Over-education and Gender Occupational Differences in Spain

Abstract This paper explores the role of over-education in shaping the negative relationship between the education level attained by employees and the fact of working in a gender-dominated occupation, in Spain, a country where the phenomenon of over-education is common. Applying multinomial logit regressions, and controlling for individual and job characteristics, the results confirm the typical finding that having a university degree decreases the odds of working in a gender-dominated occupation. However, this is only true in the case of women when considering long - more than three years - university studies. The evidence also suggests that the general spread of over-education in Spain weakens that relationship so that reducing over-education would eventually lead to more uniformity in the gender-distribution of employment across occupations.

Keywords Over-education, Occupations, Gender differences, Human capital.

1. Introduction

The increase in female employment in developed countries, spurred by increases in services and the marketization of women's housework and care-work, has facilitated a concentration of working women in specific occupations related to their "innate abilities" or "competitive advantages", such as the service and clerical sectors. This, in turn, has led to a surge in gender-inequality distribution across occupations and in gender-occupational segregation. In many European countries, this process has been favoured by the public sector, allowing the outsourcing of nurturing and care and, by providing family-friendly working conditions, enabling the reconciliation of paid work and family responsibilities (Costa 2000; Emerek et al. 2001).

Within Europe, north-south differences in the extent of marketization of women's housework and care-work, and in increases in female employment, has resulted in a differential evolution of the process across countries. Thus, there is today a broad dispersion within European countries of women's participation in the labour market and in gender job segregation. Emerek et al. (2001) and Bettio (2002) show that, for the last decades of the twentieth century, both these variables were positively correlated, so that countries with higher rates of female employment also exhibited greater gender segregation. In this context, segregation may be interpreted as the price paid by women in exchange for participation in the European labour markets.

In recent decades, however, the level of gender occupational segregation has shown a downward trend in most developed countries (Anker 1998; Costa 2000). Despite female employment continuing to rise, increases in both the education level attained by women and in the development of new technologies have made it possible for women to enter traditionally male employment and participate in new jobs created, thus reducing occupational segregation (Blau et al. 1998; Black and Juhn 2000; Dolado et al. 2001). However, this does not appear to be the case in Spain, since the increases observed in education levels and in female employment have been accompanied by a steady increase in gender segregation, from 1994 to 2008 (Otero and Gradín 2001; Cebrián and Moreno 2008; Iglesias and Llorente 2010).

Against this background, we test the hypothesis that a mismatch between educational attainment and job requirements may be shaping the association between higher education and lower segregation. Given that Spain is one of the OECD countries with the highest levels of over-education (in excess of 25%; OECD 2009), this may be a reasonable argument for explaining the persistence of gender occupational segregation over time. The existing literature has paid little attention to factors affecting gender segregation in Spain, and much of that research has focused on technical issues related to the measurement of segregation, while empirical studies have centred on assessing its magnitude and its evolution over time. Among the latter, there is evidence at the aggregate level showing certain correlations between personal characteristics and segregation (Dolado et al. 2001, 2004; Mora and Ruiz-Castillo 2003; Cebrián and Moreno 2008; Iglesias and Llorente 2010; del Rio and Alonso-Villar 2010, 2012). A common finding in these studies is that a higher level of education is correlated with a lower level of segregation. However, a systematic and rigorous econometric analysis of the factors influencing gender segregation, with individual data, has not yet been carried out, nor has the presence of significant over-education been taken into account.

In this paper, our aim is to investigate the relationship between personal and job-related characteristics, and gender inequality in occupational distribution in Spain. As explained below, we do not specifically aim to assess the impact of such characteristics on a measure of gender segregation; rather, we are interested in the link between those characteristics and the (unequal) distribution of men and women across occupations, with our main contribution being the special check for educational variables, including over-education. In pursuit of that, we carry out multivariate regression analyses using cross-sectional data to find robust associations between the personal and labor characteristics and the fact that certain occupations are gender-dominated.[1]

Our results suggest that the general belief that a more educated working population helps to reduce gender-inequality in the distribution of workers across occupations appears to apply in the Spanish case, with our main finding being that this relationship would be stronger if over-education were less extensive. Additionally, we find that short university studies, of three years of less, largely achieved by women in certain segregated fields such as health and teaching, may generate a more unequal gender distribution of workers across occupations. In this respect, the paper has two major

[1] A better knowledge of the relationship between individual characteristics and gender-inequality distribution is essential in reducing labor segmentation and wage differences across genders, since occupational segregation is viewed as one important source of the gender wage gap (Bayard et al. 2003; Amuedo-Dorantes and de la Rica 2006). The unavailability of wage information in the database we use prevents an analysis of the influence of occupational segregation on the gender wage gap.

policy implications. First, to establish measures that are not solely focused on stimulating the acquisition of higher levels of qualification, but are also designed to achieve a better matching between educational attainment and job requirements. In this line, lifelong learning activities may be used as a way to compensate for an initial mismatch. Second, to adopt measures encouraging more equal gender distribution in the choice of field of study, and to promote policies aimed at removing those norms or stereotypes that exogenously assign jobs and occupations to workers of one specific gender

The structure of the paper is as follows. Section 2 presents a brief summary of the literature and Section 3 provides statistical information about participation, segregation, and the evolution of human capital variables in Spain. In Section 4, we develop the empirical model that serves to relate these factors to the observed gender occupation differences in the Spanish labour market. Section 5 shows our estimated results, and Section 6 concludes.

2 Literature review and descriptive information

Most traditional explanations for gender-occupational inequality are based on three main arguments.[2] First, human capital accumulation (education, experience, and tenure) may differ across gender so that individuals search for jobs that are more suited to their characteristics (Mincer and Polachek 1974).[3] Second, workers choose specific jobs according to their preferences (England 2010) and to the characteristics of those jobs (e.g. women may wish to work in jobs that allow them to balance work and family responsibilities, Becker 1985), but also because the cultural norms and stereotypes in society lead them to follow "traditional" gender roles (Bergmann 1974). Third, discrimination against women exists (Becker 1985), and only those firms/sectors that do not discriminate accept women.[4] More recently, the literature has also focused on the fact that the job satisfaction of women increases with the number of women in a

[2] For reviews of theoretical and empirical findings, see Anker (1997) and Bettio and Verashchagina (2009). A succinct review of the topic can be seen in European Commission (2009).

[3] Alternatively, it has been argued (e.g., Bergmann 1995) that, provided there is segregation in the labour market, men and women choose the human capital level that is most appropriate for them.

[4] There may also be statistical discrimination, when firms suspect that women are more likely to interrupt their careers due to maternity and child rearing, and so assign them to jobs demanding lower human capital accumulation (Coate and Loury 1993).

particular occupation. Thus, psychological considerations, such as social identity theories, may help to explain gender-occupational inequality. Akerlof and Kranton (2000) claim that individuals may suffer a loss of utility when working in jobs with which they do not "identify". In this framework, social norms or stereotypes may make individuals happier working with those of the same gender. Similarly, Alesina and La Ferrara (2000) show that the individual utility derived from joining a group increases with the share of own-kind group members, and decreases with the share of a different kind.

The topic of over-education has been extensively studied in the literature, with emphasis on the negative effects of returns and on job satisfaction and on the phenomena of the bumping down and/or crowding out of less skilled workers (Moen 1999; Hartog 2000). Over-education is derived from a growth in the supply of higher-educated workers that exceeds the growth in demand. This may arise from individuals' choices in order to compensate for a lack in other observed and unobserved skills (Groot and Maasen van den Brink 2000), and as a way of gaining access to employment or to search for a better job (Dolado et al. 2009). Regarding differences between men and women, Groot and Maasen van den Brink (2000) find that women who have experienced a career interruption, e.g. due to child rearing, are more likely to be in jobs for which they are over-educated. Frank (1978) argue that, when women are the second earner in the household and their decisions are subordinated to those of men, they may suffer from restricted mobility and are more prone to be in a job for which they are over-educated.

The empirical literature in Spain has reported partial findings that we take as starting points in our contribution. To our knowledge, no study has focused on the relationship between over-education and the gender distribution in employment across occupational categories. The bulk of the literature on gender disparities in the Spanish labor market has focused on wage discrimination (Gardeazábal and Ugidos 2005; Amuedo-Dorantes and De la Rica 2006). The analysis of segregation has centred either on its measurement (Mora and Ruiz-Castillo 2003; Alonso-Villar and Del Rio 2010a) or on its evolution over time (Cebrián and Moreno 2008; Iglesias and Llorente 2010). There exist studies that search, to some extent, for correlations between segregation indices and certain worker characteristics. For example, Mora and Ruiz-Castillo (2003) show that more educated and older workers are associated with lower gender segregation. Dolado et al.

(2001, 2004) compare the US with EU countries, including Spain, finding that occupational segregation is lower among the most educated, especially if they are young. These studies also find that part-time work is related to higher segregation. Ibañez-Pascual (2008) applies multinomial logit techniques to estimate the probability of being in a gender-dominated occupation, depending on a set of individual and job characteristics, finding that education helps to reduce segregation, as do firm characteristics such as public ownership, with discrimination and stereotypes playing an important role in shaping gender differences across occupations.

Somewhat different results are presented in Del Rio and Alonso-Villar (2010, 2012) and Alonso-Villar and del Rio (2010a). These authors suggest a complementary approach to traditional "overall" measures of segregation, in order to explore the segregation of target population subgroups (women or blacks, for example). Whereas overall measures, such as the Dissimilarity Index, ID (Duncan and Duncan, 1955) and IP (Karmel and MacLachlan, 1998), inter alia, compare the distribution of two population subgroups one to the other, these authors propose local measures of segregation by which the distribution of one subgroup (women or men) is compared with the distribution of total employment in the economy, and not with the distribution of the other group. These studies axiomatically develop several local measures, showing that they possess good properties and connecting with overall segregation measures (Alonso-Villar and del Río 2010b; del Río and Alonso-Villar 2010). These measures are then used in studying the Spanish case, investigating, in turn, segregation by gender and age, by gender and educational attainment, and by gender and types of contract. [5] The authors find, first, that segregation is greater among women than among men, indicating that women are more unevenly distributed across occupations than men. Second, they show that greater segregation is observed for the youngest (16-29 years old), the lowest educated, and those with temporary contracts (in the case of men), or those with part-time contracts (in the case of women). Segregation is also greater for those in low-paid jobs. Specifically, in terms of education levels, they conclude that a higher education level is not associated with lower segregation, since segregation among the medium-educated (upper secondary) is lower than among the highly-educated (university and

[5] The case of the distribution across occupations of natives and immigrants in Spain is examined in del Rio and Alonso-Villar (2012) and Alonso-Villar and del Rio (2013).

similar), and the fact that, despite sample women exhibiting higher average education levels than men, the latter are less segregated.[6]

The issue of measurement of gender segregation is progressively growing in extension and in scope.[7] Also, there is a growing literature on the relationship between group characteristics (education, for example) and the observed level of segregation.[8] However, as argued by Gradín (2013), the procedures followed do not allow for multiple attributes, or are only appropriate when dealing with small units, which is not appropriate in our case. In consequence, we do not attempt to study the relationship between education and a particular measure of segregation. Rather, our aim focuses on examining the correlation between the characteristics capturing education and the unevenness of gender distribution across occupational categories, using multinomial logit techniques.

3 Descriptive information

In this Section, we briefly review the evolution of employment in Spain in recent decades, and present a battery of statistics showing the importance of gender inequality distribution in Spain and its relationship to education variables. Until the onset of the Great Recession, Spain enjoyed a very large increase in total employment, of which female employment represented more than half.

3.1 The increase in Spanish female employment until 2007

Our data come from the Spanish Labor Force Survey (LFS, Encuesta de Población Activa), conducted by the Spanish Institute of Statistics (INE), following Eurostat guidelines. This survey provides labor market information for a representative sample of Spanish households. We use the period 1986 to 2010 to study the evolution over time of employment indicators, focusing on year 2010 for a picture of the more recent

[6] The authors argue that this may result from some kind of segregation in the choice of university studies, since women choose to enroll in fields where their future career prospects are better, such as health or teaching (del Rio and Alonso-Villar 2012).

[7] Measures of randomness based on exposure indices (Hellerstein and Neumark 2008; Aslund and Skans 2009) arise in contraposition to measures of evenness (ID, IP, and Gini, Atkinson and Theil indices). Among these latter, measures of local segregation have been proposed as complementary to measures of "overall" segregation (Alonso-Villar and del Río 2010b; del Río and Alonso-Villar 2010).

[8] Some studies link the results of multinomial logit regressions with ID-type indices of occupational segregation (Spriggs and Williams 1996; Kalter 2000). Some others compute segregation of specific subgroups of the population (Hellerstein and Neumark 2008; Aslund and Skans 2009).

situation as well as for estimation purposes. Occupations are considered at a two-digit level of the Spanish National Classification of Occupations (CNO-1994) in this section, while it is disaggregated at the three-digit level in the estimations section.[9] These lists comprise 66 and 206 occupations, respectively.

Between 1986 and 2007, around nine million jobs were created in Spain, of which five-and-a-half million were for women. As a consequence, female participation and female employment rates both increased by around 20 percentage points (p.p.) in that period (see Table 1). These figures have come closer to the EU averages, but are still below the norm, 2 and 5 p.p., respectively. Similarly, these figures have been approaching male rates, but differences in 2007 were still substantial, around 20 p.p. in favour of men.[10] The growth in female employment has centred on the younger, the married, and the more educated. A generational or cohort effect has been witnessed, with women progressively entering the labour market, and remaining in it for a longer period than some decades ago (Cebrian and Moreno 2008). More than 90% of the increase in Spanish female employment between 1986 and 2007 was allocated to services.

(Insert Table 1)

3.2 A descriptive approach to inequality

We now focus on the distribution of working men and women across occupational categories. In order to save space, while still providing insightful evidence, we focus on those occupations that employ the largest numbers of both men and women in the Spanish labour market. Thus, we take the ten occupations for which the ratio between the number of working men in each occupation and total male employment is the highest; and we do the same for the case of women. This ratio is known as the concentration index (see Tables 2a and 2b). Whereas the ten most female-centric occupations represent more than 63% of total female employment (more than 50% with

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[9] CNO Clasificación Nacional de Ocupaciones (National Classification of Occupations) is based on the 1988 ISCO classifications, but they do not entirely coincide. Recently, the 2011 CNO tries to better adjust to the 2008 ISCO, but the data utilised in this study fits only the older classification. In our Tables, the full description of occupations is presented in order to clarify which jobs are included.

[10] During the Great Recession, gender differences have declined due to the great loss of jobs, especially among men. Thus, in 2010 (see the last column in Table 1), the male participation rate is "only" 16 p.p. above that of the female rate, with the male employment rate being 13 p.p. higher than that of females. More dramatically, male and female unemployment rates have basically converged to a 25% value in the last few years, compared to a decade ago when the difference was about 10 p.p.

only the six most concentrated occupations), this figure is considerably lower among men (barely 44%), revealing a greater homogeneity in the concentration of men across occupations, as standard deviations confirm.[11] Men work largely in manufacturing and construction (machinery and related trades workers, assemblers, labourers), about 41% of total male employment, and also in certain services (drivers, science and engineering professionals, and financial associate professionals), less than 53%, whereas female employment is primarily concentrated in the services sector (more than 85% of total female employment).

Column 4 shows the representation ratios of those occupations, computed as the ratio of female (male) share of employment in each occupation to female (male) share of total employment. Ratios above 1 indicate female (male) over-representation in an occupation, with ratios below 1 indicating under-representation. In 2010, the share of females (males) in total employment was 46% (54%). Looking at the female case, the representation ratios for the ten occupations analysed are always higher than 1.2. The position in the ordering of those occupations with a larger share of women is displayed in parenthesis, confirming that the vast majority of workers in those female-centric occupations are women. In the case of men, the evidence is somewhat different, since there are occupations with representation ratios below 1. Additionally, only five of the ten occupations considered rank among the first 15 occupations according to the share of men.[12]

(Insert Tables 2a, 2b)

Following Hakim (1993) and Anker (1998), we construct a classification of occupations into three categories, depending on the share of men (women) in each occupation. An occupation is labelled as masculinised (male-dominated, or men over-represented) if in this occupation the share of men is above the national proportion of males in employment (54%), plus a threshold (e.g. 20%). Similarly, an occupation is said to be feminised (female-dominated, or women over-represented) if the share of women in that occupation is above the national proportion of females in employment (46%), plus the same threshold. The occupations in between are said to be integrated, a category that includes those occupations with a share of women between 26% and 66%.

[11] For similar results in Spain, see Alonso-Villar and del Rio (2010a) and del Rio and Alonso-Villar (2010). This finding is also typical in Europe (Eurostat 2008; European Commission 2009).

[12] In this respect, there are many other occupations for which the replacement ratios for men are also high, above 1.5, but their contribution to total employment is less significant.

According to this criterion, eight out of the ten most female-centric occupations are labelled as feminised, whereas six out of the ten most male-centric occupations are masculinised. Thus, Table 3 shows that, whereas the weight in total employment is quite balanced across the three types of occupations, only 11% of workers in the masculinised occupations are women, and only 21% in the feminised occupations are men. This criterion can also be used to describe the evolution of gender distribution across occupations and over time. Thus, in 2002, eleven occupations were feminised, increasing to twelve in 2010. Similarly, masculinised occupations rose from twenty four in 2002 to twenty eight in 2010, whereas integrated occupations declined from thirty one to twenty six.

One second approach to check for the increase in gender differences across occupations is with the most widely-known indicator of gender segregation, the Index of Dissimilarity (Duncan and Duncan 1955). This index is computed as $ID = 1/2\sum_i |m_i - f_i|$ where m_i (f_i) is the proportion of employed males (females) working in occupation i over total male (female) employment. It ranges between 0 and 1, with 0 indicating null segregation, and 1 full segregation. With data from the Spanish LFS, the ID rose from 0.50 in 1994 to 0.55 in 2008.[13] After that, the ID trends downward, basically due to the effects of the Great Recession, which have caused a high level of unemployment in Spain, especially among men in male-dominated occupations as, for example, in construction.[14] The ID for 2010 reached a value of 0.53.

(Insert Table 3 here)

3.3 Gender occupational inequality and educational variables

Once it has been shown that the most concentrated occupations are also among the most unequally gender-distributed, we focus on the characteristics related to educational variables in those occupations. Generally speaking, many of the most feminised and

[13] Many studies have analysed the evolution of the ID in Spain (Otero and Gradín 2001; Mora and Ruiz-Castillo 2003; Iglesias and Llorente 2010, among others). Following the classification by Blau et al. (1998), these authors have shown that the "sex composition effect" clearly dominated the "occupation mix effect" during the 1990s, indicating that the increase in ID was largely due to the allocation of men/women into already masculinised/feminised occupations. In the late 1990s and early 2000s, this process has been accompanied by an increase in the number of feminised and masculinised occupations.

[14] Immigration has also contributed to the increase in ID until 2007. Amuedo-Dorantes and de la Rica (2011), del Rio and Alonso-Villar (2012) and Alonso-Villar and del Rio (2013) show that immigrant women in Spain have been employed mostly in occupations where native women were more heavily concentrated.

masculinised occupations can be considered as requiring low skills. In Tables 2a and 2b, columns five to eight, the proportions of low-educated, intermediate-educated and high-educated workers are shown. The low-educated are those who have not finished secondary school; intermediate-educated, those who have completed secondary school, but no higher; and high-educated, those who have a college degree (either short or long studies).[15] National distribution, shown at the bottom of Tables 2a and 2b, reveals that more than a half of the employed have only attained low (compulsory) education, whereas around one fourth have graduated from college. Thus, except for occupations related to teaching, associate professionals, and managers (which, by their very nature, require workers with a degree), the remaining occupations under consideration present quite low educational averages, with this being more evident in male-dominated occupations. This suggests that higher education may be associated with lower gender inequality. To check for this, we again use the widely-known ID that, although it is not additively decomposable (Mora and Ruiz-Castillo 2003), and hence not appropriate for subgroups, allows comparison with prior studies. Thus, the ID for those with no tertiary education is over 0.60, whereas it is less than 0.40 among the high educated.[16]

With data from the Spanish LFS, the proportion of the population over age 16 with above-compulsory schooling increased, between 1985 and 2007, from less than 13% to about 43%. This was accompanied by an increase in the phenomenon of over-education (Hartog 2000; Budría and Moro-Egido 2008; Ortiz 2010), confirming that the growth of higher-educated workers outpaced the growth in demand. Consequently, not all of the increase in educational attainment by the Spanish active population has led to an increase in the allocation of employees to jobs requiring higher levels of qualification. Rather, it seems that a large portion of workers may hold skills exceeding those required in their job. In this context, it is not unlikely to expect that the role of education in relieving gender inequality may be attenuated; that is, the existence of over-education may be diminishing the association between high education and lower inequality. If so,

[15] From an international perspective, low-educated are ISCED2 and intermediate-educated are ISCED3. Short high studies are ISCED5 including advanced vocational schooling and university studies requiring three years at most (Diplomaturas, Títulos Técnicos). Finally, long university degrees are ISCED6, including those requiring four or more years of study (Licenciaturas, Grados) and graduate studies (Masters, Ph.D.).

[16] These values resemble those in Dolado et al. (2004), who find that, for year 1999, and occupations interacted with activities, for those with tertiary education the ID was 0.37 in the case of younger workers, increasing to 0.49 in the case of those aged between 45 and 54 years old. These values were comparatively lower for those with less than tertiary studies, over 0.50 in all age ranges.

this may be of great importance in Spain, a country characterised by an elevated level of educational mismatch, among the highest in the OECD countries (OECD 2009; Ghignoni and Verashchagina 2013; Verhaest and Van der Velden 2013).

Column 9 in tables 2a and 2b provide a broad picture of the phenomenon in our data. Due to the way in which educational level is presented in the Spanish LFS, we have computed educational mismatch from a statistical point of view. The literature classifies four typical ways of defining educational mismatch: two are considered as subjective and two as objective (Groot and Maassen van den Brink 2000; Hartog 2000). Subjective measures come from worker self-assessment. A direct measure corresponds to the answer to the question whether the individual feels over- or under-educated for the work they do, whereas an indirect measure is obtained by comparing the actual education level of the workers with the self-report on the required education level in their job. Although there is some reason to fear upward bias in these measurements, it is often the best available measure (Hartog 2000).

The objective definitions are also of two types. The first is based on a comparison between the actual education level and the job-level requirements, established from an evaluation by professional job analysts. Conceptually, this is the best measure, but it is often difficult to implement and keep up-to-date, due to high costs and frequent changes in occupation classification, along with the escalation of job-requirements, and of the skills necessary to fill them. The second objective measure of over-education is obtained by comparing years of education attained with the average education level within the occupation of the worker. An individual is said to be over-educated if the educational level is higher than the average educational attainment in that occupation, plus a standard deviation.[17] The choice of statistical as opposed to other measures of over-education is dictated by data availability. In their meta-analytic review, Groot and Maassen van den Brink (2000) find that this statistical definition yields the lowest estimate of over-education, so that our measure of over-education provides a lower bound for the phenomenon of over-education in Spain. Looking at Tables 2a and 2b, the

[17] Alternatively, over-education can be measured by taking the modal value as a reference, rather than the average. However, this measure has the disadvantage that when the occupational disaggregation is high, as in our study, in many occupations the modal value is barely representative. For studies measuring over-education in Spain under different definitions, see Budria and Moro-Egido (2008) and Ortiz (2010), using the 1994-2001 European Community Household Panel; Nieto and Ramos (2010), using the EADA 2007 (the Spanish application of the European Adult Education Survey), and García and Montuenga (2012), who use the 2007-2010 waves of the Spanish Quality of Working Life Survey. The typical measure of over-education is more than 25% of Spanish employees.

problem of over-education is substantial in several occupations, especially in the case of those in low-skilled occupations, and of those in male-dominated occupations (see also Table 3).[18]

4. The empirical model

Our aim is to examine the relationship between characteristics capturing education and the unevenness of gender distribution across occupational categories, once we control for other human-capital-related variables, such as experience (proxied by age) or tenure, and a group of job characteristics, such as the type of contract, the sector of activity, the nationality, and the region of the worker, with the influence of over-education being specifically addressed. We carry out multinominal logit regressions in which the factor change in the likelihood of being in a gender-dominated occupation, over being in an integrated occupation, as a consequence of attaining a particular education level, and the influence of educational mismatch, are both investigated. Multinomial logit regressions allow us to compute the change in odds between several possible alternatives, depending on the characteristics and on the parameter vectors associated with those alternatives (Wooldridge 2002: 497-8; Long and Freese 2006: 224-8).

Of special interest in our investigation is evidence of how the factor change in odds of being in a gender-dominated occupation - resulting from the education level – varies when considering over-education. We are aware that, in a partial analysis, simultaneity may be at work. However, since we are using cross-section data, it is difficult to control for this with instrumental variables or longitudinal data. As a consequence, significant coefficients must be interpreted merely as partial correlation, not necessarily reflecting causality. Our guess is that the association between education and gender occupational distribution may be negatively affected when workers are employed in jobs requiring lower qualifications than those they actually hold. This may be of singular magnitude in a country like Spain, where over-education is among the most significant in the OECD countries.

Table 4 provides the definitions of our variables of interest and their average values, with data from the Spanish LFS for year 2010, from more than 60,000 observations

[18] Educational attainment is provided in the Spanish LFS in eight levels, which are used to compute the incidence of over-education. However, for purposes of description and estimation, we group them into the four levels described in Table 4.

corresponding to wage-earners only. There are more men (54%) in the sample than women (46%), and more than a half of the individuals live in couple. Around 80% of our sample are in the age-range 25-54 years old, and 30% have tenure of between 4 and 10 years (29% with shorter tenure and 39% longer). In order to ascertain the individual significance of each education level, we have four categories:[19] those who have attained compulsory studies at most (representing about 55% of the total employed); those with non-compulsory secondary studies (20%); those with short higher studies (11%); and those with upper university degrees (14%). Some 6% of individuals are immigrants, 20% work in the public sector, 76% are on a permanent contract, and 14% work part-time. Only 20% of the surveyed individuals work in Information and Communication Technology sectors (high-ICT sectors).[20] We find that almost 25% of the workers are considered to be over-educated. By gender, women are younger, less tenured, more heavily concentrated in part-time jobs, and more frequently occupied in the public sector and in high-ICT sectors, than men. Women are also less over-educated and on average more educated than men. Noticeably, the percentage of women with short university studies is double that of men.

(Insert Table 4)

5. Estimated results

We investigate the relationship between human-capital and job-related variables, and gender distribution, by considering three types of occupations. Following the classification discussed above, we distinguish between male-dominated, female-dominated, and integrated occupations.[21] In 2010, 35% of occupations are male-dominated, against 33% female-dominated, and 32% integrated. We carry out a

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[19] As said in the previous footnote, information is provided at a more disaggregated level. We finally decided to combine diverse primary and compulsory secondary studies under the label of compulsory studies, since preliminary analyses reveal no statistically significant differences between these education levels in the relationship with unevenness of gender distribution.

[20] We follow Iglesias-Fernández et al. (2011) who consider as ICT sectors only those sectors in the Knowledge Industry, which includes the following manufacturing and service activities (codes corresponding to the ISIC 3.1 Rev from the OECD): 22 Publishing, printing and reproduction of recorded media; 30 Manufacture of office, accounting and computing machinery; 32 Manufacture of radio, television and communication equipment and apparatus; 64 Post and telecommunications; 72 Computer and related activities; 73 Research and Development; 80 Education, and 92 Recreational, cultural and sporting activities. Technological development helps to reduce both gender segregation (Black and Juhn 2000; Dolado et al. 2001) and over-education (Ghignoni and Verashchagina 2013).

[21] In constructing the dependent variables, occupations are taken at the 3-digit 1994 CNO level to diminish the possible influence of vertical segregation.

multinomial logit regression to analyse the factors associated with working in a gender-dominated (male or female) occupation, relative to working in an integrated occupation, which is taken as the referent group. In tables, we present the relative risk ratios, or odds ratios, which, given that all variables are of binary type, express how the relative risk of being in a masculinised (feminised) occupation changes as a consequence of a status change in an independent variable, given that the other variables in the model are held constant.[22]

Results of our baseline model for year 2010 are shown in Table 5. Values above 1 indicate that the likelihood of being in a gender-dominated occupation, relative to being in an integrated occupation, increases after a unit change in the corresponding independent variable (other variables remaining constant), whereas values below 1 indicate a decrease. The first column in each pair of estimations refers to the change in the likelihood of working in a male-dominated occupation, relative to an integrated occupation, and the second column to the change in the likelihood of working in a female-dominated occupation, also relative to working in an integrated occupation. The first pair of columns reports estimates without the dummy variable indicating whether the individual is considered to be over-educated, and in the second pair of columns estimates are obtained when that dummy variable is included. As shown in Table 5, this dummy is found to be statistically significant, revealing the importance of explicitly considering a measure of educational mismatch in investigating the association between the unequal gender-distribution of workers across occupations and educational attainment. Nine sector fixed effects are included, to take into account that the same occupation may have different gender distributions across industries. Regional fixed effects are added, to account for certain cultural and stereotype differences across the 17 Spanish Autonomous Communities (NUTS 2 regions), as well as other time-constant determinants.[23] The referent categories are: women aged 35 to 44 years, not living in couple, with non-compulsory secondary studies, in a job for which they are not over-educated, with tenure between 4 and 10 years. These women are native, working full-time on a temporary contract, in a non-high-technology industry in the private sector.

(Insert Table 5)

[22] Relative risk ratios are computed, as exponentials, from the multinomial logit estimated coefficients (see Long and Freese 2008: 178).

[23] These estimates are not reported, but are available upon request. In Tables, significant odds ratios are marked with asterisks.

In what follows, when interpreting the odds for each of the dependent variables, the remaining variables are held constant, and the odds are computed relative to the referent category, being in an integrated occupation. (We refrain from adding these phrases in order to facilitate the reading of the results.) Values statistically significant above 1 may be interpreted as variables associated with greater inequality across occupations, whereas values statistically significant below 1 can be interpreted as variables associated with greater equality across occupations. Looking at the first two columns in Table 5, we observe that the odds of being in a male-dominated occupation are seven times greater for men than for women. Analogously, for men, the odds of being in a female-dominated occupation decrease by a factor 0.27. Provided that a large array of characteristics is controlled for, the gender coefficient can be interpreted as a measure of the odds of women/men with similar characteristics working in a gender-dominated occupation. Estimates are very different from 1, suggesting that the observed characteristics do not totally explain the unequal allocation of men and women into occupations. Thus, aside from the existence of discrimination, unobserved characteristics – such as field of study, preferences, stereotypes, etc…- represent potential arguments for the observed gender differences in occupations, suggesting that identity theories from psychological perspectives (Akerlof and Kranton 2000; Alesina and La Ferrara 2000) may also help in understanding the existence of such differences.

The odds of being in a gender-dominated occupation are expected to increase in the case of those living in couple (by a factor close to 1.1) relative to those who do not. Regarding the age variables, the most obvious result is that for younger workers (under 25), the odds of being in a male-dominated occupation are clearly lower than 1, which may be interpreted as recent cohorts of workers being associated with lower inequality. However, this does not hold for the case of being in female-dominated occupations, for which the odds are usually greater than 1 and statistically significant (save for those over 55). The category of reference when measuring education is non-compulsory secondary studies, for which, by construction, the odds are 1. There are clear differences between male- and female-dominated occupations. Thus, university education is expected to decrease the odds of being in a male-dominated occupation by factors of 0.85 and 0.42, respectively. However, only the case of having a degree of four or more years of university studies is expected to decrease the odds of being in a female-dominated occupation; the fact of having a degree of three or fewer years of university studies does increase the odds, rather than reducing them. One possible explanation for this result is that occupations in which this kind of study (intermediate university) is required (associate professionals in social science, in the sciences, in biomedical, or teaching in general) are nests for women, who are mostly allocated into these feminised occupations (Tables 2a, 2b and 3).

The likelihood of being in a gender-dominated occupation is progressively reduced as tenure increases. Provided that the results express correlations and not causality, this may be interpreted in two ways: workers in integrated occupations may have lower incentives to move to other, more gender-unequal occupations, and remain in integrated occupations; but also that workers in more unevenly-distributed occupations may wish to move more often to more integrated occupations, thus reducing their seniority. For immigrants, relative to natives, the odds of being in a gender-dominated occupation are expected to increase (by factors of 1.2 and 1.3 respectively). The odds of being in a female-dominated occupation decrease by a factor of 0.71 for those working in the public sector, relative to those working in the private sector. Working part-time is expected to increase, by a factor of 1.43, the odds of working in a female-dominated occupation, and to decrease, by a factor of 0.55, the odds of working in a male-dominated occupation. Similarly, working on a permanent contract is expected to increase, by a factor of 1.2, the odds of working in a female-dominated occupation, and to decrease, by a factor of 0.9, the odds of working in a male-dominated occupation. Finally, working in a high-ICT sector is expected to increase the odds of being in a male-dominated occupation, and to decrease the odds of being in a female-dominated occupation. This result will be analyzed in depth below.

Taken as a whole, a high education level, aside from gender, is the most outstanding characteristic associated with lower odds of being in an unevenly-gender-distributed occupation. This broad conclusion is even clearer when we include a dummy controlling for whether the individual is over-educated (as defined above). The last two columns show estimated results when adding this dummy, whose relative risk ratio is found to be statistically significant. Thus, for the over-educated, the odds of being in a male-dominated occupation are expected to increase by a factor of 2, whereas the odds of being in a female-dominated occupation are expected to decrease by a factor of 0.77. Thus, over-education is associated with a greater likelihood of being in a male-dominated occupation, and with a lower likelihood of being in a female-dominated occupation. Regarding the rest of the variables, results are very similar to those shown in the first two columns, except for the education variables. These latter deserve some consideration.

First, for those having only compulsory studies, the odds of being in a male-dominated occupation increase by a factor of 1.57 (as against 1.22, when over-education is not controlled for), whereas for those having a university degree, the odds of being in a male-dominated occupation decrease considerably (a factor of 0.51 for those with degrees of three or fewer years, as against 0.85 without the over-education dummy; and by a factor of 0.19 for those with longer-term degrees, as against 0.42, without the over-education dummy). Second, in the case of female-dominated occupations (relative to integrated occupations) the changes in the odds are less marked, with respect to the case without the over-education dummy. The main difference is in those having attained an education level corresponding to university studies of four or more years, for which being in a female-dominated occupation is associated with a decrease in the odds of 0.14, as against 0.42 when the over-education variable is not included. Again, educational attainment of a shorter university degree is associated with greater odds of being in a female-dominated occupation, by a factor of 1.28.

All these results suggest that university studies are associated with lower inequality in gender distribution across occupations. Our results coincide with most of the existing literature for the Spanish case - although they are counter to those of del Rio and Alonso-Villar (2010, 2012). Our argument in support of this distinct result is that those authors show that women's segregation is greater, despite that women are more educated, but, while they do show that women's segregation fell between 1994 and 2009, they do not relate this to the general increase in educational attainment. Additionally, controlling for over-education, as we do, makes this evidence more clear-cut. Thus, we contribute to the literature by showing different behaviour across higher education levels, and focusing on the relevance of over-education. In the case of female-dominated occupations, possession of a four-year degree appears to be the minimum level needed before we find a positive association between high education and low inequality. The inclusion of the over-education dummy shows that factor changes in the odds could have been higher if the educational attainment and the job requirements were appropriately matched. These results lead us to two main findings, put simply as follows. First, a higher education level appears to be positively associated with non-gender-dominated occupations. Second, despite the fact that over-education is associated with lower odds of being in a female-dominated occupation, the high education-low inequality link would be stronger if over-education were not present. This latter is of special relevance in the Spanish case, where over-education is not uncommon.[24]

Although educational attainment in Spain has increased in recent decades, the question remains whether the positive relationship found between educational attainment and gender equality distribution across occupations is homogenously observed across all age ranges, or whether there is a certain age range for which the relationship is stronger. A second question that requires some attention is the extent to which our results are robust when potentially different family situations are taken into account. Labour-market participation and occupational choice may be associated with household composition and/or the number of dependent individuals in the household. Ideally, knowing the number of individuals in the household - as well as their labour status - would help us to control for this, but the Spanish LFS does not provide that information. Alternatively, we use other information provided in the dataset relative to i) whether individuals live in couple, or not; and ii) whether one or more individuals in the household are employed. An additional factor that we consider worthy of analysis is participation (or not) in occupations with an elevated component of ICT. Theoretically, technological change promotes reductions in inequality by allowing women to enter traditional male occupations (Black and Juhn 2000; Dolado et al. 2001, 2004). Specifically, ICT-based occupations should be more evenly distributed, since this kind of work is not affected by past patterns of segregation, and women's participation is expected to be higher; such work requires less physical aptitude, more easily accommodates family and work duties, and vacancies are more abundant.[25]

To investigate these hypotheses, we re-run multinomial logit regressions focused on these aspects. To address the first, three different subgroups of the age range are considered. We concentrate on the middle-aged group, to avoid distortion from the periods of high education and of pre-retirement, and distinguish between ages 25-34,

[24] The different behavior observed between degrees of three or fewer years, and degrees of four or more, may underlie the finding in the series of papers by Alonso-Villar and del Río on the greater segregation of women. If a significant proportion of graduate women are allocated to occupations where short higher studies are required, such a result is not unexpected.

[25] The increase in employment in ICT occupations has helped to reduce the gender wage gap in Spain, but gender inequality in occupations has not been reduced (Iglesias-Fernandez et al. 2011).

35-44, and 45-54. Regarding the second question, we analyze two different cases: i) individuals living in couple (married or cohabitant), relative to individuals who do not (single, separated, divorced, or widowed); and ii) individuals in a household being the sole employee, relative to those in households in which two or more people are working. With respect to the final aspect, we distinguish between working in ICT sectors, or not.

Table 6 displays the odds corresponding to the three different age ranges defined above. (In order to save space, only the values for education level and type of sector are presented.) The values present a similar character to those presented in the last two columns of Table 5 (note that the over-education variable is included in estimates presented in Table 6). In general terms, for those with university studies of longer than three years, the odds of being in gender-dominated occupations are expected to largely decrease, whereas for those with only compulsory studies, the odds of being in male-dominated occupations are expected to increase, with no change expected in the odds of being in female-dominated occupations. For those with short university studies, the odds of being in male-dominated occupations are expected to fall, and the odds of being in female-dominated occupations are expected to increase slightly. Similar to the case shown in Table 5, being over-educated, or working in a high-ICT sector, is expected to increase the odds of being in a male-dominated occupation, and decrease the odds of being in a female-dominated occupation.

(Insert Table 6)

Across age ranges, the most outstanding changes can be seen in the “senior” workers, age range 45-54 years. First, university degrees of fewer than four years study are associated with increases in the odds of being in female-dominated occupations, by a factor of 1.5 (much higher than the value reported in Table 5 for all ranges, 1.28). In the other two age ranges, differences in the odds between being in female-dominated occupations, and being in integrated occupations, are not statistically significant. Second, the decrease in the odds of being in gender-dominated occupations, as a consequence of attaining the highest education level, is greatest among the senior workers. Third, for the over-educated, as the age range increases, the odds of being in male-dominated occupations are expected to increase more, and the odds of being in female-dominated occupations increase less. Therefore, younger over-educated workers are expected to suffer from lower gender-inequality distribution across occupations than older over-educated workers. Fourth, for those working in a high-ICT sector, the odds of being in a female-dominated occupation are expected to fall, whereas the odds of being in a male-dominated occupation are expected to increase, especially in the case of younger workers.

Considering the age ranges as proxies for cohort effects, these results suggest that the Spanish labour market is dynamic and that the entry of younger cohorts is helping to redesign its structure. Our results show that, in the lower age ranges, short university studies are no longer associated with greater unequal-gender-distribution across occupations. This may be due to the fact that traditionally female-dominated occupations requiring such levels of education, as for example those related to nursing, teaching, and the like, have progressively given way to the entry of male workers during the last decades. Similarly, the most extreme values observed in the group of workers aged 45-54, referring to long university studies or over-education, may be merely indicating the low proportion of highly-educated (and consequently, of over-educated) workers in this group. Finally, results indicate that the expansion of employment in high-ICT sectors observed in recent years in Spain (see Iglesias et al. 2011) is positively associated with being in male-dominated occupations, but not in female-dominated occupations.

Table 7 shows the odds for the two cases considered: living in couple, or not, and being the sole employee in the household, or not. Estimates for each of the subgroups mimic the general behaviour shown in the last two columns in Table 5, with little or no difference between them. One minor variation we might note is that having a short-cycle university degree is expected to increase the odds of being in a female-dominated occupation by factors of 1.4 when the individual does not live in couple, and 1.5 when only one member of the household is employed. Note that these factors are significantly above the average value of 1.3.

Table 8 contains the results of the relative risk ratios when distinguishing between high-ICT sectors and non-high-ICT sectors. Two major differences across education and sectors are worth mentioning. First, having only a compulsory education is expected to increase the odds of being in a male-dominated occupation only for those in non-high-ICT sectors. Second, shorter university studies are associated with increases in the odds of being in a female-dominated occupation, again only for those working in non-high-ICT sectors. Taken together, it is apparent that higher education is related to a more equal gender distribution of workers across occupations, in those sectors with high ICT. For over-educated workers, the odds of working in a gender-dominated occupation are expected to increase, by factors greater than 2, in the high-ICT sectors. By contrast, for the over-educated in non-high-ICT sectors, the odds of working in a male-dominated occupation are expected to increase, and the odds of working in a female-dominated occupation are expected to decrease (mirroring the results in Table 5). The general view is that the direct association of higher education and more equal gender distribution across occupations is more evident in high-ICT sectors, supporting the notion of developing ICT sectors as a way to reduce inequality, with over-education dampening that relationship.

(Insert Tables 7 and 8)

6 Conclusions

The aim of this article is to investigate the association, at the micro level, between a variety of personal and job characteristics of workers, focusing on the significant role of over-education, and inequality in the distribution of men and women across occupational categories. We classify occupations into three categories: male-dominated, where men are over-represented; female-dominated, where women are over-represented; and integrated, where the share of women is roughly similar to that of men. In the descriptive section of the paper, we show that female-dominated occupations are largely populated by women (80%), whereas male-dominated occupations are almost entirely filled by men (90%). We also show, first, that many of those working in gender-dominated occupations have only attained the lowest educational level and, notwithstanding that, the phenomenon of over-education is quite common in these occupations.

Our multivariate analysis, based on multinomial logit regressions using individual data, provides the main result of our study: aside from gender itself, which may capture unobserved characteristics, such as field of study, preferences, stereotypes, etc., or the existence of discrimination, the educational attainment of the worker is the most prominent factor associated with the odds of working in an integrated occupation. In particular, university education is strongly related to decreases in the odds of working in a gender-dominated occupation, with this association being more apparent once over-education is controlled for. Thus, our results suggest that the general belief of a more educated working population helping to reduce gender-inequality in the distribution of workers across occupations, appears to characterise the Spanish case, and that this relationship would be stronger if over-education were less extensive. In this respect, an immediate recommendation for policy is to establish measures that are not only focused on stimulating the acquisition of higher levels of qualification,[26] but are also designed to achieve a better matching between educational attainment and job requirements. Consequently, policies stimulating lifelong training, and the appropriate choice of professional careers, appear to be of singular importance. This would eventually help to reduce cross-gender wage differentials, since occupational segregation is viewed as one important source of the gender wage gap in Spain (Amuedo-Dorantes and de la Rica 2006).

A second important result is that the relationship between higher education and greater gender-equality differs between the two types of gender-dominated occupations. University degrees with duration shorter than four years are associated with unevenness in gender distribution only in female-dominated occupations, whereas in male-dominated occupations, these degrees are associated with greater gender equality. This result suggests that short university studies, which are largely pursued by women in certain specific fields (e.g. Health and Teaching) have generated more unequal distribution, but have also allowed women to enter the labour market, especially in services and in the public sector. This calls for the adoption of measures pursuing more equal gender distribution in the choice of studies, and for policies aimed at removing those norms or stereotypes that exogenously assign jobs and occupations to workers of one specific gender. This process appears to be already at work, since when analysing the relationship between education and gender inequality across age ranges, which may proxy for cohort effects, we see that the evidence seems to be weaker for new entrants to the labour market. Thus, in young cohorts (those aged 25-34 years), with short university degrees, the odds of working in male-dominated occupations decrease, and the odds of working in female-dominated occupations do not increase. We may then conclude that changes in cultural patterns and in labour, tax, and social legislation have coincided with the increase in education levels, to generate better conditions for the

[26] Spain today has one of the highest shares, among OECD countries, of the adult population with only compulsory education, close to 50% (OECD 2009).

extension of gender equality. Family situation appears to play only a minor role in shaping the association between education and gender-occupational distribution.

Finally, we have studied the effect of working in sectors with a significant influence of ITC, in the relationship between education level and gender inequality in occupations. Our first finding is that working in these sectors increases the odds of being in a male-dominated occupation (relative to integrated occupations), but decreases the odds of being in a female-dominated occupation (also relative to integrated occupations). This result can be better understood when looking at different age ranges, where we see that the evidence is more clear-cut in the younger generation, and when looking at different ICT sectors, since over-education has a larger presence in high-ICT sectors. Thus, it can be interpreted that the fact of working in sectors with high participation in ICT is associated with working in gender-dominated occupations, due to the development of these sectors in recent decades, and the general extension of over-education. In this context, it appears that the development of ICTs should be accompanied by an adequate match between job requirements and worker capabilities to reduce gender inequality.

This is a static analysis that could be improved upon by analysing flows across jobs, to investigate whether labour mobility helps to reduce inequality. This, and the fact that a structural analysis is not possible with the existing data (and in consequence we cannot talk about causality, but only about correlations), leaves the door open for further research on this topic. With the results obtained in this present study, an improvement in the match between jobs and employees is of undoubted importance in decreasing undesirable inequality in the distribution of men and women across occupations.

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Table 1 Employment indices in Spain (several years)

	1986			1989			1994			2000			2007			2010		
Rates	M	W	T	M	W	T	M	W	T	M	W	T	M	W	T	M	W	T
Participation	69.7	30.0	48.7	68.6	33.7	50.6	65.7	37.1	51.0	66.5	41.4	53.4	70.2	49.4	59.0	68.1	52.3	60.1
Employment	57.2	21.8	38.5	59.8	25.0	41.9	52.9	25.3	38.7	60.1	32.9	46.1	65.1	43.8	54.0	54.7	41.6	48.0
Unemployment	18.0	27.4	21.0	12.8	25.7	17.2	19.6	31.6	24.1	9.5	20.4	13.9	6.4	10.8	8.3	19.8	21.0	20.0

M, W, T stand for men, women and total, respectively. Data come from the Spanish Labor Force Survey (Encuesta de Población Activa), Spanish Institute of Statistics (INE).

Table 2a Occupational distribution by gender, average education levels, and average educational match: the 10 most female-centric occupations. Year 2010

	Number of employed (in thousands)	Female Concentration Index	Female Representation Ratio (ranking)	Compulsory	Secondary non-compulsory	Short university degrees	Long university degrees	Over-educated
Women								
Domestic cleaners and helpers in offices, hotels and other establishments (91)	1,186	14.61	1.99 (1)	86	10	2	2	33
Personal services workers (51)	830	10.22	1.90 (2)	53	39	6	2	9
Sales workers (53)	676	8.33	1.51 (10)	69	22	5	4	8
Administrative, specialised secretaries, and associate professionals in finance, mathematics, and regulatory government (34)	509	6.27	1.48 (12)	33	29	20	18	38
Cooks, waiters, and bartenders (50)	500	6.16	1.20 (15)	78	17	3	2	44
Secretaries and assistant clerks (with customer services tasks) (44)	369	4.55	1.66 (4)	42	33	14	11	23
Primary school teachers and related professions (28)	332	4.10	1.63 (5)	2	4	75	19	18
Secretaries and assistant clerks (without customer services tasks) (43)	264	3.25	1.58 (6)	44	30	14	12	25
University and higher education teachers and related professions (22)	250	3.09	1.21 (14)	0	0	16	84	15
Teachers in first university cycle in natural sciences and related professions (27)	197	2.42	1.77 (3)	0	0	96	4	4
Standard deviation (coefficient of variation)	3.82 (.60)							
National average				55	20	11	14	25

Data come from the Spanish Labor Force Survey (Encuesta de Población Activa), Spanish Institute of Statistics (INE). Occupations are defined at the two-digit CNO 1994 classification (in parentheses are the corresponding codes for 66 occupations). Female Concentration Index computed as the percentage of women in an occupation over total employed women. Female Representation Ratio computed as the ratio of female share of employment in each occupation to female share of total employment (46%), order in the ranking is included in parentheses. Educational attainment is the percentage of female workers at each educational level (definition in Table 4). Over-educated: percentage of female workers with over-education: an individual is said to be over-educated if the educational level is higher than the average educational attainment in that occupation, plus a standard deviation.

Table 2b Occupational distribution by gender, average education levels, and average educational match: the 10 most male-centric occupations. Year 2010

	Number of employed (in thousands)	Male Concentration Index	Male Representation Ratio (ranking)	Compulsory	Secondary non-compulsory	Short university degrees	Long university degrees	Over-educated
Men								
Drivers (86)	678	6.63	1.79 (10)	81	17	1	1	36
House builders and related trades workers (71)	601	5.88	1.83 (1)	87	11	1	1	26
Building finishers, painters, and related trades workers (72)	544	5.33	1.80 (6)	67	31	1	1	44
Machinery mechanics and repairers; electrical and electronic trades workers (76)	477	4.67	1.82 (4)	51	46	2	1	59
Business and administrative associate professionals (33)	412	4.03	1.28 (29)	48	22	13	17	36
Cooks, waiters, and bartenders (50)	407	3.98	0.83 (51)	78	17	3	2	23
Physical, chemical, engineering and ICT (information and communication technicians) associate professionals (30)	389	3.81	1.40 (25)	20	48	17	15	32
Protective services workers (52)	346	3.38	1.70 (13)	65	23	6	6	12
Managers in firms with 10 or more workers (11)	315	3.08	1.37 (26)	28	12	19	41	46
Sales workers (53)	295	2.89	0.56 (56)	70	22	5	3	8
Standard deviation (coefficient of variation)	1.24 (.28)							
National average				55	20	11	14	25

Data come from the Spanish Labor Force Survey (Encuesta de Población Activa), Spanish Institute of Statistics (INE). Occupations are defined at the two-digit CNO 1994 classification (in parentheses are the corresponding codes for 66 occupations). Male Concentration Index computed as the percentage of men in an occupation over total employed men. Male Representation Ratio computed as the ratio of male share of employment in each occupation to male share of total employment (46%), order in the ranking is included in parentheses. Educational attainment is the percentage of male workers at each educational level (definition in Table 4). Over-educated: percentage of male workers with over-education: an individual is said to be over-educated if the educational level is higher than the average educational attainment in that occupation, plus a standard deviation.

Table 3 Descriptive statistics by groups of occupations (percentage). Year 2010

Number of occupations	Occupation type	Proportion in employment	Men	Compulsory	Long university degree	Over-educated	Secondary non-compulsory	Short university degree

728Male35896522632

726Integrated325552221926

2912Female332146151021

Data come from the Spanish Labor Force Survey (Encuesta de Población Activa), Spanish Institute of Statistics (INE). Occupations are defined at the two-digit CNO 1994 classification (66 occupations). Proportion in employment is the percentage of occupations of each type over total number of occupations (66). Men is the percentage of male workers in each type of occupation. Educational attainment is the percentage of workers in each educational level (definition in Table 4). Over-educated: percentage of workers with over-education: an individual is said to be over-educated if the educational level is higher than the average educational attainment in that occupation, plus a standard deviation.

Table 4 Definition and average values of relevant variables. Year 2010

Variable name	Definition	Sample Average	Male	Female
Personal characteristicss				
Gender1, male; 0, female		0.54		
Marital status	1, live in couple (married/cohabitant); 0, not (single/separated/divorced/widowed)	0.57	0.60	0.55
Age				
< 25	Under 25 years	0.06	0.06	0.06
25-34	Between 25 and 34 years	0.23	0.21	0.25
35-44	Between 35 and 44 years	0.29	0.29	0.29
45-54	Between 45 and 54 years	0.27	0.27	0.27
> 54	Over 54 years	0.15	0.16	0.13
Educational level				
Compulsory studies	Primary and compulsory secondary studies	0.55	0.59	0.49
Secondary studies	Non-compulsory secondary studies	0.20	0.20	0.20
University 1	High vocational training. Degrees corresponding to 3 or less years of university studies	0.11	0.08	0.16
University 2	Degrees corresponding to 4 or more years of university studies	0.14	0.13	0.16
Overeducation	When the individual holds an educational level that is higher than the average educational attainment in her occupation, plus a standard deviation	0.25	0.27	0.22
Tenure				
Tenure < 1	Less than one year	0.14	0.13	0.15
Tenure 1-3	Between 1 and 3 years	0.15	0.13	0.18
Tenure 4-10	Between 4 and 10 years	0.29	0.27	0.32
Tenure 11-20	Between 11 and 20 years	0.20	0.22	0.19
Tenure 21-30	Between 21 and 30 years	0.13	0.15	0.11
Tenure > 30	More than 30 years	0.06	0.10	0.06
Immigrant	Immigrant=1; Native=0	0.06	0.06	0.07
Job characteristics				
Public sector	1, public sector; 0, private sector	0.20	0.16	0.24
Part-time	1, part-time; 0, full-time	0.14	0.05	0.23
Type of contract	1, permanent; 0, temporary	0.76	0.78	0.74
Sector of technology				
High-ICT Sectors	Knowledge Industry (see footnote 20)	0.12	0.10	0.15
Number of observations		65,292	36,032	29,260

Data come from the Spanish Labor Force Survey (Encuesta de Población Activa), Spanish Institute of Statistics (INE). Occupations are defined at the three-digit CNO 1994 classification (206 categories).

Table 5 Multinomial logit model. Relative Risk Ratios of being in a male- or female-dominated occupation, relative to being in an integrated occupation. Year 2010

	Male-dominated	Female-dominated	Male-dominated	Female-dominated
Male	7.56***	0.27***	7.38***	0.28***
Marital status	1.11***	1.05*	1.12***	1.05*
16-24	0.79***	1.15***	0.80***	1.13***
25-34	0.97	1.11**	0.98	1.10***
45-54	0.95	1.15***	0.96	1.15***
> 54	1.02	1.05	1.05	1.04
Compulsory studies	1.22***	1.00	1.57***	0.97
University 1	0.85***	1.17***	0.51***	1.28***
University 2	0.42***	0.42***	0.19***	0.14***
Overeducation			2.00***	0.77***
Tenure < 1	1.22***	1.18***	1.20***	1.17***
Tenure 1-3	1.14***	1.17***	1.15***	1.17***
Tenure 11-20	0.80***	0.88***	0.82***	0.88***
Tenure 21-30	0.62***	0.82***	0.64***	0.82***
Tenure > 30	0.47***	0.89	0.48***	0.87*
Immigrant	1.17***	1.30***	1.02	1.39***
Public sector	0.98	0.72***	1.00	0.71***
Part-time	0.55***	1.45***	0.52***	1.46***
Type of contract	0.90***	1.19***	0.91***	1.18***
High Tech sector	1.16***	0.66***	1.30***	0.63***
Log likelihood	-37939		-37597	
LR χ^2 (p-value)	39824 (0.0000)		40510 (0.0000)	
Pseudo R^2	0.3442		0.3501	
Observ.	52,882			

All regressions include dummies for nine occupations (1-digit level), nine industries, and the 17 NUTS II Spanish regions. *, **, *** indicate significant at 10, 5 and 1% level respectively.

Table 6 Multinomial logit model. Relative Risk Ratios of being in a male- or female-dominated occupation, relative to being in an integrated occupation, by age range (only education and sector variables). Year 2010

	Age groups					
	25-34		35-44		45-54	
	Male-dominated	Female-dominated	Male-dominated	Female-dominated	Male-dominated	Female-dominated
Compulsory studies	1.49***	1.01	1.87***	1.08	1.45***	0.94
University 1	0.56***	1.09	0.50***	0.97	0.46***	1.47***
University 2	0.21***	0.20***	0.20***	0.12***	0.15***	0.09***
Overeducation	1.78***	0.79***	2.03***	0.85***	2.70***	1.02
High Tech sector	1.98***	0.67***	1.27***	0.57***	1.02	0.74***
Log likelihood	-9250		-11025		-9695	
LR χ^2 (p-value)	10,160.55 (0.0000)		11,757.30 (0.0000)		11,070.18 (0.0000)	
Pseudo R^2	0.3545		0.3478		0.3634	
Observ.	13,103		15,532		13,888	

All regressions include dummies for nine occupations (1-digit level), nine industries, and the 17 NUTS II Spanish regions, in addition to the rest of regressors in Table 5. *, **, *** indicate significant at 10, 5 and 1% level respectively.

Table 7 Multinomial logit model. Relative Risk Ratios of being in a male- or female- dominated occupation, relative to being in an integrated occupation, by family situation (only education variables). Year 2010.

	Live in couple		Live alone		One employed		More employed	
	Male-dominated	Female-dominated	Male-dominated	Female-dominated	Male-dominated	Female-dominated	Male-dominated	Female-dominated
Compulsory studies	1.72***	0.96	1.41***	0.98	1.56***	1.07	1.57***	0.93
University 1	0.53***	1.18***	0.49***	1.41***	0.50***	1.49***	0.51***	1.21***
University 2	0.18***	0.11***	0.21***	0.18***	0.19***	0.16***	0.19***	0.13***
Overeducation	2.17***	0.79***	1.85***	0.74***	1.92***	0.82***	2.05***	0.75***
Log likelihood	-21548		-15842		-12118		-25375	
LR χ^2 (p-value)	24,490.26 (0.0000)		16,335.95 (0.0000)		13,287.38 (0.0000)		27,116.86 (0.0000)	
Pseudo R^2	0.3624		0.3402		0.3541		0.3482	
Observ.	31,003		21,879		17,404		35,478	

All regressions include dummies for nine occupations (1-digit level), nine industries and the 17 NUTS II Spanish regions, in addition to the rest of regressors in Table 5. *, **, *** indicate significant at 10, 5 and 1% level respectively.

Table 8 Multinomial logit model. Relative Risk Ratios of being in a male- or female-dominated occupation, relative to being in an integrated occupation, by level of technology (only education variables). Year 2010.

	High-tech sector		Non high-tech sector	
	Male-dominated.	Female-dominated.	Male-dominated	Female-dominated
Compulsory studies	0.98	1.03	1.67***	0.96
University 1	0.46***	1.09	0.56***	2.07***
University 2	0.15***	0.12***	0.22***	0.14***
Overeducation	3.39***	1.98***	1.92***	0.69***
Log likelihood	-5200		-30985	
LR χ^2 (p-value)	5297.17 (0.0000)		37182.24 (0.0000)	
Pseudo R^2	0.3375		0.3750	
Observ.	7,330		45,552	

All regressions include dummies for nine occupations (1-digit level), nine industries, and the 17 NUTS II Spanish regions, in addition to the rest of regressors in Table 5. *, **, *** indicate significant at 10, 5 and 1% level respectively.