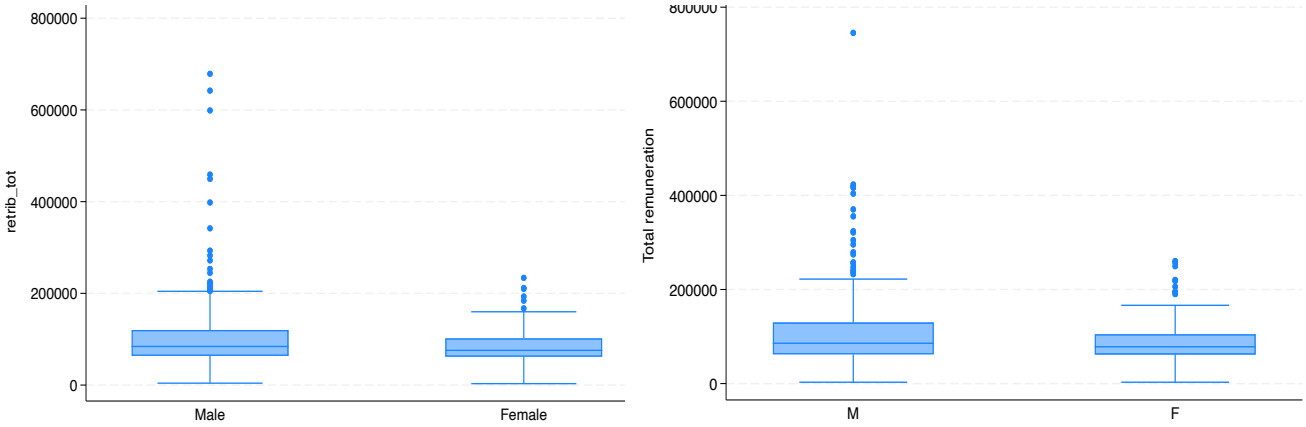
Figure 3. Boxplots on age by gender for 2019 (on the left) and 2023 (on the right)



Personal elaboration

In Figure 4 the boxplots concerning the total annual retribution for year 2019 and 2023 are displayed. It can be noted that the male boxplots for both years present a higher variability, while average value and quantiles are lower for women, by presenting a thinner boxplot for both years with few and much lower upper-outliers.

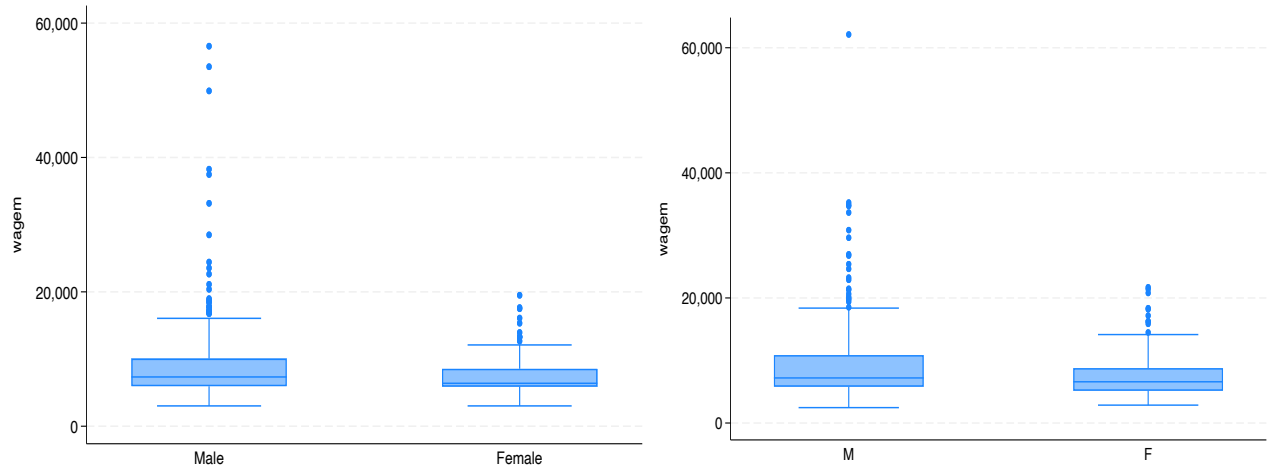
Figure 4. Boxplots on annual salary by gender for 2019 (on the left) and for 2023 (on the right)



Personal elaboration

In addition, in Figure 5 the boxplots concerning the monthly retribution for year 2019 and 2023 are presented. One can point out that again average value and quantiles are lower for women, which present also in this case thinner boxplot for both years with few and much lower upper-outliers. To conclude, with regard to the monthly salary, the observations already mentioned for the annual salary also apply; in other words, women's salaries display less variability and are more concentrated on lower wages than their male colleagues. No strong differences between 2019 and 2023 can be observed from the graphs.

Figure 5. Boxplots on monthly salary by gender for 2019 (on the left) and 2023 (on the right)

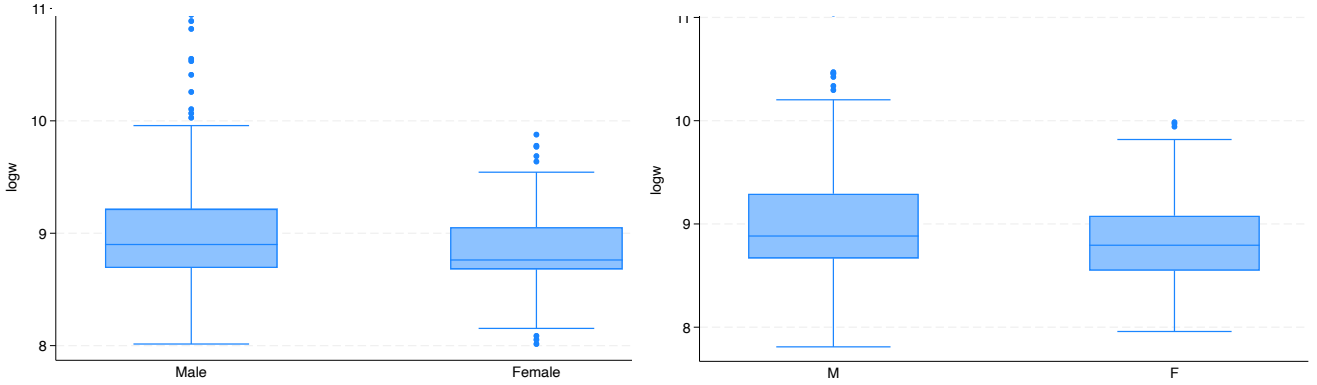


Personal elaboration

Figure 6 plots instead the monthly salary variable expressed in logarithm, i.e., the dependent variable that was used in the regression and decomposition analyses, for both years 2019 and 2023. As previously mentioned, there is a more concentrated distribution on lower values for women, especially in 2019, where the data are particularly skewed. Moreover, the whiskers for males and

females are of different lengths, with the former extending further than the latter, indicating a broader range of salaries in the male group.

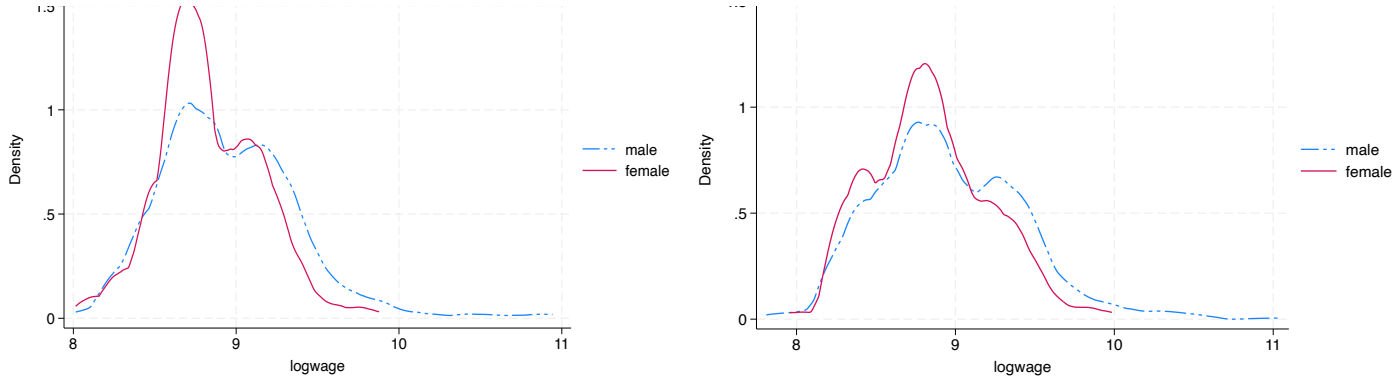
Figure 6. Boxplots on monthly log wages by gender for 2019 (on the left) and 2023 (on the right)



Personal elaboration

In Figure 7, one can observe that the distribution of women's wages is more densely concentrated on low values, with a high peak in the lower part of the distribution, in contrast to men's distribution, while men's wages present longer tails, indicating a wage differential to the disadvantage of women. Some minor differences can be noted between 2019 and 2023 that seem to indicate a slight narrowing of the gender gap. In particular, women's wages in 2023, which still remain predominantly concentrated at the lower end of the distribution, seem to show a mild greater variability than in 2019.

Figure 7. Plots on distributions of male and female monthly log wages for 2019 (on the left) and 2023 (on the right)



Personal elaboration

To conclude this preliminary analysis, summary statistics about the variables considered above are provided for faculty members in 2019 and in 2023 in Table 2. Taking into account only faculty working full time, female academics earned about 19,000 € less than male academics per year in 2019 and around 16,000 € in 2023. From this first raw wage differential we can notice a statistically significant gender wage gap, which is proven to be true also when looking at monthly retribution. On

average, women earn 1,600 € less per month than men in 2019 and 1,400 € less in 2023. Significant difference can also be found for years of experience in 2019 – with women showing less experience in the role – whereas this is not the case for 2023.

*Table 2. Summary statistics (obtained by t-tests on difference in means by gender for each variable). P-values: ***= p < 0.01; **= p < 0.05; *= p < 0.1)*

	2019			2023		
	Male	Female	Difference	Male	Female	Difference
Total earnings	99136.77	79856.59	19280.18***	99961.95	83554,6	16407.35***
Monthly earnings	8914.31	7277.24	1637.1***	8875.17	7468.91	1406.26***
Age	52.24	51.45	0.79	50.72	50.39	0.33
Experience	7.13	5.58	1.55***	8.15	7.54	0.62
Observations	445	307	138	544	385	159

Personal elaboration

3.2 Methodology

After obtaining a single dataset for both years under consideration, it was possible to progress towards the wage gap analysis through two steps. An initial estimation of the gender component of the wage gap could be obtained by estimating a wage equation, which includes all observable variables that may influence wage levels, along with a binary variable that takes the value of one if the individual is female. As mentioned in the previous section, to carry out our analysis, we focused on the variable expressing the monthly salary. Specifically for this phase, we previously generated a monthly salary variable expressed in logarithm, which we used in our applications for the investigation of the gender wage gap of faculty members.

To perform the analysis, we estimated the gender wage gap using a log monthly wage Ordinary Least Squares (OLS) regression that account for successively larger sets of control variables (1). In each of our models, our dependent variable is the monthly wage express in logarithm for each individual for both year 2019 and 2023, carrying out the estimations only on active faculty members (i.e., individual who worked at least one month in the reference year and with and active contract). We remind that by estimating the monthly wage, we control for the different number of worked months in the considered year.

$$\ln(W_i) = X_i\beta + \varepsilon_i \qquad \varepsilon_i \sim N(0, \sigma_\varepsilon^2) \tag{1}$$

$\ln(W_i)$ is the logarithm of monthly wage,

X_i are the individual characteristics, including a dummy variable identifying women within the sample,

β are the coefficients to be estimated,

ε_i is the error term.

All the observed relevant variables that could intervene in generating a gender wage gap are included on the right-hand side of our models. We included successively larger sets of variables to make the regression model clearer for interpretation: gender, age, years of experience in the academic career (at the institution), role (grade A, B or C), department of affiliation, type of emolument (freelance hospital emoluments ('*hospital_freelance*'), hospital emoluments ('*hospital_emol*'), additional emoluments from consultancy (*'consultancy*'), indemnities (broken down into indemnities from additional lecturing activities, '*ind_lect*', and allowances due to a variety of appointments, such as committee tokens, '*ind_extra*'). The model considers only faculty members that are active in the reference year (i.e., individuals who received at least one full monthly salary) and working full time.

Once the OLS regression has been performed, it becomes useful to carry out the second step of our gender wage gap analysis by analysing its components. In order to obtain the breakdown of the predicted gender wage gap into its components, we employed the Oaxaca (1973) and Blinder (1973) decomposition. The Oaxaca-Blinder decomposition is particularly useful for understanding wage disparities across demographic groups, such as gender, race, or ethnicity, and in this analysis, we focused on gender. The Oaxaca-Blinder decomposition involves partitioning the overall wage gap between two groups (in this case, female and male faculty staff) into two main components: the explained component, or the endowment effect, which captures the difference in group characteristics (e.g., education, experience) between the two groups, and the unexplained component, or coefficient effect, which reflects the difference in the returns to characteristics between the two groups. This enables us to quantify wage differences between men and women in academia, distinguishing between those that can be explained by differences in characteristics and those that result from disparities in how men and women are compensated for similar characteristics.

The total raw wage gap within two groups can be expressed as it follows:

$$\Delta W = \bar{W}_m - \bar{W}_f \tag{2}$$

where $\bar{W}_m$ and $\bar{W}_f$ are the average wages of males and females, respectively.

To perform the Oaxaca-Blinder decomposition, one must first estimate the wage functions for both groups (female and male employees) separately as it follows:

$$\ln(w_m) = X_m\beta_m + \mu_m \tag{3}$$

$$\ln(w_f) = X_f\beta_f + \mu_f \tag{4}$$

$\ln(w_m)$ is the log wage of male individuals and $\ln(w_f)$ is the log wage of female individuals,
$X_m$is a vector of characteristic of male individuals and X_f is a vector of characteristic of female individuals,
β_m represents the corresponding coefficients for male individuals and β_f represents the corresponding coefficients for female individuals, and
μ_m and μ_f are the error term.

The Oaxaca-Blinder decomposition typically involves an estimation of the two separate wage regressions using OLS regression to estimate the coefficients β_m and β_f, representing the returns to observable characteristics for each group. For clarity we omit from now on the notations $\ln(w_m)$ and $\ln(w_f)$ to express the logarithm of wages. Rearranging the terms and combining the two equations, one can obtain the full decomposition:

$$\Delta W = \bar{W}_m - \bar{W}_f = (\bar{X}_m - \bar{X}_f)\hat{\beta}_m + \bar{X}_f\,(\hat{\beta}_m - \hat{\beta}_f) \tag{5}$$

ΔW is the total wage gap between male and female individuals,
$\bar{X}_m$ and $\bar{X}_f$ are the mean characteristics of male and female individuals, respectively,
$\hat{\beta}_m$ and $\hat{\beta}_f$ are the estimated coefficients for the wage regressions for males and females, respectively.

The equation breaks down the gender wage gap into two components: i) the endowment effect:$(\bar{X}_m - \bar{X}_f)\hat{\beta}_m$ which captures the difference in group characteristics between the two groups (i.e., the explained difference), reflecting the part of the wage difference that can be attributed to differences in observed characteristics, such as education, experience, occupation, or other measurable factors and ii) the coefficient effect: $\bar{X}_f\,(\hat{\beta}_m - \hat{\beta}_f)$, which reflects the difference in the returns to characteristics between the two groups (i.e., the unexplained difference), which reflects the portion of the wage difference not attributable to differences in observable characteristics, and is typically interpreted as due to discrimination (or other unmeasured factors).

To evaluate the gender wage gap, we applied Oaxaca decomposition to our model where we have: i) the observed variable monthly wage in logarithm by gender, ii) control variables: age, years

of experience within the institution ('*exp_y*'), role (i.e., grade A and grade B, excluding grade C as the reference grade), department of affiliation (excluding the Department of Education and Human Sciences, '*eduscien*' which is the department with lowest wages), dummies reflecting the presence of additional emoluments (i.e., freelance hospital emoluments, hospital emoluments, additional emoluments from consultancy, indemnities from additional lecturing activities, and allowances due to a variety of appointments, such as committee tokens. The model considers only faculty members that are active in the reference year (i.e., individuals who received at least one full monthly salary) and working full time.

4. Results

In this section, we report the results obtained by applying the two methodologies described in the previous section in terms of measuring the gender wage gap in a large university located in Northern Italy, for both years 2019 and 2023.

4.1 Regression analysis

As a first step to be able to analyse and measure the gender wage gap, we performed an OLS regression as described in section 4. The results obtained by the estimation of the regression models can be found in Table 3 for the year 2019 and Table 4 for the year 2023.

Starting with the year 2019 and the most parsimonious model, the raw wage differential with variable '*gender*' is estimated in model (1) on the first column, with an average gap of 15% (p-value=0.000, with maximum level of significance) in 2019. Considering the mean salary of 89,740 € in 2019, this would translate into an annual loss of 13,461 € for female faculty, relative to their male peers, for the year 2019. Adding control for age (column 2) has a little effect on the gender gap, while it explains more than two points of the wage gap, meaning that women are on average younger than men. Age captures also past work experience in other grades in the same university or outside the investigated univerisity since we cannot observe the total work experience in academics of the faculty members. An additional year of age increases wages by 2.5% in 2019. In model (3), the variable *experience* ('*exp_y*') referred to the number of years of academic experience is included. However, this variable seems not significantly different from zero, but we can notice a correlation between age and experience, as expected. In model (4), the variables concerning the role of the individuals are added (i.e., '*gradeA*' and '*gradeB*', controlling by variable grade C) referring to the different faculty ranks included in this dataset (i.e., grade A, B or C). These variables, all with maximum level of significance, reduce the gap from 15% to around 8%, highlighting that there are fewer female individuals in higher academic ranks (grade A and grade B). We can assess that the impact of age and

seniority in current academic position is lower than the impact of being in Grade A or in Grade B when we control for these variables with respect to Grade C (column 4). We then control for the faculty members' departments (column 5) to detect the impact of being enrolled in different departments that catches also the presence of horizontal segregation in Academia. In this model (5) the Department of Education and Human Sciences ('*eduscien*') is excluded as our reference. It can be noted that the gender wage gap decreases to around 5%, meaning that a part of the difference is explained by the affiliation to different departments. From the different coefficients related to the single departments, we can state that faculty members of the Department of Maternal, Child and Adult Medical and Surgical Sciences ('*matsurg*') earn significantly more than members of the Department of Education and Human Sciences (55% more), and the same is true for also the Department of Surgery, Medicine, Dentistry and Morphological Sciences with interest in Transplantology ('*surgmed*') (40% more) and for the Department of Biomedical, Metabolic and Neuroscience ('*biomed'*) (17% more). It can be noted that all these three departments belong to the medical area, that can be assumed as the area with the highest salaries. In addition, the Department of Physical, Computer and Mathematical Sciences ('*phys*') has a slightly less significant positive difference (7% more). Taking into account the different components of the wages in our data set (i.e., fixed salary and additional emoluments), the final model (6) included binary variables indicating the presence or the absence of additional emoluments, broken down into freelance hospital emoluments ('*hospital_freelance*'), hospital emoluments ('*hospital_emol*'), additional emoluments from consultancy ('*consultancy*'), indemnities (divided into additional lecturing activities, '*ind_lect'*, and allowances due to a variety of appointments, such as committee tokens, '*ind_extra'*). It can be observed that the gender wage gap decreases to around 2% and stays statistically significant. Moreover, controlling for the freelance and other hospital emoluments decreases the impact of medical departments, having a higher exposure to these types of income. We find that all these additional emoluments increase the wage, with the maximum statistical significance for hospital emoluments, freelance hospital emoluments and additional emoluments from consultancy. This seems consistent with the observation made about the medical area, and reasonable with the idea of professional practices. This model (6) presents a good Adjusted R-squared value equal to 0.84, performing far better than previous models with less control variables (smaller than 0.5 for models (1)-(2)-(3) and smaller than 0.75 for models (4)-(5).

Table 3. OLS log monthly earnings estimation (2019)

Variables	(1) logw	(2) logw	(3) logw	(4) logw	(5) logw	(6) logw
gender	-0.145***	-0.126***	-0.130***	-0.0810***	-0.0541***	-0.0246**
	(0.0283)	(0.0224)	(0.0225)	(0.0196)	(0.0155)	(0.0123)
age		0.0249***	0.0259***	0.0142***	0.0112***	0.00924***
		(0.00118)	(0.00134)	(0.00136)	(0.00112)	(0.000943)
exp_y			-0.00302	0.000892	0.00521***	0.00541***
			(0.00189)	(0.00165)	(0.00131)	(0.00107)
gradeA				0.495***	0.542***	0.541***
				(0.0304)	(0.0243)	(0.0194)
gradeB				0.190***	0.224***	0.215***
				(0.0240)	(0.0188)	(0.0148)
surgmed					0.402***	0.0593
					(0.0426)	(0.0383)
comunic					0.0278	0.0167
					(0.0458)	(0.0361)
econ					0.0115	0.00737
					(0.0413)	(0.0324)
law					0.0687	0.0650
					(0.0516)	(0.0406)
engin					0.0547	-0.00462
					(0.0383)	(0.0310)
biomed					0.166***	-0.0212
					(0.0412)	(0.0339)
geochem					0.0259	0.0231
					(0.0426)	(0.0335)
lifescien					0.00791	-0.00117
					(0.0379)	(0.0298)
engmet					0.0953**	0.0390
					(0.0428)	(0.0342)
matsurg					0.554***	0.108***
					(0.0413)	(0.0414)
lingcul					-0.0601	-0.0488
					(0.0444)	(0.0349)
phys					0.0741*	0.0662**
					(0.0413)	(0.0325)
ind_lect						0.0366**
						(0.0157)
ind_extra						0.0369
						(0.0277)
consultancy						0.146***
						(0.0187)
hospital_emol						0.350***
						(0.0336)
hospital_freelance						0.266***
						(0.0306)
Constant	8.988***	7.689***	7.657***	7.999***	7.979***	8.040***
	(0.0181)	(0.0633)	(0.0663)	(0.0608)	(0.0603)	(0.0480)
Observations	752	752	752	752	752	752
R-squared	0.034	0.394	0.396	0.557	0.738	0.840

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Personal elaboration

Considering year 2023 and the most parsimonious model, the raw wage differential with variable '*gender*' is estimated in model (1) on the first column, with an average gap of 13%, with maximum level of significance, in 2023. Considering the mean salary of 92,102 € in 2023, this would translate into an annual loss of 11,973 € for female faculty, relative to their male peers for the year 2023. It can be seen already from this first model that, albeit only slightly, the gender wage gap has decreased after four years. In the second model (2), control for age is added, which causes a minimal effect on the gender gap, while it explains around two points of the wage gap, meaning that women are on average younger than men, as seen in 2019. In the third model (3), we included the variable *experience* ('*exp_y*'), referred to the number of years of academic experience in the institution. As previously noted in the discussion of the results of the 2019 data, again this variable does not appear to be statistically significant, but we can notice a correlation between age and experience, as expected. In the model presented in the fourth column (4), we added the variables expressing the role of the individuals within the institution (i.e., '*gradeA*' and '*gradeB*', controlling by variable grade C) referring to the different faculty ranks included in this dataset (i.e., grade A, B or C). These variables, all with maximum level of significance, reduce the gap from 13% to around 7%, highlighting once again the scarce presence of female individuals in higher academic ranks (grade A and grade B). Affiliation departments have been added to model (5), excluding the Department of Education and Human Sciences ('*eduscien*') as our reference. It can be noticed that the gender wage gap decreases slightly further to 6.5%, meaning that a part of the difference is explained by the affiliation to different departments. By analysing the different coefficients related to the single departments, it can be stated that faculty members of the Department of Maternal, Child and Adult Medical and Surgical Sciences (*'matsurg*') earn significantly more than members of the Department of Education and Human Sciences (56% more), and the same is true for also the Department of Surgery, Medicine, Dentistry and Morphological Sciences with interest in Transplantology ('*surgmed*') (41% more), for the Department of Biomedical, Metabolic and Neuroscience ('*biomed'*) (27% more) and the Department of Engineering Sciences and Methods ('*engmet'*), while, with a slightly less significant positive difference, the faculty member affiliated to the Department of Engineering ('*engin*') earn about 10% more. It can be noted that all of the departments with the highest salaries belong to the medical or the engineering area, where we have observed a strong gender gap, especially in grade A positions. Finally taking into account the different components of the wages in our data set (i.e., fixed salary and additional emoluments), the last model (6) included binary variables indicating the presence or the absence of additional emoluments, broken down into freelance hospital emoluments ('*hospital_freelance*'), hospital emoluments ('*hospital_emol*'), additional emoluments from consultancy ('*consultancy*'), indemnities (divided into additional lecturing activities, '*ind_lect'*, and

allowances due to a variety of appointments, such as committee tokens, '*ind_extra'*). It can be observed that the gender wage gap slightly decreases to around 5.8% and remains statistically significant. We find that all these additional emoluments increase the wage, with the maximum statistical significance for freelance hospital emoluments ('*hospital_freelance*') and additional emoluments from consultancy ('*consultancy*'), while the hospital emoluments ('*hospital_emol*') are significant at the 10% level of significance. These results are in line with the observation made about the medical area, and consistent with the idea of professional practices such as those carried out on a consultancy basis by those belonging to engineering departments. The final model (6) presents a good Adjusted R-squared value equal to 0.73, performing far better than previous models with less control variables.

Table 4. OLS log monthly earnings estimation (2023)

Variables	(1) logw	(2) logw	(3) logw	(4) logw	(5) logw	(6) logw
gender	-0.128***	-0.119***	-0.118***	-0.0657***	-0.0645***	-0.0577***
	(0.0282)	(0.0215)	(0.0215)	(0.0190)	(0.0162)	(0.0157)
age		0.0267***	0.0256***	0.00828***	0.00553***	0.00497***
		(0.00103)	(0.00138)	(0.00158)	(0.00137)	(0.00134)
exp_y			0.00218	0.0112***	0.0135***	0.0142***
			(0.00176)	(0.00163)	(0.00137)	(0.00135)
gradeA				0.571***	0.604***	1.066***
				(0.0334)	(0.0283)	(0.0686)
gradeB				0.276***	0.285***	0.285***
				(0.0253)	(0.0210)	(0.0207)
surgmed					0.412***	0.348***
					(0.0462)	(0.0462)
comunic					0.0373	0.0290
					(0.0484)	(0.0471)
econ					0.0495	0.0518
					(0.0436)	(0.0423)
law					0.0142	0.0164
					(0.0530)	(0.0516)
engin					0.0957**	0.0656*
					(0.0398)	(0.0392)
biomed					0.271***	0.237***
					(0.0419)	(0.0414)
geochem					0.0244	0.0147
					(0.0454)	(0.0441)
lifescien					0.0189	0.0143
					(0.0396)	(0.0384)
engmet					0.115***	0.0907**
					(0.0439)	(0.0429)
matsurg					0.557***	0.494***
					(0.0427)	(0.0425)
lingcul					0.0460	0.0409
					(0.0461)	(0.0449)
phys					0.0538	0.0496
					(0.0427)	(0.0414)
ind_lect						0.0324

						(0.0208)
ind_extra						0.0392
						(0.0435)
consultancy						0.195***
						(0.0409)
hospital_emol						0.109*
						(0.0645)
hospital_freelance						0.228***
						(0.0773)
Constant	8.975***	7.620***	7.660***	8.173***	8.147***	7.648***
	(0.0182)	(0.0542)	(0.0629)	(0.0625)	(0.0663)	(0.0922)
Observations	929	929	929	929	929	929
R-squared	0.022	0.432	0.433	0.569	0.714	0.732

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Personal elaboration

Comparing the results obtained in 2019 and 2023 (Table 5), it can be observed that the gender wage gap slightly decreased over the four-year period taken under consideration. While in 2019 female faculty earned 13,461 € less than their male peers, in 2023 this gap translated into a difference of 11,973 €. In both models, an important component of the gender wage gap is the role within the institution, in particular the scarcity of women in Grade A and Grade B has the greatest impact on the gender pay gap (the gender gap falls from 13% to 7%). Another aspect common to both models is the statistical significance of the age and the academic experience within the institution ('*exp_y*'), but they only reduce the gap by 1 percentage point when we account for the academic position (columns 4, 5 and 6). Furthermore, the departments belonging to the medical area, specifically the Department of Maternal, Child and Adult Medical and Surgical Sciences (*'matsurg*'), acquire significance in explaining the gender wage gap with regards to 2019. Lastly, additional emoluments related to the medical profession ('*hospital_emol*' and '*hospital_freelance*') or from consultancy ('*consultancy*') resulted to be significant and have an effect of around 1 p.p. on the gender wage gap. Both models, in their latest version (6) are found to have a high adjusted R-squared values (0.84 for 2019 and 0.73 for 2023).

Table 5. OLS log monthly earnings estimation (comparison 2019-2023)

Variables	2019 logw	2023 logw
gender	-0.0246**	-0.0577***
	(0.0123)	(0.0157)
age	0.00924***	0.00497***
	(0.000943)	(0.00134)
exp_y	0.00541***	0.0142***
	(0.00107)	(0.00135)
gradeA	0.541***	1.066***

	(0.0194)	(0.0686)
gradeB	0.215***	0.285***
	(0.0148)	(0.0207)
surgmed	0.0593	0.348***
	(0.0383)	(0.0462)
comunic	0.0167	0.0290
	(0.0361)	(0.0471)
econ	0.00737	0.0518
	(0.0324)	(0.0423)
law	0.0650	0.0164
	(0.0406)	(0.0516)
engin	-0.00462	0.0656*
	(0.0310)	(0.0392)
biomed	-0.0212	0.237***
	(0.0339)	(0.0414)
geochem	0.0231	0.0147
	(0.0335)	(0.0441)
lifescien	-0.00117	0.0143
	(0.0298)	(0.0384)
engmet	0.0390	0.0907**
	(0.0342)	(0.0429)
matsurg	0.108***	0.494***
	(0.0414)	(0.0425)
lingcul	-0.0488	0.0409
	(0.0349)	(0.0449)
phys	0.0662**	0.0496
	(0.0325)	(0.0414)
ind_lect	0.0366**	0.0324
	(0.0157)	(0.0208)
ind_extra	0.0369	0.0392
	(0.0277)	(0.0435)
consultancy	0.146***	0.195***
	(0.0187)	(0.0409)
hospital_emol	0.350***	0.109*
	(0.0336)	(0.0645)
hospital_freelance	0.266***	0.228***
	(0.0306)	(0.0773)
Constant	8.040***	7.648***
	(0.0480)	(0.0922)
Observations	752	929
R-squared	0.840	0.732

Personal elaboration

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.2 Wage decomposition analysis

To provide a more precise breakdown of the gender pay gap across different factors, we performed an Oaxaca-Blinder decomposition, as outlined in Section 3. The results obtained by our decomposition analysis are summarized in Table 6.

The gender wage gap was found to have decreased from 14.5% in 2019 to 12.8% in 2023, consistently to the regression analysis. However, within the differential one can observe a sharp change in the weight of the different components contributing to the differential. While in the 2019 decomposition, the endowments (i.e., the explained component) accounted for 83% on the difference in log wages and the unexplained component accounted for the remaining 17% of the differential, in 2023 the unexplained part of the differential was 45% and the explained one was 55%.

In Tables A1 and A2 in the Appendix, the impact of the various control variables on the explained and unexplained components of the wage gap is shown. It can be observed how, in 2019, the academic rank, in particular belonging to grade A faculty, explained 49% of the gender pay gap, while having additional emoluments explained 29% of the gap. Furthermore, it can be noted that 59% of the explained part is due to the higher presence of men in grade A positions, while the 34% is due to additional emoluments (10% due to freelance hospital emoluments ('*hospital_freelance*'), 13% due to hospital emoluments ('*hospital_emol*') and 11% due to additional emoluments from consultancy ('*consultancy*'). Other factors have relatively modest effects and are not statistically significant.

In 2023 the higher contribution by the unexplained component to the differential can be related to the medical departments with inequalities that accounted to 97% of it. Actually, within the medical departments a further opening up of the gap by gender at the disadvantage of women in Grade A occurred and, in this regard, it is also worth noting the considerable recruitment of women into fixed-term research positions thanks to the National Recovery and Resilience Plan which may have favoured the entry of more women in more precarious conditions and with lower salaries.

Table 6 – Oaxaca-Blinder decomposition. Year 2019-2023.

	2019		2023	
Variables	Differential	Decomposition	Differential	Decomposition
Male	8.988***		8.975***	
	(0.0201)		(0.0197)	
Female	8.843***		8.848***	
	(0.0176)		(0.0188)	
Differential	0.145***		0.128***	
	(0.0267)		(0.0272)	
Explained		0.121***		0.0698***
		(0.0253)		(0.0239)
Unexplained		0.0246**		0.0577***
		(0.0102)		(0.0159)
Observations	752	752	929	929

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
1: gender = M; 2: gender = F

5. Conclusions and further developments

Gender gap in academia regards different dimensions. Evidence of horizontal gender segregation across different fields of research and vertical gender segregation within research areas along with lower career advancement and participation of women in the governance of Research Performing Organisations is also pointed out in the last edition of 'She Figures' (European Commission, 2021). This essay aims to analyse an often-neglected dimension in the analysis of the gender gap in academia, which concerns the observed differential in earnings. For this purpose, administrative data on a large public university located in Northern Italy have been analysed by means of OLS regression and wage decomposition analyses and evidence has been gathered on the existence of the gender pay gap. To deepen the analysis, changes occurred from 2019 (pre-pandemic year and before the drafting of the Gender Equality Plan by the considered university) and 2023 (the year for which the most recent data is available and after the implementation of the Gender Equality Plan) were observed. Both vertical and horizontal segregation within the university have been found to be related to the observed inequalities. The regression analysis highlighted the existence of a gender pay gap within the considered university which translated into an annual loss of 13,461 € for female faculty, relative to their male peers, considering the mean salary of 2019, while in 2023 this gap accounted for a difference of 11,973 €. Once the OLS regression has been performed, an analysis of the components of the gender wage gap was carried out. In order to obtain the breakdown of the predicted gender wage gap into its components, the Oaxaca (1973) and Blinder (1973) decomposition was employed. This allowed to obtain an estimate of the observed gender pay gap, which decreased from 2019 (14.5%) to 2023 (12.8%), consistent with the regression results. However, a larger share of the differential appeared to be connected with discrimination (differences in returns of the same variables, i.e., the 'unexplained component') rather than to characteristics (i.e., the 'explained component') from 2019 to 2023 with a larger weight in the unexplained part to be found in increased inequalities within medical departments (in particular considering the gender gap at the highest academic rank and also due to an increased entry of female researchers in precarious fixed-term positions with lower wages, related to new recruitments under the National Recovery and Resilience Plan). Indeed, in 2019, the academic rank, in particular belonging to grade A faculty, explained 49% of the gender pay gap, and having additional emoluments explains 29% of the gap, while in 2023 the higher contribution by the unexplained component to the differential was related to the medical departments where inequalities that accounts to 97% of it.

Objections raised to the measurement of the gender pay gap in public universities are often related to the argument that salaries are covered by the application of collective bargaining agreements which should not imply gender differences in faculty salaries. We respond to this objection with the analysis in this essay that shows the evidence of gender pay differentials in a public university and how these are strongly related to both vertical segregation and the different weight by gender of the variable part of wages (i.e., additional emoluments, which have been broken down into freelance hospital emoluments ('hospital_freelance'), hospital emoluments ('hospital_emol'), additional emoluments from consultancy ('consultancy'), indemnities (divided into additional lecturing activities, 'ind_lect', and allowances due to a variety of appointments, such as committee tokens, 'ind_extra').

Other contrasting arguments concern the different probability of holding top positions as faculty members due to higher scientific production. In this regard, the literature on the probability of access to higher positions in the academic career clearly shows that this is not the case even when variables that take into account research productivity are included in the models (De Paola et al., 2017; Filandri and Pasqua, 2019; Filandri et al., 2023).

To reduce the observed gender pay gap, policies devoted to increase the presence of women in grade A and in tenure-track positions should be implemented consistently with the Horizon Europe guidance on gender equality plans (European Commission, 2021b). Actions aimed at achieving equal opportunities in the selection and upgrading phases of academic careers and academic career development should be implemented in this regard in order to enable structural change that endures over time. Among them, literature points to unconscious bias training for recruiters, analysis of the language used in adverts and in the gender composition of recruitment or career development panels (European Commission, 2021b) and transformative mentoring (Picardi and Agodi, 2020).

Further developments of this work include the retrieval of teaching load (measured by the number of credits taught and exams in the academic year and an assessment of teachers' overload) as it is crucial to pay attention to measuring the overload in teaching and academic management activities which are usually unrecorded and unequally distributed by gender and have been labelled as 'academic housekeeping' (e.g., responsibility in course organisation, teaching quality assurance and joint faculty-student committees). Moreover, we intend to expand the study by adding within-rank analysis and by increasing the number of observations through an increment in the number of years observed. We also plan to enlarge the case study by including other public universities located in Central and Southern Italy, characterized by different set of policies concerning the gender gap in career and in recruiting as well as by different contextual conditions and social infrastructures to

analyse the impact of internal gender equality policies and external institutional factors and labour market status on the gender pay gap.

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