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Occupational Gender Segregation and Social Conflict: Segregation and Credentialism Among Young Workers in Two Occupational Classes

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Abstract

Drawing from social conflict and credentialist theory, we analyze how the field of education influences young women's chances of access to male-dominated occupations in two occupational classes: professionals and technicians.

We further four hypotheses: 1) Women's default chances of access differ between professionals and technicians. 2) Models of capitalism have little influence over the field of education's moderation effect. 3) STEM fields of education increase women's chances of access to male-dominated occupations. 4) Moderation is stronger for male-dominated STEM educational fields.

We gather data from the European Labour Force Survey for workers between 25 and 34 years of age and compute logit models for each class. We perform decomposition analysis with the Karlson-Holm-Breen method and then compute logit models with interaction terms.

Women's default chances of access are higher among professionals. The field of education significantly increases women's chances of access. However, STEM fields such as natural sciences and agriculture, where women represent roughly 50% of graduates, perform worse than male-dominated fields of education such as ICT and Engineering. This is more pronounced among professionals, suggesting that we witness a more substantial reaction to preserving male dominance when women close their gap in opportunities compared to men.

Keywords: gender segregation, social conflict theory, credentialism.

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1. Introduction

Research on young workers' occupational gender segregation treated the phenomenon as primarily determined before labor market entry. Skill-based theories focus on how the organization of educational systems influences individual choices, pre-sorting people into different tracks that will lead to different jobs. Role-socialization theories posit that men and women are socialized to gender stereotypes that influence their behavior and search for "gender-typical" jobs. Employers and recruiters would also discriminate against people who do not conform to stereotypes.

The labor market, however, is not a vacuum. It is a space governed by the logic of power and conflict. Segregation is a phenomenon that insulates certain occupations by preventing the entrance of specific groups. It is hardly reasonable to think this may happen similarly across the labor market.

Adopting a social conflict perspective, we compare women's chances of accessing male-dominated occupations in two occupational classes: professionals and technicians. These classes share several features: both are "high-skilled", and male-dominated occupations are STEM (science, technology, engineering, and mathematics) occupations in both classes. Specifically, we want to analyse how a person's field of education moderates the relationship between gender and the chance of working in a male-dominated occupation.

We use data from the Labour Force Survey. Results show segregation has indeed a different "colour" in the two occupational classes, with professionals being the class where women are less disadvantaged than men. However, male-dominated STEM educational fields have the highest performance in increasing chances of access, indicating a potential "devaluation effect" for STEM educational fields that include more women. This is more pronounced for professionals, indicating that devaluation is stronger where women are closing their opportunity gap compared to men.

1.1. Educational systems and institutional settings: skill-based theories of segregation

For these theories, school-work transition is crucial for explaining segregation. Such theories argue that segregation in the labor market is preceded by segregation in different educational paths, where people learn the skills to find a job. Different educational systems' institutional settings and organization may reinforce or mitigate this scenario.

Estévez-Abe (2006, 2011), who developed a skill-based institutional model of segregation, conducted prominent research on this topic. The idea is that the high-skilled/low-skilled dichotomy does not capture skills complexity and heterogeneity. Estévez-Abe identifies three types of skills: generalist, industry-specific, specific to a particular economic sector, and firm-specific, specific to a certain business or organization (Estévez-Abe et al., 2001). Estévez-Abe also employs two criteria to distinguish the different types of educational systems: educational level - secondary or tertiary - and orientation - generalist or vocational.

Three "pillars" provide the foundation for this argument: atrophy and portability of skills, place of training, and structure of the training system (Estévez-Abe, 2006). Skill atrophy concerns the speed with which skills become obsolete. Portability refers to how skills can be transferred and used in different organizational settings. Generalist skills have the lowest degree of atrophy and the highest degree of portability. Firm-specific skills that are not formalized through formal qualifications or credentials and are only suitable for specific working environments have the highest degree of atrophy and the lowest degree of portability.

Each type of skill has a different place of training. General skills are trained in high schools and universities and are always delivered outside the corporate world, even when they serve to train employees (e.g., refresher courses for managers). Firm-specific skills are only trained within the company through on-the-job learning and are not institutionalized with formal credentials. Industry-specific skills can be trained in the school system, vocational schools, and apprenticeships.

Table 1. Education systems.

	Secondary education	**Tertiary education**
General/academic	Nonvocational high schools	Academic university education
Vocational/occupational	Craft, trade occupations Technical training	Professional training

Source: Estévez-Abe (2011).

Estévez-Abe (2011) argues that women will be excluded from training programs where employers' involvement is more substantial. Entrepreneurs would fear losing the investment they made since women might be absent from work more often for family reasons related to care work.

The institutional context in which students decide to enroll in a specific program at the secondary level also matters. If students are very young when asked which program they would like to enroll in, there is a higher chance that gender stereotypes will bias their decision. Educational tracking may reinforce

this bias, which forces students into different school paths according to their performance and academic aptitudes (Estévez-Abe, 2011).

Due to employers' selection, apprenticeships would be the most segregating path into the labour market. Vocational schools would be less segregating than apprenticeships because employers are not involved, but more than generalist schools, which do not require students to choose which programs they want to enroll in. This difference would be wider where educational tracking is in place.

This work opens interesting research avenues for comparative analysis. Segregation would be lower in liberal economies (namely English-speaking countries), where skill formation relies on generalist skills. Among coordinated economies, segregation should be higher in Continental European countries, where employers' involvement is high and educational tracking is in place, and lower in Nordic and Mediterranean countries, where employers are less involved and where tracking is not used (Thelen, 2014). Comparing Switzerland and Bulgaria, Heiniger and Imdorf find a higher transmission of segregation in Switzerland, where there is a tighter linkage between the educational system and the labor market (Heiniger & Imdorf, 2018).

1.2. Role congruity and lack-of-fit: role-socialization theories of segregation

Gender role theory focuses on how gender stereotypes, internalized through socialization, inform people's decisions. Men and women use gender stereotypes to evaluate what is considered "typical" or "normal" behavior for their gender, following the agentic/communal dichotomy (Heilman, 2012; Wood & Eagly, 2010). The first (male) dimension is associated with self-assertion, while the second (female) is associated with caring (Di Stasio & Larsen, 2020; Hogue et al., 2019). Consequently, women are considered kind, altruistic, and free to express emotions, whereas men are expected to be assertive, competitive, and dominant. Role congruity theory argues that people limit their job search to occupations compatible with gender stereotypes, excluding jobs with a perceived mismatch between the characteristics attributed to one's gender and the job's tasks. (Di Stasio & Larsen, 2020; Hogue et al., 2019). Women and men would think their skills are better suited to perform a gender-congruent job. Thus, Occupational segregation would result from a self-selection in which men and women search for gender-congruent occupations (Hogue et al., 2019; Wood & Eagly, 2010).

The distinction between the agentic/communal divide is why women pursue STEM education and careers to a lesser extent than men (Diekman et

al., 2010; Ochsenfeld, 2014). Schwartz and Rubel (2005) observe that in 70 different countries, women and men strongly conform to the values associated with gender roles. Women favor concern for the well-being of others, while men favor power and goal-orientation (Diekman et al., 2010).

Nevertheless, agentic and communal are also mutually exclusive. Women are not simply perceived as "communal" but also as "non-agentic," while men are perceived as "non-communal" besides as "agentic." Therefore, when applying for "gender atypical" jobs, people would be discriminated against by employers or recruiters (Heilman, 1983, 2012).

2. Segregation and social conflict: a "credentialist" framework

These theories contributed substantially to our understanding of young workers' segregation. However, they share a singular yet significant limitation. These theories view occupational segregation as primarily shaped before individuals enter the labor market. Skill-based theories argue that educational and institutional settings sort students into distinct pathways and influence their career choices. Gender role theories emphasize socialization processes and gender stereotypes internalization before labour market entry. Those who do not conform to these stereotypes may face repercussions in the form of biases and discrimination from employers and recruiters.

We highlight two elements we believe these theories overlooked:

1) *Occupational classes*: Occupations directly shape people's life chances (Grusky & Sørensen, 1998; Jonsson et al., 2009). Suggesting that occupational segregation results solely from self-selection before labor market entry lacks justification. Furthermore, the characterization of occupations should extend beyond mere gender typing, encompassing the occupational class of employment in which they are situated.
2) *Social conflict and power dynamics*: The labor market acts as a nexus where male dominance is manifested and legitimized as an established norm. Studying women's entry into male-dominated occupations calls for an examination of the elements that justify male dominance as a form of legitimate domination. This requires a different perspective on how education shapes young women's opportunities.

To outline a research agenda for exploring these elements, we propose reinterpreting occupational segregation using the theoretical tools developed by Bourdieu (1984, 2001), Parkin (1983), and Collins (1979).

2.1. Segregation as distinction

Bourdieu challenges the dichotomy between the prevailing notions of social class: the endowment of economic and material resources, linked to the realm of production, and lifestyle or status group, more related to consumption (Crompton, 2008). Arguing we could identify each class by its members' distinctive patterns of consumption, Bourdieu also delves into the dynamics of domination and exclusion that structure not only the boundaries between classes but also between different 'fractions' within each class. Like Giddens (1984), he believes one cannot speak of lifestyles or status groups without discussing the mechanisms of social restriction that accompany such groups' formation and maintenance. Consequently, he investigates the mechanisms governing the hierarchy and value of occupations, forming an "occupational hierarchy". For Bourdieu, a social class is defined not only by its location within the relations of production but also by an array of "subsidiary characteristics which may function, in the form of tacit requirements, as real principles of selection or exclusion", like gender and race (Bourdieu, 1984, pp. 132-133). In this context, segregation actively entrenches the occupational hierarchy within social classes. As Bourdieu argues, "just as all segregation (by sex or any other criterion) tends to slow down devaluation through its numerus clausus effect, desegregation restores the strength of devaluing mechanisms" (Bourdieu, 1984, p. 162). By safeguarding the occupational hierarchy, segregation restricts women's economic opportunities.

Nevertheless, this disparity may exhibit distinctive features across occupational classes. This means that women's average chances of access (Bourdieu, 1983, p. 344) to male-dominated occupations may vary between classes. The "average chances of access" are an individual's default chances for accessing a specific position (in our case, male-dominated occupations). Individual choices, vocations, and dispositions then modify these chances. This insight presents an intriguing research avenue to identify where segregation is more (or less) challenging to overcome for women.

However, we also need to account for the role of educational credentials within those dynamics of exclusion and domination that limit women's opportunities. For this purpose, the insights Frank Parkin (1983) provided are beneficial.

2.2. Social closure and credentialism

Aligning with Bourdieu's perspective, Parkin asserts that social classes encompass internal divisions based on ascriptive characteristics such as gender and race. He also contends that cultural and economic variables are pivotal in establishing dominant and subordinate groups within and across social classes.

Parkin speaks of "social closure" starting from Weber's notion of "closed economic relationships." According to Weber, when more people try to obtain scarce economic resources crucial for sustaining the livelihood of those who access them, exclusionary dynamics are triggered. In Weber's words, "One group of competitors takes an externally identifiable characteristic of another (actual or potential) group of competitors - ethnicity, language, religion, ancestry, residence - as a pretext for trying to exclude them [...] Such closure is a recurring process; it is the source of land ownership and of all corporate and other group monopolies" (Weber, 1968, p. 342).

Parkin acknowledges that "exclusionary closure" can only be legitimized through universal criteria that do not restrict economic opportunities based on birthright, which would contradict the "bourgeois spirit" of capitalist societies (Parkin, 1983). This encapsulates the paradox of capitalist economies: legitimizing a form of domination requires restricting opportunities, yet every individual, including those in subordinate positions, must have a slight chance to access the resources that confer "dominant" status.

Parkin sees "credentialism," the possession of specific educational qualifications and credentials, as one mechanism that legitimizes social closure. Originating at the crossroads of different social conflict theories (Bourdieu & Boltanski, 1978; Collins, 1979), credentialist theory challenges the functionalist notion that higher levels of education are necessary to meet the needs of a more complex society (Andres, 2016). Collins (1979, p. 60-62) contends that education has become a "cultural currency" used to expand opportunities for accessing more desirable occupations. Likewise, Parkin (1983, p. 54) emphasizes that the growing reliance on credentials serves to monitor access "to key positions in the division of labor" (Parkin, 1983, p. 54). Regarding gender, Bourdieu (1984) argues that women's growing educational attainment led to the devaluation of diplomas in France. This caused the "gradual extension of the monopoly held by academic-qualification holders over positions previously open to the academically unqualified, which has the effect of […] restricting the career openings available to the unqualified and of reinforcing the academic predetermination of occupational opportunity" (Bourdieu, 1984, p. 162).

When specific credentials are scarce, an exclusive pathway is created between worker and employer. The latter assesses the former's ability primarily upon the credentials he (or she) possesses, regardless of gender, race, or socioeconomic background (Brown, 2022). This dynamic underscores how

credentialism validates forms of dominance through meritocracy, as credentials are achieved through personal effort rather than inheritance (Andres, 2016; Brown, 2022; Parkin, 1983). However, this also means that anyone, including members of minority and dominated groups, can attain these credentials and enjoy their associated privileges. As dominated groups increasingly acquire them, diminishing their scarcity, they trigger a reaction: the introduction of new credentials. This reaction may involve higher levels of educational attainment and aims at protecting the opportunities of people belonging to dominant groups (Brown, 2022; Bourdieu, 1984; Collins, 1979).

Credentialism reflects an inherent paradox, poised between exclusion and meritocracy. While the system is structured to limit dominated groups' access to key positions in the labor market, it cannot hinder individuals from attaining strategic credentials without undermining its meritocratic rationale. This creates a window of opportunity for dominated groups to access key positions in the labor market with such credentials.

In contrast to skill-based theories, we believe models of capitalism will not significantly impact women's chances of accessing male-dominated occupations. Occupations are remarkably similar across countries. This similarity arises because job tasks are similar across countries and because occupational prestige maintains a consistent level internationally. "Pretty much everywhere, there are distinctions between weavers and tailors, and between carpenters, painters, and plumbers. The uniformity in occupations across societies is reflected in the consistency of occupational titles found in prestige studies" (Treiman, 1976, p. 286). Country clusters would be crucial if we included countries from different cultural areas (e.g., Eastern Europe, South America) where role-socialization processes and gender attitudes have different cultural roots than Western European countries. Hence, we believe models of capitalism will be inconsequential for this investigation of segregation in Western Europe.

3. Piecing the story together

We posited male-dominated occupations to be in the highest tier of the occupational hierarchy of each class. As a way of preserving such hierarchy, segregation limits women's economic opportunities. We said, however, that i) credentialism is the primary driver of segregation for young workers ii) women's default chances of accessing male-dominated occupations are different in each occupational class.

Our narrative rests on a tri-variate scheme. On the one hand, we have an x-variable, gender, that influences a y-variable, the probability of entering a

male-dominated occupation *in each class*. However, a z-variable, education, moderates the relationship between these variables. We believe this relationship is different in each class we investigate. At this point, we need to clarify:

1) which classes we are considering.
2) which educational credentials we believe to be strategic for our study.
3) how possession of such credentials is related to gender.

We want to analyze how education may influence the relationship between gender and segregation. This means our framework may hold only for high-skilled occupations, for which possessing specific educational credentials is a strong pre-condition for access. This resonates with Parkin's argument that the growth of high-skilled white-collar occupations is crucial for the increasing relevance of credentialism (Parkin, 1983). It would make little sense to apply such a framework for low-skilled manual occupations, in which the possession of educational credentials would hardly explain gender segregation. According to the International Labor Organization (ILO), the occupational classes that possess the highest skill levels (ISCO skill levels 3 and 4)[1] are managers, professionals, and technicians. We exclude managers to avoid selection issues since we are dealing with young people likely at the beginning of their careers. Professionals and technicians include both high-skilled, white-collar occupations and provide a sound basis for investigating differences between similar categories.

We believe these two classes will exhibit distinctive patterns of segregation. Women will have different default chances of accessing male-dominated occupations, indicating that an occupational class might be more open to women's entry into male-dominated occupations than the other. This may suggest that the struggle to preserve the occupational hierarchy differs in each class. Which credentials create that privileged pathway for accessing male-dominated occupations? Social conflict and credentialist theory traditionally focused on educational attainment levels as exclusionary devices. We focus instead on fields of education rather than levels of education. Specifically, male-dominated occupations among professionals and technicians are STEM occupations. Therefore, a STEM field of education likely provides that privileged pathway to male-dominated occupations. However, we refuse to work with a binary classification of "STEM" vs. "non-STEM" fields of education. As we will see in the following sections, women are largely excluded from ICT and engineering, but not from natural sciences, math, and statistics, and from agriculture and veterinary.

[1] Information on skill levels can be found at the ILO's dedicated website to the International Standard Classification of Occupations.
https://ilostat.ilo.org/resources/concepts-and-definitions/classification-occupation/

Starting from these considerations, we believe a STEM field of education will increase women's chances of accessing male-dominated occupations. This is the window of opportunity credentialism cannot deny women. However, we argue that there is also a countermovement aimed at reorganizing exclusionary mechanisms and protecting men's economic opportunities. We believe this happens within STEM fields of education. Therefore, we posit that the higher chances of access to male-dominated occupations will be associated with male-dominated STEM fields.

How does this link to gender? Following Bourdieu (2001), we believe this exclusion is rooted in a practical principle of male dominance, namely the male monopoly over technology and technological objects. This indicates that women's exclusion from STEM fields, which has gained attention recently for policymaking reasons (White & Smith, 2022), is rooted in assumptions and presuppositions regarding what we perceive as "gender-typical" behaviors. Women's exclusion grants men a privileged pathway to STEM occupations, enabling men to reap the material and symbolic rewards associated with them. In this way, we do not refuse the socialization hypothesis but ground it in a social conflict perspective.

We also said we do not believe models of capitalism will influence women's chances of accessing male-dominated occupations. To test this hypothesis, we cannot ignore that there are indeed between-model differences in the way education is organized. If women are more likely to pursue a "gender-atypical" education in countries with a generalist secondary education model, this would impact the tri-variate relation we discussed. This might confound our analysis since the possible impact of the educational field might hide a "model effect". Hence, we should include a second moderator, a variable referring to the model of capitalism, to our theoretically driven tri-variate scheme to check how much of the relationship between gender and the chance of entering a male-dominated occupation is captured by the field of education.

4. Research hypotheses

We further four hypotheses; we draw the first from Bourdieu's concept of "distinction." It posits that women have different "default" chances of access to male-dominated occupations before observing the educational field's moderation effect.

H1. Women's default chances of access will be different between professionals and technicians.

We also argued that models of capitalism will have little influence over this relationship.

H2. Models of capitalism have little to no influence over the field of education's moderation effect.

What happens after the moderation effect? Re-interpreting segregation with Bourdieu's tools allows us to understand that the severity of segregation varies across different occupational classes. However, default chances of access to a given position (in our case, occupations) may change based on individual choices and dispositions. We cannot formulate hypotheses at this stage. Only the empirical analysis will tell us if the variation in women's chances of access differs between the two classes or if it is relatively consistent.

The third and fourth hypotheses, drawn from Parkin and Collins, posit that STEM education offers women an opportunity to enhance their chances of accessing male-dominated occupations. However, we also acknowledge that, in reaction, credentialism operates to restrict women's opportunities further. Hence, we argue that STEM fields like ICT or engineering should lead to the highest increase in women's chances of access, given that women are still a minority within these fields. Conversely, we expect moderation by fields such as natural sciences, or agriculture and forestry to be weaker, as women represent a higher percentage of graduates in such fields.

H3. Moderation by the field of education increases women's chances of access to male-dominated occupations.

H4. Moderation by the field of study is stronger for male-dominated STEM educational fields.

5. Data and variables

We gather data from the European Labour Force Survey (EU-LFS) for eight Western European countries: Italy, Sweden, Ireland, France, Germany, Spain, Denmark, and Great Britain. We restrict our sample to workers between 25 and 34 years of age. We created a pooled cross-section database to increase the sample size, including data from 2015 to 2019, resulting in a sample of 390,651 individuals.

The dependent variable is a dummy variable that takes value 1 if a person works in a male-dominated occupation and 0 if the occupation is not male-dominated. We used the numerical threshold to label occupations: if men are more than 66.6% of the workforce, that occupation is considered male-dominated (Jacobs, 1989; Torre, 2019; Torre & Jacobs, 2021). We derive the dummy variable from the three-digit ISCO-08 code included in the LFS, which is adequate for conducting empirical research on occupational segregation (Torre, 2019).

The key explanatory variable is sex, coded 0 for males and 1 for females. We also have two moderators: the field of study at the highest level of education achieved and the model of capitalism.

The EU-LFS follows the UNESCO classification criteria for coding its variable on fields of education.

Table 2. Fields of education and training.

Generic programmes and qualifications	
Education	Information and Communication Technologies
Arts and Humanities	Engineering, Manufacturing and Construction
Social Sciences, Journalism and Information	Agriculture, Forestry, Fisheries and Veterinary
Business, Administration and Law	Health and Welfare
Natural Sciences, Mathematics and Statistics	Services

Source: UNESCO.

From this structure, we recoded two variables. The first one takes a value 0 for "non-STEM" fields and 1 for STEM fields. Our STEM fields are Natural Sciences, ICT, Engineering, and Agriculture and Veterinary.

The second variable maintains a non-STEM category but keeps STEM fields in separate categories. We will further discuss this choice in the section dedicated to the analytical strategy.

We clustered countries in models of capitalism: Denmark and Sweden into the "Nordic" model (as reference category), France and Germany into the "Continental" model, Spain, and Italy into the "Mediterranean" one, and Ireland and the UK into the "English-Speaking" model.

Control variables include educational attainment level, size of the firm where a person works, marital status, and year of participation in the survey.

6. Analytical strategy

We compute logit models for each occupational class. Mediation analysis is the best approach to investigate our hypotheses. This technique involves the decomposition of the effect of a predictor X on a variable Y in two components: the "part mediated by Z is called the indirect effect, while the part unmediated by Z is called the direct effect. The sum of the indirect and direct effects is called the total effect, equal to the effect of x on y when the control variable is omitted" (Breen et al., 2013, p. 165). We use the Karlson-Holm-Breen (KHB) method that allows decomposition with nonlinear models. This

method will return us the estimates of two models: the "reduced model", that does not include Z-variables, and the "full model", that includes the moderators. The difference between these models is the indirect effect.

We will compute average partial effects that give us women's default chances of access to male-dominated occupations relative to men's, and how these change after including the moderators.

At this stage, we only observe the mediation by the STEM field of education "tout court", without focusing on the differences between the different STEM fields. For this goal, we do not apply KHB decomposition. We do not want to see how the X's regression coefficient changes in different models because we want to see which STEM field of education predicts the highest increase in chances of access. Hence, it is more straightforward to compute a logit model with an interaction term between gender and the field of study and then compute the average marginal probabilities (AME).

7. Results

We provide the list of professional and technical occupations we labelled as male-dominated. We can see that all occupations can be classified as STEM. These occupations absorb roughly 24% of the workforce in our sample (97,139 individuals).

Table 3. Male-dominated occupations among professionals.

	Freq.	Percent	Cum.
Science and engineering professionals	1	0.00	0.00
Engineering professionals (excluding electrotechnology)	18603	41.28	41.28
Electrotechnology engineers	3973	8.82	50.10
Information and communications technology professionals	2388	5.30	55.40
Software and applications developers and analysts	18013	39.97	95.37
Database and network professionals	2086	4.63	100.00
Total	45064	100.00	

Source: EU-LFS.

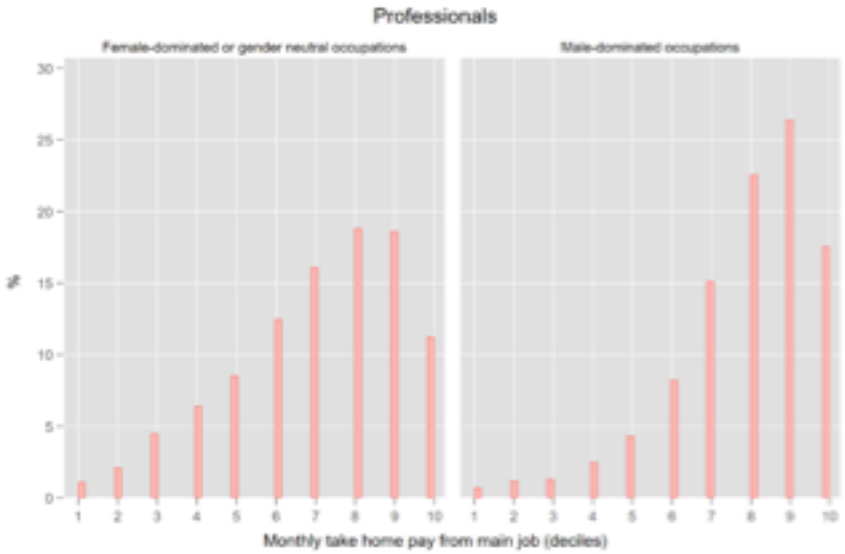
Table 3.1. Male-dominated occupations among technicians.

	Freq.	Percent	Cum.
Science and engineering associate professionals	4	0.01	0.01
Physical and engineering science technicians	26075	50.07	50.08
Mining, manufacturing and construction supervisors	9581	18.40	68.48
Process control technicians	4241	8.14	76.62
Ship and aircraft controllers and technicians	1277	2.45	79.07
Information and communications technology operations and user support technicians	8941	17.17	96.24
Telecommunications and broadcasting technicians	1956	3.76	100.00
Total	52075	100.00	

Source: EU-LFS.

The following graph portrays the wage structure, by deciles, for full-time employees. In both classes, male-dominated occupations are concentrated in the highest wage deciles, while female-dominated and gender-neutral occupations concentrate in the distribution's middle-lower part.

Graph 1. Wage structure



Source: Author's elaboration from EU-LFS data. Countries: Spain, France, Germany, Italy, Denmark, Sweden, Ireland, UK. Time period: 2015-2019.

Regarding the fields of education, we do find women to be largely excluded from STEM fields. However, moving away from a binary STEM vs. non-STEM dichotomy unveils a more nuanced scenario.

Table 3.2. Gender composition of field of study.

	Male	Female	Total
Non-STEM	83047	172635	255682
	32.48	**67.52**	**100.00**
STEM	83469	27837	111306
	74.99	**25.01**	**100.00**
Total	166516	200472	366988
	45.37	**54.63**	**100.00**

Source: Author's elaboration from EU-LFS data. Countries: Spain, France, Germany, Italy, Denmark, Sweden, Ireland, UK. Time period: 2015-2019.

Table 3.3. Gender composition of field of study.

	Male	Female	Total
Non-STEM	83047	172635	255682
	32.48	**67.52**	**100.00**
Natural sciences, mathematics, statistics	8280	9158	17438
	47.48	**52.52**	**100.00**
ICT	15672	2825	18497
	84.73	**15.27**	**100.00**
Engineering	57382	13562	70944
	80.88	**19.12**	**100.00**
Agriculture and veterinary	2135	2292	4427
	48.23	**51.77**	**100.00**
Total	166516	200472	366988
	45.37	**54.63**	**100.00**

Source: Author's elaboration from EU-LFS data. Countries: Spain, France, Germany, Italy, Denmark, Sweden, Ireland, UK. Time period: 2015-2019.

Only ICT and Engineering are segregated. Natural sciences, mathematics, and statistics as well Agriculture and Veterinary are not segregated, with a gender composition close to a 50-50 split.

7.1. KHB decomposition

7.1.1. Professionals

The coefficient for "female" tells us that in the reduced model, women are, on average, 26.66% less likely than men to access male-dominated occupations among professionals. We can interpret this data as women's average chances of access or "default chances" of entering a male-dominated occupation. When we include the moderators, this disadvantage decreases to 14.9%. Including the two moderators determines an 11.7-point increase in women's chances of access. The confounding percentage shows that the two moderators capture 44.06% of the relation between X and Y.

Table 4.1. KHB results and confounding percentage.

	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
Male	(base outcome)					
Female						
Reduced	-0.266	0.002	-149.260	0.000	-0.270	-0.263
Full	-0.149	0.002	-81.850	0.000	-0.152	-0.145
Diff	-0.117	.	.	.	.	.

Number of obs = 179535
Pseudo R2 = 0.35
Note: Standard errors of difference not known for APE method.

Variable	Confounding ratio	Confounding Percentage	Dist_Sens
Female	1.788	44.060	0.893

Finally, the components of difference show that the field of study increases women's chances of access by 9.6 percentage points. This accounts for 81.5% of the difference between the reduced and the full model. Models of capitalism seem to have a negligible impact.

Table 4.2. Components of difference.

Z-Variable	Coef	Std_Err	P_Diff	P_Reduced
Continental	-0.001	0.000	1.020	0.450
Mediterranean	-0.000	0.000	0.270	0.120
Anglo-Saxon	0.000	0.000	-0.090	-0.040
Stem	-0.096	0.001	81.510	35.910

7.1.2. Technicians

Among technicians, women are, on average, 35% less likely than men to access a male-dominated occupation. After including the moderators, women's chances improved by 17.4 points. The moderators capture 49.79% of the relation between X and Y.

Table 4.3. KHB results and confounding percentage.

	Coefficient	Std. err.	z	P>z	[95% conf. interval]	
Male	(base outcome)					
Female						
Reduced	-0.349	0.002	-165.720	0.000	-0.353	-0.345
Full	-0.175	0.002	-79.170	0.000	-0.179	-0.171
Diff	-0.174	.	.	.	.	.

Number of obs = 162272
Pseudo R2 = 0. 38
Note: Standard errors of difference not known for APE method.

Variable	Confounding ratio	Confounding Percentage	Dist_Sens
Female	1.992	49.790	0.924

We again observe little contribution by models of capitalism. The field of study improves women's chances by 12.1 points, around 70% of the 17.4-point change between the reduced and the full model.

Table 4.4. Components of Difference.

Z-Variable	Coef	Std_Err	P_Diff	P_Reduced
Continental	-0.002	0.000	1.000	0.500
Mediterranean	0.000	0.000	0.000	0.000
Anglo-Saxon	0.000	0.000	-0.100	-0.050
Stem	-0.121	0.001	69.440	34.570

7.2. Logit models with interaction terms

KHB decomposition helped observe women's default chances of access and how they change after mediation. Now, we want to compare women's chances of access across the four STEM fields we presented in Table 3.1. In this case, computing logit models with an interaction term between gender and the field of study recoded as in Table 3.1 is a better solution. We then compute AMEs for each class. The interaction term allows us to sum the AME associated with gender with those of each field of study, giving us women's chances of access relative to men who did not pursue a STEM education. We present tables only for AMEs, which are more interpretable than log-odds coefficients. In the methodological appendix, we include regression results with coefficients expressed as log-odds.

7.2.1. Professionals

Among professionals, women who studied Natural sciences have roughly the same chances to access a male-dominated occupation as men without a STEM education. Instead, women are 10.2% less likely to access such occupations for agriculture and veterinary. This changes radically for ICT and engineering, with women that are respectively 55.7% and 40.7% more likely to access male-dominated than men without a STEM education.

Table 5. AMEs.

	dy/dx	std. err.	Z	P>z	[95% conf.	interval]
Female	-0.111	0.002	-59.560	0.000	-0.114	-0.107
Natural sciences, math, statistics	0.133	0.004	35.020	0.000	0.126	0.141
ICT	0.668	0.006	104.690	0.000	0.655	0.680
Engineering	0.518	0.004	143.370	0.000	0.511	0.525
Agriculture and veterinary	0.009	0.007	1.380	0.167	-0.004	0.023

Note: dy/dx for factor levels is the discrete change from the base level.

7.2.2. Technicians

Among technicians ICT and engineering are still the most performing fields in increasing the chances of access, even though ICT does not perform as well as it does among professionals. Women are respectively 37.8% and 42.6% more likely than men without a STEM education to access male-dominated occupations. Natural sciences performs better among technicians

since women are 15.8% more likely to access male-dominated occupations than men without STEM education. "Agriculture and veterinary" also performs better, although women are still 4% less likely to access a male-dominated occupation than men without a STEM education.

Table 5.1. AMEs.

	dy/dx	std. err.	z	P>z	[95% conf interval]	
Female	-0.147	0.002	-63.810	0.000	-0.152	-0.143
Natural sciences, math, statistics	0.305	0.008	39.800	0.000	0.290	0.320
ICT	0.525	0.010	50.280	0.000	0.505	0.545
Engineering	0.573	0.004	146.650	0.000	0.565	0.580
Agriculture and veterinary	0.107	0.008	12.730	0.000	0.091	0.124

Note: dy/dx for factor levels is the discrete change from the base level.

8. Discussion

Our results show that segregation is a distinctive phenomenon. Decomposition analysis with the KHB method allowed us to observe the initial disadvantage that women face, before observing the effect by the field of study, for entering male-dominated occupations. We argued this metric would tell us how a class is "hostile by-default" to women's entry into male-dominated occupations. From our data, it seems entry barriers to male-dominated occupations are higher among technicians. Women's average changes of access among professionals are 26-points lower than men's. Instead, such chances are almost 35-points lower among technicians, suggesting that segregation is more severe to overcome in this class. Previous research stated that professionals, like other "high status" occupations such as managers, tend to have more gender egalitarian values than "low status" occupations, such as production workers (Cotter et al., 2011; Hausermann & Kriesi, 2016). However, less was known about the difference between occupational groups that compose the "new middle classes" (Bornschier et al., 2021; Oesch, 2006) regarding gender inequalities. Our evidence suggests professionals seem to be more "progressive" than technicians when it comes to gender barriers in accessing male-dominated occupations. Future research should investigate how differences between the middle classes, starting from the different "work logics" and work settings (Oesch, 2003) in which job tasks are performed in the two classes, could influence gender segregation.

Nevertheless, the picture becomes more complex when we look at the moderation by the field of study. We saw that in both classes the moderation effect by the field of study is similar, both in absolute terms (9.6 and 12.1-points

increase in women's chances of access) and relative terms (they both account for roughly 35% for the variation between the reduced model and the full model). From our logit models with the interaction term between gender and the field of study, we also saw that in both classes ICT and Engineering were indeed the fields that projected the highest increase in chances of access. This indicates both classes are witnessing a reorganization of exclusionary principles, as STEM fields are becoming less effective in securing a place among male-dominated occupations. What appears to be crucial is having credentials acquired in a *male-dominated STEM field* of study. However, there are important differences between classes regarding this phenomenon. Specifically, there is evidence of a different "polarization" in the performance of the different STEM fields of study between the two classes. Among technicians, ICT and Engineering determine, respectively, a 52.5 and a 57.3-point increase in chances of access, against the 30.5 and 10.7-point increase for Natural Sciences, Math, and Statistics, and Agriculture and Veterinary. Among professionals, we see instead that ICT and Engineering determine a 66.8 and a 51.8-point increase in chances of access, against a much poorer performance by gender-neutral STEM fields. In this class, Natural Sciences, Math, and Statistics and Agriculture and Veterinary project respectively a 13.3 and 0.9-point increase in women's chances of access.

Among professionals, women with educational credentials acquired among the field of Natural Sciences have basically the same chances of access to male-dominated occupations of a man without STEM education. Agriculture and Veterinary, instead, has no moderating capacity. When we move to technicians, we see that Natural Sciences projects an increase that doubles the gender penalty. Agriculture and Veterinary continues displaying a poor performance, although it projects a higher increase than it does for professionals. Technicians are the class where barriers to male-dominated occupations are higher, but once women overcome these barriers, the specific field of study in which they gained their credentials is less important. This changes for professionals, where women are less "disadvantaged by default", but gaining credentials in the "right" STEM fields of study (the male-dominated ones) is a more pressing issue.

The reorganisation of exclusionary principles appears stronger among professionals, where women's default chances of access are higher. This tells us that in those occupational classes where women enjoy a lower initial disadvantage, observed with a lower gender penalty before the moderation effect by the field of study, we may witness a stronger reaction in the reorganisation of exclusionary principles. This evidence could mean that when women start from a less disadvantaged position or may start to "break through" the gender barriers that insulate male-dominated occupations from women's entrance, a new barrier starts to form, reshaping the course of that "privileged

path" that eases access to male-dominated occupations. In our case, we see a different degree of polarization between male-dominated and gender-neutral STEM fields of study. Our data seems to suggest that this process is indeed distinctive of each class.

We know that encouraging female participation to STEM education is crucial. However, our evidence tells us that if we do not intervene on such exclusionary mechanisms, that we can understand only if we interpret segregation as social conflict, we are likely to see the rise of newer forms of exclusion, that go beyond the simple divide between STEM vs. non-STEM credentials.

We also found little evidence in favour of a "model effect". This corroborates further the idea that, when conducting research on countries belonging to the same cultural area, occupational classes are more important than models of capitalism. This does not mean there is no room for exploring between-country differences in occupational gender segregation, but simply that we need to work with more diverse sample of nationalities than Western European countries. However, this calls into question a different theoretical framework than ours, one in which cultural differences in gender values and attitudes are better accounted for.

Our research has certain limitations. We had to work with existing categories that we had to take for granted, with no possibility of questioning their structure. This is the case of the UNESCO classification of fields of education and training. For example, "natural sciences, math, and statistics" is a wide field of study compared to ICT. In the future, it would be fruitful to work with more detailed classifications regarding fields of education. Lastly, our findings apply to young, high-skilled workers. Researchers will have to identify other legitimation and exclusion mechanisms that inform occupational segregation for other social groups.

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Appendix

Logistic regression results with log-odds coefficients.

PROFESSIONALS	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Gender (r.c male)							
female	-1.362	.025	-54.53	0	-1.411	-1.313	***
Field of study (r.c "non STEM")							
Natural sciences, math, statistics	.952	.034	27.75	0	.885	1.019	***
ICT	3.795	.033	116.25	0	3.731	3.859	***
Engineering	2.917	.021	136.03	0	2.875	2.959	***
Agriculture and Forestry	-.114	.125	-0.91	.361	-.359	.131	
Gender#field of study (r.c male "non STEM")							
female#Natural sciences, math, statistics	.788	.052	15.17	0	.686	.89	***
female#ICT	.269	.062	4.30	0	.146	.391	***
female#Engineering	.491	.038	13.10	0	.418	.565	***
female#Agriculture and Forestry	.741	.184	4.02	0	.379	1.102	***
Firm size (r.c less than 50 employees "small")							
medium-large	.489	.017	29.52	0	.457	.522	***
Level of education (r.c upper secondary education)							
post-secondary non tertiary	-.376	.05	-7.48	0	-.475	-.278	***
short-cicle	-.525	.046	-11.47	0	-.615	-.436	***
bachelor	-.192	.031	-6.15	0	-.254	-.131	***
master	-.254	.03	-8.41	0	-.314	-.195	***
doctorate	-.487	.049	-9.98	0	-.583	-.391	***
Marital status (r.c single)							
Widowed, divorced or legally separated	-.025	.094	-0.27	.787	-.158	.209	
Married	.047	.017	2.73	.006	.013	.081	***
Model of capitalism (r.c Nordic)							
continental	.273	.019	14.21	0	.236	.311	***
mediterranean	-.092	.03	-3.03	.002	-.152	-.033	***
anglo-saxon	.198	.027	7.22	0	.144	.252	***
Year (r.c 2014)							
2015	.061	.026	2.31	.021	.009	.112	**
2016	.024	.026	0.90	.369	-.028	.075	
2017	.068	.026	2.60	.009	.017	.119	***
2018	.112	.026	4.25	0	.061	.164	***
2019	.162	.027	6.09	0	.11	.213	***
Constant	-2.306	.1	-23.01	0	-2.502	-2.109	***
Mean dependent var	0.224	SD dependent var			0.417		
Pseudo r-squared	0.403	Number of obs			179535		
Chi-square	76987.263	Prob > chi2			0.000		
Akaike crit. (AIC)	114023.391	Bayesian crit. (BIC)			114285.943		

*** *p<.01, ** p<.05, * p<.1*

Note: there are no observations for primary and lower-secondary education.

TECHNICIANS	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Gender (r.c male)	-1.506	.022	-68.73	0	-1.549	-1.463	***
female							
Field of study (r.c "non STEM")	1.466	.049	29.73	0	1.37	1.563	***
Natural sciences, math, statistics	2.852	.04	70.44	0	2.772	2.931	***
ICT	2.799	.02	141.14	0	2.76	2.838	***
Engineering	.785	.063	12.38	0	.66	.909	***
Agriculture and Forestry							
Gender#field of study (r.c male "non STEM")	.944	.067	14.03	0	.812	1.076	***
female#Natural sciences, math, statistics	.212	.087	2.43	.015	.041	.383	**
female#ICT	.66	.039	17.12	0	.585	.736	***
female#Engineering	.23	.118	1.95	.051	-.001	.461	*
female#Agriculture and Forestry							
Firm size (r.c less than 50 employees "small")	.432	.016	27.79	0	.402	.463	***
medium-large							
Level of education (r.c upper secondary education)	-.496	.028	-17.77	0	-.551	-.441	***
post-secondary non tertiary	.023	.025	0.92	.36	-.026	.071	
short-cicle	-.201	.019	-10.34	0	-.239	-.163	***
bachelor	-.438	.026	-16.91	0	-.489	-.387	***
master	-.243	.12	-2.03	.042	-.478	-.008	**
doctorate							
Marital status (r.c single)	-.049	.072	-0.67	.5	-.19	.093	
Widowed, divorced or legally separated	-.112	.017	-6.40	0	-.146	-.077	***
Married							
Model of capitalism (r.c Nordic)	-.125	.021	-6.01	0	-.166	-.084	***
continental	.053	.027	1.96	.05	0	.106	*
mediterranean	-.07	.034	-2.06	.039	-.137	-.003	**
anglo-saxon							
Year (r.c 2014)	.005	.026	0.18	.856	-.046	.055	
2015	-.015	.026	-0.57	.568	-.066	.036	
2016	.007	.026	0.26	.793	-.044	.057	
2017	.091	.026	3.47	.001	.04	.142	***
2018	.093	.027	3.49	0	.041	.145	***
2019	-1.476	.03	-49.80	0	-1.534	-1.418	***
Constant	-1.506	.022	-68.73	0	-1.549	-1.463	***

Mean dependent var	0.275	SD dependent var	0.447
Pseudo r-squared	0.396	Number of obs	162272
Chi-square	75653.473	Prob > chi2	0.000
Akaike crit. (AIC)	115326.263	Bayesian crit. (BIC)	115586.186

*** *p<.01, ** p<.05, * p<.1*

Note: there are no observations for primary and lower-secondary education.