

The Origins of the Gender Pay Gap: the Role of School-to-Work Transition

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Early gaps matter for life-cycle differences in women's and men's careers

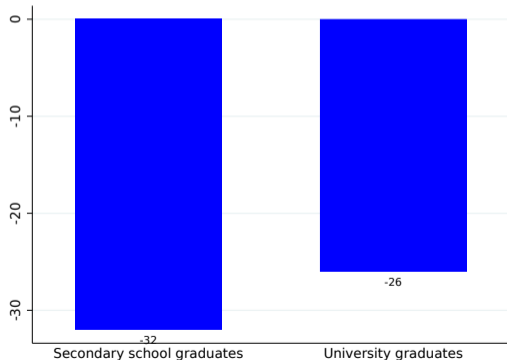
- Despite some convergence, gender earnings gaps among **workers** remain high in advanced economies
 - Women's **labour input** is lower ...
 - ... but there is also a substantial gender gap in **pay per hour** (16% in the EU)
- **When** do women's and men's careers diverge?
 - The literature has zoomed in on the gendered effect of **parenthood** (i.e., *the child penalty*; Kleven, Landais & al., 2019 and 2021, Casarico & Lattanzio, 2022, De Philippis & Lo Bello, 2022) ...
 - ... but recent research also highlights the prominence of gaps **earlier in the career** (Bianchi & al., 2023), in the first years on the labour market
- Initial gaps:
 - are especially concerning if later events widen them
 - may call for policies different from those that target the child penalty

What are the determinants of early career gaps?

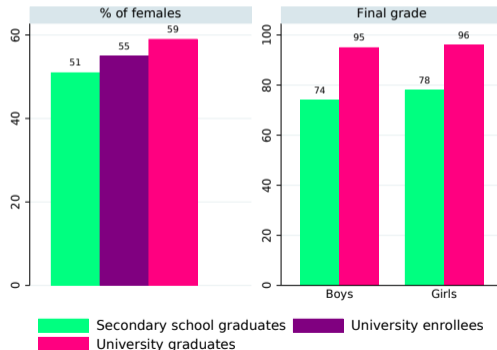
This question is especially relevant for young Italian workers because:

- % earning gaps (F-M) just 1 year after graduation are sizable ...

Condition 1 year after graduation



- ... **despite** girls graduating in higher numbers, faster and with better grades



Note: Graduating cohorts of 2011-2018. Graduates who 1 year after graduation are working and not studying. University graduates are 2nd level or single-cycle graduates.

Roadmap and our contribution

- We exploit a unique administrative dataset for Italy that combines several data sources on **education** and **early career outcomes**
- We study the determinants of early career gender gaps
 - **education choices**
 - *fields of study, even for the same level of education, are a crucial determinant of earnings* (Kirkeboen & al., 2016; Altonji & al., 2016, 2022)
 - **since field of study choices differ substantially by gender, we study their role for the gender gap**
 - **jobs' and firms' characteristics**
 - *sectors, occupations, and firms play a role in shaping the gender gap* (Goldin, 2014; Card & al., 2015; Cardoso & al., 2016; Sloane & al., 2021; Casarico & Lattanzio, 2022)
 - **we study whether this is true even within fields of study** (see also Huneus & al., 2021)

Data

- **Target population**: universe of graduates from **upper secondary** and **tertiary education** (1st, 2nd, single cycle degrees) over **2011-2018**
- **Who are they?**
 - **Demographics**: *gender*, age, municipality of birth, marital status (2011-19)
 - **Mother and father's** income and education at the time of students' graduation

Data

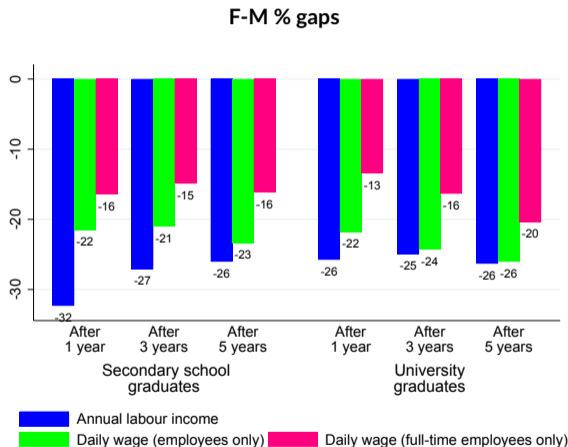
- **Target population**: universe of graduates from **upper secondary** and **tertiary education** (1st, 2nd, single cycle degrees) over **2011-2018**
- **What did they study?**
 - **field**: secondary school (university) **ID** and **track (major)**
 - **performance**: final grade and age at graduation

Data

- **Target population**: universe of graduates from **upper secondary** and **tertiary education** (1st, 2nd, single cycle degrees) over **2011-2018**
- **What do they do in the labour market?**
 - **All workers** → **Labour income 2011-2019**
 - Employees: annual and daily wages
 - Self-employed: annual wages only
 - For **employees only** → **Type of job 2011-2019**
 - schedule (full vs part-time), stability (permanent vs fixed-term), 6-digit occupation, municipality of work, sector (incl. *public sector*), employer ID
 - For **private employees only** → **Characteristics of employer 2011-2019**
 - workforce composition (inc. gender and educ.) and wages, balance sheet variables

The early career gender gaps

Gaps emerge right after graduation and do not shrink later

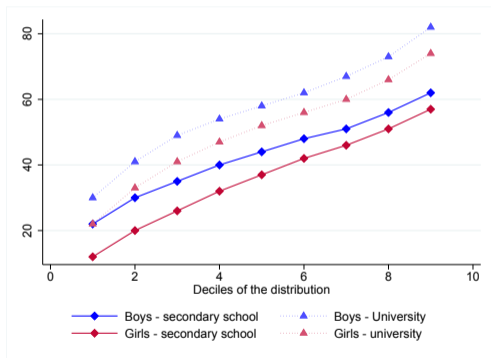


- Annual gap > daily gap > full-time (FT) daily gap → role of **days worked** and **part-time** **Intensive**
- Still, the gap in pay rates is substantial; for uni. graduates ↑ over time

Note: cohorts of 2011-2018 after 1 year, 2011-2016 after 3 years, 2011-2014 after 5 years. Graduates who 1/3/5 year(s) after graduation are working and not studying. University graduates are 2nd level or single-cycle graduates.

The FT pay gap is there along the entire distribution

Daily wages of FT employees 1 year after graduation



Note: cohorts of 2011-2018, full-time employees only. Graduates who 1 year after graduation are working and not studying. University graduates are 2nd level or single-cycle graduates.

- Different from what usually found, the FT daily gap is **not** larger at the top of the distribution
- Why? From full population matched e-e data (ASIA OCC) we see that the widening of top gaps occurs **later in the career**

Secondary school University

The anatomy of early career gender gaps

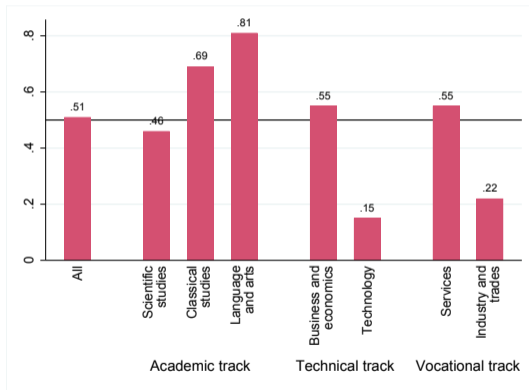
A two-step analysis

- For a given level of education, we model early career gender gaps as the outcome of a two-step process:
 1. Girls and boys choose which track/major to graduate from (**education**)
 2. After graduation, they choose if being self-employed or employee; if employees, they match with a firm (**work**)
- In practice:
 1. We explore how much differences in **education** (performance, field of study) can explain the **overall** gender gap
 2. For any field of study, we explore how much differences in **employer and job characteristics** can explain the residual gender gap (i.e. the **within-field** gender gap).

Step 1: the role of education choices for
aggregate gender gaps

High school: boys and girls select into different tracks

% of females among high-school graduates, by track



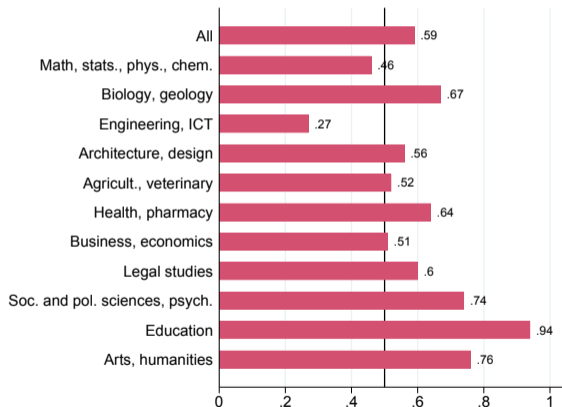
- Girls less likely to choose math-intensive tracks
- Even if they had a comparative advantage in math at the end of middle school

Middle-to-high-school transition

Note: cohorts of 2011-2018.

University: boys and girls select into different majors

% of females among 2nd cycle degree graduates, by major



- Girls less likely to graduate from **STEM majors**

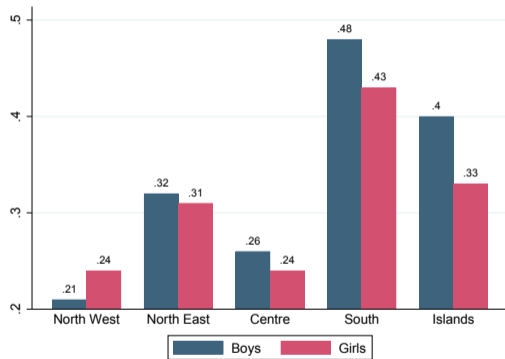
- Even if they graduated from maths-intensive high school tracks

STEM graduates by track

- STEM gap larger among high-school **top achievers**

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

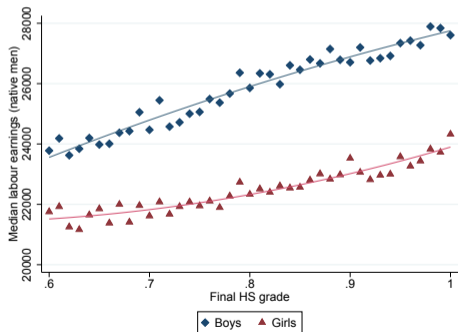
University: girls are less likely to move away from home to study



- Girls are less likely to move out of their birth region to go to university, especially from the South and Islands

University: all in all, girls choose less remunerative paths ▶ Secondary school

- Girls graduate from less remunerative degrees (university \times major)
- Financial returns of a degree measured by the median earnings of its non-immigrant male graduates 5 years after graduation



- Gap is larger for **higher ability students**
- Differences depend mostly on choices of major (rather than univ.)
▶ By majors
- Similar pattern for other measures of degree quality (Anvur VQR scores, QS ranking)

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

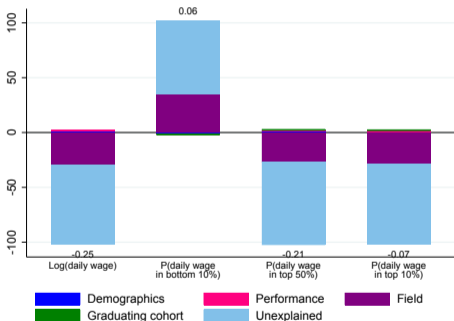
How much do different educational choices matter?

- **Oaxaca-decompose** the gender gap in:
 - average daily wage
 - probability of being a **top earner** (top 10%)
 - probability of being a **good earner** (top half)
 - 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's out of the birth region (for uni. graduates only)
- Control also for differences in:
 - socio-demographics characteristics (reg. of birth, marital status, ventiles of parents' income)
 - academic performance (final grade and age at graduation)
- For high school graduates, we focus only on those who graduated from non academic tracks

Oaxaca decomposition

High-school graduates

Gap in daily wage (F-M) 1 year after graduation, private employees only



- Most of the gap (70%) is unexplained
- Field of study is the only characteristic that matters
- Annual wages, all workers

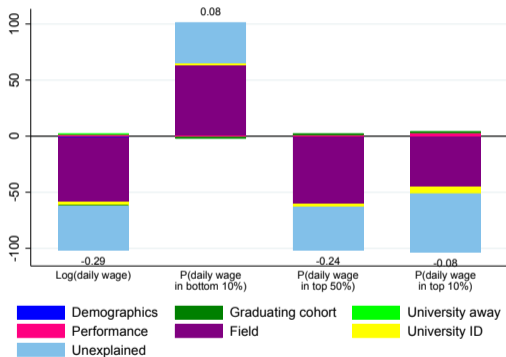
Note: cohorts of 2011-2018 who graduated from non academic tracks and who 1 year after graduation are working and not studying.

Overall difference normalized to 100, actual value displayed at the top of the bar.

Oaxaca decomposition

University graduates

Gap in daily wage 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, actual value displayed at the top of the bar.

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

Step 1: main takeaways

- Overall, differences in educational choices and performance explain on average:
 - **30%** of the early career gender wage gap among **high school graduates**
 - **60%** of the early career gender wage gap among **university graduates** (less at the top of the distribution)
- **Field of study is the only characteristic** among educational controls **that seems to matter**
- However there are still sizable gender wage gaps **within** narrowly defined fields, up to 30-45% Within-field gaps
- Why? Let's move to step 2

Step 2. The role of job and firm characteristics for within-fields gender gaps

Early career gender gaps in jobs and employers' characteristics

- We consider a rich set of jobs' and employers' attributes
 - **Type of employment** (private and public sector employees, self-employed)
 - **Contract** characteristics (part-time, permanent)
 - Workplace **distance** from birth municipality
 - **Firm characteristics** (size, age, value added per worker, average wage, average educ. employees, share of women)
- We compute both **overall** and **within-field** gender gaps in all these dimensions
- Within-field gender gaps:
 - let J be the number of fields
 - for any attribute $i \in I$ we compute J field-specific gender gaps
 - we summarize the features of the distribution of J within-field gender gaps for attribute i by showing its 25, 50 and 75 percentiles
 - we consider ≈ 15 high-school tracks and ≈ 20 university majors

Even within narrowly defined fields, girls and boys hold different jobs

Gender gap (girls-boys) in type of employment, 1 year after graduation

	All		Within fields		
	M	F-M	p25	p50	p75
<i>A. High-school graduates</i>					
Private sector employees (%)	94.4	1.5	-0.6	1.0	2.6
Public sector employees (%)	0.5	0.5	0.2	0.4	1.2
Self-employed (%)	4.9	-1.9	-3.3	-2.0	-0.6
<i>B. University graduates</i>					
Private sector employees (%)	74.6	-2.4	0.4	1.5	4.2
Public sector employees (%)	6.5	7.4	0.1	0.8	2.2
Self-employed (%)	19.0	-5.0	-5.1	-3.5	-0.9

Notes: cohorts who graduated from non-academic upper secondary school tracks or university (2nd level or one-cycle degrees) degrees in the period 2011-2018. Only graduates who work and no longer study are considered. Column (1) displays the value among males; column (2) reports the gender gap (female-male); columns (3), (4) and (5) show the 25th, 50th and 75th percentiles of the distribution of the within-field-of-study gap.

- Virtually all high-school graduates start as private sector employees
- Among uni. graduates, girls more likely than boys to be public sector employees and less likely to be self-employed
- Within job type gender gaps

Even within narrowly defined fields, girls and boys hold different jobs

High-school graduates, employees only

Gender gap (girls-boys) in job and employer characteristics, 1 year after graduation

	Private employees				
	All		Within fields		
	M	F-M	F-M		
			p25	p50	p75
Part-time contract (%)	29	20.8	13.0	19.7	22.9
Permanent contract (%)	23	-2.4	-2.7	-1.9	0.5
High-skill occ. (%)	10	-2.8	-3.9	-1.5	0.3
Medium-skill occ. (%)	60	20.0	15.0	17.8	21.6
Low-skill occ. (%)	30	-17.3	-17.7	-15.0	-13.3
Firm distance from birth muni.	93	-6.9	-16.9	-3.2	4.4
Firm average age	17	-2.4	-3.6	-2.0	-1.3
Firm size	31	-9.2	-13.7	-9.4	-1.4
Co-workers' average educ.	12	0.3	0.2	0.2	0.3
Female co-workers (%)	33	28.6	22.3	25.1	28.4
Firm VA per worker	38	-6.8	-10.0	-5.9	-3.1
Firm av. wage	1937	-175	-229.8	-143.6	-82.6

Note: cohorts of 2011-2018 who graduated from non academic tracks and who 1 year after graduation are working and not studying. Employees only.

Even within narrowly defined fields, girls and boys hold different jobs

University graduates, employees only

Gender gap (girls-boys) in job and employer characteristics, 1 year after graduation

	Private employees					Public employees				
	All		Within fields			All		Within fields		
	M	F-M	F-M			M	F-M	F-M		
			p25	p50	p75			p25	p50	p75
Part-time contract (%)	14	17.6	2.6	6.1	9.6	18	2.5	-1.3	1.6	5.1
Permanent contract (%)	38	-7.2	-6.3	-3.5	-2.6	30	-6.9	-10.8	-3.1	-0.9
High skill occ. (%)	66	-12.0	-5.9	-2.9	-1.2	84	7.1	0.0	1.1	3.5
Medium skill occ. (%)	30	13.1	2.7	6.5	8.2	14	-7.0	-6.2	-1.6	-0.1
Low skill occ. (%)	4	-1.2	-3.9	-2.3	-0.5	2	0.1	0.0	0.2	1.0
Firm distance from birth muni.	246	-46.4	-24.5	-9.8	9.1	283	-21.4	-84.4	-12.8	22.7
Firm average age	22	-2.6	-2.1	-1.5	-0.8					
Firm size	189	-89.7	-20.4	-6.2	4.6					
Co-workers average educ.	14	-0.2	-0.1	0.0	0.1					
Female co-workers (%)	37	19.9	8.4	11.5	14.8					
Firm VA per worker	61	-12.6	-5.9	-3.8	-2.2					
Firm av. wage	2983	-522.4	-276.6	-144.6	-53.7					

Note: cohorts of 2011-2018. 2nd cycle and single Graduates who 1 year after graduation are working and not studying. Employees only.

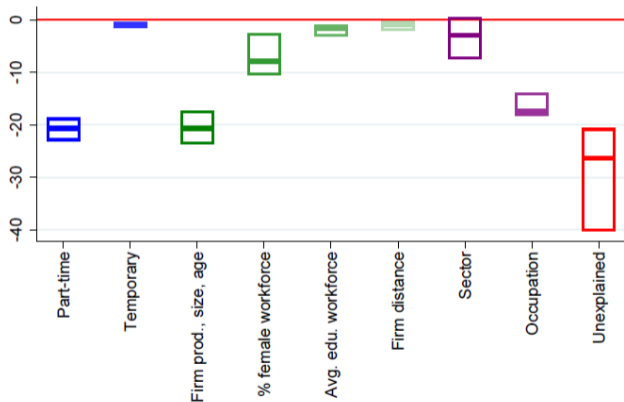
How much do differences in job and employers' attributes matter?

- From the start, **even within fields of study**, girls:
 - more likely to work part-time
 - match with firms closer to home, smaller, lower-paying, and less productive
- Zoom-in
- match with firms that employ more females
- How much do each of these attributes help explain the within-field gender gap? For **each** high-school track and university major, we **Oaxaca-decompose the within field gender pay gap**
- Given J fields and I attributes:
 - for each attribute $i \in I$ we compute its contribution $c \in C$ to the j -th field-specific gender gap $\rightarrow (c_1^i, c_2^i, \dots, c_{j-1}^i, c_j^i)$
 - for each attribute i , we plot the 25th, 50th and 75th percentiles of $(c_1^i, c_2^i, \dots, c_{j-1}^i, c_j^i)$
- We focus on **private sector employees**, for whom we have the entire information set

Oaxaca decomposition

High-school graduates, 1 year after graduation, private sector employees

Average (log) daily wage



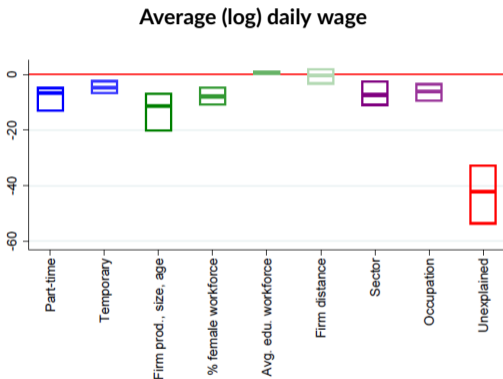
25, 50 and 75 percentiles of effects across 16 fields with a favourable gender gap.
Median overall difference = -0.24

- The main determinants of within-field wage differentials are:
 - firm characteristics
 - part-time work
- In the median field, \approx **25%** of the gap in average daily wage is still unexplained

Note: cohorts who graduated from non-academic high school tracks in the period 2011-2018 and who are working and not studying 1 year after graduation.

Oaxaca decomposition

University graduates, 1 year after graduation, private sector employees



25, 50 and 75 percentiles of effects across 22 fields with a favourable gender gap.
Median overall difference = -0.12

Note: cohorts who graduated from university (2nd cycle or single cycle degrees) in the period 2011-2018 and who are working and not studying 1 year after graduation.

- Firm characteristics are the main determinant of within-field wage differentials
- In the median field, more than **40%** of the gap in average daily wages is still unexplained
- The unexplained component is even higher ($> 50\%$) for within-field differences in the prob. of being a top earner (not shown)

Wrap-up and conclusions

Overall, controls explain 75-80% of the gap in (log) daily wages

We estimate the overall explanatory power of education choices, job, and employer attributes with a regression-based approach

Gender gap in daily wages (girls-boys) 1 year after graduation

Secondary School grad.			University grad.		
Raw (1)	Edu contr. (2)	Job contr. (3)	Raw (4)	Edu contr. (5)	Job contr. (6)
Average (log) daily wage					
-0.260*** (0.002)	-0.185*** (0.002)	-0.064*** (0.002)	-0.283*** (0.002)	-0.114*** (0.002)	-0.051*** (0.002)
584,339	583,975	583,949	280,004	280,002	279,959
% of tot gap explained					
	28.8	46.5		59.7	22.3

Source: bovinietal2022 calculations based on administrative data from the Ministry of Education and Merit (MIM), the Ministry of University and Research (MUR), the Ministry of Labour and Social Policies (MLPS), the Italian Social Security Institute (INPS), and from tax records made available thanks to an agreement with ISTAT. **Notes:** cohorts who graduated from upper secondary school or university (2nd level or one-cycle degree) in the period 2011-2018. Only gradu-

- Sec. school: 75% explained by controls (40% of which due to edu controls)

- University: 80%

Conclusions

- Women earn less than men from the very beginning of their career both because they:
 - select into **less remunerative fields** of study
 - are employed in **lower paying jobs within fields of study**
- For **high school graduates**: **job characteristics explain most of the gap** (especially part-time and firm characteristics)
- For **university graduates**: **majors are the main determinant of the gap**
- Overall, even after controlling for this rich set of variables, there is still an **unexplained component**
 - 20-25% at the average
 - larger at the top of the distribution

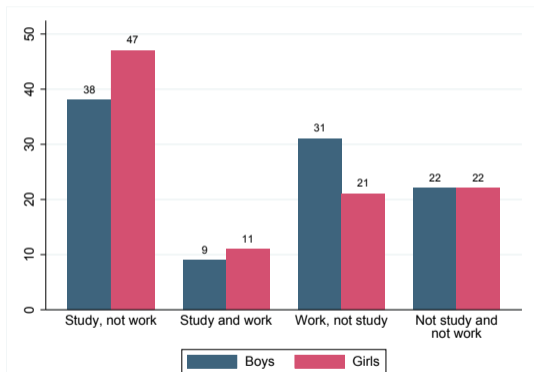
Thank you!

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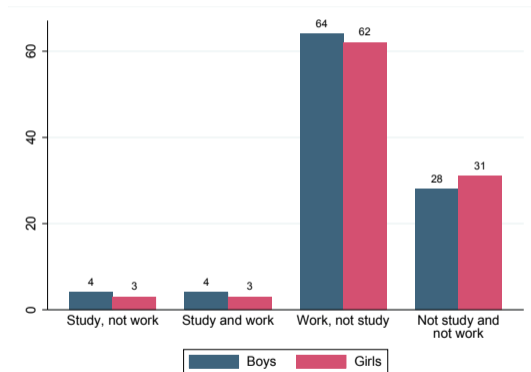
Appendix

Condition 1 year after graduation [Back](#)

Secondary school graduates



University graduates

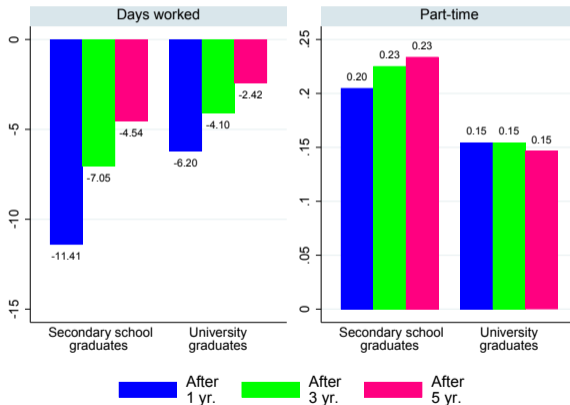


Notes: cohorts who graduated from upper secondary school or university (2nd level or one-cycle degree) in the period 2011-2018. An individual is classified as studying if they are enrolled in a course 1 year after graduating from upper secondary school (panel a) or from university (panel b). An individual is classified as working if they have a non-zero annual labour income.

Gaps in days worked and part-time incidence

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Gap (F-M) in days worked (%) and in part-time incidence (p.p.)

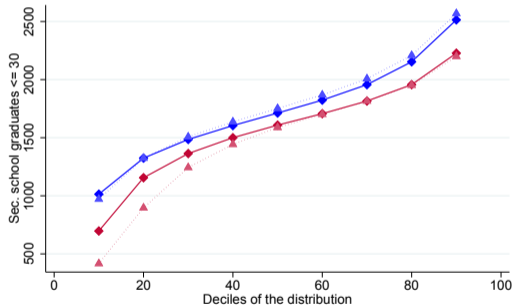


Note: cohorts of 2011-2018 after 1 year, 2011-2016 after 3 years, 2011-2014 after 5 years. Graduates who 1/3/5 year(s) after graduation are working and not studying. University graduates are 2nd level or single-cycle graduates.

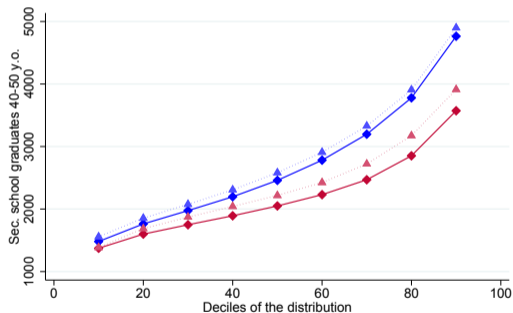
Gender gaps along the distribution, by age

Secondary school graduates [Back](#)

Younger than 30



Aged 40-50

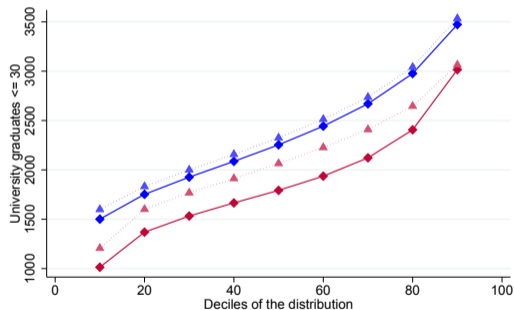


Source: Asia matched employer-employee. Note: average over years 2014-2018.

Gender gaps along the distribution, by age

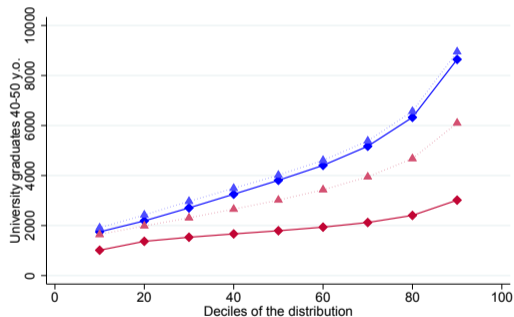
University graduates [Back](#)

Younger than 30



Men - monthly wage Men - monthly wage FTE
Women - monthly wage Women - monthly wage FTE

Aged 40-50

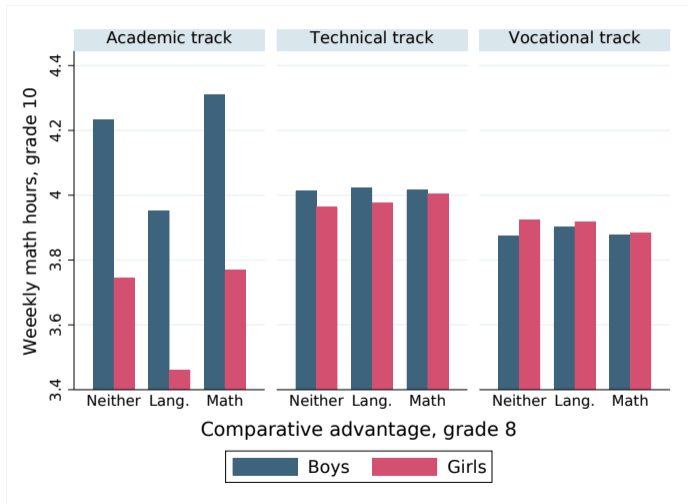


Men - monthly wage Men - monthly wage FTE
Women - monthly wage Women - monthly wage FTE

Source: Asia matched employer-employee. Note: average over years 2014-2018.

Middle-to-high-school transition

[Back](#)

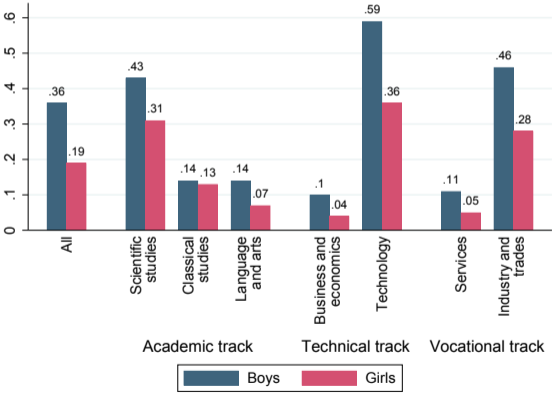


Source: INVALSI. Notes: Comparative advantage at grade 8 and weekly Mathematics instruction hours at grade 10 are computed for the cohort who attended grade 8 in the scholastic year 2014-15 and grade 10 in the scholastic year 2016-17.

STEM graduates, by high school tracks

University graduates [Back](#)

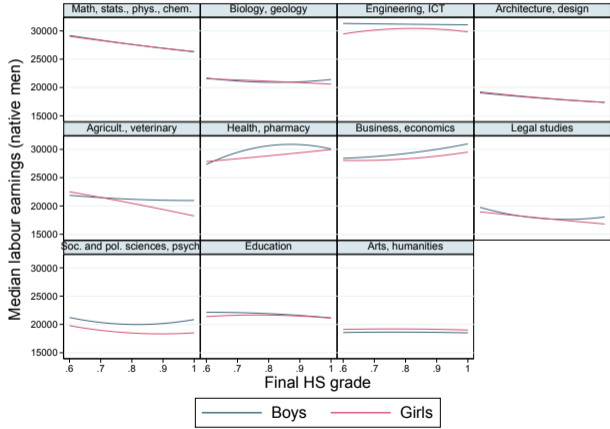
% of narrow STEM graduates, by HS track



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

Differences depend entirely on choices of majors (rather than university)

▶ back

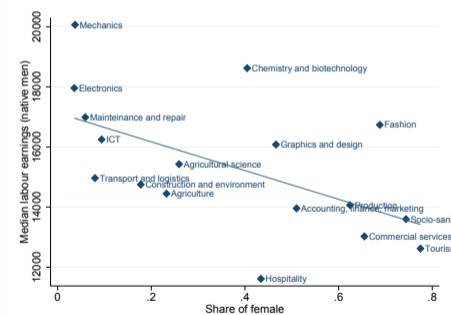
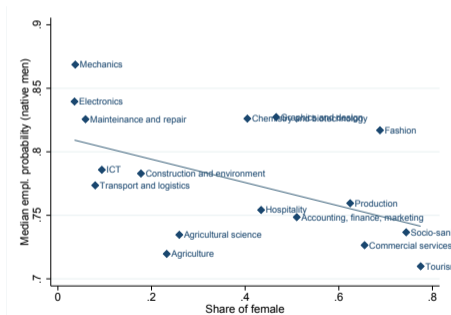


Note: 2016-2018 2nd level and single cycle graduates for which the high school final grade is available.

Secondary school: all in all, girls choose less remunerative tracks

▶ back

- Higher % of females in high-school tracks where male graduates have a **lower employment rate** and **lower earnings**

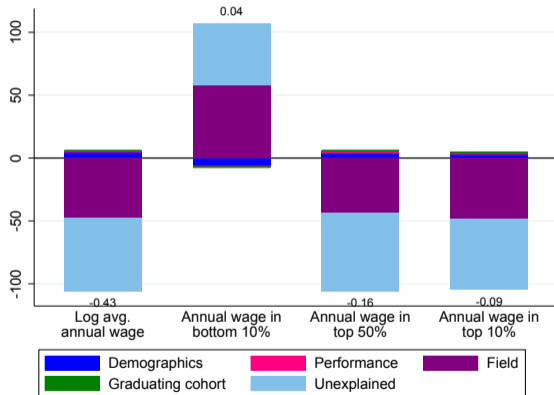


Note: cohorts who graduated from non-academic (i.e. technical and vocational) tracks of upper secondary school in 2011-2018. On the x axis, one reads the share of girls among graduates by track; on the y-axis, one reads the employment rate (left panel) or the median annual income (right panel) 5 years after graduation by track, computed on the population of male native graduates who stop studying after secondary school. The blue line captures the linear fit to the data.

Oaxaca decomposition

High-school graduates [▶ Back](#)

Annual labour income 1 year after graduation, all workers

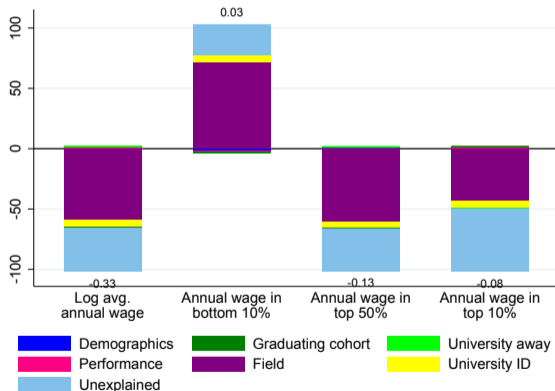


Note: cohorts of 2011-2018 who graduated from non academic track and who 1 year after graduation are working and not studying. Overall difference normalized to 100, actual value displayed at the top of the bar.

Oaxaca decomposition

University graduates [▶ Back](#)

Annual labour income 1 year after graduation, all workers

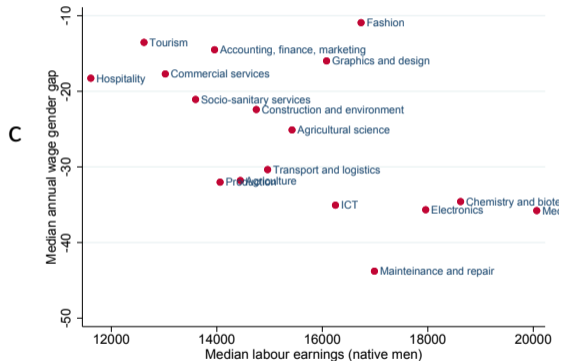


Note: cohorts of 2011-2018. Graduates who 1 year after graduation are working and not studying. Overall difference normalized to 100, actual value displayed at the top of the bar.

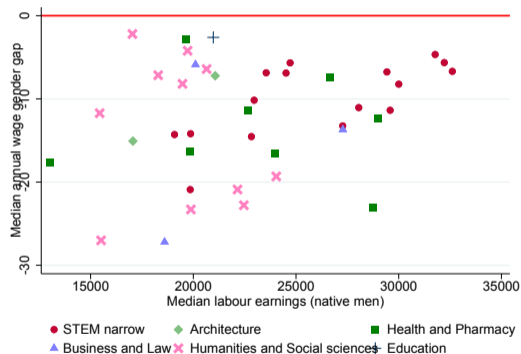
Early careers gaps exist even within narrowly defined fields of study

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Within high school tracks



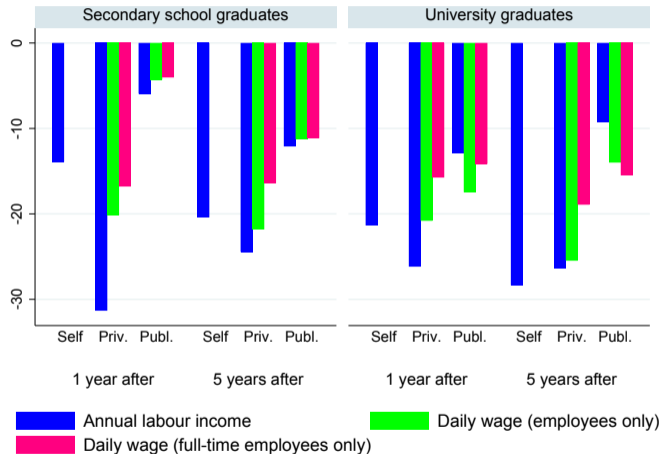
Within university majors



Notes: Cohorts who graduated from upper secondary school or university (2nd level or one-cycle degree) in the period 2011-2018. On the x-axis, high-school tracks (panel a) and university majors (panel b) are sorted according to their quality, as measured by the median annual labour income 5 years after graduation of their native, male graduates (between 2011 and 2014) who are employed and did not continue to study. For each track/major the y-axis displays the median gender gap in annual labour income 5 years after graduation of their graduates (between 2011 and 2014) who are employed and did not continue to study.

Early career gender gaps by type of employer

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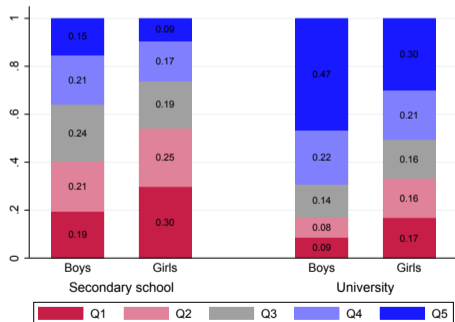


Note: cohorts of 2011-2018 1 year after; cohorts of 2011-2016 3 years after; cohorts of 2011-2014 5 years after. Graduates who 1/3/5 years after graduation are working and not studying.

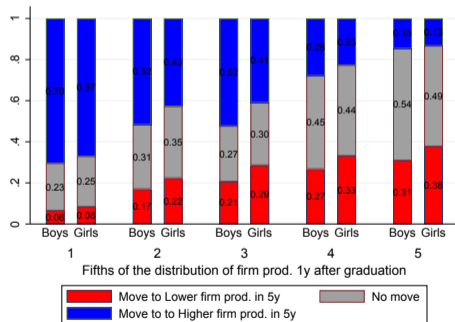
Job moves and firm-level productivity [▶ Back](#)

- Girls match from the start with less productive firms ...
- ... and are less likely to climb up the firm productivity ladder

Allocation 1 year after graduation across firm productivity bins



Movements along the firm productivity ladder between 1 and 5 years after graduation



Note: Only graduates who work and no longer study are considered. Panel a: boys' and girls' allocation into fifths of the distribution of employer productivity (value added per worker) 1 year after graduation. Panel b: red (blue) bars capture the probability of falling down (climbing up) the productivity ladder, i.e. moving to a firm with productivity lower or equal (higher) than that of the origin firm; grey bars represent the probability of remaining in the same firm. Private sector employees only, as the information on productivity is not available for public sector employees.

Early gender gaps for bottom and top earners

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Gender gap (girls-boys) 1 year after graduation

Secondary School grad.			University grad.		
Raw	Edu contr.	All contr.	Raw	Edu contr.	All contr.
(1)	(2)	(3)	(4)	(5)	(6)
Prob. being in top 10% of the distribution					
-0.076***	-0.054***	-0.017***	-0.084***	-0.042***	-0.027***
(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Prob. being in bottom 10% of the distribution					
0.065***	0.044***	0.017***	0.079***	0.029***	0.012***
(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
584,339	583,975	583,949	280,004	280,002	279,959