The Gender Wage Gap in Italy: Evidence from ISFOL PLUS 2016-2021

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Abstract. *Gender wage inequality remains a pressing issue in Italy, shaped by both structural and cultural factors. This study examines the gender wage gap using the Oaxaca-Blinder decomposition method, which separates differences due to observable characteristics - such as education and work experience - from those unexplained, often interpreted as signs of discrimination.*
Using several waves of ISFOL PLUS data, the analysis shows that the overall wage gap has narrowed over time, suggesting progress. However, a growing share of the gap remains unexplained by observable factors, indicating that discriminatory dynamics may have intensified. The wage gap varies across age groups, being smaller among younger workers and larger among older ones. Regional disparities have also diminished, showing convergence between Northern and Southern Italy. Quantile regression results highlight that the gap is most pronounced at both the lower and upper ends of the wage distribution, revealing the coexistence of wage floor effects and glass ceilings. These findings suggest that, despite improvements, structural and cultural barriers to full gender pay equality persist in Italy.

Keywords. *Gender wage gap, Oaxaca-Blinder decomposition, wage discrimination, Italy, labor market inequality*

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1 Introduction

Gender wage inequality remains one of the most persistent and multifaceted challenges facing modern labor markets, reflecting deeply rooted economic, institutional, and cultural barriers to equality. Despite decades of legislative efforts, improved educational attainment among women, and evolving social norms, significant wage disparities between men and women persist across developed economies. According to the World Economic Forum [2024], Italy ranks 87th out of 146 countries in the Global Gender Gap Index, which measures progress in closing gender gaps across economic participation, educational attainment, health, and political empowerment. This ranking underscores the substantial challenges Italy faces in achieving gender equality, particularly in labor market outcomes.

The Italian gender wage gap (GWG) presents a complex and somewhat paradoxical picture. While official statistics report a modest unadjusted hourly gender pay gap, this figure conceals substantial heterogeneity and likely understates true inequality. The discrepancy between hourly and annual earnings measures highlights how working time arrangements and employment continuity shape gender wage inequality in ways that simple hourly comparisons may obscure. Moreover, Italy exhibits one of the

lowest female employment rates in the European Union, implying strong selection effects whereby only women with particularly strong labor market attachment and high earning potential remain employed. Consequently, the modest observed hourly wage gap among employed workers may mask substantial underlying inequality.

The persistence of the gender wage gap underscores enduring challenges in understanding the nature and sources of labor market inequality. Wage differentials may reflect variations in productivity-related characteristics such as education, experience, and occupational choice, as well as the influence of discriminatory practices, unequal treatment, and structural barriers that systematically disadvantage women. A comprehensive understanding of these dynamics extends beyond theoretical interest, carrying significant implications for social policy, economic efficiency, and intergenerational mobility. When women consistently earn less than men, households experience heightened economic insecurity, female labor supply decisions become distorted, and human capital investments yield diminished returns, thereby reinforcing cycles of inequality Olivetti and Petrongolo [2016].

This study provides a comprehensive empirical analysis of the gender wage gap in Italy using three waves of high-quality survey data from the ISFOL PLUS (Participation, Labor, and Unemployment Survey) covering the years 2016, 2018, and 2021. Our analysis focuses on full-time employees aged 18-64, allowing us to trace the evolution of wage inequality over a critical five-year period that spans both pre-pandemic economic conditions and the initial recovery phase. After excluding observations with missing values in key control variables, our analytical sample comprises 22,830 workers (61.6% of the 37,717 full-time employees initially identified). By restricting attention to full-time workers, we isolate differences in hourly compensation from differences in hours worked, providing cleaner estimates of wage-setting mechanisms and discrimination.

Our research addresses two primary questions: First, we analyze how the gender wage gap varies across different demographic groups, geographic regions, and points along the wage distribution. Second, we examine to what extent the gap can be explained by observable characteristics such as education, experience, and occupation, versus what portion reflects structural discrimination in the labor market.

We employ the Oaxaca-Blinder decomposition method to systematically separate the portion of the gap attributable to differences in observable characteristics from the portion reflecting differences in how men and women are compensated for these same characteristics. This latter component, commonly interpreted as evidence of discrimination or unequal treatment, proves substantial in the Italian context. Our main findings indicate that the unadjusted wage gap declined from 14.6% in 2016 to 7.2% in 2021, yet approximately 68% of the 2021 gap remains unexplained by observable characteristics, up from 62% in 2016. This large and increasing unexplained component suggests that discriminatory dynamics and unequal returns to human capital continue to play a central role in Italian gender wage inequality.

Our findings contribute to the growing body of research on gender inequality in European labor markets. The substantial age and regional heterogeneity we document suggests that targeted interventions addressing the specific barriers facing different demographic groups may be required to achieve meaningful progress toward pay equity.

The remainder of this paper proceeds as follows. Subsection 1.1 situates Italy within the broader European context, describing key labor market characteristics and regional disparities that shape gender inequality. Section 2 reviews the empirical literature on gender wage gaps, focusing on recent studies and identifying gaps that our analysis addresses. Section 3 describes the ISFOL PLUS data, variable construction, and sample selection procedures. Section 4 presents our main empirical results, including

descriptive statistics, regression analyses by year and gender, Oaxaca-Blinder decompositions, and quantile regression estimates. Section 5 concludes with a discussion of policy implications and directions for future research.

1.1 Italy in the European Context

Italy combines a relatively modest unadjusted hourly gender pay gap with one of the lowest female employment rates in Europe, creating a paradox whereby observed wage differentials understate true inequality due to selective employment of high-potential women.

Female employment in Italy remains among the lowest in the European Union. According to Eurostat [2024], only 57.4% of women aged 20-64 were employed in 2024, compared to 76.8% of men - a gender gap of 19.4 percentage points. This places Italy near the bottom of EU rankings, exceeded only by Greece. For comparison, the EU average female employment rate stands at 70.8%, with Nordic countries approaching gender parity (Sweden: 79.9% women, 83.9% men). This low participation rate reflects multiple reinforcing factors including traditional gender norms emphasizing women's family responsibilities, inadequate childcare infrastructure (according to OECD [2023], the enrolment rate of children aged 0–2 in childcare services in Italy is 26.4%, below the OECD and EU averages of 36.0% and 32.6%, respectively), and workplace cultures penalizing career interruptions.

Part-time employment represents another crucial dimension of gender inequality. Eurostat [2023b] reports that 28.4% of employed EU women work part-time, compared to just 8.4% of men. While part-time arrangements can facilitate work-family balance, they often entail substantial penalties: lower hourly wages for comparable work, reduced access to training and promotion opportunities, and diminished pension entitlements. The concentration of women in part-time employment explains much of the gap between hourly (2.2% according to Eurostat [2023a]) and annual (20%) earnings differentials, as women work fewer hours per week and fewer weeks per year. Our analysis, by focusing on full-time workers, isolates pure wage effects from hours effects but consequently understates total gender inequality.

Occupational and sectoral segregation in Italy remains pronounced. According to Italian Government – Department for Equal Opportunities [2022], Italy ranks 28th (last) in Europe regarding female labor market participation, occupational quality, and sectoral segregation, with women's employment substantially lower than men's, particularly among mothers. Sectoral disparities persist [European Institute for Gender Equality (EIGE), 2019]: 26% of women work in education, health, and social services, versus 7% of men, while only 6% of women are employed in STEM occupations compared with 31% of men. These patterns are consequential, as male-dominated sectors typically provide higher wages.

Italy's sharp regional dualism constitutes another defining feature affecting gender inequality. Northern regions - particularly Lombardy, Veneto, Piedmont, and Emilia-Romagna - feature advanced manufacturing, strong exports, high productivity, and relatively high wages. Southern regions - including Calabria, Sicily, Campania, and Puglia - face chronic unemployment, limited industrial development, and heavy reliance on agriculture, tourism, construction, and public employment. The North-west maintains first place in the ranking of per capita GDP, with a current value of around 37 thousand euros, almost double that of the South, at just over 19 thousand euros per year - a 95% differential [Istituto Nazionale di Statistica (ISTAT), 2021]. This economic divide translates into substantial wage differences.

Gender wage gaps vary systematically across Italy's territorial divide. Northern regions exhibit rel-

atively smaller gaps, while Southern regions show larger disparities [Accetturo et al., 2022]. These geographic differences persist even after controlling for education, occupation, and industry, indicating that regional labor market structures, cultural norms, enforcement of anti-discrimination regulations, and informal employment all contribute to the variation. Several mechanisms may explain the larger gaps in the South. First, higher unemployment suggests stronger selection effects, yet gaps remain substantial. Second, women are more concentrated in lower-paying public sector jobs. Third, informal employment is more prevalent in the South, evading labor protections. Finally, traditional gender norms are more entrenched in Southern regions. Understanding whether these gaps primarily reflect differences in individual characteristics or worse treatment (discrimination) has important implications for regionally targeted policies - a question our regional decomposition analysis addresses.

2 Literature review

Research on the gender wage gap has evolved significantly over the past two decades, progressing from simple documentation of average disparities to a more nuanced examination of their structural, institutional, and distributional determinants. Early contributions for Italy, such as Zizza [2013], provided a foundational understanding of wage differentials by applying the Oaxaca–Blinder decomposition to SHIW data from 1993 to 2008. Her findings revealed that observable characteristics - education, experience, and occupation - accounted for only part of the gender wage gap, while a substantial unexplained component persisted, particularly in the private sector where weaker collective bargaining and greater managerial discretion prevailed. This evidence highlighted the centrality of discrimination and occupational segregation in shaping Italian wage structures.

Subsequent analyses expanded both the temporal scope and methodological depth of this research. Mussida and Picchio [2014] examined the evolution of gender wage inequality between 1993 and 2012 and showed that, although mean gaps narrowed modestly, disparities at the upper end of the wage distribution remained remarkably stable. Their results underscored the existence of a persistent glass ceiling, as women's rising educational attainment did not translate into equivalent wage gains, indicating structural barriers that limit returns to human capital. The cyclical dimension of gender inequality was explored by Piazzalunga and Di Tommaso [2019], who analyzed the period of the Great Recession and found that the gender wage gap widened primarily due to changes in returns to characteristics rather than differences in characteristics themselves. These findings suggest that economic downturns can exacerbate discrimination, as weaker labor market conditions tend to increase employers' bargaining power and reduce women's access to high-quality employment.

Geographical and institutional heterogeneity represents another key feature of Italian wage inequality. Brown et al. [2022] documented that gender wage gaps are systematically higher in Southern regions, even after accounting for education, occupation, and sectoral composition. Their results highlight the enduring North–South divide and the weaker institutional enforcement of labor protections in the South, where informal employment and traditional gender norms are more pervasive. However, they did not explicitly disentangle the extent to which regional disparities reflect differences in worker characteristics as opposed to unequal returns to those characteristics - a question that remains central to understanding regional labor market dynamics and that the present study addresses through regional decompositions.

Sectoral segmentation has also emerged as an important factor in explaining wage disparities. Castagnetti and Giorgetti [2019] compared the public and private sectors and found that wage gaps were substantially smaller in the public administration, where collective bargaining and pay transparency are

stronger, yet glass ceiling effects persisted even there. Complementary evidence from Card et al. [2016] using matched employer–employee data indicated that both within-firm pay differentials and sorting across firms contribute significantly to the gender wage gap. Approximately 40% of the gap stems from differences in pay within firms, while another 20% is attributable to women's concentration in lower-paying employers, suggesting that discrimination operates simultaneously at the intra- and inter-firm levels.

Distributional approaches have further refined the understanding of gender wage inequality. Studies by Addabbo and Favaro [2011] and by Fortin et al. [2011] emphasized that mean-based decompositions conceal substantial heterogeneity across the wage distribution. Through quantile regression and decomposition methods, they demonstrated the coexistence of sticky floor effects at the lower tail - where women are concentrated in low-paid, precarious jobs - and glass ceiling effects at the top, where women face barriers to promotion and access to high-return positions. These insights motivated a shift from traditional mean-based analyses to methods that account for the entire wage distribution, revealing that discrimination can operate differently across wage levels and occupational hierarchies.

Further research has explored heterogeneity across education levels and life-cycle stages. Piazzalunga [2018], using the AlmaLaurea dataset on Italian university graduates, found that even among highly educated workers, an unexplained wage differential persisted and tended to widen along the wage distribution, again indicating the presence of glass ceiling dynamics. Maida and Weber [2022] evaluated the impact of Italy's gender board quota law and found that, although the representation of women on corporate boards increased substantially, there were no significant spillover effects on broader wage outcomes or career advancement opportunities. Their findings suggest that institutional interventions, while necessary to promote visibility and representation, are insufficient on their own to address deeper structural inequalities within firms.

The COVID-19 pandemic has introduced a new context for studying gender wage dynamics. Barbieri et al. [2022] documented that women were disproportionately affected by job losses during the initial lockdowns of 2020, particularly in service sectors such as hospitality and retail, and that they were more likely to re-enter the labor market in lower-paid positions. These developments indicate that external shocks can reshape wage structures and reinforce pre-existing inequalities, making post-pandemic monitoring and targeted policy responses essential.

Taken together, the existing literature portrays a complex and persistent pattern of gender wage inequality in Italy. Despite improvements in women's educational attainment and labor force participation, wage disparities endure across sectors, regions, and points of the wage distribution. The unexplained component of the gap - often estimated between 60 and 70 percent - suggests that discrimination and unequal returns to comparable characteristics continue to play a central role. At the same time, the coexistence of sticky floor and glass ceiling phenomena, combined with the structural North–South divide and limited policy effectiveness, underscores the multifaceted nature of the problem. Building on these findings, the present study extends previous work by applying a unified Oaxaca–Blinder decomposition to the most recent ISFOL PLUS waves (2016, 2018, and 2021), integrating regional and distributional perspectives, and examining how the sources of the gender wage gap evolved during the COVID-19 period. In doing so, it contributes to a more comprehensive understanding of both the magnitude and the underlying mechanisms of gender wage inequality in contemporary Italy.

Despite this rich body of work, several important gaps motivate our analysis. Most studies rely on SHIW or EU-SILC data with limited sample sizes for detailed subgroup analysis and potential measurement error in self-reported earnings, whereas ISFOL PLUS offers larger samples and more detailed

occupational information enabling finer-grained analysis. While several studies document geographic variation, systematic decomposition of whether regional gaps reflect characteristic differences versus differential treatment remains limited, which our regional Oaxaca-Blinder analysis addresses. Comprehensive analysis of how gap composition evolved through the pandemic is absent, and our systematic decompositions across 2016, 2018, and 2021 provide the most up-to-date assessment. Although quantile methods have been applied, analysis of how gaps and their sources vary jointly across distribution, region, and time remains sparse, which our combined quantile-region-time analysis fills. Finally, existing research insufficiently explores age-cohort heterogeneity in recent data, despite younger cohorts experiencing different institutions and norms, and our age-specific analysis reveals striking life-cycle patterns requiring explanation.

3 Data and methodology

3.1 Descriptive statistics

The empirical analysis draws on micro-data gathered by the Italian Institute for the Development of Vocational Training for Workers (ISFOL) through the Participation, Labor, and Unemployment Survey (PLUS). This data was collected as part of a collaborative project with the Italian Ministry of Labor and Social Policy, initiated in 2005, aimed at creating a dataset for studying wage inequality by gender. The dataset includes data waves from the years 2016, 2018, and 2021.

Table 1: ISFOL PLUS Samples Size and Composition

Year	Males	Females	Total
2016	23.241	29.278	52.519
2018	20.353	24.647	45.000
2021	19.229	27.053	46.282

Our analysis focuses on full-time employees aged 18 to 64. We restrict the sample to salaried employees, excluding: (1) part-time workers, who face different wage-setting mechanisms and for whom women are disproportionately represented (32.8% of women versus 9.5% of men in 2016, narrowing to 24.7% versus 12.0% by 2021); (2) self-employed, whose earnings include capital income rather than pure labor compensation; (3) individuals aged 65 and above, representing non-standard employment; (4) students, job seekers, pensioners, and other inactive individuals; and (5) observations with missing or implausible wage values. These restrictions aim to create a homogeneous sample focused on standard employment relationships. Our analysis is limited to earnings from the main job, which constitutes the largest portion of income for most workers.

Table 2 reports the sample selection process. From an initial 143.801 individuals across three waves, we retain 37.717 full-time employees after applying the restrictions described above. To ensure consistent model estimation, we further exclude observations with missing values in key control variables (region, occupation, marital status, presence of children, firm size, and health status), yielding a final analytical sample of 22.830 workers—representing 61.6% of the full-time sample and 15.9% of the initial PLUS population. While this sample reduction raises potential selection concerns, sensitivity analyses indicate that included observations do not differ systematically from excluded ones in terms of mean wages or gender distribution.

Table 2: Sample selection flow

Selection Step	N	% Retained
Initial PLUS sample (2016, 2018, 2021)	143,801	100.0%
Employed individuals	59,400	41.3%
Full-time workers	37,717	63.5%
Valid wage data	37,717	100.0%
Final analytical sample (complete cases)	**22,830**	**60.5%**
Males	13,361	58.5%
Females	9,469	41.5%

The dependent variable is the natural logarithm of hourly wages, calculated as:

$$\ln(w_i) = \ln\left(\frac{\text{Annual Gross Earnings}_i}{\text{Weekly Hours}_i \times 52}\right) \tag{1}$$

where annual gross earnings include all wage and salary income from the main job, and weekly hours reflect typical hours worked. We winsorize wages at the 1st and 99th percentiles to reduce the influence of extreme outliers while retaining distributional information.

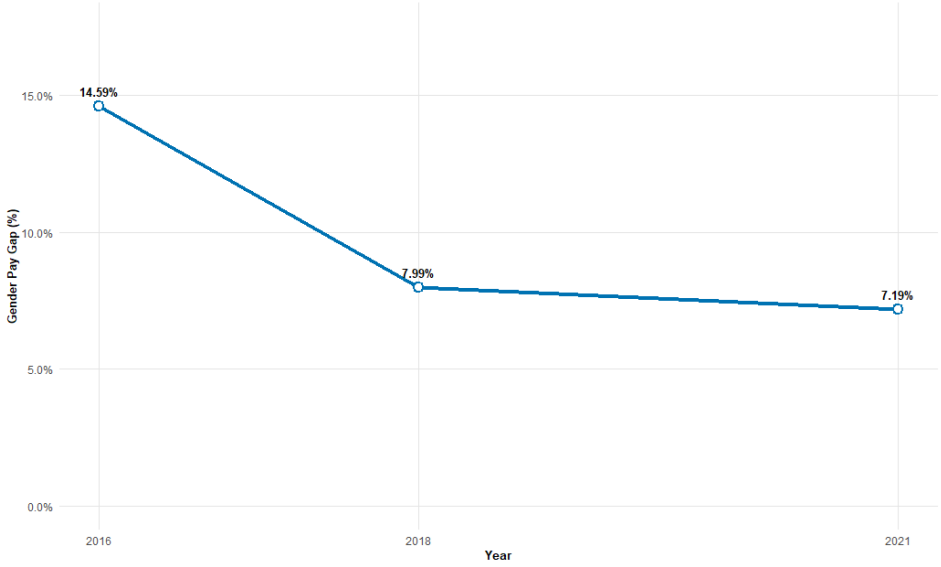

Figure 1: Gender wage gap trend (full-time workers only)

The Figure 1 captures the gender wage gap percentage across the years 2016, 2018, and 2021. In 2016, the gap stood at 14.6%, indicating that, on average, women earned significantly less than men. By 2018, it had fallen to nearly 8%, reflecting a substantial reduction in wage disparities. This downward trend continued into 2021, when the gap further decreased to 7.2% - a reduction of 0.8 percentage points from 2018. This improvement likely reflects the cumulative impact of policy reforms, increased advocacy for wage transparency, and evolving workplace dynamics. Nonetheless, a gap of 7.2% remains significant, highlighting the ongoing need for targeted measures to achieve full pay equality.

Figure 2 reveals pronounced age heterogeneity in the gender wage gap. In 2016, the gap ranged from 12.5% (ages 25-29) to 22.7% (ages 50-64), exhibiting a life-cycle gradient wherein disparities widen with age. By 2021, younger workers experienced dramatic improvements - the gap fell to just 3.4% for ages 25-29 and 6.0% for ages 18-24 - while older workers (50-64) continued to face substantial inequality

(19.6%), albeit reduced from 23.4% in 2018. This pattern suggests that while entry-level wage parity has improved, structural barriers causing gaps to accumulate over careers remain entrenched. Policies must therefore address both initial discrimination and life-cycle mechanisms such as motherhood penalties and limited advancement opportunities.

Overall, while the pandemic may have contributed to some progress for younger age groups, the data reveals that older age groups, particularly women nearing retirement, still face enduring pay disparities. These trends highlight the need for targeted interventions and policies to address the root causes of gender pay inequities across all stages of a woman's career.

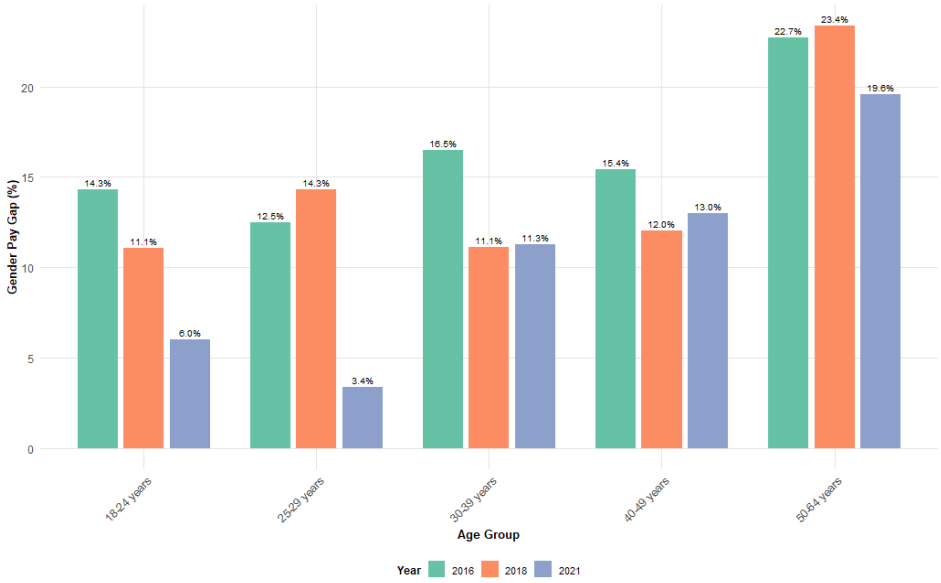

Figure 2: Gender wage gap by age groups

The Figure 3 examines the distribution of part-time work between men and women over the three years, highlighting how gender roles in employment have evolved. In 2016, the data shows that 32.8% of women worked part-time compared to only 9.5% of men, indicating that women were significantly more likely to work part-time, potentially due to family responsibilities or societal expectations. By 2018, a slight decrease in the proportion of part-time workers was observed for both genders, with 31.5% of women and 9.0% of men working part-time, suggesting a trend toward more full-time employment across the board.

In 2021, there was a notable shift: the proportion of women working part-time dropped to 24.7%, while for men, it increased slightly to 12.0%. This could reflect changes in work-life balance priorities or the lingering effects of global disruptions like the COVID-19 pandemic. Despite these shifts, the gender disparity in part-time employment remained evident, with women consistently more likely than men to work part-time, though the gap narrowed slightly over the years.

Figure 4 illustrates the evolution of regional gender wage gaps across Italy. In 2016, the GWG exhibited a clear North-South gradient: Southern regions (Calabria, Sicily, Campania) displayed values exceeding 16%, Central Italy ranged between 14-15%, while Northern regions (Lombardy, Veneto, Piedmont) showed the lowest disparities at 12-13%.

By 2018, this pattern persisted, though modest convergence emerged in Central regions (13-14%).

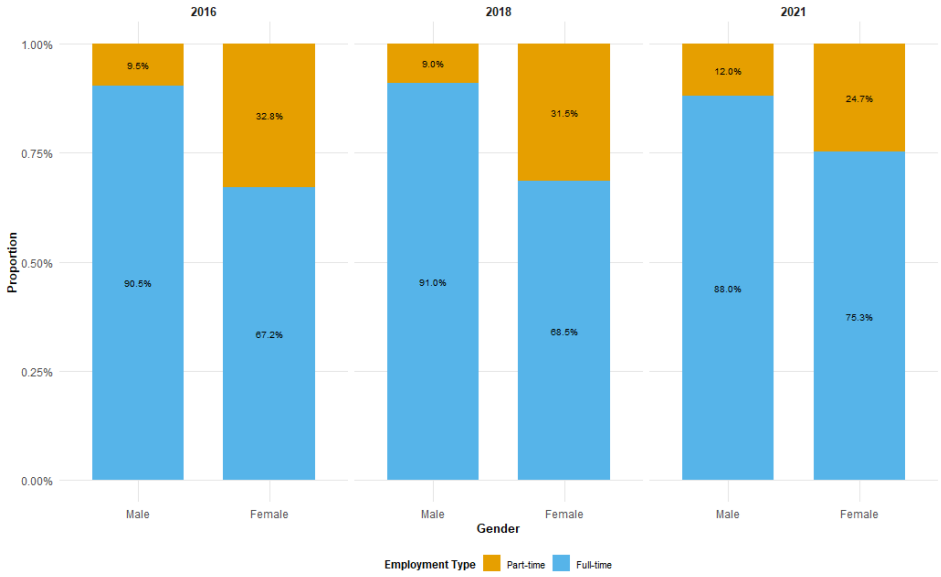

Figure 3: Part-time work distribution by gender

Northern regions maintained their advantage with values below 13%. The 2021 data reveal significant progress: Northern regions (Trentino-Alto Adige, Friuli Venezia Giulia) achieved gaps below 12%, while Southern regions narrowed to approximately 13-14%, indicating substantial convergence though North-South disparities remain evident.

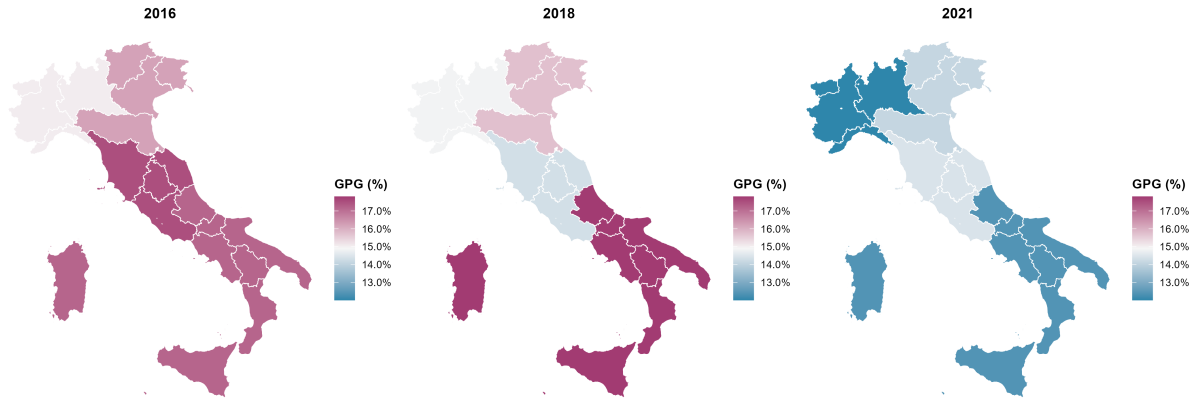

Figure 4: Gender wage gap in Italy by region

The regional differences in GWG remain notable. While Northern Italy generally exhibits lower GWG levels, reflecting more progress in reducing income disparities, Southern Italy, despite some improvements, continues to face higher gender wage gaps. Central regions show a relatively stable trend, with moderate disparities persisting over time.

3.2 Wage equation and Oaxaca-Blinder decomposition

The empirical strategy is based on a standard Mincer-type wage equation estimated separately for men and women:

$$\ln(w_i) = X_i\beta + \varepsilon_i \tag{1}$$

where w_i denotes the hourly wage, X_i is a vector of individual and job-related characteristics (including age, education, occupation, industry, region, and firm size), and ε_i is an error term. The coefficients β capture the returns to these characteristics.

To analyze the sources of the gender wage gap, we apply the Oaxaca–Blinder decomposition Oaxaca [1973], Blinder [1973], which separates the observed wage differential between men and women into an explained component (differences in characteristics) and an unexplained component (differences in returns to characteristics). Formally, the mean wage gap can be expressed as:

$$\overline{W}_m - \overline{W}_f = (\bar{X}_m - \bar{X}_f)\hat{\beta}_m + \bar{X}_f(\hat{\beta}_m - \hat{\beta}_f) + (\bar{X}_m - \bar{X}_f)(\hat{\beta}_m - \hat{\beta}_f) \tag{2}$$

The first term, $(\bar{X}_m - \bar{X}_f)\hat{\beta}_m$, represents the explained component - differences due to observable characteristics. The second and third terms together constitute the unexplained component, typically interpreted as reflecting discrimination or unequal returns to similar characteristics.

This framework enables us to quantify how much of the wage gap is driven by differences in endowments (education, experience, occupation, region) versus differences in the way these characteristics are rewarded in the labor market.

4 Results

4.1 Regression analysis

Table 3 presents the estimated wage determinants separately for men and women. The comparison reveals both significant gender-based differences and notable similarities in the factors influencing the natural logarithm of hourly wages (ln_w). In both models, regional disparities emerge as a key determinant shaping wage differentials.

Regional disparities reveal significant wage penalties outside the Northwest, with larger effects for women: Center penalties are -0.051 ($p < 0.001$) for men and -0.068 ($p < 0.001$) for women, while South and Islands penalties reach -0.082 and -0.112 respectively. This gender asymmetry indicates stronger regional wage inequalities for women, reflecting structural labor market differences and weaker economic opportunities in peripheral regions.

Municipality size exhibits an urban premium concentrated in metropolitan areas. Relative to municipalities under 5,000 inhabitants, cities exceeding 250,000 show wage premia of 4.4% for men and 4.1%

Table 3: Gender-specific determinants of log hourly wages

	Male	**Female**
Region (Ref. Northwest)		
Northeast	-0.008 (0.013)	-0.022 (0.016)
Center	-0.051*** (0.014)	-0.068*** (0.017)
South and islands	-0.082*** (0.013)	-0.112*** (0.017)
Municipality size (Ref. < 5.000)		
5.000-20.000	-0.005 (0.014)	0.002 (0.017)
20.000-50.000	-0.016 (0.016)	0.019 (0.020)
50.000-250.000	0.011 (0.017)	0.006 (0.021)
> 250.000	0.043* (0.017)	0.040* (0.020)
Age group (Ref. 18-24 years)		
25-29 years	0.175*** (0.019)	0.172*** (0.023)
30-39 years	0.331*** (0.021)	0.316*** (0.023)
40-49 years	0.389*** (0.022)	0.426*** (0.027)
50-64 years	0.448*** (0.021)	0.409*** (0.027)
Occupational category (Ref. Blue-collar workers)		
Managers and professionals	0.096*** (0.013)	0.027 (0.016)
White-collar workers	0.007 (0.011)	0.003 (0.014)
Not classified	0.040 (0.034)	-0.003 (0.032)
Marital status (Ref. Single)		
Married	0.098*** (0.017)	0.038* (0.018)
Separated/Divorced	0.019 (0.030)	0.005 (0.032)
Widowed	-0.049 (0.068)	-0.165** (0.056)
Presence of children (Ref. With children)		
Without children	-0.044** (0.016)	-0.071*** (0.018)
Firm size (Ref. 1-9 employees)		
10-15 employees	0.111*** (0.018)	0.041* (0.020)
16-49 employees	0.097*** (0.015)	0.079*** (0.017)
50-249 employees	0.128*** (0.015)	0.111*** (0.017)
250+ employees	0.180*** (0.015)	0.115*** (0.019)
Health status (Ref. Very bad)		
Bad	-0.110 (0.068)	-0.290*** (0.063)
Fair	-0.095 (0.065)	-0.235*** (0.059)
Good	-0.059 (0.065)	-0.264*** (0.058)
Very good	-0.060 (0.065)	-0.252*** (0.059)
Year (Ref. 2016)		
2018	0.111*** (0.012)	0.161*** (0.016)
2021	0.331*** (0.012)	0.371*** (0.015)
(Intercept)	4.129*** (0.076)	4.354*** (0.074)
Number of observations	13.361	9.469
R^2	0.156	0.137
Adjusted R^2	0.154	0.134

Notes: Standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001.

for women, with intermediate sizes displaying no significant effects. This metropolitan concentration suggests that urban advantages - labor market thickness, industry agglomeration, productivity spillovers - benefit both genders equally, though sectoral sorting may slightly favor men.

Age-earnings profiles rise monotonically, peaking at ages 50-64 with returns of 56.5% for men and 50.5% for women relative to the 18-24 baseline. While patterns are similar across genders, women's slightly lower late-career returns may reflect accumulated effects of career interruptions, caregiving responsibilities, or promotion barriers.

Occupational categories reveal stark gender asymmetries. Managers and professionals earn 10.1% more than blue-collar workers among men but show no significant premium (2.7%, n.s.) among women. White-collar status yields no wage advantage for either gender relative to blue-collar work, indicating that occupational hierarchies primarily differentiate high-skill roles rather than middle-tier positions. Women's inability to monetize professional status points to persistent occupational segregation or unequal valuation of comparable credentials.

Marital status effects diverge sharply by gender. Marriage increases male wages by 10.3% ($p < 0.001$) but yields only a marginal 3.9% premium for women ($p < 0.05$). This "marriage premium" for men likely reflects household specialization and employer perceptions favoring married men as stable, committed workers. Conversely, widowhood imposes a 15.2% penalty on women ($p < 0.01$) but none on men, suggesting gender-specific vulnerabilities to life-course disruptions and caregiving burdens.

The presence of children exhibits a counterintuitive pattern: childless workers earn less than parents, with penalties of 4.3% for men and 6.9% for women. This reverses conventional "motherhood penalty" findings and likely reflects severe selection effects in Italy's low female employment context (57.4%). Women remaining employed full-time despite children represent an exceptionally high-earning, strongly attached subset, while labor force exit disproportionately affects lower-wage mothers. Compositional bias thus generates an apparent "motherhood premium" that masks genuine penalties experienced by women who reduce hours or exit employment.

Firm size generates monotonic wage premia across all categories. Relative to firms with 1-9 employees, men in firms with 10-15 workers earn 11.7% more, 16-49 workers 10.2% more, 50-249 workers 13.7% more, and 250+ workers 19.7% more. Women exhibit similar patterns but with consistently smaller coefficients: 4.2%, 8.2%, 11.7%, and 12.2% respectively. These premia reflect productivity advantages, bargaining power, union presence, and structured wage policies in large firms. Women's systematically lower returns suggest occupational segregation within firms, limited promotion access, or differential wage-setting treatment even in large organizations.

Health status shows puzzling gender-specific patterns. For men, health coefficients are uniformly negative but insignificant. For women, however, all health levels yield large negative coefficients relative to "Very bad" health: "Bad" health -25.2% ($p < 0.001$), "Fair" -21.0%, "Good" -23.2%, "Very good" -22.3%. This paradox - where better health correlates with lower wages - likely reflects extreme selection: women in very poor health remaining employed full-time constitute a highly selected group with exceptional earning power or job protections, while healthier women face broader occupational constraints. Alternatively, endogeneity in self-reported health (influenced by work stress or job quality) may generate reverse causation.

Temporal effects reveal steady wage growth: relative to 2016, log wages increased 11.7% in 2018 and 39.2% in 2021 for men, and 17.5% and 44.9% for women. Women's slightly faster wage growth

Table 4: Wage models by year

	2016	2018	2021
Region (Ref. Northwest)			
Northeast	-0.019 (0.020)	-0.007 (0.019)	-0.020 (0.013)
Center	-0.098*** (0.022)	-0.038* (0.019)	-0.047*** (0.014)
South and islands	-0.181*** (0.023)	-0.062** (0.021)	-0.059*** (0.015)
Municipality size (Ref. < 5.000)			
5.000-20.000	0.011 (0.022)	0.000 (0.019)	0.002 (0.014)
20.000-50.000	0.013 (0.027)	0.014 (0.023)	-0.010 (0.016)
50.000-250.000	0.040 (0.026)	0.006 (0.024)	0.003 (0.020)
> 250.000	0.047 (0.026)	0.018 (0.026)	0.059*** (0.018)
Gender (Ref. Male)			
Female	-0.084*** (0.017)	-0.039** (0.015)	-0.051*** (0.011)
Age group (Ref. 18–24 years)			
25–29 years	0.361*** (0.047)	0.168*** (0.044)	0.102*** (0.014)
30–39 years	0.573*** (0.046)	0.257*** (0.044)	0.240*** (0.018)
40–49 years	0.673*** (0.048)	0.315*** (0.045)	0.337*** (0.024)
50–64 years	0.717*** (0.048)	0.356*** (0.046)	0.355*** (0.021)
Occupational category (Ref. Blue-collar workers)			
Managers and professionals	0.104*** (0.022)	0.046* (0.019)	0.066*** (0.014)
White-collar workers	0.033 (0.018)	-0.021 (0.017)	0.011 (0.012)
Not classified	-0.135 (0.096)	-0.009 (0.068)	0.036 (0.024)
Marital status (Ref. Single)			
Married	0.092** (0.024)	0.055* (0.022)	0.067*** (0.018)
Separated/Divorced	0.028 (0.040)	-0.018 (0.040)	0.026 (0.033)
Widowed	-0.107 (0.073)	-0.093 (0.085)	-0.146 (0.076)
Presence of children (Ref. With children)			
Without children	-0.033 (0.023)	-0.035 (0.022)	-0.086*** (0.018)
Firm size (Ref. 1-9 employees)			
10-15 employees	0.076** (0.028)	0.098*** (0.025)	0.043* (0.019)
16-49 employees	0.111*** (0.026)	0.113*** (0.022)	0.030 (0.016)
50-249 employees	0.166*** (0.023)	0.150*** (0.021)	0.037* (0.017)
250+ employees	0.190*** (0.024)	0.190*** (0.023)	0.087*** (0.018)
Health status (Ref. Very bad)			
Bad	-0.042 (0.095)	-0.009 (0.105)	-0.387*** (0.097)
Fair	0.006 (0.093)	0.011 (0.102)	-0.357*** (0.093)
Good	0.005 (0.091)	0.062 (0.101)	-0.368*** (0.092)
Very good	0.017 (0.092)	0.056 (0.102)	-0.365*** (0.093)
(Intercept)	3.813*** (0.115)	4.199*** (0.125)	4.965*** (0.101)
Number of observations	6.806	6.874	9.150
R^2	0.162	0.063	0.154
Adjusted R^2	0.158	0.059	0.152

Notes: Standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001.

suggests narrowing gender gaps, potentially reflecting minimum wage policies, collective bargaining improvements, or pandemic-related compositional shifts.

Overall, the analysis confirms that while some determinants of wages - such as age and firm size - operate similarly across genders, others, particularly occupational categories, marital status, and family circumstances, continue to disadvantage women. The strong firm-size gradient, consistently larger for men, points to within-labor-market inequalities that persist even after controlling for observable worker characteristics. The positive temporal trends, with women showing slightly stronger wage growth, suggest that the gender wage gap may be gradually narrowing over time, although persistent structural inequalities remain evident in the Italian labor market.

Table 4 examines temporal evolution. Regional convergence is evident: Center penalties declined from -0.098 in 2016 to -0.047 in 2021, while South penalties fell from -0.181 to -0.059. Metropolitan premia strengthened over time, becoming significant only in 2021 (6.1%). Gender gaps narrowed from -0.084 to -0.039 before widening to -0.051, suggesting non-monotonic pandemic effects.

Age-earnings profiles compressed substantially: the 25-29 premium fell from 43.5% to 10.7%, while 30-39 premia declined from 77.3% to 27.1%. This compression indicates diminished early-career returns, possibly reflecting labor market flexibilization, precarious entry conditions, or cohort-specific shocks. Conversely, late-career premia (50-64) remained stable at approximately 40-43%, suggesting persistent seniority-based wage structures.

Firm-size premia contracted sharply: the largest-firm premium fell from 20.9% to 9.1%, with similar compression across all categories. This convergence may reflect minimum wage policies disproportionately benefiting small-firm workers, declining unionization in large firms, or structural changes in labor market segmentation.

Health effects, negligible in 2016-2018, became strongly negative across all categories in 2021 (approximately -32% to -38%). This abrupt shift likely reflects pandemic-related measurement changes, selection effects (sick workers remaining employed being exceptionally high-earners), or endogeneity in health reporting rather than substantive wage determination.

Overall, the results indicate that although regional and occupational wage gaps have narrowed over time, firm size and gender remain central drivers of inequality. Between 2016 and 2021, wages show signs of convergence across regions, age groups, and firm sizes, yet gender disparities persist. These patterns call for a closer examination of how much of the gender gap reflects differences in characteristics versus unequal returns, explored in the next section through Oaxaca-Blinder decomposition.

4.2 Oaxaca-Blinder decomposition

The Oaxaca–Blinder decomposition provides a detailed view of the underlying factors contributing to the gender wage gap. The results across the years 2016, 2018, and 2021 reveal meaningful variations in how observable characteristics and their returns influence wage disparities between men and women.

In 2016, the coefficient component accounted for 61.6% of the total gender wage gap, while 31.2% was explained by endowment differences and 7.2% by the interaction term. This pattern indicates that differences in how men and women were rewarded for similar characteristics played the dominant role in driving wage inequality. Although part of the gap was due to observable factors such as education,

experience, or occupation (endowments), the majority derived from differential returns to these factors. This suggests the persistence of gender-based discrimination in pay, where women received lower remuneration than men with comparable qualifications and experience.

By 2018, the relative contributions shifted considerably. The coefficient component decreased to 48.8%, while the endowment effect increased to 41.4%, and the interaction term rose to 9.8%. These changes indicate some progress in reducing wage discrimination: returns to characteristics became more equitable, while differences in observable characteristics - such as age, education, and employment sectors - gained relative importance. Nonetheless, the coefficient component remained substantial, implying that unequal treatment in how similar attributes are rewarded continued to play a central role in explaining the wage gap.

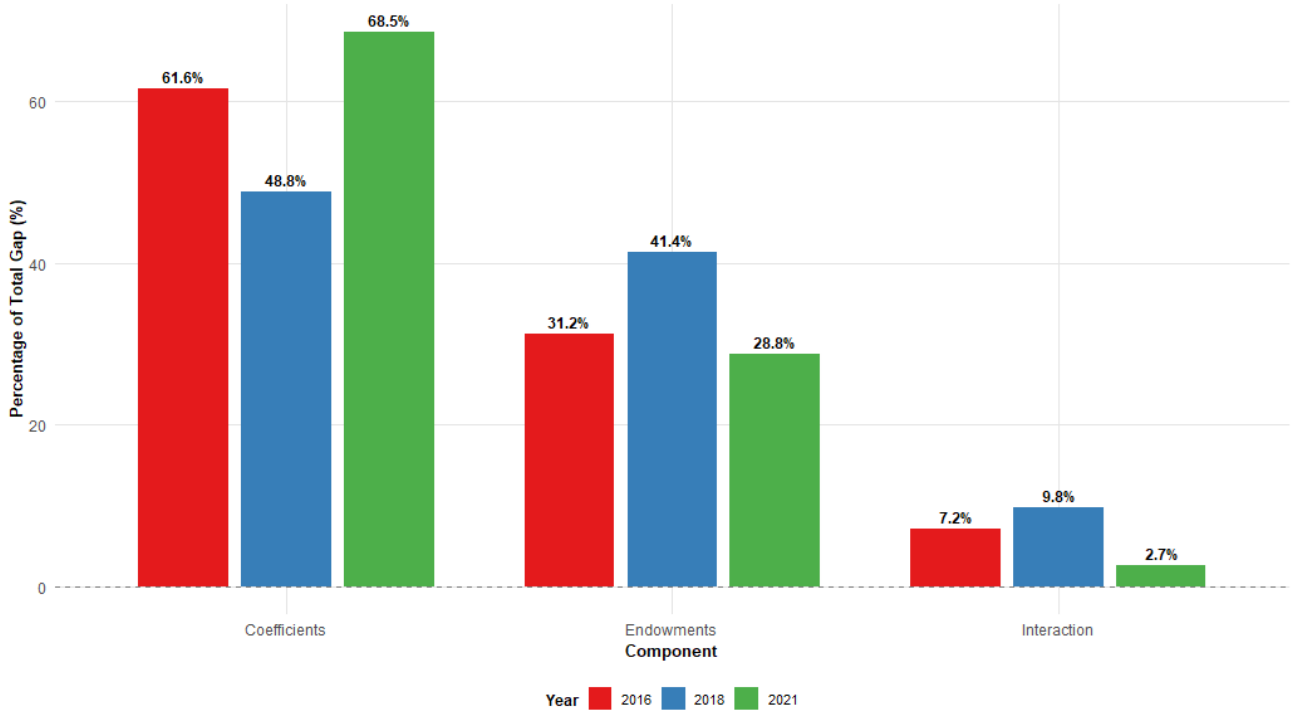

Figure 5: Oaxaca-Blinder decomposition of gender wage gap

In 2021, the pattern evolved once again, with the coefficient component rising sharply to 68.5%, the endowment contribution decreasing to 28.8%, and the interaction term dropping to 2.7%. This suggests a renewed widening of the wage gap driven primarily by differences in returns to characteristics rather than by differences in the characteristics themselves. Observable traits such as education or experience explained only a small fraction of the disparity, indicating that men and women had become increasingly similar in measurable attributes. However, the strong dominance of the coefficient effect underscores that women continued to face unequal valuation of their skills and characteristics in the labor market, reflecting persistent discrimination or structural barriers limiting their career advancement and earning potential.

Overall, the decomposition across the three years shows that differences in coefficients - that is, in the returns to similar characteristics - remain the principal source of the gender wage gap. The endowment component contributes moderately, suggesting that observable differences between men and women explain only part of the disparity. The interaction component, while smaller, captures how gender differences in characteristics and their treatment jointly influence the wage structure.

These findings reinforce the view that gender wage inequality is primarily driven by discriminatory practices or unequal rewards for comparable attributes, rather than by differences in human capital or labor market participation. Policies focused on pay transparency, equal opportunity, and reducing implicit bias in hiring and promotion could therefore play a crucial role in narrowing the remaining gap.

4.3 Robustness of the results

Several complementary analyses confirm the robustness of our findings.

First, quantile regression estimates reveal a U-shaped pattern: the gender wage gap equals 7.5% at the 10th percentile, 3.8% at the median, and 4.4% at the 90th percentile, pointing to the coexistence of sticky floor and glass ceiling effects across the wage distribution. Second, propensity score matching using nearest neighbors (8.974 matched pairs) yields an average treatment effect of 0.0865 log points (approximately 9%), slightly larger than OLS estimates, confirming that observable characteristics alone cannot account for the gender penalty. Finally, alternative specifications - such as winsorizing wages, trimming outliers, and estimating tobit models - produce consistent results, with the gender coefficient remaining between -0.04 and -0.05 log points. Together, these tests demonstrate that the main conclusions are stable and not driven by modeling assumptions or sample composition.

Sample composition, stability, and limitations Our analytical sample (22.830 observations, 61.6% of full-time workers) does not differ systematically from excluded cases (<2% wage difference), mitigating selection bias. Separate Oaxaca–Blinder decompositions by region and year confirm the dominance of the coefficient effect (ranging from 61.6% in 2016 to 68.5% in 2021), indicating persistent discriminatory dynamics. However, the cross-sectional nature of PLUS data limits causal inference. Omitted variables and measurement error may partly affect estimates, and focusing on full-time workers excludes potential part-time penalties.

5 Discussion and conclusions

Our analysis reveals persistent gender wage inequality in Italy over 2016-2021. While the gap narrowed modestly, this reduction stems primarily from improved observable characteristics among women rather than equitable returns to those characteristics. The Oaxaca-Blinder decomposition confirms that discrimination and structural barriers remain the dominant drivers of inequality.

The findings suggest that discrimination in wage-setting and limited access to high-return occupations remain key mechanisms behind the persistence of inequality. Women's higher educational attainment does not translate into equivalent pay, implying an undervaluation of female human capital. The age profile of the decomposition points to a widening gap among workers in their forties, consistent with motherhood penalties and slower career progression after childbirth. Regional fixed effects reveal that unexplained disparities are systematically larger in Southern Italy, reinforcing the role of regional labour market segmentation and weaker institutional enforcement.

The 2021 estimates, which partly capture the post-pandemic labour market, show a modest contraction of the overall gap but continued dominance of the unexplained component. This suggests that

temporary shocks such as the COVID-19 crisis may have altered employment patterns without fundamentally reducing structural inequality.

From a policy perspective, these results call for targeted interventions. Expanding pay transparency, promoting flexible work arrangements for both genders, and strengthening childcare and parental leave policies could help reduce the persistence of gender-based wage penalties. Future research should extend the analysis by exploiting longitudinal data to capture career dynamics, exploring firm-level decompositions to identify within- and between-firm effects, and applying nonparametric methods to test the robustness of the Oaxaca–Blinder assumptions.

Overall, while the Italian gender wage gap has narrowed slightly over the past decade, the persistence of its unexplained component highlights that equality in human capital endowments has not yet translated into equality in rewards.

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