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La questione salariale in italia

The motherhood penalty and the fatherhood bonus: causal evidence on gender gaps in italy (2018-2022)

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CONTEXT

✓ Despite the formal recognition of the **principle of equal pay between men and women**, the Gender Pay Gap (GPG) persists in advanced economies. This gap reflects **structural factors** operating throughout the life cycle and in various institutional contexts.

✓ **Persistent gender earnings inequality** remains a structural feature of the Italian labour market.

✓ GPG is driven largely by the extensive margin (while in many EU countries, hourly wage differentials carry more weight): lower female participation and reduced working hours - nearly 60% of the overall gap is driven by lower female participation).

✓ **Parenthood** is identified as a critical turning point ("Child Penalty") that amplifies divergence over the life cycle. Child penalty and glass ceiling amplify gender inequalities

✓ The child penalty affects mothers but not fathers and persists for many years following the birth of the first child.

CONTEXT

- ✓ Three key measures: **Unadjusted GPG, Adjusted GPG, Gender Overall Earnings Gap (GOEG)**.

- ✓ **Italy**-presents a distinctive profile: contained hourly wage gaps masking profound structural inequalities in access to and continuity in employment.

  - ✓ While hourly wage gaps appear modest compared to EU averages, overall earnings gaps (incorporating employment & hours) are substantial

  - ✓ Hourly GPG is contained, but there are strong inequalities based on education, occupation, and sector.

  - ✓ GOEG stood at **39.9%** in 2022, above the EU average (*32.8%*).

- ✓ **Total Fertility Rate (1.18)**: at historic low, with **-36% births** since 2008 peak.

RESEARCH QUESTIONS

✓ This analysis was conducted within the ISTAT thematic laboratory "Has the Pandemic Further Weakened Fertility in Italy? Mapping the Economic and Social Determinants of the Demographic Crisis through Integrated Data". Please note that these data constitute experimental statistics and do not fall under official statistics.

✓ Analyze the effect of parenthood on the pay differential between women and men: does the **birth of a child** amplify gender inequality in Italy?

✓ Does **parenthood** represent a temporary shock or a mechanism that amplifies **gender inequalities**? Through which **labour market margin** does this inequality manifest?

- **Wages per hour:** Intensive margin penalties?

- **Employment stability:** Probability of remaining employed (extensive margin)?

- **Labour input:** Adjustments in working hours and part-time transitions (intensive margin)?

✓ Study divergent and symmetric wage trajectories by gender after childbirth.

✓ How **heterogeneous** are the effects across different segments? CONTRACT TYPES▪ WAGE LEVELS▪ GEOGRAPHY▪ EDUCATION

RESEARCH CONTRIBUTIONS

- ✓ Provides **causal evidence** on the Gender Parenthood Gap in Italy for the 2018–2022 period.

- ✓ Disentangles the "Motherhood Penalty" from the "Fatherhood Bonus".

- ✓ **Methodological Advantages**

  - ✓ Use of a **longitudinal and counterfactual perspective** applied to an extended and integrated micro-database:

    - ✓ Adopting a **quasi-experimental design** with within-gender counterfactuals;

    - ✓ Combining exact matching on 2018 characteristics with Difference-in-Differences (DiD) estimation.

  - ✓ Integration of administrative data from different registers allows for overcoming the limits of sample surveys, obtaining a more **complete and detailed vision:**

    - ✓ Exploiting a massive **administrative dataset** integrating multiple statistical registers;

    - ✓ **Census-like coverage** of the private non-agricultural sector;

    - ✓ **High-granularity data** on wages, hours, and contracts.

THEORETICAL FRAMEWORK

Key Concepts

Motherhood Penalty

The systematic negative impact on women's labour market outcomes following childbirth. It manifests through time reallocation toward unpaid care work and employer bias (statistical discrimination), leading to reduced earnings, hours, and career progression.

Fatherhood Bonus

A wage or stability premium observed for men after becoming fathers. Interpreted through the breadwinner model, where fatherhood signals increased responsibility to employers, inducing greater labour market attachment, work effort, and retention.

Gender Parenthood Gap (GPG-P)

GPG-P $= \Delta\_Mothers - \Delta\_Fathers$

A synthetic measure of the net causal divergence in career trajectories driven by parenthood. It aggregates the penalty for mothers and the premium for fathers to capture the **total expansion of gender inequality** induced by the birth of a child.

RBI (Base Register of Individuals and Households): Official reference for usual resident population. Provides detailed demographic info about: gender, age, residence, citizenship, marital status, level of education and household composition

RBI VARIABLE NAME	NATURE	FIRST YEAR AVAILABLE
Gender	individual	2019
Date of birth	individual	2019
Place of birth	individual	2019
Citizenship	individual	2019
Educational attainment	individual	2019
Municipality of usual residence	individual	2019
Family code	individual	2019
Relationship with the head of the household	individual	2019
Marital status	individual	2019

DATA SOURCES - RBI

Anvis: Anagrafic Virtual Statistical longitudinal database. From 2012 Anvis is annually updated with microdata event on births, deaths and migrations. Critical for identifying the treatment event: links parents to children born in 2019.

ANVIS VARIABLE NAME	NATURE	FIRST YEAR AVAILABLE
Gender	individual	2012
Date of birth	individual	2012
Place of birth	individual	2012
Citizenship	individual	2012
Type of administrative registration event	demographic event	2012
Type of administrative de-registration event	demographic event	2012
Date of administrative registration event	demographic event	2012
Date of administrative de-registration event	demographic event	2012
Municipality of administrative registration	demographic event	2012
Municipality of administrative de-registration	demographic event	2012
Parent identifier (for those born since 2012)	demographic event	2012
Acquisition of citizenship	demographic event	2012
Foreign state of origin	demographic event	2012
Foreign state of destination	demographic event	2012

DATA SOURCES - ANVIS

LR-RACLI: Thematic Labour Register (Private Non-Agricultural Sector). Longitudinal source for jobs, wages, hours worked, labour costs, and contract types at the job-position level.

CATEGORY	DESCRIPTION
Target Units	**Job position** (labour link between individual and economic unit) Individual Economic unit
Target Variables	**Employment – Stocks** (no. of job positions, no. of employed…) **Employment – Flows** (no. of activations, no. of terminations…) **Labour Input** (paid hours, hours worked…) **Labour Income** (Wages/Salaries, Contributions, Benefits/Allowances) **Labour Cost** (Wages, Employer-paid contributions, …)
Main Classifications	Occupations and qualifications Type of working hours Type of contract Occupational status (ICSE - International Classification of Status in Employment) Occupational condition of all individuals
Time References	Month Week, Day (for some measures), Year
Governance & Metadata (DynaMetis)	Metadata-Driven Orchestration: Dynamically manages data lineages, structural mappings, and semantic transformation rules between Administrative Sources and the SIR.
Target Population	**The set of all job positions in the Italian economy**

DATA SOURCES – LR

DETERMINISTIC RECORD LINKAGE

Data Integration Process (Linkage)

Joining Databases for Integrated Analysis

- ✓ The linkage process integrated data from the **Base Register of Individuals (RBI)**, the **Virtual Statistical Population Register (ANVIS)**, and the **RACLI Register**. The result is a consistent and enriched system combining demographic and labor information at the individual level.

- ✓ This integration enabled the creation of the study's final population: **parents of children born in 2019 and employed in the non-agricultural private sector.**

Linkage between RBI and ANVIS

- ✓ Starting from 420,000 births in 2019, deterministic linkage identified **390,000 mothers** and **358,000 fathers** in the Base Register of Individuals (RBI).

- ✓ The failure to identify approximately 30,000 mothers in the RBI is mainly due to missing or incomplete information at the time of SIM integration, initial 2019 issues related to Municipalities joining the ANPR (National Resident Population Register), and a small share of parents not resident in Italy as of 31.12.2019. The impact of these non-responses significantly improved in subsequent years.

Linkage between RBI/ANVIS and RACLI

- ✓ Deterministic record linkage using the **pseudonymized individual code**.

- ✓ This integration was made possible by the interoperability between the registers of Istat's **Integrated System of Registers (SIR)**.

SITUATION IN 2019 (b)	N 2019	2016	2017	2018	2019	2020	2021	2022
Woman with child born in 2019 in families with minors	204,327	36.8	37.2	36.7	31.2	29.8	31.0	33.5
Woman with child born in 2019 in families without minors	185,896	48.6	51.6	51.7	43.4	40.2	40.3	42.1
Woman with children born in 2019	390,223	42.4	44.1	43.9	37.0	34.7	35.4	37.6
Woman in families with minors born before 2019	3,268,819	32.4	33.6	34.4	35.5	34.8	36.5	38.6
Woman in families without minors	3,155,940	35.6	39.6	42.2	43.8	42.3	43.6	45.0
Woman without children born in 2019	6,424,759	34.0	36.5	38.2	39.6	38.5	39.9	41.8
TOTAL WOMEN	**6,814,982**	**34.5**	**37.0**	**38.5**	**39.4**	**38.3**	**39.7**	**41.5**
Man with child born in 2019 in families with minors	170,293	58.7	60.3	61.2	61.4	60.4	60.5	60.3
Man with child born in 2019 in families without minors	187,441	56.2	58.4	59.7	60.4	59.7	59.9	59.9
Man with children born in 2019	357,734	57.4	59.3	60.4	60.9	60.1	60.2	60.1
Man in families with minors born before 2019	2,992,397	50.6	52.0	52.9	53.6	53.2	54.3	55.2
Man in families without minors	4,918,305	43.6	46.2	48.0	49.0	48.0	49.1	50.0
Man without children born in 2019	7,910,702	46.3	48.4	49.9	50.7	49.9	51.1	52.0
TOTAL MEN	**8,268,436**	**46.7**	**48.9**	**50.4**	**51.2**	**50.4**	**51.5**	**52.0**

DETERMINISTIC RECORD LINKAGE

POPULATION DEFINITION

Study Cohort (2019 Births)

Population Definition

Inclusion Criteria

- ✓ Parents of children born in 2019 (identified via ANVIS)

- ✓ Resident in Italy as of 31/12/2019

- ✓ Employed in the private non-agricultural sector (identified via LR)

- ✓ Pre-treatment year: 2018 (baseline characteristics)

- ✓ Post-treatment window: 2018–2022 (5-year follow-up)

Study Domain

Analysis restricted to the **Private Non-Agricultural Sector** to ensure homogeneous wage setting mechanisms and comparability (Filtered via LR RACLI (Public sector employees and self-employed workers are excluded from the main analysis due to data availability/comparability constraints).

METHODOLOGY

Design Overview

Stage 1: Unadjusted Differentials (Phenomenological)

Provides a descriptive snapshot of market inequality, capturing the combined effects of occupational segregation and structural differences prior to causal isolation.

$$GPG_{unadjusted} = (R_m - R_f)/R_m \times 100$$

Stage 2: Causal Impact Analysis (Quasi-Experimental)

Isolates the net effect of the transition to parenthood from pre-existing adverse selection using a Difference-in-Differences (DiD) strategy on balanced samples.

- ✓ **Estimation Strategy: Within-Gender Matching** To avoid gender selection bias, effects are estimated separately:

  Δ_Mothers = Mothers - NonMothers
  Δ_Fathers = Fathers - NonFathers

- ✓ **Objective: The Gender Parenthood Gap (GPG-P)** Defined as the divergence in career trajectories driven specifically by female penalisation and/or male premia

  Δ_Mothers - Δ_Fathers

RESULTS: UNADJUSTED DIFFERENTIALS (1)

Evolution of median annual earnings (welfare adjusted)* and gender gap. Comparison between new parents (2019 cohort) and non-parents. Absolute and percentage values. Years 2018 and 2022.

Categoria	Female annual earnings	Male annual earnings	Annual gap 2018	Female annual earnings	Male annual earnings	Annual gap 2022	Variation (p.p.)
	2018			2022			
Parents Cohort (Birth 2019)	11.356	16.560	31,40%	11.501	21.117	45,50%	+14,1 p.p.
Non-Parents Control	8.743	14.443	39,50%	10.597	18.040	41,30%	+1,8 p.p.

The annual earnings gap widens dramatically, increasing by 14.1 p.p. over the four-year period.

✓ This divergence is driven by an ***asymmetric dynamic***: while median male earnings grow by 27.5%—supported by greater employment continuity—female median earnings exhibit substantial stagnation, increasing by only 1.3%.

✓ The unadjusted measure quantifies the ***worsening of inequality within couples*** and society at large, documenting the increased distance between mothers and fathers and the resulting greater dependence of households on male income

A smaller increase (+1.8 p.p.) is observed for the non-parent group.

* This measure synthesises the interaction between the price of labour, the quantity of labour supplied (hours worked), and welfare components—understood here as income-replacement benefits associated with legally protected absence events

Evolution of median hourly wages and gender gap. Comparison between new parents (2019 cohort) and non-parents. Absolute and percentage values. Years 2018 and 2022.

Categoria	Female hourly wage	Male hourly wage	Hourly gap 2018	Female hourly wage	Male hourly wage	Hourly gap 2022	Variation (p.p.)
	2018			2022			
Parents Cohort (Birth 2019)	10,81	11,39	5,1%	11,37	12,53	9,3%	**+4,2 p.p.**
Non-Parents Control	10,74	11,45	6,2%	11,29	12,37	8,7%	+2,5 p.p.

The hourly wage gap nearly doubles (+4.2 p.p.) for new parents over the four-year period.

✓ The "price" penalty (hourly wage) exists but remains relatively contained compared to volume effects.

A smaller increase (+2.5 p.p.) is observed for the non-parent group.

To understand the drivers of the earnings collapse observed in the unadjusted data, it is necessary to isolate the net impact through counterfactual analysis. In this perspective, it is essential to distinguish between employment stability (population-level analysis) and economic outcomes (panel-based analysis).

METHODOLOGY

Within-Gender Counterfactuals

The Comparison Challenge

Directly comparing mothers to fathers is biased because women already face structural disadvantages.

- ✓ **Pre-existing Structural Gaps:** Significant disparities in part-time work and annual hours exist before parenthood, leading to a median annual wage for women nearly 50% lower than men's.

- ✓ **Ex-ante Wage Advantage:** Future fathers are more concentrated in high-pay segments and less in low-pay roles compared to future mothers.

- ✓ **Methodological Necessity:** Due to these baseline imbalances, isolating the causal impact of parenthood requires a strategy that accounts for pre-existing selection biases.

Gender-Specific Counterfactuals

We construct two independent control groups to estimate causal effects separately:

- ✓ **Mothers vs. Non-Mothers:** Isolates the pure "Motherhood Penalty".

- ✓ **Fathers vs. Non-Fathers:** Isolates the pure "Fatherhood Bonus".

Identification Strategy

- ✓ Matching on **X (2018)** ensures "parallel trends" assumption plausibility. Changes in **Y (2018-2022)** are then attributed to parenthood via DiD.

Matching Covariates (2018)

VARIABLE CATEGORY	DESCRIPTION / DEFINITION	BALANCING STATUS
Workplace Region	NUTS-2 region of the workplace in 2018	Exact Match
Age Class	Ten-year age cohorts (e.g., 25-34, 35-44)	Exact Match
Education	Binary: Tertiary degree (University) vs. No tertiary degree	Exact Match
Household	Presence of minors in the household in 2018 (Pre-birth)	Exact Match
Place of Birth	Binary: Born in Italy vs. Born abroad	Exact Match
Stability (2018)	Employment stability indicator: Full-Time Full-Year (FTFY) dependent job in pre-event year	Exact Match

Outcome Variables (2018 – 2022)

Variable Category	Description / Definition	Measurement Objective
Employment Persistence	Binary indicator of an active employment position in the private sector in 2018 and 2022.	*Analyzes the **extensive margin**: assesses the ability to remain in the labor market following childbirth.*
Annual Earnings (Welfare-Adj)	Gross annual income including replacement benefits for protected absences (maternity/paternity leave).	*Synthesizes the interaction between **labor price**, **labor supply** (hours worked), and welfare components.*
Labour Input	Annual hours worked.	*Analyzes the **intensive margin**: identifies reductions in working hours or shifts to part-time status.*
Job Quality	Hourly wages, contract type (permanent vs. fixed-term), and full-time/part-time status.	*Evaluates the **qualitative shock** and potential segregation into lower-paying job segments.*

METHODOLOGY

Net Causal Effect (Difference-in-Differences)

Compares share of dependent workers with active job positions in 2018 and 2022 between Parents (Treatment) and Matched Non-Parents (Control) separately for each gender. *The values measure the intra-gender variation in the incidence of active positions (stability) over time within the private non-agricultural sector for mothers/fathers compared to a non-parent control group.*

$$\Delta_{Gender} = [100 * Y_{Treat,\,22} / Y_{Treat,18}] - [100 * Y_{Control,\,22} / Y_{Control,18}]$$

The differences Δ represent the net causal effect of parenthood on job stability over a four-year period (from 2018 to 2022). Negative delta values indicate that the event has reduced the probability of maintaining an active position after four years, relative to the control group's trend. The indicator may be affected by the transition of workers outside the domain (from employee to self-employed or from private to public sector employee). Although marginal in size, the impact may not be distributed equally between the two comparison groups.

Gender Parenthood Gap (GPG-P)

$$GPG\text{-}P = \Delta_{Mothers} - \Delta_{Fathers}$$

A negative value indicates an expansion of gender inequality induced by childbirth.

METHODOLOGY

Statistical Inference & Models

Employment Persistence (Binary):

Assessed via Z-test for proportions.

Measures standardized divergence of census-based parent groups from counterfactual trends.

- ✓ **Dual Hypothesis Testing Framework**: The statistical significance of the observed Gender Pay Gap for Parents (GPG-P) is validated through a specialized testing framework designed to account for the specific distributional properties of the underlying variables.

- ✓ **Significance Testing for Job Persistence**: As job persistence is modeled as a binary indicator of labor market attachment, significance is assessed using a Z-test for proportions; given the census-based nature of the parent populations, the test quantifies the standardized divergence of these groups from the counterfactual trends established by the matched control groups. An absolute value **|Z| > 1.96** indicates a significant difference at the **95% confidence level**.

EMPLOYMENT STABILITY: OVERALL GPG-P (I)

Occupational stability differentials (Motherhood Penalty vs Fatherhood Bonus) and Parenthood Gender Gap between 2018 and 2022 by education, geographical area, age, workplace region, and pre-event job characteristics. Percentage points.

METRIC	Δ MOTHERS' NET EFFECT (VS NON-MOTHERS)	Z-SCORE (MOTHERS)	Δ FATHERS' NET EFFECT (VS NON-FATHERS)	Z-SCORE (FATHERS)	GPG-P (NET GAP)
Total Population	-8.65 p.p.***	54.23	+1.44 p.p.***	13.67	-10.09 p.p.

Significant at: *** (p < 0,001. ** (p < 0,01). n.s. (not significant).

MOTHERHOOD PENALTY
Net reduction in employment stability for mothers compared to matched non-mothers.

FATHERHOOD BONUS
Net increase in employment stability for fathers compared to matched non-fathers.

NET GENDER PARENTHOOD GAP (GPG-P)
The overall causal impact on employment stability (2018–2022).
Parenthood drastically widens the gap.

✓ *The overall GPG-P clearly indicates that **parenthood** substantially **amplifies gender disparities in job security.***

✓ *Parenthood acts as a **stabilizing force for men** and a **destabilizing factor for women**, leading to a structural divergence in career trajectories*

✓ *The **Z-score for mothers (54.23) is exceptionally high**, indicating that the negative impact of motherhood on employment stability is a robust, structural phenomenon. In contrast, **fatherhood provides a small but significant stability bonus***.

EMPLOYMENT STABILITY: OVERALL GPG-P (2)

Occupational stability differentials (Motherhood Penalty vs Fatherhood Bonus) and Parenthood Gender Gap between 2018 and 2022 by education, geographical area, age, workplace region, and pre-event job characteristics. Percentage points.

METRIC	Δ MOTHERS' NET EFFECT (VS NON-MOTHERS)	Z-SCORE (MOTHERS)	Δ FATHERS' NET EFFECT (VS NON-FATHERS)	Z-SCORE (FATHERS)	GPG-P (NET GAP)
No Degree	-10.34 p.p.***	51.02	+1.66 p.p.***	14.35	-12.00 p.p.
University Degree	-4.62 p.p.***	16.84	+0.31 p.p.n.s.	1.46	-4.93 p.p.
North-Center	-7,47 p.p.***	43,44	1,25 p.p.***	12,08	-8,72 p.p.
South & Islands	-12.14 p.p.***	33.63	+1.68 p.p.***	7.74	-13.82 p.p.

Strongest Penalty: Women without a degree face a stability penalty more than double that of graduates (-10.34 vs -4.62). The "Fatherhood Bonus" is also concentrated among non-graduates (+1.66), driving the GPG-P to -12.00 p.p.

Human Capital Shield: A university degree acts as a partial buffer. For graduate mothers, the penalty is halved (-4.93 GPG-P). Notably, for graduate fathers, the stability bonus is statistically insignificant (n.s.), suggesting career paths are less influenced by "breadwinner" stability effects at high skill levels.

Regional Divergence
The transition to *__parenthood exacerbates regional disparities.__*

While the *__"Fatherhood Bonus" is slightly higher in the South__* (+1.68 vs +1.25), the *__"Motherhood Penalty" is nearly 5 percentage points larger__* (-12.14 vs -7.47).
This suggests that in weaker labor markets, the rigidities associated with childcare translate more directly into labor market exit for women.

EMPLOYMENT STABILITY: OVERALL GPG-P (3)

Occupational stability differentials (Motherhood Penalty vs Fatherhood Bonus) and Parenthood Gender Gap between 2018 and 2022 by education, geographical area, age, workplace region, and pre-event job characteristics. Percentage points.

METRIC	Δ MOTHERS' NET EFFECT (VS NON-MOTHERS)	Z-SCORE (MOTHERS)	Δ FATHERS' NET EFFECT (VS NON-FATHERS)	Z-SCORE (FATHERS)	GPG-P (NET GAP)
15-25 years	-15,62	22,17	2,30	3,57	-17,92
25-35 years	-7,83	38,72	1,96	13,03	-9,79
35-45 years	-8,50	37,28	0,96	7,54	-9,46
45-55 years	-8,83	4,28	0,06	0,14	-8,89
Italy	-8,29	49,66	0,90	7,65	-9,19
Abroad	-10,67	21,94	3,18	13,63	-13,85

Vulnerability Trap
Young mothers (15-25) face the highest exit risk
(-15.62 p.p.), suggesting parenthood is incompatible with early career entry for women.

Migrant Asymmetry
Foreign-born women face the steepest stability penalties.
Foreign-born fathers enjoy the largest 'Fatherhood Bonus' (+3.18 p.p.), widening the gap significantly within migrant households (-13.85 p.p.).

EMPLOYMENT STABILITY: OVERALL GPG-P (4)

Occupational stability differentials (Motherhood Penalty vs Fatherhood Bonus) and Parenthood Gender Gap between 2018 and 2022 by education, geographical area, age, workplace region, and pre-event job characteristics. Percentage points.

METRIC	Δ MOTHERS' NET EFFECT (VS NON-MOTHERS)	Z-SCORE (MOTHERS)	Δ FATHERS' NET EFFECT (VS NON-FATHERS)	Z-SCORE (FATHERS)	GPG-P (NET GAP)
FTFY	-4,06	15,84	0,37	3,24	-4,43
Fixed-term contract	-15,51	47,84	3,15	12,50	-18,66
Permanent contract	-7,06	42,91	0,83	8,23	-7,89
Full-time	-6,95	39,44	1,17	11,05	-8,12
Part-time	-10,95	47,38	1,89	6,27	-12,84
LPJ (Low Pay Job)	-16,13	26,41	2,80	5,48	-18,93
HPJ (High Pay Job)	-3,92	11,53	0,73	4,87	-4,65

The "Precariousness Trap"
The penalty is most severe for those in precarious employment. *__The penalty is over 4 times larger for mothers in fixed-term contracts__* (-18.66 p.p.) compared to those in stable FTFY positions (-4.43 p.p.). Crucially, *__fatherhood acts as a stabilization mechanism for men in precarious jobs (+3.15 p.p.), creating a massive divergence in career trajectories for vulnerable workers__*.
__Mothers in low-pay positions face the most severe penalty__ (-16.13 p.p.), suggesting parenthood pushes vulnerable workers out of the market entirely. The gap vs fathers reaches nearly 19 percentage points.

High Pay Shield
The penalty for mothers (-3.92 p.p.) is four times smaller than in LPJs, but career damage persists even at the top.

METHODOLOGY

Net Causal Effect (Difference-in-Differences)

Compares outcome changes (2018→2022) between Parents (Treatment) and Matched Non-Parents (Control) separately for each gender.

$$\Delta \text{Gender} = (Y_{Treat, 22} - Y_{Treat, 18}) - (Y_{Control, 22} - Y_{Control, 18})$$

Gender Parenthood Gap (GPG-P)

Quantifies the divergence in career trajectories driven by female penalization and/or male premia. The estimated GPG-P isolates the specific penalty borne by mothers who remain in employment, capturing a "pure" measure of lost competitiveness and within-career reallocation of working time.

$$GPG\text{-}P = \Delta_{Mothers} - \Delta_{Fathers}$$

A negative value indicates an expansion of gender inequality induced by childbirth.

Balanced Panel Approach

Estimation of outcome differentials over the 2018–2022 period follows a longitudinal cohort approach based on a balanced panel, restricting the analysis to individuals who remain employed throughout the observation window. This ensures that the GPG-P computed for earnings and labour input is not distorted by selective attrition: the 2022 medianI reflects the characteristics of persistent employment relationships, which are typically more stable and higher quality.

METHODOLOGY

Statistical Inference & Models

Continuous Outcomes (Wages/Hours):
Evaluated using the Mann-Whitney U-test.
Non-parametric approach robust to skewed wage distributions and outliers. U-statistics converted to Z-scores to compare effect sizes across dimensions.

Double-Robust DiD Estimator:

OLS specification to isolate residual effects.

$$Y_{it} = \alpha + \beta_1 Parent_i + \beta_2 Post_t + \delta(Parent_i \times Post_t) + \gamma X_{it} + \varepsilon_{it}$$

Base Model: Controls for matching covariates, sector (NACE), and firm size.

Full Model: *Adds job characteristics (contract, hours, qualification) to separate composition effects from the residual wage penalty.*

Statistical Significance Thresholds:

The z scores represent the standardized Z-statistic derived from the Mann-Whitney U-test. An absolute value $|Z| > 1.96$ indicates statistical significance at the 95% confidence level ($p < 0.05$), while $|Z| > 2.58$ indicates significance at the 99% level ($p < 0.01$).

DIFFERENCES IN INDICATORS OF LABOUR INPUT AND JOB QUALITY (I)

Occupational stability differentials (Motherhood Penalty vs Fatherhood Bonus) and Parenthood Gender Gap between 2018 and 2022 by pre-event job characteristics. Percentage points.

Economic Indicator	Δ Mothers (A)	U-score (A)	Δ Fathers (B)	U-score (B)	GPG-P (A - B)
Hours Worked	-27.55 p.p.	-65,42	-0.78 p.p.	2,65	-26.77 p.p.
Hourly Wage	-2.52 p.p.	-23,28	+0.05 p.p.	-1,76.	-2.57 p.p.

The **_gap in working hours_** is the single largest driver of overall earnings inequality.

✓ Inequality is driven mainly by the "extensive margin" (time supply), confirming a massive time penalty for mothers.

✓ The penalty is primarily a **"Time Tax"**, driven by a sharp reduction in labor input (**–27.55 p.p.** in hours worked).

✓ The **_extreme negative U-scores_** (**-65.42**) denote a massive, structural deviation from the counterfactual trend.

✓ The **_net hourly wage penalty is marginal_** (**–2.52 p.p.**), confirming that mothers are pushed out of full-time work rather than paid significantly less per hour.

✓ **_The net hourly GPG-P (-2.57 p.p.) is smaller than the unadjusted change (+4.2 p.p.)_**, confirming that part of the widening in the hourly wage gap is not caused by childbirth per se, but by **_pre-existing adverse selection_**: women who become mothers tend to be employed in sectors or firms characterised by flatter wage dynamics than those of fathers

✓ **_The score for Hourly Wage (-1.76)_** is not statistically significant (p > 0.05), suggesting that fatherhood does not induce a wage premium in terms of hourly pay rates.

DIFFERENCES IN INDICATORS OF LABOUR INPUT AND JOB QUALITY (2)

Occupational stability differentials (Motherhood Penalty vs Fatherhood Bonus) and Parenthood Gender Gap between 2018 and 2022 by pre-event job characteristics. Percentage points.

Economic Indicator	Δ Mothers (A)	U-score (A)	Δ Fathers (B)	U-score (B)	GPG-P (A - B)
Annual Earnings	-35.33 p.p.	-52,47	+0.08 p.p.	3,87	-35.41 p.p.
Annual Earnings (Welfare Adj.)	-25.45 p.p.	-41,28	+0.56 p.p.	4,02	-26.01 p.p.

✓ While the unadjusted annual earnings gap for the study group increases by more than 14 percentage points over the four-year period (from 31.4% to 45.5% p.p.), **the GPG-P captures a substantially larger net loss in women's earnings potential:** the counterfactual approach reveals that childbirth generates a Gender Parenthood Gap (GPG-P) of −26.01 p.p. in terms of expected annual earnings growth.

✓ The comparison between the gross GPG-P and the welfare-adjusted GPG-P highlights the **effectiveness of income-replacement benefits in cushioning the immediate loss of earnings** for those who remain employed, while failing to compensate for the structural damage resulting from reduced work intensity.

✓ For **fathers** the **impact of parenthood on annual earnings growth is statistically neutral** (+0.34 percentage points).

✓ The earnings increase observed in the unadjusted male data does not reflect a discretionary "fatherhood premium", but rather the continuation of a standard career trajectory that, unlike the female one, does not experience deviations.

DIFFERENCES IN INDICATORS OF LABOUR INPUT AND JOB QUALITY

Summary of Parenthood Impact: Raw Median DiD vs. Regression Models (OLS)

Dependent Variable	Group / Gap	Raw Median DiD (Descriptive)	OLS Base Model (Total Effect)	OLS Full Model (Direct Effect)
Hours Worked	Mothers	-237	-103.00***	-70.00***
(Annual)	Fathers	-4	+20.00***	+1.00 (ns)
	GPG-P	-233	-123.00	-71.00
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Hourly Wage	Mothers	-0.27	+0.56***	+0.60***
	Fathers	+0.01	-0.10*	-0.07 (ns)
	GPG-P	-0.28	+0.66	+0.67

Hours Worked
- ✓ **Female Penalty:** The penalty for mothers decreases but does not disappear even when controlling for work schedule, settling at **-70 annual hours** (p < .0001).
- ✓ **Male Neutrality:** The effect of childbirth on fathers becomes statistically null, confirming that the birth event does not modify the male labor supply when contractual conditions are equal.
- ✓ **Segregation:** A negative differential of over 100 annual hours is observed, which disappears only when the control for part-time status is introduced.

Hourly Wages
- ✓ **Hourly Wage Paradox:** While the median differential is negative (-€0.28), *both base and full model shows a positive coefficient for mothers (+ €0.56 /+€0.60),* suggesting that the *Motherhood Penalty pushes lower-wage female workers out of the market*.
- ✓ *Mothers who remain employed* full-time *do not suffer a penalty on "price"* (hourly wage), but they suffer a loss in terms of opportunities and total earnings growth.

Summary of Parenthood Impact: Raw Median DiD vs. Regression Models (OLS)

Dependent Variable	Group / Gap	Raw Median DiD	OLS Base Model (Total Effect)	OLS Full Model (Direct Effect)
Annual Earnings	Mothers	-2,775	-2,034.46***	-1,255.44***
(Welfare Adjusted)	Fathers	+250	+337.66***	+61.65 (ns)
	GPG-P	-3,025	-2,372.12	-1,317.09
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Annual Earnings	Mothers	-3,758	-2,306.66***	-1.588.05***
(Gross)	Fathers	+178	+255.10**	-17.59 (ns)
	GPG-P	-3,936	-2,561.76	-1,570.46

Welfare-adjusted Annual Earnings
- ✓ **Motherhood Penalty:** The DiD interaction coefficient for mothers is negative and highly significant (p < .0001).
- ✓ The raw differential observed on medians (-€3,025), finds confirmation in the Base Model estimates (-€2,372), validating the robustness of the phenomenon net of initial demographic and sectoral characteristics.
- ✓ **Composition Effect:** Comparison with the GPG-P estimated by the Full Model (-€1,317) reveals that approximately 44% of the overall gap is explained by the segregation of mothers into reduced or less protected contracts.

Fatherhood Bonus (Inconsistent): The *wage premium for fathers* (+€338 in the base model) loses all statistical significance in the full model , proving *it is not a direct "bonus" but a reflection of greater occupational stability.*

Summary of Parenthood Impact: Raw Median DiD vs. Regression Models (OLS)

Dependent Variable	Group / Gap	R2 (Base)	R2 (Full)
Annual Earnings (Welfare Adjusted)	Mothers	0.3208	0.6069
	Fathers	0.2443	0.4733
	GPG-P		
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Hours Worked (Annual)	Mothers	0.1883	0.3941
	Fathers	0.1749	0.3988
	GPG-P		
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Annual Earnings (Gross)	Mothers	0.3021	0.5686
	Fathers	0.2417	0.4720
	GPG-P		
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Hourly Wage	Mothers	0.0338	0.0684
	Fathers	0.1407	0.3133
	GPG-P		

Model Validity and Statistical Fit

✓ Robustness: The *stability between the descriptive (median) estimate and the base model* confirms that the phenomenon is a solid causal effect rather than a statistical artifact.

✓ Goodness of Fit (R^2): For mothers, the R^2 rises from 0.32 (Base) to 0.61 (Full), indicating that *workplace characteristics explain the predominant share of wage variance*.

FAMILY STRUCTURE EFFECTS (1)

Annual earnings (Welfare adjusted) and differentials by household composition. Comparison between new parents (2018 cohort) and non-parents. Absolute and percentage values. Years 2018 and 2022.

Situation in 2018	Gender	Annual Earnings 2018	Annual Earnings 2022	% Variation	Gap 2018	Gap 2022	Variation
At least one child in 2019							
Household without other minors	Men	16.108 €	20.997 €	+30,3%	28,8%	40,9%	+12,1 p.p.
	Women	11.466 €	12.418 €	+8,3%			
Household with other minors	Men	17.068 €	21.257 €	+24,5%	34,3%	50,5%	+16,2 p.p.
	Women	11.220 €	10.519 €	-6,2%			
No children in 2019							
Household without other minors	Men	11.947 €	16.097 €	+34,7%	36,1%	31,1%	- 5.8 p.p.
	Women	7.629 €	11.096 €	+45,45%			
Household with other minors	Men	18.661 €	20.841 €	+11,68%	45,9 %	51,7%	+ 5 p.p.
	Women	10.090 €	10.058 €	-0,32%			

METHODOLOGY

Net Household Impact Indicator

The "Net Household Impact" is calculated as the algebraic sum of the average causal effects estimated for mothers and fathers.

$$\text{Net Household Impact} = \Delta \text{ Mothers} + \Delta \text{ Fathers}$$

While the **GPG-P** measures the *divergence* or inequality between partners, the Net Impact measures the *total variation* in resources available to the "representative household" compared to a counterfactual "childless household."
A negative value implies that the gains (if any) of one partner do not compensate for the losses of the other, resulting in a net reduction of household welfare or labor market attachment.

Limitation: This is a sum of median effects on individuals, serving as a proxy for the household-level effect under the assumption of assortative mating (partners with similar pre-childbirth characteristics). These aggregate figures provide a "macro" snapshot of the phenomenon.

Upcoming Analysis: To isolate the causal mechanism, *we will proceed with a micro-level reconstruction using integrated register data (RBI), which allows us to precisely map the household structure and disentangle the specific contribution of each birth order to the observed inequality.*

FAMILY STRUCTURE EFFECTS (2)

Differentials and Parenthood Gender Gap by household composition. Percentage points. Years 2018 and 2022

Variable	Δ Mothers (A)	Δ Fathers (B)	GPG-P (A - B)	Net Household Impact (A + B)
FIRST CHILD in 2019 (Households without minors)				
Persistence	-9.59 p.p.	+1.92 p.p.	-11.51 p.p.	**-7.67 p.p.**
SUBSEQUENT CHILDREN in 2019 (Households with minors)				
Persistence	-7.49 p.p.	+1.03 p.p.	-8.52 p.p.	**-6.46 p.p.**

Persistence (Labor Market Attachment)

✓ **Systemic Household Drop-out:** The birth of a child leads to a significant erosion of the couple's overall labor market attachment.

✓ At the **first child**, the household suffers a net reduction in job persistence of **-7.67 p.p.**, driven by a *dramatic maternal exit* (-9.59 p.p.) that is only marginally cushioned by a *modest increase in paternal stability* (+1.92 p.p.).

✓ In the case of **subsequent children**, although fathers show a slight "commitment effect" (+1.03 p.p.), the net impact remains negative at -6.46 p.p. This indicates that the probability of at least one parent (the mother) leaving the labour market increases with parity, reinforcing a long-term decline in the household's economic resilience.

FAMILY STRUCTURE EFFECTS (3)

Differentials and Parenthood Gender Gap by household composition. Percentage points. Years 2018 and 2022

Variable	Δ Mothers (A)	Δ Fathers (B)	GPG-P (A - B)	Net Household Impact (A + B)
FIRST CHILD in 2019 (Households without minors)				
Gross Annual Earnings	-37.51 p.p.	-7.21 p.p.	-30.30 p.p.	**-44.72 p.p.**
Earnings (Welfare Adj.)	-45.31 p.p.	-6.55 p.p.	-38.76 p.p.	**-51.86 p.p.**
Hourly Wage	-4.28 p.p.	-0.18 p.p.	-4.10 p.p.	**-4.46 p.p.**
Hours Worked	-25.53 p.p.	-5.91 p.p.	-19.62 p.p.	**-31.44 p.p.**

Household Economic Shock (First Child):
- ✓ The transition to the first child triggers a **severe negative shock** for the entire household. The Net Household Impact on Welfare-Adjusted Earnings is **-51.86 p.p.**, indicating that both partners lose ground compared to their childless counterfactuals.
- ✓ Unlike the "Fatherhood Bonus" often cited in literature, fathers at the first birth experience a significant **penalty** (-6.55 p.p. in earnings, -5.91 p.p. in hours), compounding the maternal loss rather than mitigating it.

FAMILY STRUCTURE EFFECTS (4)

Differentials and Parenthood Gender Gap by household composition. Percentage points. Years 2018 and 2022

Variable	Δ Mothers (A)	Δ Fathers (B)	GPG-P (A - B)	Net Household Impact (A + B)
		SUBSEQUENT CHILDREN in 2019 (Households with minors)		
Gross Annual Earnings	-27.83 p.p.	+1.72 p.p.	-29.55 p.p.	**-26.11 p.p.**
Earnings (Welfare Adj.)	-21.60 p.p.	+1.82 p.p.	-23.42 p.p.	**-19.78 p.p.**
Hourly Wage	-1.67 p.p.	-0.11 p.p.	-1.56 p.p.	**-1.78 p.p.**
Hours Worked	-24.77 p.p.	+0.27 p.p.	-25.04 p.p.	**-24.50 p.p.**

Divergence at Subsequent Births:

✓ For subsequent children, the dynamic shifts. Fathers achieve a small **positive premium** (+1.82 p.p. in earnings), aligning with the breadwinner model. For mothers who remain employed, additional children reinforce the reduction in labor supply. The GPG-P for hours worked surges to **-25.04 p.p.**, crystallizing a pattern of low work intensity and vertical segregation.

✓ However, this premium is **structurally insufficient** to offset the maternal penalty (-21.60 p.p.). The household still suffers a net loss of **-19.78 p.p.**, confirming that the "specialization of roles" strategy fails to preserve the family's economic standing relative to non-parents.

The "Double Loss" Mechanism:

✓ Across all configurations, the sum of effects (Δ M + Δ F) remains consistently negative. This debunks the myth that gender specialization enhances household efficiency: parenthood erodes the combined earning power of the couple, driven largely by the massive withdrawal of maternal labor supply (Time Tax).

✓ The penalty evolves from an initial binary risk (exit vs. stay) to a continuous constraint on career progression (hours/intensity) as family size increases.

CONCLUSION

Key Takeaways

✓ **Structural Shock:** Parenthood is not transient; it acts as a catalyst for permanent divergence.

✓ **Extensive Margin:** Inequality is driven by time (hours) and stability (-10.09 p.p. GPG-P), not just wages.

✓ **Vulnerability:** Penalties are most severe for fixed-term contracts, low-pay jobs, and in Southern Italy.

Limitations & Future Work

✓ Scope limited to private non-agricultural sector.

✓ Potential unobserved heterogeneity beyond matched covariates.

✓ Future: Micro-level reconstruction using integrated register data (RBI), in order to precisely map the household structure and disentangle the specific contribution of each birth order to the observed inequality.

DISCUSSION

Mechanisms: Breadwinner vs. Caregiver

✓ The interaction of family structures, labor market institutions, and gender norms creates a reinforcing mechanism where motherhood leads to reduced employment, which in turn strengthens the perception of women as secondary earners.

✓ Fathers benefit from a **"Retention Bonus"** rooted in the breadwinner model: parenthood signals increased responsibility, leading to stronger labor market attachment.

✓ Mothers face a **"Detachment Effect"** driven by caregiving expectations: immediate reduction in working hours and transitions to part-time contracts., higher exit rates, especially among fixed-term and low-pay positions (negative GPG-P).

✓ Asymmetry is reinforced by **institutional & cultural factors**.

✓ Scarcity of affordable childcare (0-3 years) limits maternal labor supply.

✓ Current leave policies often fail to incentivize shared caregiving responsibilities.

✓ *Parenthood acts as a stabilizing force for men and a destabilizing factor for women, creating a structural divergence in career trajectories.*

DISCUSSION

Policy Implications

✓ **From "Conciliation" to "Sharing":** Shift focus from maternal-only flexibility to mandatory, non-transferable paternity leave to break the "second earner" trap and neutralize the fatherhood bonus asymmetry.

✓ **Targeting the Extensive Margin:** Policies must address employment continuity and full-time retention. Expand affordable, high-quality childcare (0-3) with territorial equity to reduce the "Time Penalty".

✓ **Stabilization Pathways:** Specific incentives for converting fixed-term contracts of new parents into permanent ones, countering the high exit risk (-18.66 p.p. GPG-P) observed in temporary employment.

✓ **Support for Vulnerable Groups:** Tailored interventions for young mothers, migrants, and low-wage workers who face the steepest penalties and highest risk of labour market exit.