The occupational returns to the field of study: a gender perspective

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THE OCCUPATIONAL RETURNS TO FIELD OF STUDY: A GENDER PERSPECTIVE

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Unequal gender outcomes in occupational success unravel through different channels in higher education. Using the AlmaLaurea dataset with 80% of Italian graduates and 98 fields of study, this article investigates whether men and women receive similar returns when choosing the same field of study, net of their ability and occupation. A bi-dimensional approach is applied to the topic by relying on Kanter's theory of relative numbers and the status theory of gender, therefore examining both the quantitative and qualitative differences between fields. The results show that the higher share of women in fields of study is not necessarily associated with better outcomes: the most gender 'balanced' subfields of study are the most unequal in terms of income, followed by employment and authority. Except for authority, token women in fields of study with a lower proportion of women (15–20 percent) tend to be more similar to men in their occupational achievement, while the presence of a large majority of women tends to also be associated with lower gender gaps, indicating that the relationship between the gender composition of the field of study and the gender gap is inverse U-shaped. Separate analyses show that the gender gap on the labour market is more pronounced in nurturing fields, despite that they are perceived to appeal to the 'natural' abilities of women and net of the field gender composition. Moreover, structural advantage of men in these fields stands out in income and authority, and comparably less in employment.

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1.Introduction

It is a well-known fact that field of study at the university level determines future labour market trajectories both in income and in terms of occupational level and stability (Davies and Guppy 1997; Gerber and Cheung 2008). However, fields of study are unequally valued on the labour market. For instance, graduates from technical and science fields experience a smoother entrance overall in the labour market (Pietro and Cutillo 2006; Salas-Velasco 2007) and obtain better first jobs in terms of social status (Bernardi, 2003). Moreover, fields of study such as technical (engineering and architecture), hard social sciences (economics, business and statistics) and hard sciences (such as chemistry and physics) offer increased probability of finding stable employment compared to disciplines in the humanities (Ballarino and Bratti, 2009; Reimer et al., 2008). Finally, graduates in the hard sciences are also advantaged in terms of income (Arcidiacono, 2004; Boero et al., 2004; Katz-Gerro and Yaish, 2003; Kelly et al., 2010; Kim et al., 2015a)

Previous literature has shown that the distribution of men and women across fields of study is uneven and results in a profound gender gap in educational returns (Barone 2011; Reskin 1993). There is substantial evidence that women self-select into fields of study including education, arts and humanities and social sciences that tend to have lower occupational returns (Charles and Bradley 2009; Kim, Tamborini, and Sakamoto 2015; Ma and Savas 2014; Ochsenfeld 2014; Triventi 2010). Barone (2015) further referred to care-oriented courses as female, highlighting how the humanistic-scientific and care-technical divide in choices of higher education explain most of the gender pay gap. In contrast to the abundant interest in the problem of gendered selection into fields of study, there has been less research to investigate *to what extent and why* men and women receive similar economic returns when choosing the same field of study. In a less recent analysis, Brown and Corcoran (1997) concluded that women in the US receive a small income premium when choosing 'male' dominated fields of study, while men who choose 'female' dominated fields are penalized. In a more recent study, Quadlin (2019) found that women's choices of majors in the US are associated with lower expected earnings than men's choices even when men and women had the same initial preferences in terms of desired rewards for professional success and remuneration. In the Italian context, Piazzalunga (2018) found that the gender gap is particularly high for graduates in law, political and social sciences, and economics and statistics.

This article studies the gender gap in employment outcomes by field of study net of ability, contributing to the latter stream of research. It moves beyond previous studies in several ways. First, it analyses fields of study in detail to distinguish between the plethora of (sub)fields that can mask key differences in individual career trajectories. In other words, the disaggregation of fields enables a high level of precision that is needed to understand the influence of these factors on individual labour market outcomes and their interaction with gender. Second, the gender gap in outcomes is studied by accounting for the type of occupation that the graduates enter, that is, by considering pay differences across occupations. More attention to occupational levels as well as gaps leads to a more refined and novel set of results. Furthermore, this article employs a bi-dimensional approach, examining both the quantitative and qualitative differences between fields. A well-known theory of relative numbers by Elisabeth Kanter (1997) suggests that the group composition in terms of gender creates different outcomes for men and women; this was applied to different settings including occupations, job queues and fields of study (Campero and Fernandez, 2019; Tolbert et al., 1999). The underlying argument as to why relative numbers matter touches upon different work cultures, exposure to particular models of behaviour and interactions between men and women. Contrary to this, status theory predicts that qualitative differences in occupations and fields of studies affect women's labour market outcomes. Unlike the theory of group

composition, it directly acknowledges the meaning attached to each gender. More specifically, women as a group are supposed to be disadvantaged in all fields of study with the only exception of those fields in which they are expected to have a comparative advantage in terms of the perceived 'natural' abilities. These fields involve a high degree of women's physical or mental care for others, including teaching, care work or nursing (Campero and Fernandez 2019; Charles and Bradley 2009; Lueptow, Garovich-Szabo, and Lueptow 2001; Williams and Best 1990). While the theory predicts an overall female penalty due to women being considered of a 'lower rank' or as the less competent gender, the qualitative differences between fields of study suggest that there may also be rewards leading to female advantage.

Therefore, the article focuses on several questions: Do men and women receive different rewards when graduating from the same fields of study, net of ability and occupation? If so, are the different rewards linked to the gender composition of these fields? Or, are different rewards linked to the perceived 'natural' abilities of men and women in specific fields of study? Does the gender composition of the field of study matter to the same extent in fields in which women are supposed to perform better? Finally, do the gaps vary in terms of outcomes of occupational achievement: employability, income and levels of authority?

The theoretical framework of this article is applied on a detailed and exhaustive dataset of Italian graduates (AlmaLaurea) that has the advantage of providing rich information on educational choices, occupational choices and occupational success. Italy is a country with one of the smallest gender pay gaps within the OECD, at 5.6 percent in comparison to the OECD average of 13.5 percent and the US gap of 18 percent (OECD 2020). In addition, the dataset offers an overarching view on the gender gap by bringing together the demographic characteristics and the ability measures of the graduates with their choices of fields of study and occupations. The focus of this research is on the likelihood of employment, monthly net earnings and job authority, which illustrates the different supervisory responsibilities that individuals might have. The article first outlines theoretical stances and research hypotheses. The second section describes the data and methodology, followed by the results, discussion and conclusions.

2.Theory
Impact of relative numbers
Substantial presence or absence of socially and culturally distinct individuals in groups can influence the interaction between members and their behaviours. Group composition affects individuals in various ways, ranging from the exposure to diversity to a hegemonic culture (Tolbert, Graham, and Andrews 1999) or the role of networking and the presence of discriminatory practices for minority group members (Levine and Moreland 2006). In other words, the relative numbers can have both social and economic consequences for group members. The theory of relative numbers by Elisabeth Kanter (1997) suggests that the size of the minority group has important consequences for the experiences of individuals in a given environment. Kanter argued that there is more space for hostile behaviours against a minority if it is particularly small. Following the same line of thinking that highlights the importance of relative numbers in a given group, Blalock (1970) instead suggested that it is when the minority group increases in size that the majority group starts to feel threatened. In most cases, this theory has been employed to analyse group composition in terms of gender (Kanter 1997) and it has been applied in the context of the workplace and occupations (Campero and Fernandez 2019).

Fields of study are a particular example of group formation and interaction that starts at an early stage in an individual's career. It is relevant to focus on fields chosen at the university level, as students socialize in their immediate circles and are in close contact with their peers, which impacts

their future careers. For instance, women in female-intensive fields of study and men in male-intensive fields of study can create support networks and alliances that could bring them better opportunities in the form of income or supervisory responsibilities once they enter the labour market. Also, the gender composition of fields of study has direct consequences on the labour supply, which may influence potential discriminatory practices. Yet, Kanter's typology, which uses gendered proportions as a contextual dimension, is rarely utilised in relation to fields of study even though it can be easily extended to this type of research. Some exceptions include Sax (1996), who studied the academic outcomes of students through the lens of Kanter's theory without finding any effect of gender composition and Mastekaasa and Smeby (2008), who found that women drop out less frequently from fields with favourable gender composition.

Kanter defined three major groups: skewed groups that contain a large proportion of one gender, so-called 'dominants' (up to 85 percent), and a small minority of so-called 'tokens'; the second group is tilted—the majority and minority are divided proportionally between 35 and 65 percent; the third and final group is balanced, with between a 60:40 to 50:50 percent split in terms of each gender. Each proportion is expected to generate some specific behaviours. The typology is gender neutral, implying that when members of either sex comprise less than some critical proportion of the group, this is consequential for the status and behaviour of the minority gender, assuming that men and women are similarly affected by underrepresentation (Spangler, Gordon, and Pipkin 1978)

However, a gender neutral approach might be questionable if and when everyday interactions are strongly shaped by gender (Zimmer 1988). Thus, due to cultural and social constraints, the underrepresentation of women in certain fields is more likely to have negative consequences for women's labour market opportunities than those for men. An additional dimension to understanding female disadvantage is to explicitly tackle how gender by itself may influence the employment opportunities of men and women in specific fields of study.

Status characteristic theory

In comparison with theories that emphasize the importance of relative proportions in a group, status theory highlights gender as a diffuse status characteristic (Fiske et al. 2002; Correll 2004). According to the theory, women as a group are considered low status and therefore are professionally disadvantaged (Ridgeway 2001). The main mechanism through which the disadvantage in the workplace takes place is performance expectation, which is assumed to be lower for those with low status characteristics. Different experimental studies have confirmed a regular gender gap in competence evaluations in favour of men (Cuddy, Fiske, and Glick 2004; Ridgeway 2001; Correll and Benard 2005) and a harsher evaluation standard for women (Fuegen et al. 2004).

The assumptions of status theory imply that a male[i] bonus in professional outcomes appears independently of the field of study that women select. However, the comparative advantage that women have in tasks requiring nurturing abilities may compensate for their low status or even prevail over its limitations (Correll 2004). Beliefs in the 'natural' abilities of each gender result from widely shared stereotypical beliefs that are reflected in early socialization processes and the organization of everyday life (Ridgeway 2001; Ridgeway and Correll 2004) . Thus, these beliefs highlight the typical male and female features that are thought to be the basis for the distinction between more masculine and more feminine jobs (Charles and Bradley 2002). The meta-analysis provided by Luptow et al. (2001) not only confirmed the stability of stereotypical categorization of men and women but it also showed how it increased between 1974 and 1997. Moreover, the fact that women are still mostly responsible for caregiving at home (Campero and Fernandez 2019) has

reinforced the perception and the stereotypical idea that they are more suitable for 'nurturing' fields and professions (Lueptow, Garovich-Szabo, and Lueptow 2001).

Even though there is no clear definition of what exact subjects constitute 'nurturing' fields of study, they can be described as those that involve a high level of care work and the provision of help to others. Within this definition, fields of study such as nursing, education and social work are not only female dominated but are also considered 'nurturing' (Mastekaasa and Smeby 2008). Williams (1992) grouped nursing, elementary school teaching, librarianship and social work into female professions without, however, specifying nurturing ability as the main criteria. Typically, the chosen academic majors for women also include education and a variety of types of health professions (Brown and Corcoran 1997). Charles and Bradley (2009) labelled as nurturing all fields involving administrative duties and personal care. Barone (2011, 159) focused on the care-technical divide in education and emphasized how women choose fields that have symbolic affinity with traditional caring roles. Fields of study such as nursing and social work clearly belong to 'care' jobs, but psychology or medicine can also be defined as related to traditional caring roles (Barone 2011). At the same time, many humanities majors such as history and arts can also lead to teaching professions involving the care of children, despite not being originally placed within the care sector (Teichler 2007).

Status theory therefore highlights a division between masculine and feminine roles, contrasting with the vision that numerical representation is a key to explaining unequal gender outcomes at work.

3. Hypotheses

As mentioned above, this article focuses on fields of study from a bi-dimensional perspective. First, female presence is quantified in each subfield of study by analysing female and male intensive fields of study. Second, women's overall status and comparative advantage in each field is scrutinized. The importance of diversity within each group is the basis of the first perspective. Skewed groups with only a small number of women could have important consequences on the degree to which women are exposed to discrimination and difficulties in the work environment. 'Tokens' in particular attract a high level of gender stereotypes due to their small size. Thus, it is expected that women in a male intensive environment face special problems and experience larger gaps in occupational success. Due to various potential mechanisms, the degree to which disadvantage takes place may vary depending on the dimension of occupational success of interest. Therefore, for a more complete picture on the gender gap, these hypotheses are tested on three different outcomes: employment, authority and income.

More specifically, it is expected that:

H1a: Fields with a relatively large proportion of women (above 65 percent) reduce the male bonus in employment, income and authority as women are less likely to be disadvantaged.

H1b: Men have the largest bonus in employment, income and authority in fields in which women are a large minority (below 15 percent).

Based on Kanter's theory (1997), this article also argues that balanced fields of study might differ in the environment and dynamics that they offer to students who choose these specialties. This kind of environment might provide for balanced interactions and networking, and therefore superior outcomes, although Kanter's theory is inconclusive as to the effects that balanced environments can have on individuals due to the potential to form subgroups. Thus, it is expected that on average:

H1c: Balanced fields of study will provide the smallest bonus for men in terms of employment, income and authority.

Finally, individual occupational outcomes do not depend exclusively on gender composition, but also on the qualitative characteristics of fields defined as 'feminine' or 'masculine'. Following status characteristics theory, it is expected that the influence of the gender composition of fields might be unequal depending on whether women pursue so-called 'nurturing' fields. More specifically, it is hypothesized that:

H2: In 'nurturing' fields, men will have a lower bonus in terms of employment, income and authority, regardless of group composition.

4. Data and variables

Sample

This article uses cross-sectional data from the Italian inter-university consortium AlmaLaurea, which provides both auxiliary and survey data on individuals who graduate from 64 Italian universities.[ii] One major advantage of this dataset lies in its exhaustiveness: it offers administrative information on demographic and academic characteristics for approximately 80 percent of Italian graduates. All Italian universities were invited to be part of the consortium; while 80% of universities enrolled, the remaining 20 percent are in the process of joining or have set up their own follow up surveys of their students after graduation. Although the initial dataset fully resembles the general population, the AlmaLaurea consortium further ensures the representativeness of the dataset through the use of specifically designed weights (AlmaLaurea 2019).

The administrative data is linked to the survey data *Condizione Occupazionale dei Laureati,* which is an optional survey that follows graduates' employment five years after graduation for the 2010 graduate cohort, with a response rate of 72 percent. Therefore, all graduates who are part of the analysis graduated after the Bologna reform, which standardized higher education qualifications across Europe and reshaped the Italian educational system. These are graduates with long degrees that last between 5-6 years or short degrees that have the format "3+2" (Bachelor and Master).

The sample is restricted in several ways. First, it is restricted to respondents under the current age of 35, as the focus of the article is on early labour market outcomes and by this age the majority have already had some work experience (Aina and Pastore, 2012). Second, the sample was restricted to native-born Italians, as migration processes might alter labour market access and income differentials. Third, the graduates from the defence and security fields of study were excluded as they have different career trajectories from the general population of advanced degree holders (e.g. military occupations). This provides an analytical sample of 56,879 individuals when employment status is employed as a dependent variable, whereas the sample decreases to 37,870 in the analyses relying on income and authority. The sample decreases due to unemployment (15 percent) and non-response on items such as income and occupation (16 percent). **Table 1** presents the descriptive statistics of the sample of employed graduates and also for the subsamples of nurturing and non-nurturing fields of study.

Dependent variables

The employment variable is a dummy that takes value 1 if the individual is employed and 0 if the individual is unemployed. The employed graduates are those who work in full time/part time employment or in additional training financed by the employer or those who work and study at the same time. The unemployed individuals are those not in employment but available to work, and

looking for a job in the last four weeks. The income variable is an ordered category of net earnings, with thirteen intervals in which each observation falls. For the purpose of the analyses, the upper and lower bounds of income are created, and consequently logged to correct for the slightly skewed distribution of income. The latter enables us to get percentage change in income with a change in independent variables, and to obtain the percentage difference between women's and men's income change. Job authority was measured using the question "In your job, do you formally supervise other employees?". The answer was coded using a dichotomous distinction as followed in other studies (Dämmrich and Blossfeld 2017; Yaish and Stier 2009).We consider the formal supervision only, as recognized at the workplace, excluding thus any informal supervision.

Gender composition of the subfields of study
Because the AlmaLaurea dataset offers a very detailed classification of fields of study, they are presented in disaggregated form. Every field of study is disaggregated into specific subfields amounting to 98 subfields.[iii] For example, engineering has subfields including IT engineering, spatial engineering and communication engineering, and linguistics has subfields such as linguistics and modern literature, cultural anthropology, philology and literature, musicology or archival. For a full list of subfields, see **Appendices.** Moreover, the proportion of women is computed for each subfield of study from the current sample of all graduates, ranging from the following: 7 percent of women in mechanical engineering, 12 percent of women in electronic engineering, 25 percent in civil engineering and 35 percent in geography and industrial engineering up to relatively balanced proportions in history, statistics, economics and dentistry (from 40 percent to 50 percent). Women make up a large majority of graduates in biotechnology and nursing, communication and sociology and the social sciences (from around 68 percent to 75 percent). Women are also a majority in art, linguistics, psychology and early education (approaching or above 90 percent).

Nurturing fields
There is no straightforward definition of nurturing vs non-nurturing subfields of study in the current literature. As a result, this article provides a conservative definition of nurturing and non-nurturing disciplines by combining different scientific evidence. More precisely, nurturing subfields are defined as those that involve a high degree of women's physical or mental care for others (Lueptow, Garovich-Szabo, and Lueptow 2001, 26), also known as 'caregiving' (Campero and Fernandez 2019). A unique classification system was created for nurturing fields by searching for a component of care in the description of the field of study. The nurturing fields resulting from this classification process incorporate the following: psychology, social work, cognitive sciences, pedagogy, nursing and midwifery sciences, rehabilitation care, health care science, preventive health care, primary education, pharmacy and industrial pharmacy.[iv]

Control variables
The dataset has a rich range of controls related to ability, demographic characteristics of respondents and the character of work and occupations[v]. *Ability* related variables are: university awarding the degree, the university grades, delay in graduation, employment at graduation and high school grade. *Demographic variables* are age of respondent, area of residence, marital status and number of children. Variables representing the *character of work* are: occupation, sector of occupation (private versus public), geographic area of work, and the number of worked hours. The AlmaLaurea dataset offers a unique advantage in tracking the respondent's university: 64 dummies for Italian universities are included to account for the differences in the labour market outcomes due to university quality or prestige. The ability of graduates is measured twice, through the grades at

graduation, and as a final high school grade, accounting for a possible ability-based selection into university and jobs. By considering employment at graduation, attention is paid to the amount of work experience and tenure at work for young graduates. To take marital status into account, the dataset distinguishes between graduates who are single, married and divorced. Moreover, to approximate for possible career interruptions, a control is employed for the number of children, ranging from one, two or more children. The occupational sector (private/public/NGO) and the actual occupations are also included to account both for differences in levels of pay and types of jobs as well as for potential gender segregation in those fields. The actual occupations are given in two digits as 33 occupations, the full list of which is provided in the **Appendices**. By controlling both for the area of residence and the area of work, geographic mobility of graduates for work is also considered. The number of weekly working hours is introduced as a variable with 12 categories to control for the possibility that the gender gap in income and authority might be due to a difference in time spent at work. This measure is preferable to the distinction between full-time and part-time employment because it provides a higher level of precision in working hours.

5.Methods
Following the theoretical expectations about potentially U-shaped relationship between the gender composition of the field and the gender gaps in occupational outcomes (H1a, H1b, H1c), we use logistic models with a linear and a quadratic term of the women's share in fields of study to study authority and employment and interval regressions to study net income (earnings). Interval regression is an example of a linear model that is suitable when precise information on variable is missing and is given as an interval in which it falls (e.g income range). The model relies on the lower and upper bound of the variable range as a dependent variable.[vi]

The first part of the analysis includes and particularly focuses on an interaction between gender of the respondent and the share of women in each field of study for the entire sample. The second and third part of the analysis replicate the analysis on subsamples (nurturing vs non-nurturing fields of study). Following a highly skewed distribution of the independent variable for the nurturing field and due to a potential for collinearity, the quadratic term of the share of women is dropped in further analyses for the nurturing subsample, to ensure a higher stability of coefficients. The scope of additional analyses on subsamples is to understand whether nurturing or non-nurturing fields exhibit different patterns in terms of gender gap in the labour market.

The analyses were weighted to correct for bias due to non-response and sample design, and ensure representativeness of the graduate population at the national level. The weights were provided by the AlmaLaurea and they were constructed by considering gender, discipline grouping, geographical area of university and place of residence after graduation (AlmaLaurea 2019).

Table 1 shows that average lower bound of the monthly income is about 1,208 euros while the upper bound is about 1,462 euros. Regarding employment, about 26 percent have supervisory roles and most of the surveyed graduates reside in Italy; yet around 5 percent of graduates work abroad without changing the residence. The average percentage of women for all subfields is 60.5 percent, which shows that women overall constitute a majority of graduates. Nurturing fields contain about 17 percent of all graduates. The average age is 25.84 at the time of graduation. The graduates' academic performance is rather high: about 37 percent of graduates obtain the highest grade level, while the average delay in graduation is less than a year. Mean secondary school grade is also relatively high, 84 points out of 100. With regards to the occupational sector, 16 percent of employed graduates work in the public sector while 80 percent work for the private sector; only 4 percent work in the NGO field. Regarding marital status, about 57 percent of graduates are single and 87 percent had no children at the time of the survey. There is substantial difference between

nurturing and   non-nurturing fields of study in the composition of the sample. The average percentage of women in the sample, and the average share of women in fields of study are higher in nurturing fields; 33 percent of jobs are in the public sector, and graduates seem to show lower ability as measured in university and high school grades. The sample of all graduates is very similar in its composition to the sample of employed graduates (table available upon request).

Table 1. Descriptive statistics

	Sample Mean (SD)	Nurturing Sample Mean (SD)	Non-Nurturing Sample Mean (SD)
Employment	0.84*		
Income (lower bond)	1208.218 euro	1038.063 euro	1245.605 euro
Income (upper bond)	1462.299 euro	1288.259 euro	1500.539 euro
Authority	0.253	0.176	0.269
Gender			
Women	0.596	0.855	0.538
Men	0.404	0.145	0.461
Share of women in			0.549
subfields of study	0.605	0.856	
	(0.227)	(0.084)	(0.210)
Nurturing fields	0.18		
Age	25.840	26.297	25.740
	(2.089)	(2.88)	(1.85)
Geographical residence			
North	0.472	0.426	0.482
Centre	0.194	0.192	0.195
South	0.331	0.379	0.321
Abroad	0.012	0.013	0.011
University Grades			
66-90	0.020	0.036	0.016
91-100	0.138	0.186	0.128
101-105	0.174	0.201	0.168
106-110	0.293	0.299	0.292
110 with Laude	0.372	0.276	0.393
Marital status			
Single	0.570	0.475	0.590
Married	0.425	0.515	0.405
Divorced	0.004	0.089	0.040
Number of children			
None	0.872	0.777	0.893
One	0.122	0.213	0.103
Two or more	0.004	0.097	0.038
Sector			

Public	0.159	0.332	0.120
Private	0.796	0.560	0.848
NGO	0.044	0.107	0.031
Hours worked			
Up to 44	0.766	0.940	0.727
More than 44	0.234	0.060	0.273
Delay in graduation (in years)			0.848
	0.875	0.997	
	(1.134)	(1.451)	(1.050)
Secondary school grades	84.403	79.297	85.5211
	(14.432)	(16.708)	(13.633)
Employed at graduation			
Yes	0.304	0.401	0.283
No	0.695	0.598	0.716
Region of employment			
North of Italy	0.531	0.503	0.538
Centre of Italy	0.216	0.235	0.212
South of Italy	0.199	0.248	0.189
Abroad	0.051	0.013	0.060
N	37,870	6,822	31,048

Source: AlmaLaurea 2010. Note: The descriptive statistics for university attended, occupations but also of the sample of all graduates (regardless of their employment status) is available on request. Unweighted data. *Refers to the sample of all graduates.

6. Analysis and results

This article considers the gender gap in educational returns by accounting for both the quantitative and qualitative differences of graduates' fields of study. As mentioned above, this is examined using models that predict labour market outcomes in terms of employment, income and authority both for the entire sample but also specified in terms of nurturing vs non-nurturing fields of study (**Table 2**).

Table 2. Logistic regression of employment and authority. Interval regression of (net monthly) income (selected coefficients)

Variables	General (1) Employment	(2) Income	(3) Authority	Nurturing (1) Employment	(2) Income	(3) Authority	Non-Nurturing (1) Employment	(2) Income	(3) Authority
Man	0.354	-0.0788***	0.0683	0.676	0.257***	0.790	0.779***	-0.0416*	0.00902
	(0.237)	(0.0211)	(0.156)	(1.049)	(0.0921)	(0.974)	(0.226)	(0.0218)	(0.161)
Share of women in fields of study (0-100)	-5.005***	-1.363***	-1.885***	-0.379	-0.182*	-0.467	-2.448***	-1.093***	-2.108***
	(0.614)	(0.0660)	(0.477)	(0.447)	(0.0945)	(0.906)	(0.607)	(0.0718)	(0.516)
Man# Share of women	0.971	0.794***	0.880	-0.347	-0.189*	-0.629	-0.382	0.676***	1.378**
	(0.772)	(0.0789)	(0.573)	(1.274)	(0.114)	(1.199)	(0.788)	(0.0887)	(0.633)
Share of women squared	3.472***	0.987***	1.225***				0.853*	0.688***	1.483***
	(0.445)	(0.0525)	(0.384)				(0.472)	(0.0611)	(0.442)
Man# Share of women squared	-1.202*	-0.739***	-0.861				-0.129	-0.658***	-1.536**
	(0.644)	(0.0732)	(0.533)				(0.711)	(0.0901)	(0.635)
Constant	3.565***	6.921***	0.475	2.062**	6.419***	0.235	2.958***	6.864***	0.405
	(0.363)	(0.0702)	(0.427)	(0.812)	(0.130)	(1.304)	(0.401)	(0.0844)	(0.474)
Observations	56,879	37,870	37,851	8,931	6,822	6,783	47,924	31,048	31,048

Standard errors in parentheses; *p<0.005, **p<0.01, ***p<0.001.

Note: All models were adjusted for age, geographical area of residence, university grades (GPA), university fixed effects, delay in graduation, secondary school grade, work at graduation, marital status and the number of children. Sector, hours worked, individual occupation and geographical area of work are additionally controlled for in the models employing income and authority.

Testing Kanter's theory

The general models in **Table 2** show a quadratic relationship between share of women in fields and occupational success, and that the joint interaction between share of women and gender is substantive in the models predicting income and employment. The male bonus in income and employment increases steadily according to a higher share of women in a particular discipline until it reaches a peak, after which it starts to decline (interaction coefficient is 0.97 and 0.79, quadratic interaction at -1.20 and -0.73 for employment and income respectively). No significant differences by gender are found in the association between gender composition of the field of study and authority.

Graphs 1, 2 and **3** show the average gender gap in labour market outcomes with 95 percent confidence intervals. Although the interpretation is given using the original Kanter's typology that includes five groups (from the 'token' to the 'majority'), the results are, for more precision, displayed in a disaggregated manner using continuous share of women in subfields.

Graph 1. Regression models predicting male bonus in employment status, income and authority. Logistic and interval regressions. Average marginal effects.
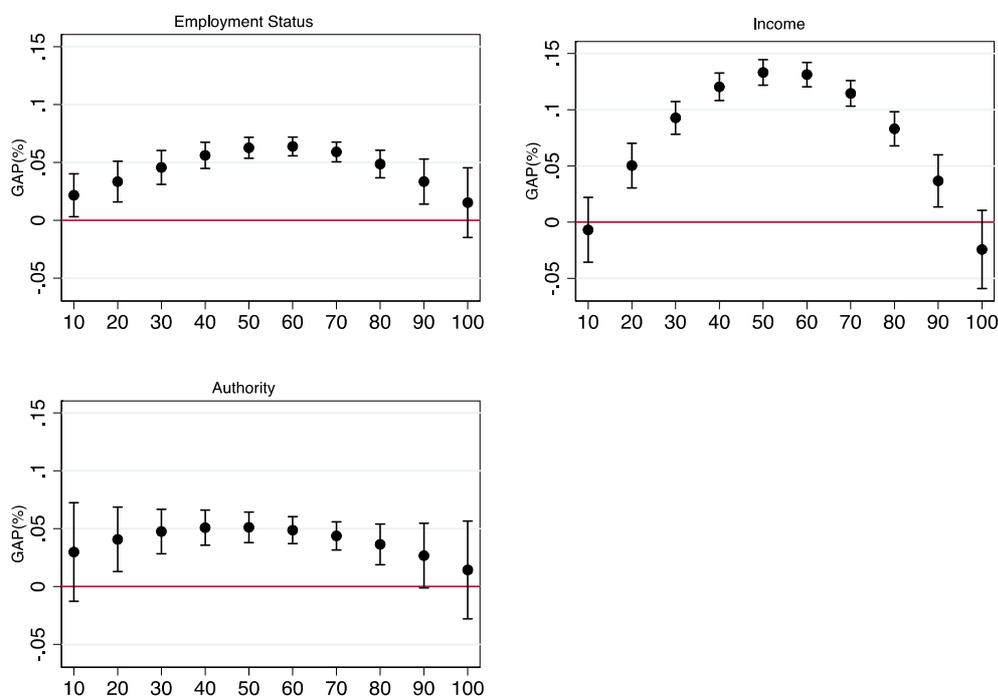
Graph 1 illustrates the results of the three labour market outcomes discussed in the article: employment status, income and authority. At first glance, it shows that men almost always have a labour market bonus, regardless of the gender composition of the field of study and the labour market outcome considered. It is observed that the male bonus follows an inverse U-shape: the bonus is smaller in fields of study with the lowest and the highest concentration of women. The greatest discrepancy in labour market outcomes is in income, followed by employment status and authority.

As predicted by Kanter (1977), **Graph 1** indeed confirms that the proportion of individuals with certain characteristics in a group (e.g. gender) matters for employment outcomes. More specifically,

the proportion of women is directly associated to labour market gender gaps. Even though the graph illustrates the importance and the consequences of being a 'token' in any group, it also shows the importance of challenging a gender-neutral approach to tokenism (Zimmer 1988). The prediction of Kanter (1977) that individuals who are 'tokens' are more disadvantaged than the ones belonging to the 'balanced' groups could not be proved for both genders. Contrary to hypothesis H1b, the male bonus is smallest when women are tokens, indicating some form of relative advantage for women in fields where they are fewer in number with respect to other fields. Yet, in line with H1a we find that in fields in which men are tokens (with a large majority of women), the male bonus is lowest, creating some form of 'disadvantage' for men. Interestingly, women are most penalized in balanced groups even though these are, according to the theory, meant to create more meritocratic environments enabling lower gender gaps in occupational success. Information for more specific outcomes follows below.

Employment status
When it comes to employment, there is light difference between men and women in the fields of study in which the share of women is lower than 10 percent (for instance subfields such as mechanical, electrical, electronic) and no difference when the share is above 90 percent (subfields such as pedagogy, social services, modern European and American languages and elementary school teaching). When women represent more than 20 percent of the total number of graduates in a given field, the difference in employment starts to increase, ranging from about 3 percentage points up until about 6 percentage points in fields of study when women account for between 40–70 percent of graduates (subfields as different as environmental and territorial engineering, finance, urban planning, law, philosophy, veterinary medicine, nursing and midwifery). The complete list of subfields is available in the **Appendices**.

Income
Income is the outcome with the steepest inverse U-shape patterns. As in the case of employment status, the fields of study with the lowest (under 10 percent) and the highest number of women (above 90 percent) are the least affected by the income gender gap. As the number of women in a given field of study increases, the income gap becomes visible, with men having a bonus of between five percentage points when women are above 20 percent of a given field of study to up until about 13 percentage points when the field of study is more gender balanced from 50–60 percent (musicology and musical heritage, political science, economics and business sciences, philosophy, science and technology, economics, biomedical engineering, design, European studies, public administration sciences, design, architecture and mathematics).
In other words, even when the numerical presentation of women is high or balanced, men are still better remunerated. Explanations of the income gender gap might be related either to the fact that men have more formal and informal responsibilities or that women are discriminated against in terms of the perception that they are the less productive gender (Lueptow, Garovich-Szabo, and Lueptow 2001).

Authority
Compared to employment status and income, when formal authority is considered as an outcome, the male bonus is rather constant at a 5 percentage point difference. However, in subfields of study made up of less than 10 percent (mechanical and electrical engineering) and more than 90 percent women (primary school teaching or pedagogy) the difference is no longer significant. Similar to the constant gap of below 5 percent in employment, men are advantaged in their workplace by having

more formal authority than women in almost all subfields of study, although the gap tends to be significantly smaller than in income. This result partly confirms the notion that men encounter a structural advantage at the workplace even if they work in female intensive professions (Williams 1992). Relating this result to the previous finding, it might also be speculated that men's higher income is due to their degree of formal and informal responsibilities irrespective of their field of study.

Nurturing vs non-nurturing fields: do they matter?
Starting with women's patterns of disadvantage on the labour market, the second part of the analysis evaluates whether these patterns persist when nurturing and non-nurturing fields of study are considered separately. The nurturing fields in the sample start at above 65 percent for their share of women, showing a high level of female representation in terms of composition in all nurturing fields of study. The lowest representation of women is in nursing and midwifery sciences at 69 percent and in science and technical health professions at 72 percent up to social services and policies at 91 percent and pedagogy and childcare at 92 percent and 96 percent respectively.
Table 2 shows models that predict labour market outcomes on the subsample of nurturing and non-nurturing subfields. The results depict some difference to the models generated using the entire sample of fields of study: in the nurturing fields, there is a gendered effect of field of study only for income. Yet, the models on the subsample of non-nurturing subfields indicate the existence of significant interactions with gender for both income and authority, but not employment.

Graph 2. Regressions predicting male bonus in employment status, income and authority, above 65 percent of share of women in fields of study. Nurturing fields. Logistic and interval regressions. Average marginal effects.

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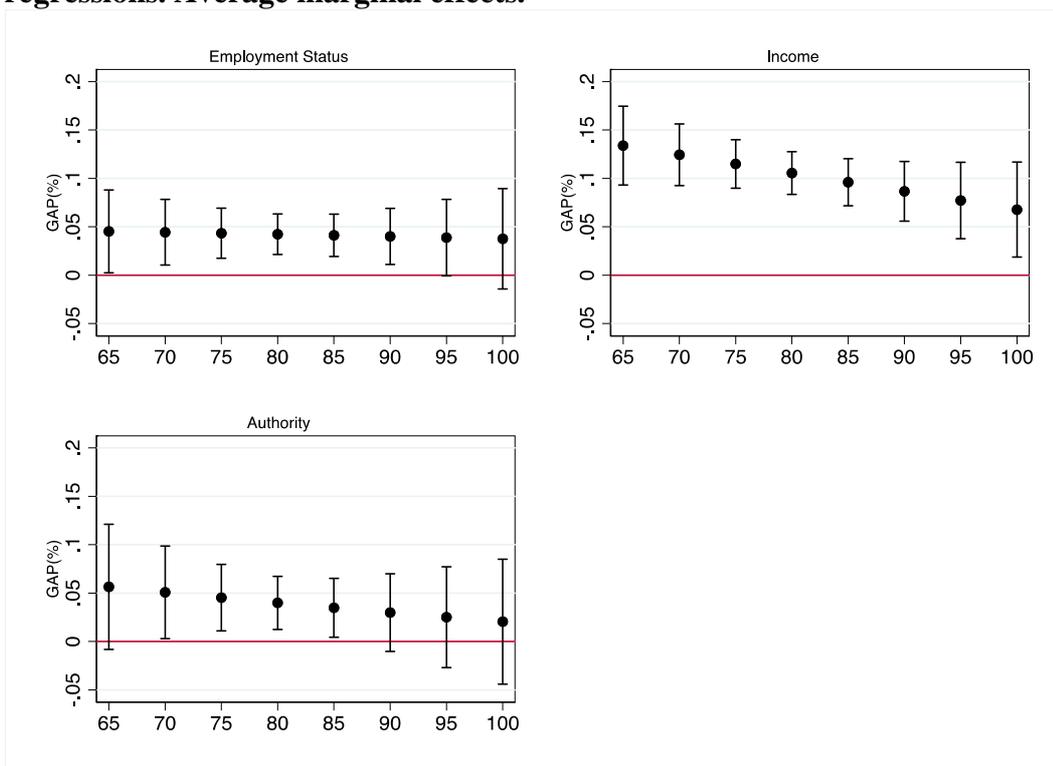
To understand whether the different rewards that men and women receive on the labour market are also linked to the specific characteristics of fields of study, **Graph 2** portrays the labour market outcomes only for nurturing fields. As the analysis focuses only on the nurturing fields in which the lowest percentage of women in a given field is 69 percent, the graph shows predictions for above 65 percent of share of women in fields of study.

In the nurturing fields of study, men are about 4 percentage points more likely to be employed independently of the share of women in the field of study. The gap is thus rather constant across different fields of study. However, in the case of authority, fields that have around 70 percent of women such as nursing and midwifery or over 75 percent share of women (psychology, pedagogy or social services), show the male bonus of 5 percentage points. The bonus declines with higher share of women to 3 percentage points, and disappears with very female intensive courses.

The highest income gap for the nurturing fields is found when there are 65-70 percent of women in a given field; men have an income bonus of about 13 percentage points. The income bonus for men decreases gradually when the number of women in a field increases. Yet, even when there is a high majority of women in a field (close to maximum), men continue to retain an income bonus of about 6 percentage points.

Table 3. Male bonus in outcomes along the share of women in fields of study, after adjusting for covariates. Non-nurturing fields. Predictions from logistic (employment, authority) and interval regression models (income).

Share of women	Employment		Income		Authority	
	AME	Std.Error.	AME	Std.Error.	AME	Std.Error.
10	0.04	0.01	0.02	0.01	0.03	0.02
20	0.05	0.01	0.07	0.01	0.04	0.01
30	0.05	0.01	0.10	0.01	0.05	0.01
40	0.06	0.01	0.12	0.01	0.06	0.01
50	0.06	0.00	0.13	0.01	0.06	0.01
60	0.06	0.00	0.13	0.01	0.05	0.01
70	0.06	0.00	0.11	0.01	0.04	0.01
80	0.06	0.01	0.08	0.01	0.02	0.01
90	0.05	0.02	0.03	0.02	0.00	0.02
100	0.04	0.03	-0.02	0.03	-0.02	0.03

Table 3 shows the gap when the non-nurturing fields of study are considered alone. The gender gap remains and it is slightly more pronounced in employment and authority than when the overall sample is considered. Also, the 'balanced' subfields are still those most related to gender disadvantage in all outcomes. More precisely, men are about 6 percentage points more likely to be employed than women in 'balanced' disciplines, which have between 40 percent and 60 percent of the share of women such as chemistry, economics or public administration. When it comes to income, men have a bonus of about 13 percentage points in 'balanced' groups with between 50 percent and 60 percent share of women. For an easier comparison to the nurturing fields, **Graph 3** shows the labour market outcomes for non-nurturing fields when the share of women in fields is above 65 percent.

Graph 3. Regressions predicting male bonus in employment status, income and authority, above 65 percent of share of women in fields of study. Non-nurturing fields. Logistic and interval regressions. Average marginal effects.
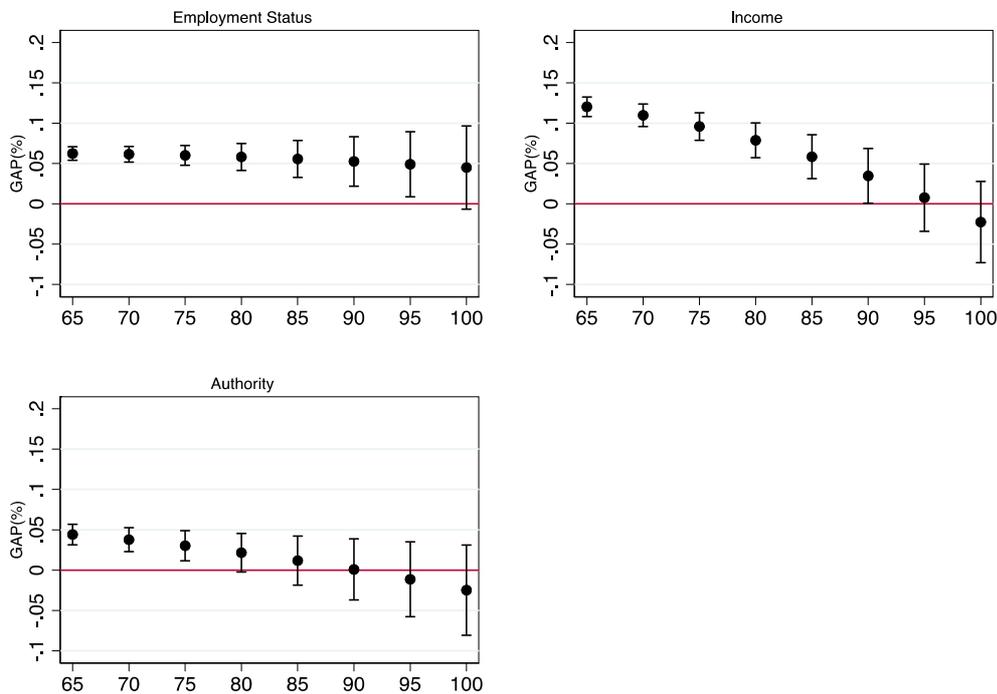
By comparing the **Graph 2** and **Graph 3**, the contrast between non-nurturing and nurturing fields is visible. In contrast to the expectations that nurturing fields could serve as levellers of gender gaps, the comparison on income shows that nurturing fields have on average higher income gender gaps, showing a less steep decline along a higher share of women in the field. For example, when there are around 85 percent women in a given field, in the non-nurturing fields, the male bonus decreases to 6 percentage points while it remains relatively high in nurturing fields at 10 percentage points. Following the same pattern, the gender gap in authority is higher in the nurturing fields than in the non-nurturing fields. It is around 3 percentage points in the non-nurturing fields when share of women is at around 75 percent in contrast to 4.5 percentage points in the nurturing fields. The gap for both groups disappears when there is around 90 percent of share of women in a given field. In the case of employment status, employment gap is higher in non-nurturing fields, on average by 2 percentage points.

Considering **Graph 2** and **Graph 3,** the hypothesis H2 could not be proven as the male bonus is overall not smaller in nurturing than in non-nurturing fields. The unequal patterns complement the first part of the analysis by highlighting that women's unequal labour market returns are not only the product of the numerical representation of women but also reflect the divide between different types of fields of study.

7.Discussion and conclusion

This article builds on previous literature that showed that the distribution of individuals across fields of study is gendered and thus consequential for labour market outcomes (Barone 2011; Reskin 1993). Taking advantage of the detailed categorization of fields of study provided by the AlmaLaurea dataset in the Italian context, this article above all highlights that fields can be perceived as a channel for persistent gender inequality in occupational success. Moreover, this article adds to the study of the gender gap in occupational outcomes and reflects two important perspectives: the effects of intermediate context in fields of study in the form of relative numbers of both genders and the importance attached to gender roles in the definition of the field of study. In other words, it builds upon the division between contextual and structural characteristics of fields of study. Structural characteristics such as gender, class or race impact everyday life and this impact is reflected in the outcomes of choosing a particular field of study. The percentage of women in fields of study is important because of the expectation that a sufficient number of women can change the shared intergroup culture.

The findings of this article support the general principle of Kanter's theory that the number of individuals in a certain group change outcomes. However, its empirical analysis calls such claims into question due to the finding that the share of women in fields of study is not necessarily associated with the labour market outcome as predicted by the theory. Contrary to the hypotheses based on Kanter's typology, a higher numerical representation of women does not necessarily lead to better outcomes (Zimmer, 1988). These results hold even when a detailed categorization of graduates' occupations was included in the analysis, thus, considering the baseline income levels across occupations.

Except for authority, token women in fields of study with a lower proportion of women (15–20 percent) tend to be more similar to men in their occupational achievement. In other words, the findings of this article suggest that women in mechanical, electrical, electronic, automation or aerospace nuclear engineering fields face lower degree of disadvantage in comparison to other disciplines. In fact, their higher visibility as a group seems to actually benefit women in such workplaces. This is contrary to some of the evidence that suggests the opposite (Perrucci 1970; Zuckerman and Cole 1975), in which STEM fields are often analysed singularly, without being confronted with other disciplines. Some differences are still found in the level of authority, perhaps because women might be given less important or more 'feminine' roles in predominantly male professions (Reskin and Ross 1992).

Yet, the most gender 'balanced' subfields of study are the most unequal in terms of income, followed by employment and authority. This refers to fields such as political science, economics and business sciences, philosophy, design, architecture and mathematics, to name a few. Women in these fields perhaps experience a culture that has not become inclusive enough for female students as they enter once predominantly male fields. This can manifest itself in terms of the 'glass ceiling' that creates obstacles for women's promotion and career advancement (Morrison, White, and Van Velsor 1992). It can be further speculated that the advantage of men over women might also relate to employer discrimination: employers may simply prefer men over women when there is a gender-balanced environment. This might be related to the fact that women are perceived as being 'less able' when they compete with men in these disciplines (Lueptow, Garovich-Szabo, and Lueptow 2001).

The presence of a large majority of women, for example of above 90 percent, in fields such as pedagogy, social services, modern European and American languages and elementary school teaching, however, tends to also be associated with lower gender gaps, indicating that the relationship between the gender composition of the field of study and the gender gap is actually

inverse U-shaped. A large predominance of women in certain fields might facilitate the inclusion of women in networks in which informal socialization occurs. For example, it may strengthen the supply of women and create a culture that is more open to them (Blommaert et al. 2019).

The second part of the analysis shows that its results are much more nuanced than Kanter's theory predicts—the share of tokens is important but not in the direction suggested by the theory. The relative proportions of each gender are of limited value if the social and cultural contexts in which the interactions between men and women take place are not subject to consideration.

Specifically, the second part of the article explores the gender gap in occupational success from a qualitative point of view that accounts for whether fields of study are perceived as 'nurturing': Is the experience of women in non-nurturing fields different from their experience in nurturing ones? Is the care-non-care divide more important than anything else (Barone 2011)? These questions go beyond the role of numbers because the experiences of women and men also depend of the characteristics of a given profession, and whether that profession or field is qualified as 'caring'. By moving beyond the composition of women in each field, a more refined picture develops of the way inequality on the labour market is constructed. Yet, contrary to the expectations, separate analyses for nurturing and non-nurturing fields in this article show that the 'glass escalator' (Williams, 1992) for men is on average lower in the case of non-nurturing subfields.

Thus, women actually benefit *less* from meritocratic labour market opportunities if they choose fields of study such as nursing and midwifery sciences, pharmacy, cognitive sciences, rehabilitation care, psychology, social services and policy, science of technical health professions and childcare, which have traditionally carried a symbolic affinity for women (Barone 2011). As a robustness check, pharmacy was excluded from the analysis (as it could be considered both a nurturing and non-nurturing field, depending on the particular specialization). Given this change in the analysis, the results followed the same patterns. In other words, the fields of study perceived to appeal to the 'natural' abilities of women, in which they are believed to be 'naturally' better' (Correll and Benard, 2005, p. 91) as they involve caregiving or helping others (Charles and Bradley 2009) could *not* be considered as levelling the gender inequality on the labour market. In contrast, the gender gap in the labour market is particularly pronounced in these fields.

These results are reminiscent of the potential accumulation of disadvantage for women in these professions: nurturing fields are largely devalued professions that are often characterized by low salaries and compromising working conditions (England et al. 1988). Additional occupational gap due to gender augments already substantial female disadvantage due to high numerical representation in undervalued fields of study. In other words, the summed up female disadvantage contrasts the comparative advantage for women that could have been expected due to stereotypical beliefs that women perform better in these professions (England et al. 1988). Therefore, structural advantage of men stands out particularly in care-oriented professions, mostly in income and authority, and comparably less in employment.

To conclude, the increase in the number of female students in industrialized countries has led to the higher representation of women in all disciplines, even to the point of disproportionality (Mastekaasa and Smeby 2008). However, this study shows that there are different channels through which unequal gender outcomes in occupational success unravel and how they are perpetuated through higher education. These unequal returns persist in both the gender composition within fields of study as well as the lasting division between those that are defined as 'nurturing' and 'non-nurturing' fields. These two channels are not separate as they complement each other in reproducing gender inequality on the labour market and beyond. Thus, it is at this intersection that we need to search for the mechanisms that contribute to gendered returns by fields of study.

8.Limitations and future directions

Throughout the analysis, the focus is on young age adults, as the labour market estimates are taken five years after graduation. For this reason, the estimates may be a subject of life cycle bias because respondents are not at the prime of their careers and sorting among them still takes place (Marini and Fan 1997). Moreover, differential selection on unobserved traits for both men and women in different fields of study may still contribute to the unobserved gap. Complementing observational data with experimental designs could help unravel in greater detail the mechanisms and the extent to which gender bias itself can be linked to occupational outcomes for different fields of study. This article employs the Italian context as a case study but future research would benefit from comparisons between different countries.

Research Ethics

This article relies on anonymized observational data (AlamaLaurea) that do not require ethic clearance. Thus, no assessment of the ethics committee was required. The data analysis was conducted in the AlamaLaurea office (Bologna, Italy) due to data protection.

Endnotes

[i] Occasionally we used male/female as adjectives to describe gender, thus, not referring to sex.

[ii] AlmaLaurea is an inter-university consortium of 64 Italian universities that has three main aims: (1) to assess the satisfaction of graduates with their degrees and the skills gained during their studies; (2) to monitor graduates' labour market outcomes one, three and five years after graduation; (3) to facilitate the access of graduates to the labour market by allowing Italian and foreign companies to access graduates' CVs (updated by graduates themselves).

[iii] The major fields are: Architecture, Veterinary Medicine, Chemistry/Pharmacy, Economics/Statistics, Physical Education, Geo-Biology, Law, Engineering, Teaching, Literature, Linguistics, Medicine, Nursing, Political Science, Psychology and Science.

[iv] When the analyses were repeated for nurturing fields without pharmacy there was no significant change in the results.

[v] A version of the analyses included graduates' expectations about their future pay and career which was asked immediately after graduation. Previous research (Quadlin 2019) suggests that these are important to include as regressors because preferences and expectations may drive success. The results and conclusions of the analyses in this article do not change with the inclusion of these variables but the sample size drops significantly. For the latter reason, they are not added as controls in the main models. These analyses are available upon request.

[vi] Linear regression models with income midpoints were also used as a robustness check without any change in results.

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Table 4. Complete list of subfields by women's share and the type of subfield (nurturing versus non-nurturing)

Share of women in Subfield	Subfields	Frequency	Nurturing
.0	Engineering of building systems engineering	3	
.071	Mechanical engineering	1,095	
.080	Electrical engineering	174	
.125	Electronical engineering	584	
.126	Automation engineering	182	
.133	IT engineering	890	
.152	Aerospace and astronomic engineering	242	
.157	Energetic and nuclear engineering	152	
.160	Naval engineering	56	
.171	Telecommunication engineering	449	
.174	IT	664	
.225	Organization and management of sports and motor activities	71	
.238	Geo-physics science	21	
.238	Civil engineering	928	
.271	Forestry	177	
.295	Science of the materials	142	
.301	Physics	455	
.303	Agrarian science and technology	244	
.349	Chemical engineering	229	
.351	Technics and information for information society	54	
.358	Geological science	360	
.367	Managing engineering	1,114	
.37	Science and technics of sport	166	
.38	Geography	66	
.39	Universe science	59	
.41	Science and technology of the industrial chemistry	100	
.41	Environment and territorial engineering	593	
.45	Botanical science and animal technology	91	
.45	Finance	257	
.45	History	359	
.45	Dentary and dental prosthesis	482	
.46	Urban planning	133	
.48	Statistics	95	

.49	Science and technological environmental studies	233	
.5	Security engineering	2	
.5	Chemistry	402	
.5	Musicology and musical heritage	67	
.51	Political science	480	
.53	Food sciences and technologies	276	
.54	Economics and business sciences	4,838	
.54	Philosophy	693	
.55	Science and technology of motor	328	
.55	Economics	1,115	
.55	Biomedical engineering	333	
.56	Design	195	
.57	European studies	146	
.57	Public administration sciences	270	
.58	Architecture and building-engineering	3,020	
.58	Mathematics	409	
.60	Actuarial and financial statistics science	202	
.62	International relations	1,078	
.63	Law	6,402	
.64	Mathematical and physical modelling	11	
.64	Medicine and surgery	3,888	
.65	Agricultural biotechnology	82	
.65	Entertainment services and multimedia production	560	
.67	Natural sciences	196	
.67	Industrial biotechnology	319	
.68	Information and editorial systems	683	
.69	Nursing and midwifery sciences	199	X
.69	IT methodologies for humanities	26	
.69	Veterinary medicine	564	
.72	Sciences of public and business communication	1,050	
.72	Science of technical health professions	153	X
.73	Sociology and social research	382	
.73	Social sciences for cooperation, development and peace	253	
.73	Landscape architecture	34	
.74	Communication theories	311	
.75	Cultural anthropology and ethnology	193	
.75	Pharmacy and industrial pharmacy	2,241	X
.75	Medical, veterinary and pharmaceutical biotechnology	635	
.75	Archelogy	386	

.75	Conservation of the architectural heritage	176	
.76	Cognitive sciences	29	**X**
.77	Philology, literature and history	250	
.77	biology	1,713	
.77	Rehabilitation care	96	**X**
.77	Preventive health care	22	**X**
.78	Theology	23	
.79	Modern philology	983	
.81	African language and literature	161	
.82	Archival and library sciences	180	
.86	System design and touristic management	189	
.86	Conservation and restauration of cultural heritage	131	
.86	History of art	770	
.87	Psychology	3,443	**X**
.87	Linguistics	191	
.88	Modern languages for communication and international cooperation	855	
.88	Adult education and continuing education sciences	182	
.90	Translation and interpretation	525	
.90	Modern European and American languages and literature	848	
.91	Social services and policies	506	**X**
.92	Pedagogy	518	**X**
.93	Planning and management of social services	253	
.96	Primary education	1,784	**X**

Table 5. List occupations included in the analysis

	Occupations
1	Members of legislative and government bodies, managers and equivalent of the public administration
2	Entrepreneurs, administrators and directors of large companies
3	Entrepreneurs and managers of small businesses
4	Specialists in mathematical, computer science, chemical, physical and natural sciences
5	Engineers, architects and similar professions
6	Specialists in life sciences
7	Health specialists
8	Specialists in human, social, artistic and management sciences
9	Training and research specialists
10	Technical professions in the scientific, engineering and production fields
11	Technical professions in health and life sciences
12	Technical professions in organization, administration and in financial and commercial activities
13	Technical professions in public services
14	Employees assigned to secretarial functions
15	Employees in charge of money movements and customer support
16	Employees assigned to administrative, accounting and financial management
17	Employees assigned to the collection, control, conservation and delivery of documentation
18	Qualified professions in commercial activities
19	Qualified professions in accommodation and catering activities
20	Qualified professions in health and social services
21	Qualified professions in cultural, security, cleaning and personal services
22	Craftsmen and skilled workers in the mining, building and building maintenance industries
23	Craftsmen and metalworkers specialized and installers and maintainers of electrical and electronic equipment
24	Craftsmen and skilled workers of precision mechanics, artistic craftsmanship, printing and similar
25	Farmers and skilled workers in agriculture, forests, animal husbandry, fishing and hunting
26	Artisans and skilled workers in food processing, wood, textiles
27	Operators of industrial installations
28	Semi-skilled workers of fixed machinery for mass production and assembly workers
29	Fixed machinery operators in agriculture and the food industry
30	Drivers of vehicles, mobile machinery and lifting equipment
31	Unqualified professions in commerce and services
32	Unqualified professions in domestic, recreational and cultural activities
33	Unqualified professions in agriculture, green maintenance, breeding
33	Unskilled professions in manufacturing, mining and construction