The Origins of the Gender Pay Gap: Education and Job Characteristics

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Bank of Italy

MEND THE GAP IN ECONOMICOPPORTUNITIES IN EUROPE ANDCENTRAL ASIA
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Motivation

Despite some convergence, women still earn less than men

- Some literature has traced back the origins of the gap to sorting patterns in the labour market. Women sort into:
  - lower-paying firms (e.g. Casarico and Lattanzio, 2024)
  - lower-paying sectors and occupations (e.g. Delfino, 2024)
  - closer-to-home locations (e.g Caldwell and Danieli, 2024)

- Yet, gender gaps manifest much earlier when girls and boys are still in education. Girls:
  - have overtaken boys academically (e.g. Blau and Kahn, 2017)
  - choose very different fields of study (e.g. Kahn and Ginter, 2018)

- Growing evidence that in increasingly specialized economies:
  - the type of education matters as much as the level
  - earning gaps among university fields of study can be as large as the college-high school premium (e.g. Altonji et al, 2012 and 2016)

Question

- To what extent are gender earnings gaps that stem from labour market specialization actually rooted in pre-labour market specialization?

- At which juncture does the pipeline that brings women into high-paying jobs start to leak?

Contribution

We add to the literature on the role of pre-labour market specialization for gender gaps in the labour market

- Sloane et al. (2021): women sort into majors with lower potential earnings
- Huneeus at a. (2021): gender gaps in firm-specific premia found in AKM decompositions are for two-thirds explained by differences in college majors

We bridge two strands of the empirical literature on the determinants of wage differentials that have developed somewhat separately

- Firms and jobs (e.g. Cardoso et al., 2016; Coudin et al., 2018; Bruns, 2019; Casarico and Lattanzio, 2024; Sloane et al., 2021; Lordan and Pischke, 2022; Delfino, 2024); (Le Barbanchon et al., 2021; Caldwell and Danieli, 2024)
- Workers' level and type of education (e.g. Blau and Kahn, 2017; Kahn and Ginther, 2018; Sloane et al., 2021; Altonji et al., 2012, 2016)

Focus

We focus on early-career pay gaps among Italian university graduates

- Why early-career gaps?
  - Gender disparities at entry remain relevant and play an important role in aggregate gender gap dynamics (Arellano-Bover et al., 2023)
  - Initial gaps do not shrink but widen over time mostly due to the gendered effect of parenthood (e.g. Kleven et al., 2019, 2020)

- Why university graduates?
  - The % of youth with a tertiary degree is increasing in almost all countries
  - University fields of study provide very specialized types of skills that in advanced economies can matter as much as or more than the level of education
  - University fields of study are more comparable across countries than high school tracks

Roadmap

We model a two-step gender gap-generating process

1. Girls and boys enroll in university and choose the field of study
   - To what extent does gender heterogeneity in fields of study choices explain the aggregate gender gap in daily wages?
     - Preview: It matters a lot

2. After graduation, they enter the labour market and match with a job and a firm
   - To what extent do within-field differences in firms and jobs explain within-field gender gaps in daily wages?
     - Preview: They matter but less

Institutional Setting, Data, and Sample

Institutional setting

- High-schools offer three tracks: academic, technical, vocational
- All 5-year high school diploma allow pursuing tertiary education in every field
- Some majors have a fixed number of seats and an admission test
- Universities follow the standards set by the *Bologna process*
  - 3-year Bachelor's Degree (*Laurea Triennale*)
  - 2-year Master's Degree (*Laurea Specialistica*)
  - 5- or 6-year Single Cycle Degree (*Laurea Magistrale a Ciclo Unico*)

Data - Demographics and education

- Target population: universe of Italian university graduates over 2011-2018
- Who are they?
  - Demographics: *gender*, age, municipality of birth, marital status
  - Mother and father's income at the time of students' graduation

  Source: Ministry of Finance, tax records, 2011-2018
- What did they study?
  - field: university **ID** and **major**
  - performance: final grade and age at graduation

  Source: Ministry of Education, administrative records, 2011-2018

Data - Labour market

- What do they do in the labour market?
  - **All workers** $\rightarrow$ Labour income
    - Employees: annual and daily wages

    Source: Ministry of Finance, tax records, 2011-2019
  - **Employees only** $\rightarrow$ Type of job
    - Schedule (full vs part-time), stability (permanent vs fixed-term), 6-digit occupation, municipality of work, sector (incl. *public sector*), employer ID

    Source: Ministry of Labour, Mandatory reporting data, 2012-2019
  - **Private employees only** $\rightarrow$ Characteristics of employer
    - Workforce composition (inc. gender and educ.) and wages, balance sheet variables

    Source: Social Security Institute, mandatory reporting data, 2014-2018. Statistical Institute, balance sheet data, 2012-2019

Sample

- 8 (4) cohorts of graduates for labour market outcomes 1 (5) year(s) after graduation ▸ Sample stat. 1
  - Today, mostly outcomes 5 years after graduation
  - Similar picture for outcomes 1 year after graduation

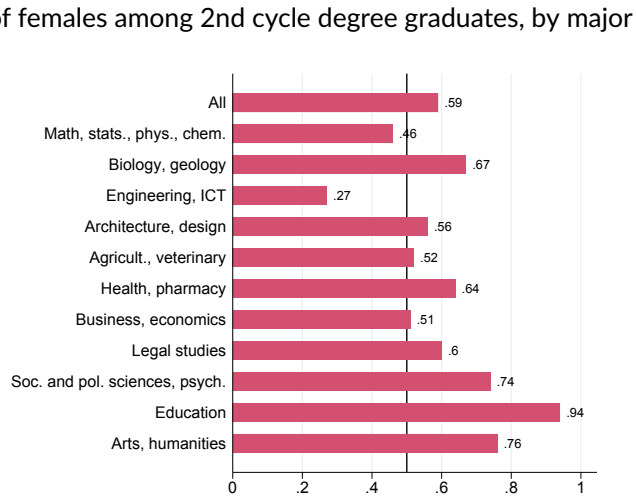
- We have data on all graduates but focus on those with a Master's or single cycle degree
  - Largest group
  - Looking for a job is for most the first next step after graduation

- For most of the analysis we focus on private sector employees who 1 (5) year(s) after graduation are no longer in education and work in Italy ▸ Sample stat. 2
  - Sample with more info. on labour market outcomes
  - Sizable early-career gender gap in daily wages
  - Analysis that can be replicated on public sector employees and self-employed deliver similar findings

Step 1: The role of education for aggregate early career gender gaps

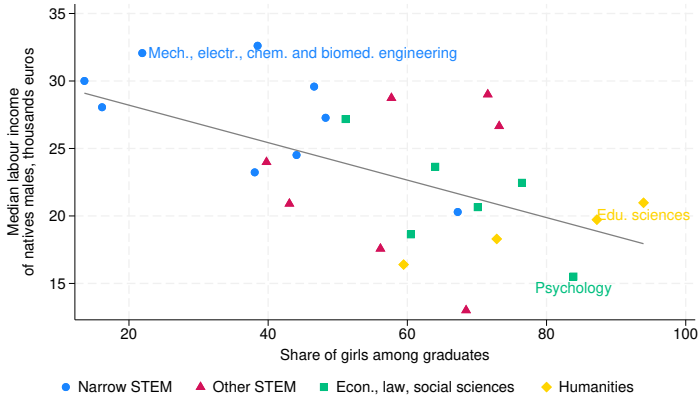
Boys and girls select different university majors

Performance



Notes: cohorts of 2011-2018. 2nd cycle or single cycle graduates.

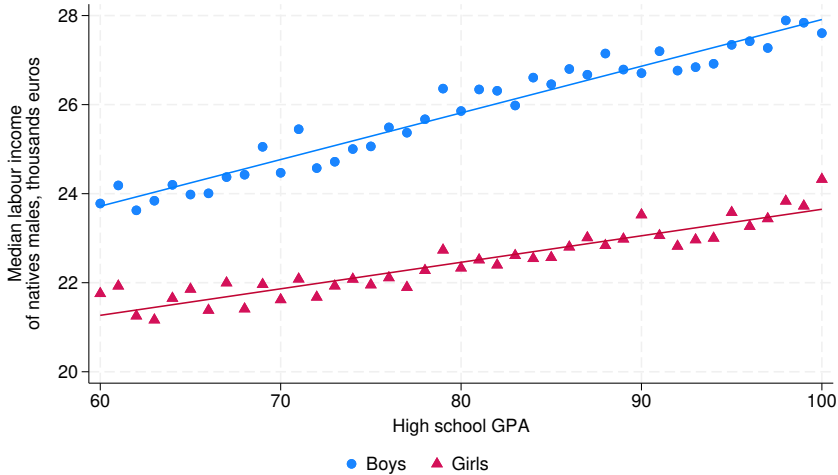
All in all, girls choose less remunerative majors



Note: On the *x*-axis, 2011-2018 cohorts of 2nd level and single cycle graduates. On the *y*-axis, native male graduates of 2011-2014 who 5 years after graduation work and no longer study.

The average gender gap in the *expected payoff* of major choices is 13%

The gap in major choices is larger for higher ability students



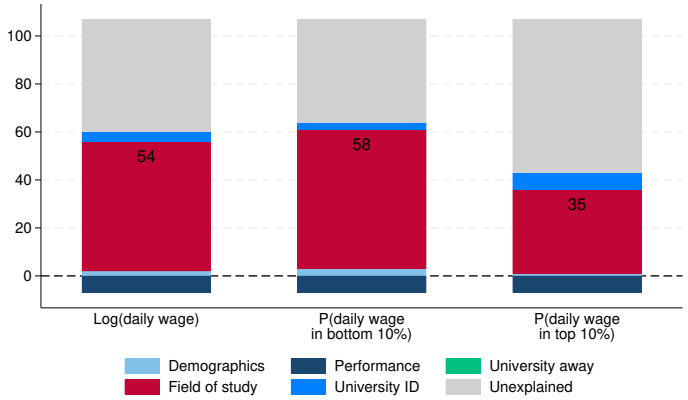
Note: 2016-2018 2nd level and single cycle graduates for which the high school final grade is available.

How much do different education choices matter?

- **Oaxaca-decompose** the gender gap in:
  - average daily wage
  - probability of being a top earner (top 10%)
  - probability of being a bottom earner (bottom 10%)
- Assess what % of the gap depends on educational choices:
  - field of study
  - university ID and whether it is out of the birth region
- Control also for differences in:
  - academic performance (final grade and age at graduation)
  - socio-demographics characteristics (reg. of birth, marital status, ventiles of parents' income)

Oaxaca decomposition - Fields of study matter a lot

Contribution to the gap in daily wage 5 years after graduation, private employees only



- Fields of study explain almost 60% of the average gap
- At the top, relative to the bottom:
  - larger % of gap unexplained
  - university ID matters more

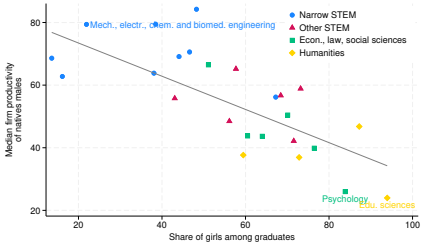
All workers

1 year after grad.

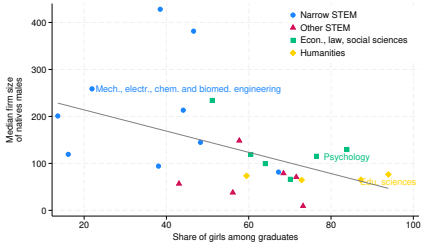
Note: cohorts of 2011-2014. 2nd cycle and single cycle graduates who 5 years after graduation are working and not studying. Overall difference normalized to 100.

Why? Different majors → different labour markets (1)

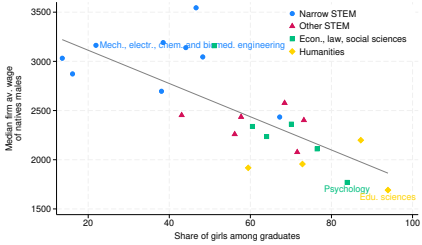
Firm productivity



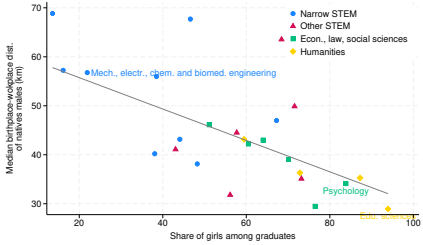
Firm size



Firm average wage



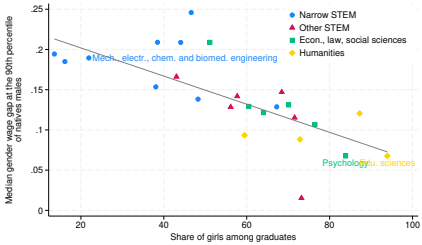
Birthplace-workplace distance



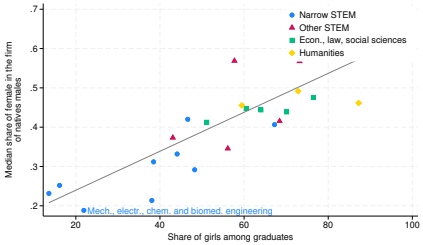
Note: 2011-2018 2nd level and single cycle. Median firms' characteristics of non-immigrant male graduates 5 years after graduation (cohorts 2011-14).

Why? Different majors → different labour markets (2)

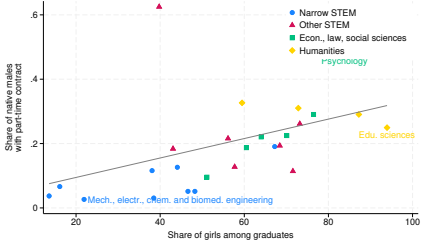
Within-firm gender wage gap (90th perc.)



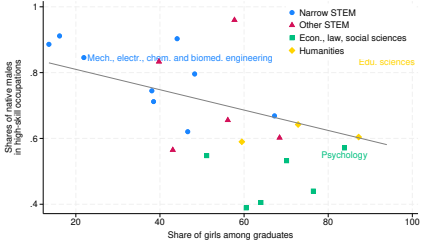
% of women in the firm



% with a part-time contract



% in high-skilled occupation

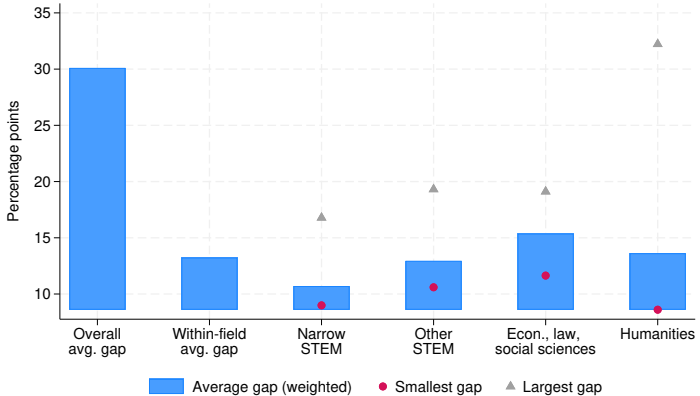


Note: 2011-2018 2nd level and single cycle. Median firms' characteristics of non-immigrant male graduates 5 years after graduation (cohorts 2011-14).

Step 2: the role of firms and jobs for early-career within-field gaps

Even within fields, there exist significant gender wage gaps

Gender average daily wage gap 5 years after graduation, by group of fields



Note: cohorts graduating between 2011-2014 in a 2nd level and single cycle degree who are working as private sector employees and not studying 5 years after graduation.

How much do differences in firms and jobs matter?

- For each university major, we **Oaxaca-decompose the within field gender pay gap**
- In the next slides we show the weighted average of within-field contributions

Within-field gaps: a lot remains unexplained ...

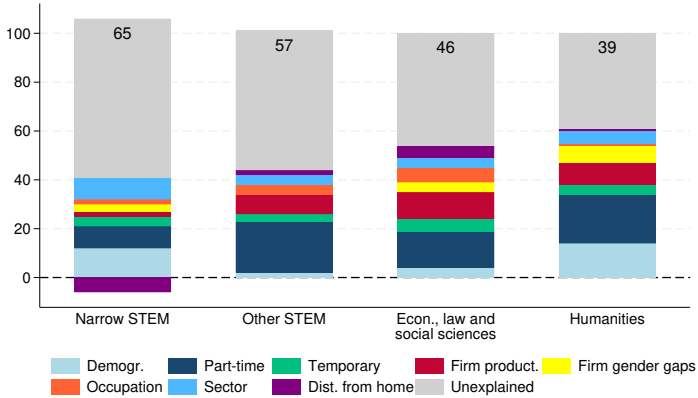
Average contribution to the within-field gap in daily wage 5 years after graduation, private employees only

Note: cohorts graduating between 2011-2014 in a 2nd level and single cycle degree who are working as private sector employees and not studying 5 years after graduation. Overall difference normalized to 100. "Demogr." includes: marital status, dummies for ventiles for household income, region of birth, and cohort dummies. "Firm product." includes: firm size, age, value added per worker, and average education level of the workforce. "Firm gender gaps" includes: the share of women in the firm, and the firm-level wage gap at the average and the 90th percentile. "Distance from home" is the distance between the birth municipality and the work municipality aggregated in 10 bins.

- Almost 60% of the average wage gap is not explained by job and firm characteristics
- At the top, larger % of gap unexplained (80%)
- At the bottom, large contribution of part-time contract

… especially in narrow STEM fields

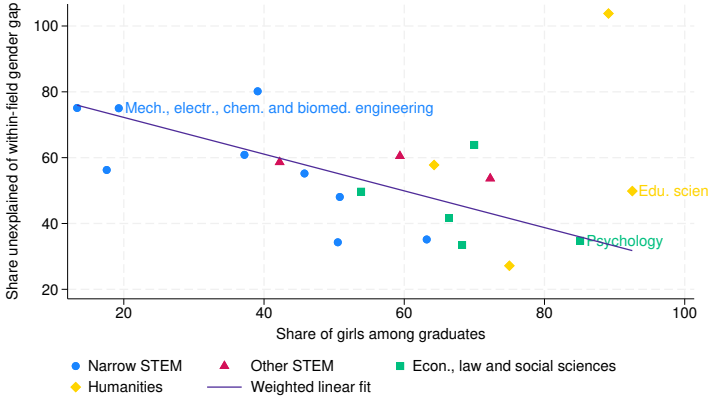
Average contribution to the within-field gap in daily wage 5 years after graduation, private employees only



Note: cohorts graduating between 2011-2014 in a 2nd level and single cycle degree who are working as private sector employees and not studying 5 years after graduation. Overall difference normalized to 100. Among humanities, we exclude literature because it is an outlier.

Largest unexplained component for narrow STEM fields

Girls are less likely to be found in fields with a large unexplained component



Girls are less likely to graduate in majors with a **larger share of the gender gap that remains unexplained**

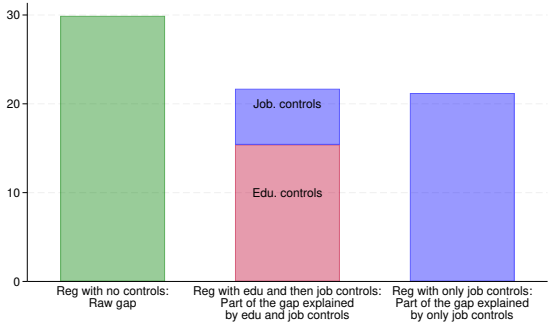
Note: cohorts graduating between 2011-2014 in a 2nd level and single cycle degree who are working as private sector employees and not studying 5 years after graduation.

In a nutshell: pre-labour market specialization is a crucial driver of labour market specialization

- In standard settings (no info on majors) we usually find a large role for firm characteristics
- Students first choose majors and then jobs
  - majors matter a lot for the aggregate gap
  - conditional on fields of study choices, jobs matter much less
- We run 2 different regressions:
  1. only job/firm controls (as if we do not know the field of study)
  2. controlling first for education controls (field of study) and then looking at the additional effect of adding job/firm controls

Contribution of job characteristics taking and not taking into account field of study choices

Gender gap in daily wage 5 years after graduation, private employees only



Note: cohorts graduating between 2011-2014 in a 2nd level and single cycle degree who are working as private sector employees and not studying 5 years after graduation.

- Controlling for job char. but not for majors (col. 3): large role for firm/job characteristics (**70% of the gap**)
- Controlling for majors, and then adding job characteristics (col. 2): firm/job char. matter **only for 20% of the gap**, majors for more than half

Conclusions

- Women earn less than men from the very beginning of their careers
- For university graduates, **majors explain almost 60% of the gender wage gap**, even 5 years after graduation
  - Different choices of majors **are associated with very different labour market prospects**
- Within-field gender wage gaps are still significant but **large component *not* explained by very rich set of job and firms characteristics**
  - Evidence that girls select majors with **lower** unexplained component of within-major gender wage gap
- Overall, the **choice of majors is an important mediator of the role of firms for gender gaps**.
  - Call for policies that operate already at school, when students select fields of study

Thank you!

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Sample selection

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Sample selection - sequential steps

	All	Men	Women
	A. 1 year after graduation		
All graduates	1.015	400	615
(*i*) Work in Italy and not in edu.	640 (63%)	270 (64%)	370 (62%)
(*ii*) Work as employee	570 (88%)	230 (85%)	640 (91%)
(*iii*) Employer found in the data	430 (75%)	170 (75%)	260 (76%)
(*iv*) Employer is private	**370** (87%)	**160** (92%)	**210** (84%)
	B. 5 years after graduation		
All graduates	470	190	280
(*i*) Work in Italy and not in edu.	350 (74%)	140 (74%)	210 (75%)
(*ii*) Work as employee	280 (80%)	110 (81%)	170 (77%)
(*iii*) Employer found in the data	240 (85%)	90 (83%)	150 (86%)
(*iv*) Employer is private	**190** (81%)	**80** (89%)	**110** (77%)

Notes: cohorts graduating in 2011-18 (2011-14) in Panel A (B). Units are in thousands and rounded to the closest (higher) multiple of 10. Percentages are the % of individuals selected in step s, out of the pool selected in step $s-1$.

Sample summary statistics

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Main samples and other samples - basic socio-demographic characteristics

	All employed	Private employees	Public employees	Self-employed	Private employees Oaxaca sample
	(1)	(2)	(3)	(4)	(5)
% female (1 yr)	58.3	57.6	75.0	50.8	53.7
% female (5 yr)	60.2	59.0	77.3	54.7	55.1
% annual earnings gap (1 yr)				21.3	
% annual earnings gap (5yr)				28.3	
% daily wage gap (1 yr)		**20.8**	17.5		28.0
% daily wage gap (5 yr)		**25.5**	14.0		30.1
Parental income at grad.	51613	50044	43389	63050	50044

Notes: cohorts graduating in 2011-18 (2011-14) for outcomes 1 (5) year(s) after graduation. The statistics on parental income at the time of graduation are computed on the 2011-18 cohorts. For self-employed days worked are not available. The percentage gender gap in daily wages or annual earnings is computed as $100 \times \frac{w_m - w_f}{w_m}$, where f indexes the women and m indexes the men. The focus is on graduates who 1 (5) year(s) after graduation work and no longer study.

Girls perform as well as or better than boys within all university majors

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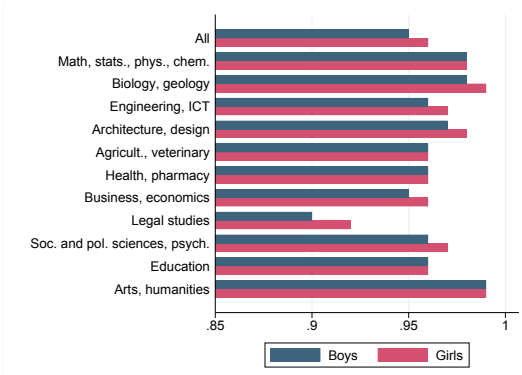
Average graduation grade by field of study and gender



Notes: cohorts of 2011-2018. 2nd cycle and single cycle graduates. Grades range from 60 to 110 *cum Laude*.

Oaxaca decomposition - Education controls, All workers

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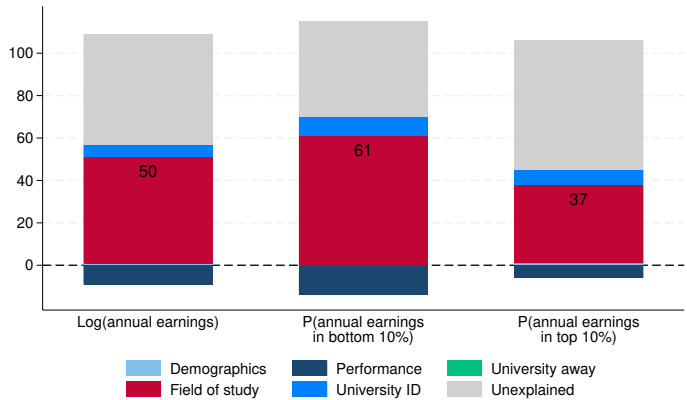
Contribution to the gap in annual labour earnings 5 years after graduation, all workers



Note: cohorts of 2011-2014. 2nd cycle and single cycle graduates who 5 years after graduation are working and not studying. Overall difference normalized to 100.

Oaxaca decomposition - Education controls, 1 year after graduation

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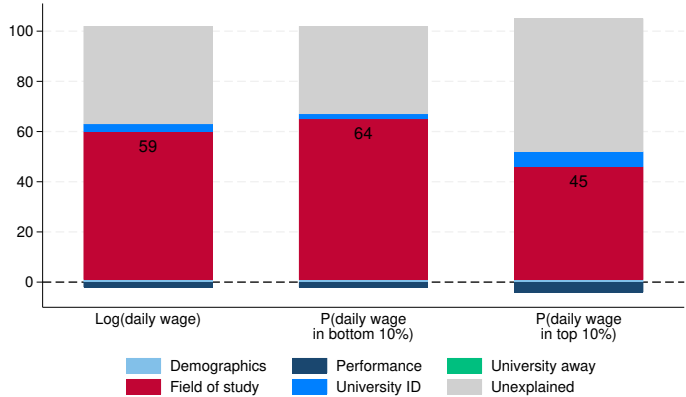
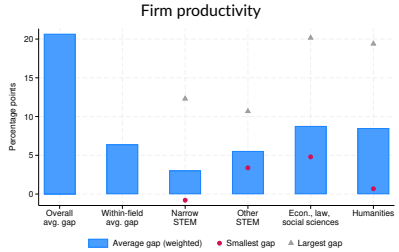
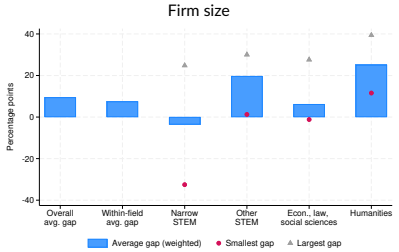
Contribution to the gap in daily wages 1 year after graduation, private employees only

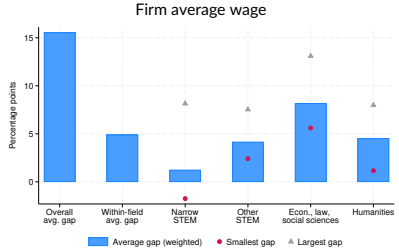


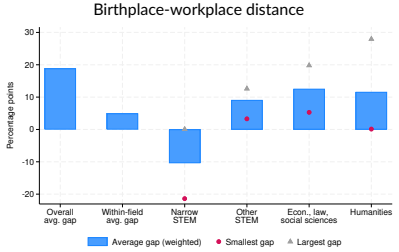
Note: cohorts of 2011-2018. 2nd cycle and single cycle graduates who 1 year after graduation are working and not studying. Overall difference normalized to 100.

Within-fields, girls and boys match with different firms and jobs (1)



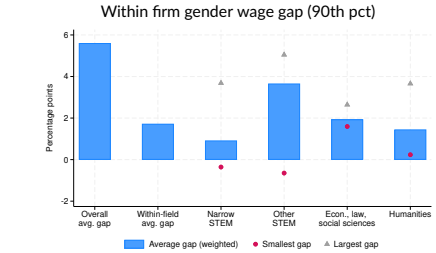


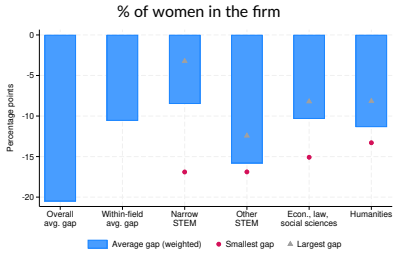


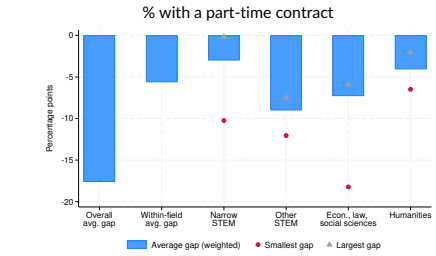


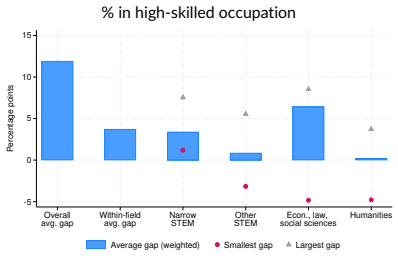
Note: cohorts graduating between 2011-2014 in a 2nd level and single cycle degree who are working as private sector employees and not studying 1 year after graduation. We exclude Medicine, Dentistry, and Veterinary because 1 year after graduation very few are employed.

Within-fields, girls and boys match with different firms and jobs (2)









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