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Gender segregation in the Spanish labor market: An alternative approach[*]

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Abstract

The aim of this paper is to study occupational segregation by gender in Spain, which is a country where occupational segregation explains a large part of the gender wage gap. As opposed to previous studies, this paper measures not only overall segregation, but also the segregation of several population subgroups. For this purpose, this paper uses new measures recently proposed by Alonso-Villar and Del Río (2008). Moreover, two decompositions of their local segregation curves are proposed, which allows us to go further in the empirical analysis.

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1. Introduction

Sociologists and economists have devoted a great deal of attention to analyzing segregation.[1] Most of these studies have focused on the case of two population subgroups: blacks/whites, high/low social position, women/men, etc. (Duncan and Duncan, 1955; Karmel and Maclachlan, 1988; Silber, 1989; Hutchens, 2004; and Jenkins et al., 2006), even though in recent years the study of segregation in the case of multiple categories of individuals has received increasing attention among scholars (Silber, 1992; Boisso et al., 1994; Reardon and Firebaugh, 2002; Frankel and Volij, 2008; and Mora and Ruiz-Castillo, 2008).

Within this literature, the study of gender segregation in the labor market -- and in particular, occupational segregation -- has received special consideration (Silber, 1989; Hutchens, 1991, 2004; and Mora and Ruiz-Castillo, 2003, 2004, among others). Anker (1998) offers five reasons why researchers and policy-makers in developed countries should care about occupational segregation by sex apart from equity concerns. First, the tendency of women to concentrate in low pay/status jobs has a negative impact on how men see women, and also on how women see themselves. This reinforces gender stereotypes and fosters female poverty, which has important consequences on female-headed households. Second, the exclusion of women from certain occupations implies a waste of human resources, which leads to extremely inefficient results when women are high-skilled people. Third, sex segregation imposes important rigidities, reducing the ability of the market to respond to labor changes. Certainly, these factors should not be ignored in a global economy concerned with efficiency and competitiveness. Fourth, occupational segregation by sex has a negative effect on the education of future generations, in particular, regarding the fields of study that boys and girls opt to choose. Five, approximately one-third of the gender wage gap at international level is due to occupational segregation by sex. This is also a significant argument for concern about segregation, since according to the European Structure of Earnings Survey for 2002 provided by EUROSTAT (2007), the average earnings per hour of women in the European

[1] For a review of occupational segregation measures, see Flückiger and Silber (1999). James and Taueber (1985) also offer an interesting discussion of segregation indexes in the case of school segregation.

Union (EU) are about 75% of men's,[2] which has also important consequences in terms of poverty (Gradín et al., 2006; Del Río et al., 2008).

When measuring segregation, in a context of either two or more than two groups, most indexes actually measure overall segregation rather than the segregation of a particular demographic group, since they quantify the discrepancies among all the distributions of population subgroups across organizational units. Thus, in the case of occupational segregation by gender, the distribution of female workers across occupations is usually compared with that of males. However, one can be interested not only in measuring aggregate segregation, but also in exploring the segregation of a target group, since the distribution of a demographic group across occupations can be rather different from that concerning other population groups.[3]

Measuring the segregation level of a given group does not imply, however, that the segregation of that group can be determined without taking into account the remaining population subgroups. Segregation is indeed a phenomenon that requires considering the relative position of individuals with respect to others, as happens when measuring poverty according to a relative approach. In fact, both phenomena have more in common than one might expect at first sight. Thus, in order to quantify the relative poverty level of a country, the income level of the whole population is usually taken into account in order to calculate the poverty line (i.e., the income level of reference). Certainly, if the income level of a group changes, the poverty level of other groups may be altered because of the threshold shift. However, this interdependence among groups does not prevent one from finding out the poverty level that a target group suffers (by using, for example, the decomposability property of the popular family of indexes proposed by Foster, Greer, and Thorbecke, 1984). Analogously, if the distribution of a demographic group across organizational units varies, this change may affect not only the segregation level of this group, but also that of other groups, since the distribution of reference (that of the whole

[2] Hungary, Sweden, Slovenia and Poland are the countries with the lowest gender wage gaps -- female earnings representing between 85% and 89% of males' earnings. The gap is larger in countries such as United Kingdom, Slovakia, Cyprus, Estonia, Germany, Austria, Ireland, Greece and Spain, where the ratio is between 70% and 75%.

[3] As documented by Anker (1998, p 285), there are occupations around the world that are strongly feminized (nursing, secretary/typist, housekeeper, bookkeeper/cashier, building caretaker/cleaner and tailor/sewer), which suggests that male workers are not distributed evenly across occupations, even though "the value of these niches to women is often of dubious value as these occupations tend to have low pay and status". Therefore, both women and men can be excluded from occupations mainly-dominated by the other sex (or perhaps, men are not interested in working in feminized occupations).

population) may have been modified. As in the case of relative poverty, we maintain that the segregation level of a target group can be calculated and that it is a powerful approach to go deeper in the study of segregation. In fact, the measurement of female segregation in the labor market is not a new topic in the literature. In this regard, three decades ago, Moir and Selby Smith (1979) offered a variation of the index of dissimilarity to measure the industrial segregation of female workers in the Australian labor market.[4] However, as far as we know, only Alonso-Villar and Del Río (2008) have explored this issue axiomatically, while proposing new indices that satisfy basic properties.

The aim of this paper is to study occupational segregation by gender in Spain, which is a country where occupational segregation explains a large part of the gender wage gap. In this regard, by using the European Structure of Earnings Survey for 1995 Plasman and Sissoko (2004) estimated that this contribution represents about 29.6% in Spain, while it decreases to 13% in Belgium and to 5.3% in Italy. As opposed to previous studies that analyze gender segregation in Spain, such as Mora and Ruiz-Castillo (2003, 2004), and Otero and Gradín (2001), this paper measures not only overall segregation, but also the segregation of several population subgroups. In this regard, this paper first shows the occupational segregation of both women and men. For this purpose, this paper uses several local segregation measures: Those proposed by Moir and Selby Smith (1979) and Lewis (1982), together with new measures recently proposed by Alonso-Villar and Del Río (2008) (AV-DR, henceforth). In addition, this paper studies whether age, type of contract (temporary/permanent), type of job (part-time/full-time), education level, and salary affect the distributions of women and men across occupations in the same way. In doing so, total population is, first, partitioned by gender and age (young, middle-aged, elderly), giving rise to six target groups; next, by gender and type of contract, giving rise to four target groups, and so on. Therefore, occupational segregation by gender is also analyzed in a framework of multiple groups.

Regarding the overall segregation measurement, this paper applies the mutual information index, which has been recently characterized by Frankel and Volij (2007) in terms of basic axioms. The mutual information index, whose good properties have been emphasized by Mora and Ruiz-Castillo (2008), can be expressed as the mean of one of the local indexes proposed by AV-DR when weighing each target group by its demographic weight, which

[4]By following the same reasoning, Lewis (1982) defined an analogous index to measure male segregation.

allows one to determine the contribution of each group to overall segregation. In order to compare the robustness of our results, we also use other overall segregation measures previously proposed in the literature, such as those proposed by Silber (1992) and Reardon and Firebaugh (2002), which are also additively decomposable in terms of other local segregation indexes offered by AV-DR.

In addition, this paper also proposes two theoretical decompositions of the local segregation curve put forward by AV-DR, which allows us to go further in our empirical analysis. A decomposition of the local segregation curve is obtained when partitioning occupations into different classes, which is in line with the decomposition of the Lorenz curve by population subgroups proposed by Bishop *et al*. (2003). An alternative decomposition of the local segregation curve according to a classification of the individuals of the target group is also offered.[5] In particular, these decompositions allow us to quantify the degree of feminization/masculinization of the jobs included in each target group.

The paper is structured as follows. Section 2 presents the local segregation measurement proposed by AV-DR together with several overall segregation measures proposed in the literature, including the mutual information index. Section 3 proposes two decompositions of their local segregation curves. In Section 4, the above measures and their decompositions are used in order to analyze occupational segregation by gender in Spain in 2007 by using data from the Spanish Current Population Survey (EPA). Finally, Section 5 presents the main conclusions.

2. An alternative measurement of segregation

Following Reardon and O'Sullivan (2004, p. 122), "segregation can be thought of as the extent to which individuals of different groups occupy and experience different social environments. A measure of segregation, then, requires that we (1) define the social environment of each individual, and (2) quantify the extent to which these social environments differ across individuals." Although different dimensions of the problem have been described in the literature (Massey and Denton, 1988; Reardon and O'Sullivan, 2004), evenness is the most popular (Duncan and Duncan, 1955; James and Taueber,

[5] This decomposition parallels that proposed by Alonso-Villar (2009) in a context of industrial concentration.

1985; Reardon and Firebaugh, 2002; Hutchens, 2004; Chakravarty and Silber, 2007). According to this perception, segregation exists if the population subgroups in which the economy can be partitioned (blacks/whites/Hispanics, high-educated women/low-educated women/high-educated men/low-educated men, for example) are not similarly distributed among organizational units (schools, occupations, etc.). This is the approach followed in this paper.

2.1 Local segregation

When occupational segregation in the labor market is analyzed, the indexes commonly used quantify overall segregation. However, one can be interested not only in measuring aggregate segregation, but also in exploring the segregation of a target group (high-educated women, for instance). AV-DR tackle this matter in a multigroup context by proposing an axiomatic framework in which to study the occupational segregation of any population subgroup. In doing so, they compare the distribution of the target group among categories (occupations, for example) with the distribution of total employment, and propose basic axioms for a local segregation measure (i.e., for measuring the segregation of any target group). In measuring segregation in the labor market, this implies that the target group is segregated so long as its distribution across occupations departs from the employment structure of the economy. In addition, a local segregation curve for each target group is put forward and new local indexes consistent with it are proposed. In particular, a class of decomposable segregation indexes (related to the generalized entropy family) consistent with non-crossing local segregation curves is characterized in terms of basic axioms. In what follows, we present the notation and introduce these tools.

$$G \text{ subgroups} \times J \text{ occupations}$$

$$E = \begin{bmatrix} c_1^1 & \cdots & c_J^1 \\ \vdots & & \vdots \\ c_1^G & \cdots & c_J^G \end{bmatrix} \rightarrow \begin{bmatrix} \sum_j c_j^1 = C^1 \\ \vdots \\ \sum_j c_j^G = C^G \end{bmatrix}$$

$$\downarrow$$

$$\left[\sum_g c_1^g = t_1 \quad \cdots \quad \sum_g c_J^g = t_J \right]$$

Consider an economy with $J>1$ occupations among which total population, denoted by *T*, is distributed according to distribution $t\equiv(t_1,t_2,...,t_J)$, where $t_j>0$ represents the number of individuals in occupation j $(j=1,...,J)$ and $T=\sum_j t_j$. Let us denote by $c^g\equiv(c_1^g,c_2^g,...,c_J^g)$ the distribution of the target group g in which we are interested $(g=1,...,G)$, where $c_j^g\le t_j$. Distribution c^g could represent, for example, high-educated women or any other group of citizens in which we are interested. Therefore, the economy can be summarized by matrix, *E*, which represents the number of individuals of each target group in each occupation, where rows and columns correspond to population subgroups and occupations, respectively. Note that the total number of individuals in occupation j is $t_j=\sum_g c_j^g$, and the total number of individuals of target group g is $C^g=\sum_j c_j^g$. In order to measure the segregation of a target population group we compare the corresponding row, $(c_1^g,...,c_J^g)$, with the total sum of the rows, $(t_1,...,t_J)$, both distributions expressed in proportions. In other words, distribution $\left(\frac{c_1^g}{C^g},...,\frac{c_J^g}{C^g}\right)$ is compared with $\left(\frac{t_1}{T},...,\frac{t_J}{T}\right)$.

Within this framework, AV-DR propose the following measures in other to quantify the segregation of target group g:

$$G^g=\frac{\sum_{i,j}\frac{t_i}{T}\frac{t_j}{T}\left|\frac{c_i^g}{t_i}-\frac{c_j^g}{t_j}\right|}{2\frac{C^g}{T}},$$

$$\Phi_a(c^g;t)=\begin{cases}\frac{1}{a(a-1)}\sum_j\frac{t_j}{T}\left[\left(\frac{c_j^g/C^g}{t_j/T}\right)^a-1\right] & \text{if } a\neq 0,1\\ \sum_j\frac{c_j^g}{C^g}\ln\left(\frac{c_j^g/C^g}{t_j/T}\right) & \text{if } a=1\end{cases},$$

where the first measure is a variation of the classic Gini index and the second represents a family of indexes related to the generalized entropy family (*a* can be interpreted as a

segregation aversion parameter).[6] These indexes, together with a variation of the index of dissimilarity proposed by Moir and Selby Smith (1979)

$$D^g = \frac{1}{2}\sum_j \left| \frac{c_j^g}{C^g} - \frac{t_j}{T} \right|,$$

will be used later in the paper to analyze female and male segregation in Spain.[7]

An advantage of the family of indexes Φ_a is that its members are decomposable:

i) *Decomposition by subgroups of occupations.* Given a partition of occupations in *K* classes, we denote by C^{gk} the number of individuals of the target group g who work in class k ($k = 1,...,K$), and by c^{gk} the distribution of the target group among the categories included in that class, so that $(c^g;t) = (c^{g1},...,c^{gK};t^1,...,t^K)$. Then, the generalized entropy family of indexes can be decomposed as follows:

$$\Phi_a(c^{g1},...,c^{gK};t^1,...,t^K) = \sum_k \left(\frac{C^{gk}}{C^g}\right)^a \left(\frac{T^k}{T}\right)^{1-a} \Phi_a(c^{gk};t^k) + \Phi_a(C^{g1},...,C^{gK};T^1,...,T^K)$$

where the first addend of the above formula represents the *within-group* component, i.e. the weighted sum of segregation inside each class, while the second addend reflects the *between-group* component.

ii) *Decomposition by subgroups of individuals.* In order to analyze segregation differences between individuals of the target group, let us classify them into several mutually-exclusive subgroups. Without loss of generality, consider that there are only two subgroups *A* and *B* so that $(c^g;t) = (c^A + c^B;t)$. Then the contribution of subgroup *A* to the segregation level of the whole target group according to index Φ_2 is

$$IC_A = \rho_A \left(\frac{C^A}{C^g}\right) \sqrt{\frac{\Phi_2(c^A;t)}{\Phi_2(c^g;t)}},$$

---

[6] Indexes $\Phi_a(c^g;t)$, where $a \neq 0$, are defined on the space of employment distributions $(c^g;t)$ where all components of vector c^g are positive. If all components were strictly positive, then another index could be used: $\Phi_a(c^g;t) = \sum_j \frac{t_j}{T} \ln\left(\frac{t_j/T}{c_j^g/C}\right)$ if $a = 0$.

[7] Both D^g and G^g take values within the interval $[0,1)$, while Φ_a can be easily transformed in order to take values within that interval.

where ρ_A is the correlation between distributions $(\underbrace{\frac{c_1^g}{t_1},...,\frac{c_1^g}{t_1}}_{t_1},...,\underbrace{\frac{c_J^g}{t_J},...,\frac{c_J^g}{t_J}}_{t_J})$ and $(\underbrace{\frac{c_1^A}{t_1},...,\frac{c_1^A}{t_1}}_{t_1},...,\underbrace{\frac{c_J^A}{t_J},...,\frac{c_J^A}{t_J}}_{t_J})$, and c_j^A is the number of target individuals in occupation j belonging to class *A*. Therefore, $IC_A + IC_B = 1$.

These decompositions will be used later on in our empirical analysis.

2.2 Overall segregation

The mutual information index

$$M = \sum_g \frac{C^g}{T} \log\left(\frac{T}{C^g}\right) - \sum_j \frac{t_j}{T}\left[\sum_g \frac{c_j^g}{t_j} \log\left(\frac{t_j}{c_j^g}\right)\right]$$

is "a measure of the amount of information that one random variable contains about another random variable" since it quantifies "the reduction in the uncertainty of one random variable due to the knowledge of the other" (Cover and Thomas, 1991, p. 18). This index, borrowed from the literature on information theory, has been recently used by Frankel and Volij (2008) to quantify school segregation by race in the US because of its good axiomatic properties (Frankel and Volij, 2007; Mora and Ruiz-Castillo, 2008). For the same reason, this index is used in our empirical section to measure occupational segregation by gender in the Spanish labor market. It is easy to show that M can be rewritten as follows:

$$M = \sum_g \frac{C^g}{T} \Phi_1\left(c^g; t\right).$$

Therefore, this overall segregation measure can be built by aggregating a local index in an appealing manner: each target group is weighted by its demographic weight, which seems helpful for empirical analyses, since it allows one to find out the contribution of each target group to overall segregation.[8]

[8] As in the case of the most popular poverty indexes according to a relative approach (see Foster, Greer, and Thorbecke, 1984), the interdependence that exists among groups (via the distribution of reference) does not prevent one from quantifying the contribution of each population group to overall segregation.

In order to compare the robustness of our results, we also use other overall segregation measures previously proposed in the literature, such as those offered by Silber (1992) and Reardon and Firebaugh (2002). In this vein, the index proposed by the former, I_p, can be written as the weighted mean of local index D^g for each target group in which the economy can be partitioned:

$$I_p = \sum_g \frac{C^g}{T} D^g .$$

On the other hand, the unbounded Gini index, G, proposed by Reardon and Firebaugh (2002) to measure overall segregation is the weighted mean of local index G^g for each target group:

$$G = \sum_g \frac{C^g}{T} G^g .$$

3. Decomposing segregation curves

In the context of occupational segregation by gender, traditional segregation curves represent the cumulative proportion of female workers corresponding to the cumulative share of male workers, once the occupations have been ranked by increasing gender ratios (the number of women divided by the number of men in each occupation). Therefore, these curves actually measure overall segregation, rather than female segregation. To analyze the segregation of any demographic group, AV-DR propose to use what they called a local segregation curve. Thus, to calculate this local segregation curve, first, the categories (occupations) have to be ranked in ascending order of the ratio $\frac{c_j^g}{t_j}$ ($j = 1,...,J$) and, second, the cumulative proportion of employment, $\sum_{i \le j} \frac{t_i}{T}$, is plotted on the horizontal axis and the cumulative proportion of individuals of the target group (high-educated women, for example), $\sum_{i \le j} \frac{c_i^g}{C^g}$, is plotted on the vertical axis. Therefore, this curve can be written as

$$S^g{}_{(c^g;t)}(\tau_j) = \frac{\sum_{i \le j} c_i^g}{C^g},$$

where $\tau_j \equiv \sum_{i \leq j} \frac{t_i}{T}$ is the proportion of cumulative employment represented by the first *j* occupations.

As shown by AV-DR, index G^g together with the family of indexes $\Phi_a(c^g;t)$ are consistent with non-intersecting S^g curves. In other words, when comparing two different distributions, if the segregation curve of one of them dominates that of the other (i.e., if the segregation curve of the former lies at no point below the latter and at some point above), these indexes (and also any other local segregation index satisfying *scale invariance*, *symmetry in groups*, *movement between groups*, *and insensitivity to proportional divisions*) will take a higher value when it is evaluated at the dominated distribution. This makes the use of these curves a robust procedure. However, if curves cross or if one is interested in quantifying the extent of segregation, the use of indexes satisfying the basic properties seems the most appropriate. One should keep in mind that when curves cross, the conclusion reached with an index may differ from that of others since even though all these local indexes have in common the aforementioned basic properties, they disagree regarding additional properties. This is a consequence of the different weights that each index gives to discrepancies in occupations between the benchmark and the distribution of the target group.[9]

While additive decompositions of indexes have been proposed in the literature of segregation, as far as we know, no decompositions of segregation curves have been yet suggested. In what follows, we offer two forms of decomposing local segregation curve S^g.[10] First, we present a decomposition of the curve according to a partition of occupations into several classes, and, second, we propose a decomposition of the curve according to a classification of individuals into several groups.

First, let occupations be classified into several mutually exclusive classes. Without loss of generality, consider two mutually exclusive classes, so that $(c^g;t) = (c^{g1}, c^{g2}; t^1, t^2)$. Following the decomposition proposed by Bishop *et al.* (2003) to decompose the Lorenz curve by population subgroups, define indicator G_1^j so that $G_1^j = 1$ if occupation *j* belongs

[9] These differences also appear in the literature of income distribution when measuring inequality and poverty with indexes consistent with the Lorenz and TIP criterion, respectively.
[10] The decompositions proposed here could also be applied to the traditional segregation curve.

to class 1 and $G_1^j = 0$ otherwise. Indicator G_2^j can be defined analogously. By using vector c^{g1}, we can build $\tilde{c}^{g1}$ as the J-dimensional vector resulting from enlarging vector c^{g1} with zero-values for those occupations that are not included in class 1, i.e. $\tilde{c}^{g1} = (c_1^g G_1^1, ..., c_J^g G_1^J)$. In other words, $\tilde{c}^{g1}$ is a fictitious distribution having the same dimension as the original distribution c^g so that it can be compared to the distribution of total employment *t*. Analogously, we can build distribution $\tilde{c}^{g2}$.

Proposition 1. Given a partition of occupations into two mutually exclusive classes so that the distributions c^g and t can be expressed as $(c^g; t) = (c^{g1}, c^{g2}; t^1, t^2)$, the local segregation curve $S^g{}_{(c^g;t)}$ for the target group, *g*, can be decomposed as follows:

$$S^g{}_{(c^g;t)}(\tau_j) = \frac{C^{g1}}{C^g} \tilde{S}^g{}_{(\tilde{c}^{g1};t)}(\tau_j) + \frac{C^{g2}}{C^g} \tilde{S}^g{}_{(\tilde{c}^{g2};t)}(\tau_j),$$

where $\tilde{S}^g{}_{(\tilde{c}^{gh};t)}(\tau_j) = \dfrac{\sum_{i \le j} c_i^g G_h^i}{C^h}$ $(h = 1, 2)$ represents the pseudo-segregation curve for fictitious distribution $(\tilde{c}^{gh}; t)$ once occupations have been ranked according to ratios $\dfrac{c_j^g}{t_j}$.[11]

Proof:

The segregation curve of $(c^g; t)$ can be decomposed as $S^g{}_{(c^g;t)}(\tau_j) = \dfrac{C^{g1}}{C^g} \dfrac{\sum_{i \le j} c_i^g G_1^i}{C^{g1}} + \dfrac{C^{g2}}{C^g} \dfrac{\sum_{i \le j} c_i^g G_2^i}{C^{g2}}$. Note that $\dfrac{\sum_{i \le j} c_i^g G_1^i}{C^{g1}}$ is the value of the pseudo-segregation curve corresponding to the distribution $(\tilde{c}^{g1}; t)$. Analogously, $\dfrac{\sum_{i \le j} c_i^g G_2^i}{C^{g2}}$ is the value of the pseudo-segregation curve corresponding to $(\tilde{c}^{g2}; t)$. This completes the proof.

□

[11] Note that $\tilde{S}^g{}_{(\tilde{c}^{g1};t)}$ does not represent the segregation curve of the distribution $(c^{g1}; t^1)$, nor that of fictitious distribution $(\tilde{c}^{g1}; t)$, since the ranking of occupations is that of the original distribution $(c^g; t)$. We call pseudo-segregation curve $\tilde{S}^g$ the segregation curve obtained when the ranking is that of curve S^g.

Note, first, that this decomposition can be straightforwardly generalized to K classes, and, second, even though curve $\tilde{S}^g$ is not a segregation curve, it can be easily interpreted. Thus, the expression:

$$SC_k = \frac{C^{gk}}{C^g} \frac{\tilde{S}^g_{(\tilde{c}^{gk};t)}(\tau_j)}{S^g_{(c^g;t)}(\tau_j)} \tag{1}$$

measures the contribution of class k to the value of the segregation curve S^g in the corresponding percentile. For instance, assume that the occupations are classified into four large categories. The above decomposition allows us to calculate the contribution of each class to each cumulative decile. In particular, we can determine the proportion of jobs in the first decile belonging to each class of occupations.

Moreover, function $S^g_{(\tilde{c}^{gk};t)}$ also enables us to determine how individuals of the target group working in occupations included in class k are distributed among non-cumulative deciles of the whole distribution. In this regard, expression

$$\tilde{S}^g_{(\tilde{c}^{gk};t)}(\tau_j + 0.1) - \tilde{S}^g_{(\tilde{c}^{gk};t)}(\tau_j) \tag{2}$$

indicates the proportion of the target individuals working in class k in each (non-cumulative) decile of total employment.

Second, without loss of generality, let individuals of the target group be classified into two mutually-exclusive subgroups, A and B, so that $(c_1^g,...,c_J^g) = (c_1^A + c_1^B,...,c_J^A + c_J^B)$. Denote by C^A (respectively C^B) the number of individuals of the target subgroup A (respectively B).

Proposition 2. If the target group can be divided into two mutually-exclusive subgroups A and B so that $(c^g;t) = (c^A + c^B;t)$, then the local segregation curve of the target group, $S^g_{(c^g;t)}$, can be decomposed as follows:

$$S^g_{(c^g;t)}(\tau_j) = \frac{C^A}{C^g} \tilde{S}^A_{(c^A;t)}(\tau_j) + \frac{C^B}{C^g} \tilde{S}^B_{(c^B;t)}(\tau_j),$$

where $\tilde{S}^{A}_{(c^A;t)}\left(\tau_j\right)=\frac{\sum_{i\le j} c_i^{\,A}}{C^A}$ represents the pseudo-segregation curve corresponding to $(c^A;t)$, and $\tilde{S}^{B}_{(c^B;t)}\left(\tau_j\right)=\frac{\sum_{i\le j} c_i^{\,B}}{C^B}$ is the pseudo-segregation curve corresponding to $(c^B;t)$, once occupations have been ranked according to ratios $\frac{c_j^g}{t_j}\forall j$.[12]

Proof:

Note that, on one hand, the segregation curve of $(c^g;t)$ can be decomposed as $S^{g}_{(c^g;t)}(\tau_j)=\frac{C^A}{C^g}\frac{\sum_{i\le j} c_i^{\,A}}{C^A}+\frac{C^B}{C^g}\frac{\sum_{i\le j} c_i^{\,B}}{C^B}$. On the other hand, the second component of the first and second addend is, respectively, the pseudo-segregation curve of target subgroups *A* and *B*, since occupations-sectors are ranked from low to high $\frac{c_j^g}{t_j}$ ratios with $j=1,...,J$ and not according to the corresponding ratios of each subgroup. This completes the proof.

□

This decomposition can also be straightforwardly generalized to more than two subgroups, and it is easily interpretable, so that expression

$$SC_A=\frac{C^A}{C^g}\frac{\tilde{S}^{A}_{(c^A;t)}(\tau_j)}{S^{g}_{(c^g;t)}(\tau_j)} \qquad (3)$$

measures the contribution of the target subgroup *A* to the segregation curve of the whole target group. For instance, in analyzing female occupational segregation, we can be interested in distinguishing between the contribution of high-educated women and that of low-educated. The above decomposition permits us to find out whether in the first decile of the distribution of occupations there are mainly low or high-educated female workers. Furthermore, if *A* represents the subgroup of high-educated female workers, expression

[12] Notice that $\tilde{S}^{A}_{(c^A;t)}$ does not represent the segregation curve of distribution $(c^A;t)$ since the ranking of occupations-sectors is that of the original distribution $(c^g;t)$.

$$\tilde{S}^{A}_{(c^A;t)}(\tau_j + 0.1) - \tilde{S}^{A}_{(c^A;t)}(\tau_j) \qquad (4)$$

enables us to determine how these women are distributed among the deciles of the whole distribution, i.e., whether they work in feminized jobs or not.

4. Occupational segregation in Spain

The data used in this paper comes from the Spanish Current Population Survey (EPA) conducted by the Spanish Institute of Statistics (INE) by following EUROSTAT's guidelines. This survey offers labor market information of a representative sample of Spanish households and is commonly used for international comparisons. Our data corresponds to the second quarter of the year 2007. Occupations are considered at a two-digit level of the CNO-1994 (*National Classification of Occupations*), and the list includes 66 occupations.

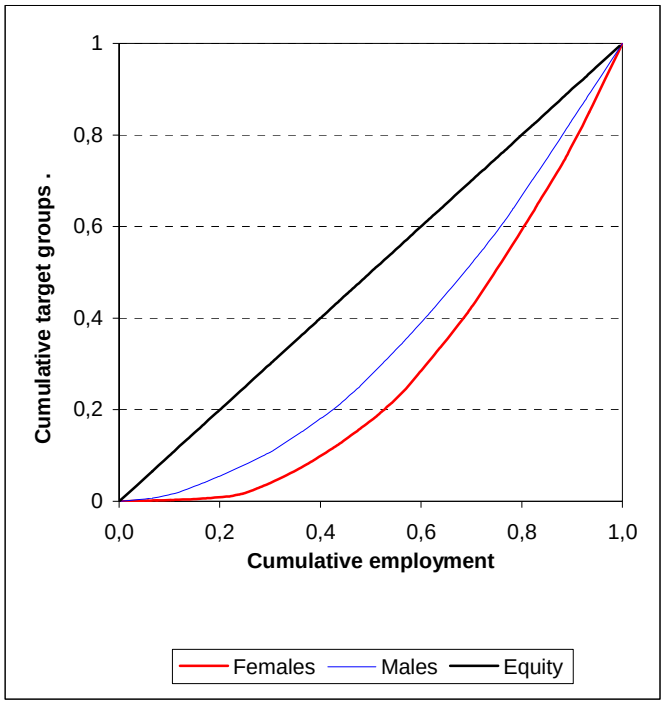

Figure 1. Local segregation curves of female and male workers.

The local segregation curves show that the distribution of male workers dominates that of females, since the curve corresponding to the former is above that of the latter (see Figure 1).[13] Therefore, the occupational segregation of female workers is higher than that of

[13] Intuition suggests that in the binary case, if one group has more members than the other, the segregation curve of the former cannot be dominated by that of the latter. This matter seems less problematic when there

males for any segregation index consistent with these curves. In fact, all the local indexes given in Table 1 show remarkable higher values for females than for males. Thus, one of them almost triples their value ($\Phi_{0.1}$), while others double it (Φ_a with $a = 0.5,\ 1,\ 2$).

LOCAL SEGREGATION	$\Phi_{0.1}$	$\Phi_{0.5}$	Φ_1	Φ_2	D^g	G^g	**Employment share (%)**
FEMALE SEGREGATION	0.57	0.42	0.33	0.27	0.33	0.42	41
MALE SEGREGATION	0.20	0.18	0.15	0.13	0.23	0.29	59
OVERALL SEGREGATION			M		I_p	G	
GENDER SEGREGATION			0.22		0.27	0.35	
FEMALE CONTRIBUTION (%)			59.8		50	50	
MALE CONTRIBUTION (%)			40.2		50	50	

Table 1. Local and overall segregation indexes (2 target groups), and employment shares.

Consequently, as shown in Table 1, even though female workers represent 41% of total employment, they contribute around 60% to overall gender segregation according to the mutual information index (which is related to local index Φ_1, as explained in Section 2.2). This contribution diminishes to 50% when using instead indexes I_p and G (which are related, respectively, to local indexes D^g and G^g). This difference probably arises from the fact that index Φ_1 gives a higher relative weight to strongly feminized and masculinized occupations than indexes D^g and G^g do. Note that in our case, there are important discrepancies between male and female distributions regarding occupations mainly dominated by the other sex. Thus, as shown in Figure 1, the range of occupations with almost no female workers is much larger than that with no males. In fact, 20% of the total employment corresponding to the most masculinized occupations of the economy only represents 0.9% of female workers, while 20% of the total employment corresponding to the most feminized occupations represents 5.5% of male workers (Table A3 in the Appendix shows a list of the top 10 most masculinized and feminized occupations).

In order to go further in the gender analysis, we study the occupational segregation of the economy in a multigroup context. Thus, we consider relevant partitions of individuals: by sex and age; sex and education level; sex and type of contract; sex and type of job; and sex

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are more than two target groups (which is the context where we focus in our remaining analysis). In any case, we should note that, even in the binary case, we cannot conclude which group suffers more segregation by just knowing its weight in the economy, since segregation curves can cross (see Appendix).

and salary level. For this purpose, we use several of the decompositions defined in Sections 2 and 3.

Sex and age

We can first wonder if occupational differences by sex only affect elderly workers, or also young cohorts. In order to answer this, we partition workers (both women and men) into three groups: young individuals (16 to 29 years old), middle-aged individuals (30 to 44 years old) and elderly individuals (over 45 years old). Therefore, six target groups are jointly considered in the analysis.

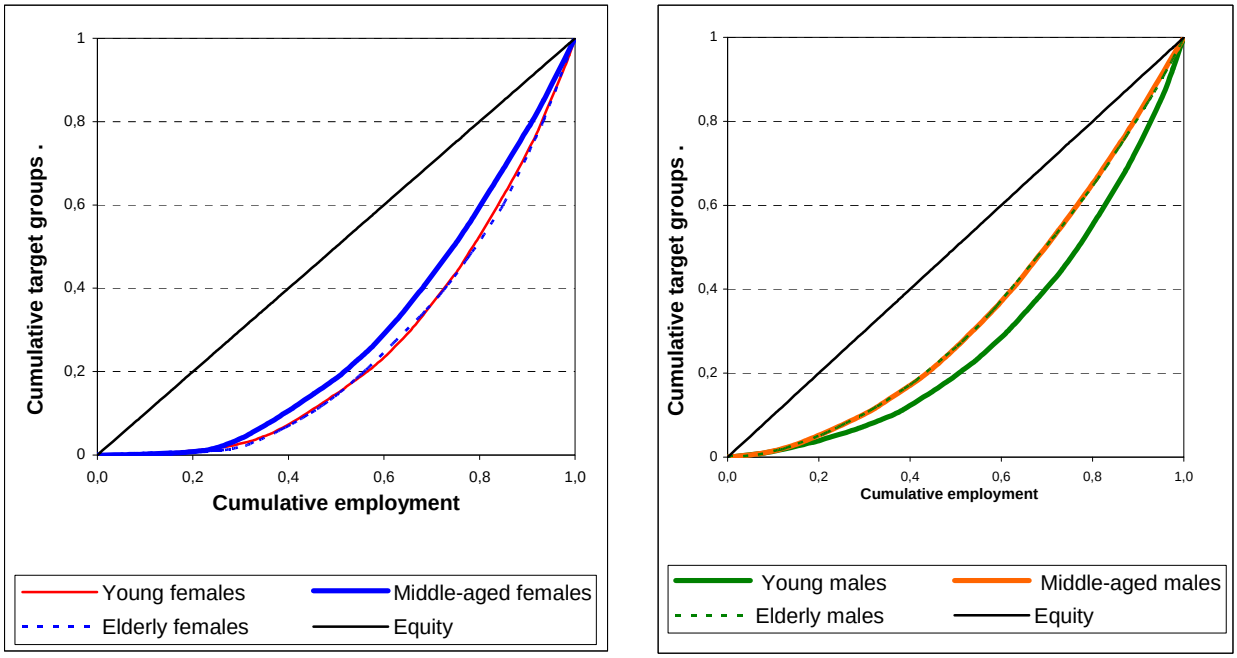


Figure 2. Local segregation curves by gender and age (6 target groups)

Figure 2 shows the local segregation curve of each of them. For the sake of clarity, female segregation curves are shown in the left side, while male segregation curves are shown in the right. We find that regarding female workers, the middle-aged group has the lowest segregation, since the corresponding curve dominates those of the remaining women, while with respect to males, the young-aged group in the one having the highest segregation. When using local segregation indexes, we confirm the above results (see Table 2). According to most indexes, we also find that the elderly female group has a segregation level that is higher than that of the young group, while for males the segregation of the middle-aged and elderly groups is rather similar. On the other hand, the

indexes suggest that in any age group, female workers suffer more segregation than males. Therefore, even when comparing young cohorts, segregation is higher for women.

Table 2 also shows the decomposition of female (male) segregation by age, according to index Φ_2,[14] which allows us to go further in the analysis (see column 7):

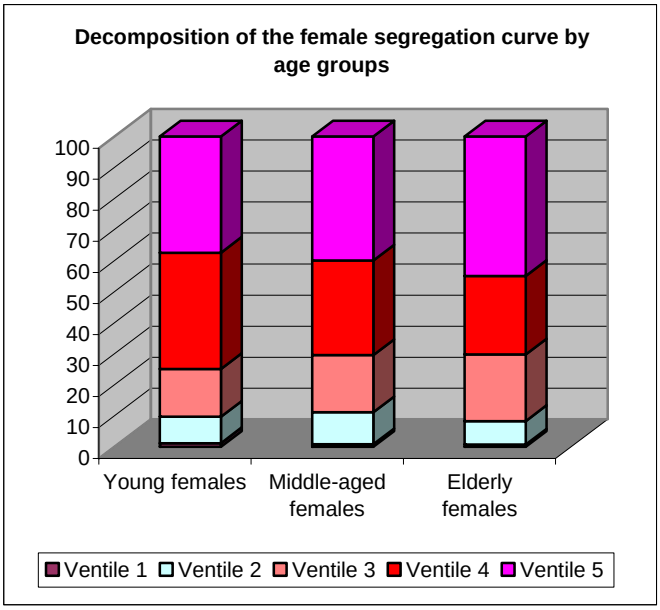
a) Elderly women contribute to explain female segregation at a higher extent than expected according to the demographic weight of this group (32.15% against 30.03%).
b) In the male case, both young and middle-aged workers contribute to male segregation at a higher extent than expected (25.72% against 22.98%, and 44.71% against 43.24%, respectively).

LOCAL SEGREGATION	$\Phi_{0.1}$	$\Phi_{0.5}$	Φ_1	Φ_2	D^g	G^g		**Decomposition of female/male segregation by age** Φ_2 **(%)**	**Distribution of female/male workers between groups of age (%)**
FEMALE WORKERS								100	100
<30 years old	0.67	0.49	0.40	0.38	0.37	0.48		24.79	25.28
30 to 44 years old	0.57	0.41	0.32	0.26	0.32	0.42		43.06	44.69
>45 years old	0.80	0.53	0.42	0.39	0.36	0.49		32.15	30.03
MALE WORKERS								100	100
<30 years old	0.35	0.31	0.29	0.30	0.31	0.42		25.72	22.98
30 to 44 years old	0.22	0.19	0.17	0.15	0.24	0.31		44.71	43.24
>45 years old	0.23	0.19	0.17	0.15	0.24	0.32		29.57	33.79

Table 2. Occupational segregation by sex and age (6 target groups), decomposition by age, and distribution of female and male workers by age.

We are now interested in determining how the female (male) target groups are distributed among the deciles of total employment when occupations are ranked from low to high feminization (masculinization) rates. In order to do this, we decompose the female (male) segregation curve by age groups (as explained in expression (4), except that here we use ventiles rather than deciles). As shown in Figure 3, almost 45% of elderly women work in the most feminized jobs of the economy (5th ventile), while this percentage is lower than 40% for the other two groups of age. Regarding males, we find that over 40% of young men work in the most masculinized jobs of the economy (5th ventile), while the other two groups are more evenly distributed across ventiles.

[14] The values of index Φ_2 for male and female workers are given in Table 1.



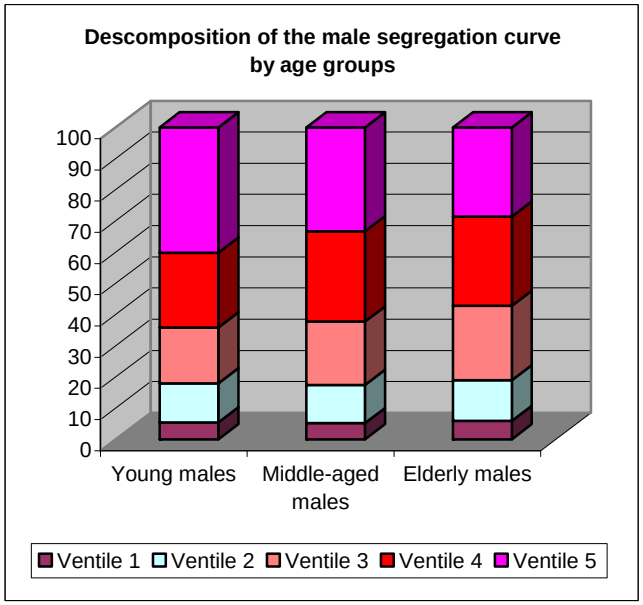


Figure 3: Decomposing female and male segregation curves by age groups.

Sex and education level

Both female and male workers have been now classified into three groups: low-educated (those who have not finished secondary school); intermediate-educated (those who have completed secondary school); and high-educated (those who have a college degree).[15] The distribution of workers among the three classes suggests that in the Spanish labor force the education level of female workers is higher than that of males (see Table 3, last column).

Figure 4 shows the local segregation curves of the six target groups (*F* represents female workers while *M* corresponds to males). When comparing male and female subgroups we find that the curves of intermediate-educated men clearly dominate those of any female educational subgroup. What is more, the segregation curve of high-educated men also dominates that of high-educated women.

[15] It also includes those who have obtained a degree in "formación profesional superior" (vocational training, 2nd technical college).

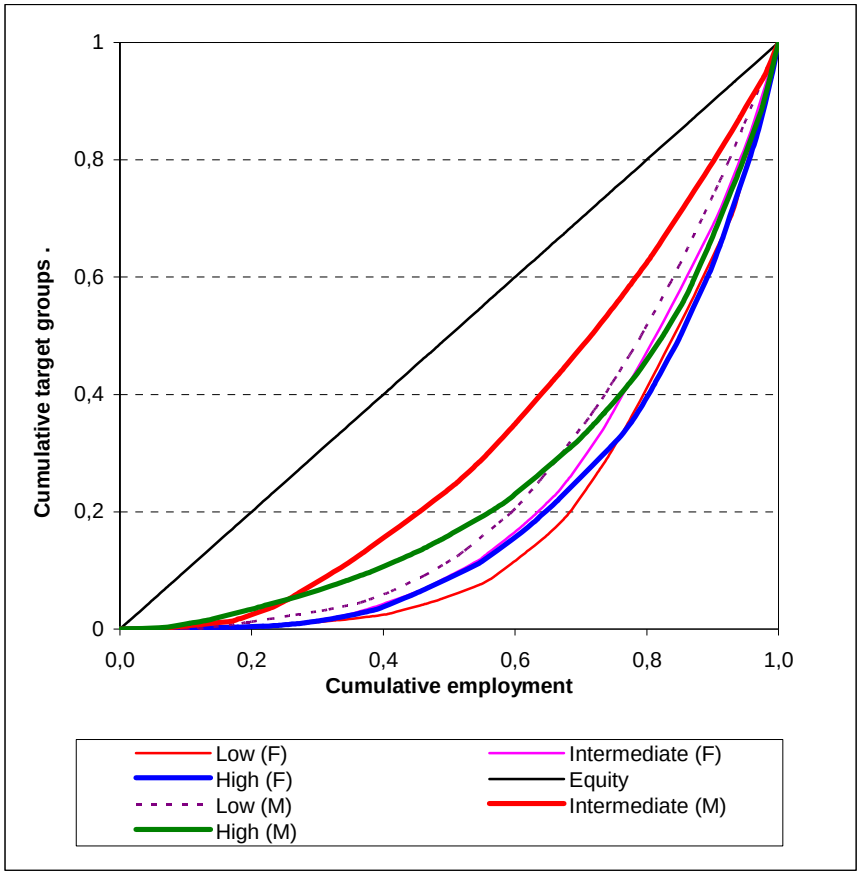


Figure 4: Local segregation curves by gender and educational level (6 target groups)

LOCAL SEGREGATION	$\Phi_{0.1}$	$\Phi_{0.5}$	Φ_1	Φ_2	D^*	G^*		**Decomposition of female/male segregation by education, Φ_2 (%)**	**Distribution of female/male workers between educational groups (%)**
FEMALE WORKERS								100	100
Low-educated	1.55	0.81	0.67	0.72	0.49	0.61		40.87	37.05
Intermediate-educated	1.20	0.67	0.54	0.53	0.44	0.55		27.26	24.82
High-educated	1.07	0.72	0.62	0.70	0.45	0.59		31.87	38.13
MALE WORKERS								100	100
Low-educated	1.22	0.56	0.44	0.40	0.40	0.50		66.43	48.25
Intermediate-educated	0.69	0.30	0.23	0.19	0.26	0.35		21.00	22.84
High-educated	0.48	0.43	0.41	0.49	0.37	0.50		12.57	28.91

Table 3. Occupational segregation by sex and education (6 target groups), decomposition of Φ_2, and distribution of female and male workers by education level.

Table 3 also shows that the occupational segregation level of female workers is higher for the low-educated, while most indices show that intermediate-educated women suffer the lowest segregation. A similar pattern is shown by the male distribution; even though the segregation level of any educational group is always lower for men. The decomposition of

female (male) segregation by education level according to index Φ_2 (see Table 3, column 7) shows that:

a) Low-educated women are the educational group that contributes at a higher extent to explain female segregation. Thus, this group explains about 41% of the segregation of female workers (this percentage is a little higher than expected according to the demographic weight of this group, which is 37%).

b) In the male case, the decomposition of the index by educational groups substantially differs from the demographic weight that each group has. In this vein, the contribution of low-educated men to male segregation is much higher than expected (66.4% against 48.3%), while the opposite happens when looking at the high-educated males (12.6% against 28.9%).

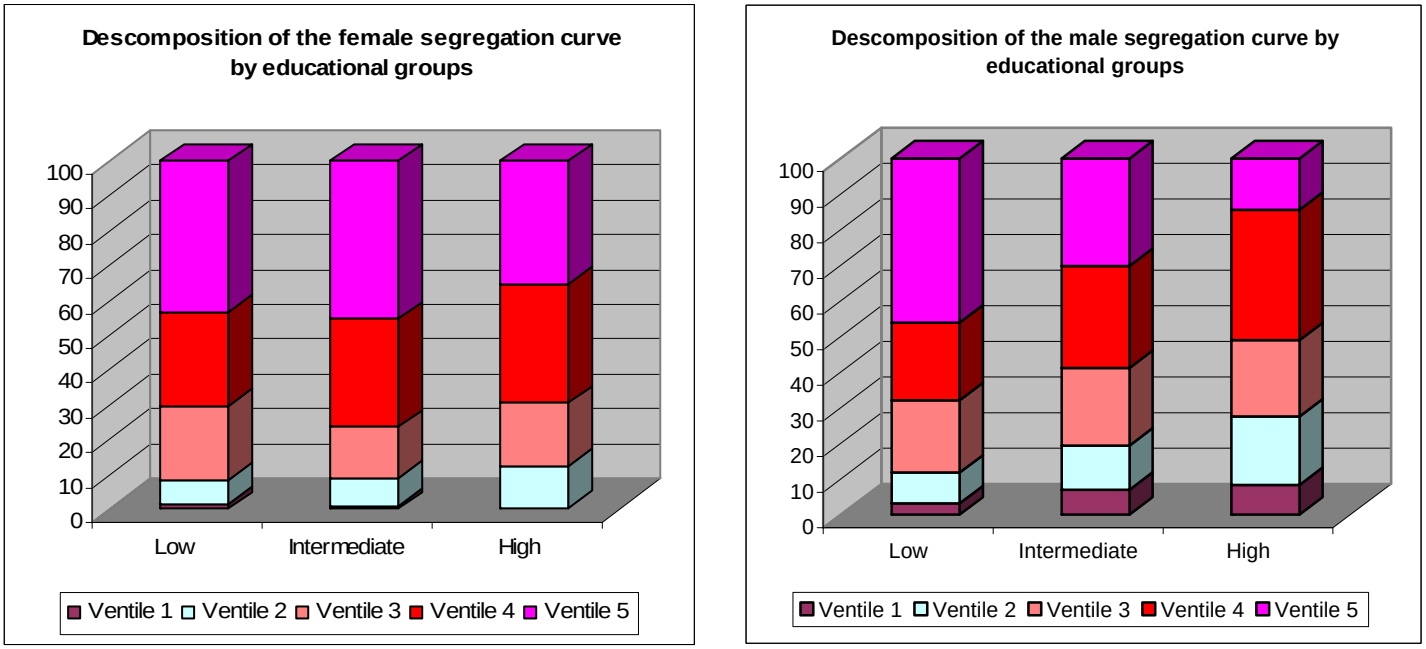


Figure 5: Decomposing female and male segregation curves by educational groups.

When decomposing the segregation curve of female workers by educational groups, we find that around 35% of high-educated women work in the most feminized jobs of the economy (5^{th} ventile), while this percentage rises to 43% and 45%, respectively, in the case of low- and intermediate-educated women (see Figure 5). Regarding males, we observe that the proportion of high-educated men who work in the most masculinized jobs is much lower (around 14%). The low-educated male workers, however, tend to concentrate in the 5^{th} ventile at a much higher extent (46%).

Sex and Type of contract (temporary versus permanent)

According to our data, 66.7% of female workers have permanent contracts, while this percentage rises to 69.2% in the case of male workers (see Table 4, last column).

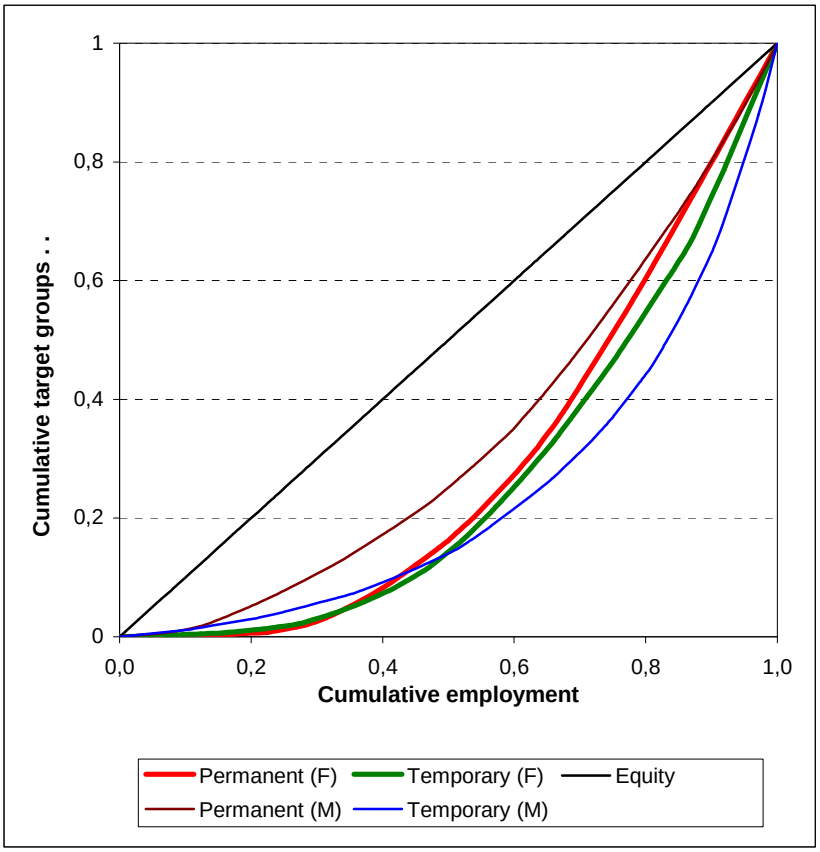


Figure 5: Local segregation curves by gender and type of contract (4 target groups)

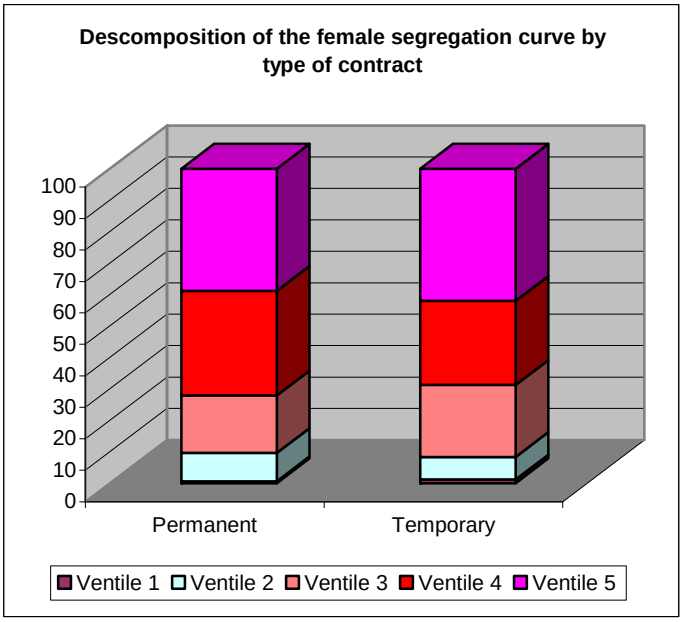
Figure 5 shows the segregation curves of four target groups: females with permanent jobs, females with temporary jobs, males with permanent jobs, and males with temporary jobs. We find that differences between female curves are rather small, while regarding males differences by type of contract seem remarkable. We also see that the curve of males with permanent contracts dominates those of workers with temporary contracts (including both men and women).

When using segregation indexes, the analysis shows that the occupational segregation level of permanent workers is much higher for women than for men, while the opposite happens with respect to temporary jobs according to most indexes (see Table 4). This is partially due to the remarkable differences between the segregation level of males having permanent jobs and those having temporary jobs. Thus, the decomposition of female (male) segregation according to local index Φ_2 shows that the distinction between

permanent and temporary contracts is more important to explain male segregation than female segregation, since in the former case the contribution of temporary jobs to occupational segregation is 10 points over what one would expect (40.6% against 30.8%), while in the latter case there is almost no difference (33.8% against 33.3%).

LOCAL SEGREGATION	$\Phi_{0.1}$	$\Phi_{0.5}$	Φ_1	Φ_2	D^*	G^*		**Decomposition of female/male segregation by type of contract, Φ_2 (%)**	**Distribution of female/male workers between groups (%)**
FEMALE WORKERS								100	100
Permanent	0.67	0.46	0.35	0.28	0.34	0.43		66.21	66.74
Temporary	0.61	0.46	0.38	0.35	0.36	0.47		33.79	33.26
MALE WORKERS								100	100
Permanent	0.24	0.21	0.18	0.17	0.25	0.33		59.36	69.22
Temporary	0.50	0.46	0.45	0.53	0.39	0.52		40.64	30.78

Table 4. Occupational segregation by sex and type of contract (4 target groups), decomposition of Φ_2, and distribution of female and male workers by type of contract.



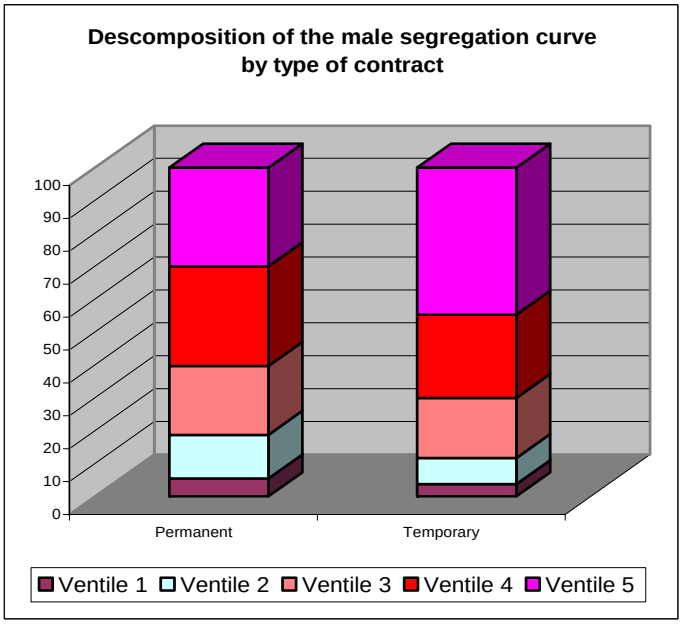


Figure 6: Decomposing female and male segregation curves by type of contract.

In line with the above results, Figure 6 indicates that the decomposition of the female segregation curve by type of contract does not show significant differences between the distribution of permanent jobs across ventiles and that of temporary jobs. However, when decomposing the male segregation curve remarkable discrepancies among both types of contract do appear. In fact, while male workers with permanent jobs have an even

distribution across ventiles, those with temporary jobs tend to concentrate in the most masculinized occupations of the economy (over 44% of them are in the 5th ventile).

Sex and type of job (part-time versus full-time)

About 23% of female workers have part-time jobs, while this ratio decreases to 4.3% regarding males, which means that women tend to concentrate in part-time jobs to a higher extent (Table 5, last column). One should keep in mind that, on one hand, over 31% of workers (either women or men) who work part-time do not do it because they prefer this option but because they have not found a full-time position. On the other hand, the reasons why men and women choose this type of job differ substantially. In this vein, family responsibilities is the main reason for 5% of men working part-time, while this percentage rises to over 34% in the case of females (figures provided by the INE).

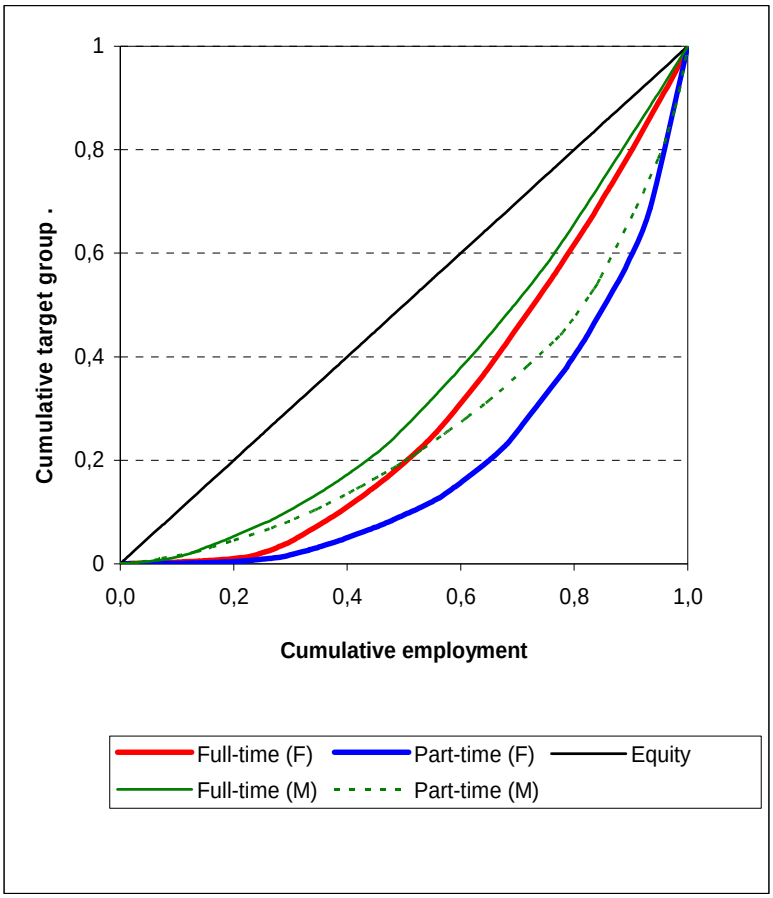


Figure 7: Local segregation curves by gender and type of job (4 target groups)

Figure 7 clearly shows that the segregation curve of men working full-time dominates those of women. Moreover, the segregation curve of males working part-time seems also to dominate that of their female coworkers. On the other hand, part-time female workers

suffer more segregation than the remaining female workers. In fact, the indexes strongly increase when comparing the former with the latter, duplicating in many cases its value (Table 5). The indexes also show that, even though occupational segregation of females is higher than that of males in the two cases, the type of job affects both sexes in the same direction.

LOCAL SEGREGATION	$\Phi_{0.1}$	$\Phi_{0.5}$	Φ_1	Φ_2	D^*	G^*		**Decomposition of female/male segregation by type of job, Φ_2 (%)**	**Distribution of female/male workers between groups (%)**
FEMALE WORKERS								100	100
Full-time	0.52	0.38	0.30	0.24	0.31	0.40		68.66	76.97
Part-time	1.12	0.72	0.62	0.75	0.45	0.59		31.34	23.03
MALE WORKERS								100	100
Full-time	0.22	0.19	0.17	0.14	0.24	0.31		99.68	95.71
Part-time	0.40	0.36	0.37	0.50	0.34	0.46		0.32	4.29

Table 5. Occupational segregation by sex and type of job (4 target groups), decomposition of Φ_2, and distribution of female and male workers by type of job.

The decomposition of index Φ_2 by type of job shows that the contribution of part-time employment to female segregation is about 31.3% (see Table 5, column 7), even though the demographic weight of this group is 23%, which implies that the effect of part-time jobs to the occupational segregation of women is higher than expected. However, the contribution of this type of job to male segregation is almost zero (value 4 points lower than its demographic weight).

On the other hand, the decomposition of the female segregation curve by type of job (see Figure 8) shows that part-time female workers tend to concentrate in the most feminized jobs of the economy at a higher extent than women working full-time (55% against 37% are in the 5^{th} ventile). In other words, part-time jobs are more feminized than full-time jobs. The degree of masculinization in the case of men working part-time is not so strong, since only 11% of them are in the most masculinized jobs of the economy. This value is much lower than the one corresponding to men working full-time (34% of them are in the 5^{th} ventile). In fact, when comparing the distribution of women and men working part-time across ventiles, we find that the latter are more evenly distributed across intermediate ventiles, while the former are not. Perhaps, the fact that only 4% of male workers are in part-time jobs can affect this result.

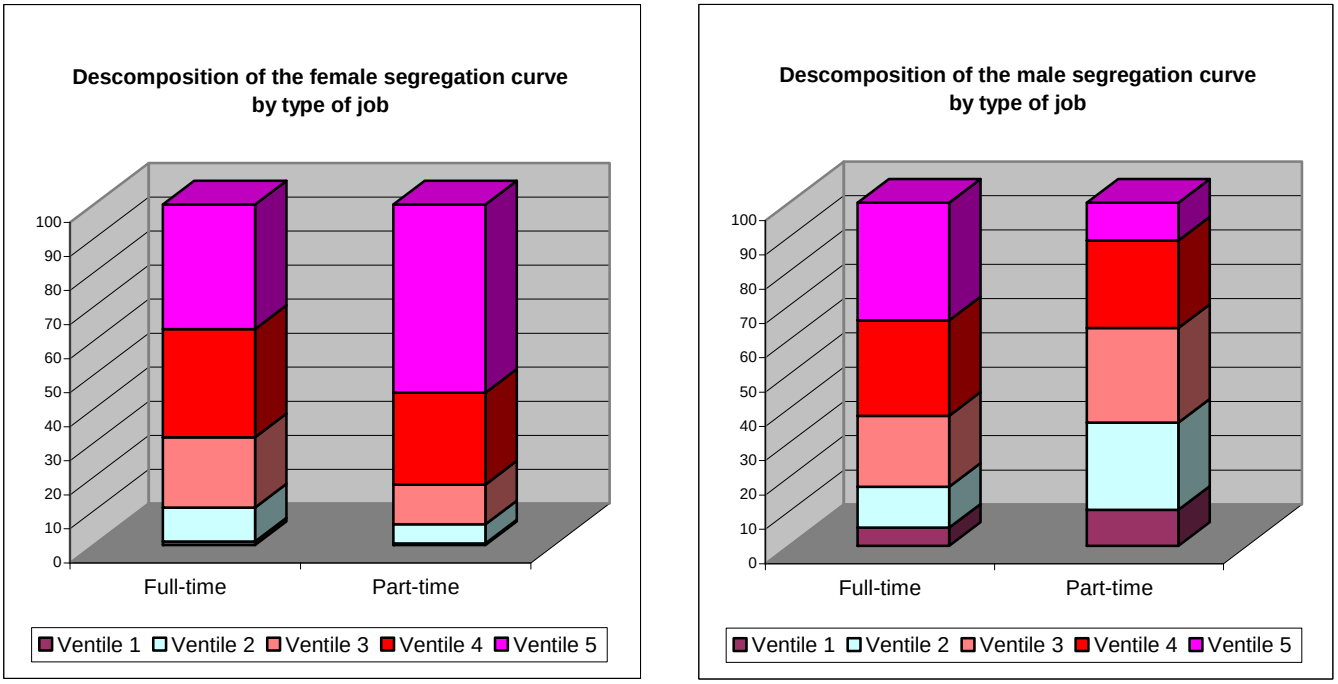


Figure 8: Decomposing female and male segregation curves by type of job.

Sex and salary level

In this section, the 66 occupations have been partitioned into three classes of similar sizes according to their average wage per hour. Since the EPA does not gather any salary data, this information comes from the Earning Survey (*Encuesta de Estructura Salarial*) conducted by the INE in 2002. As shown in Table 6, the distribution of female and male workers across the three classes is similar.

LOCAL SEGREGATION	$\Phi_{0.1}$	$\Phi_{0.5}$	Φ_1	Φ_2	D^*	G^*		**Within-Between decomposition of female/male segregation by occupational salary level Φ_1**	**Distribution of female/male workers between classes (%)**
FEMALE WORKERS								99.95% - 0.05%	100
Low wage	0.74	0.54	0.42	0.35	0.38	0.47			40.84
Intermediate wage	0.69	0.49	0.37	0.29	0.35	0.43			33.83
High wage	0.13	0.12	0.12	0.12	0.21	0.27			25.33
MALE WORKERS								99.95% - 0.05%	100
Low wage	0.30	0.25	0.21	0.17	0.27	0.33			40.37
Intermediate wage	0.19	0.17	0.16	0.15	0.25	0.31			33.00
High wage	0.07	0.07	0.06	0.05	0.14	0.18			26.63

Table 6. Occupational segregation by sex and salary (6 target groups), and distribution of female and male workers by salary level.

The analysis shown in Table 6 suggests that both women and men who are in low-paid jobs have higher occupational segregation, while lower segregation is achieved in high-paid jobs.[16] However, this partition does not seem helpful to explain either female or male occupational segregation, since the *between-group* component is near zero for both sexes. In other words, a classification of 66 occupations by their average salary does not seem relevant. The reason is that the distribution of females and males across classes is rather similar, which implies that all classes share a similar gender ratio (that of the whole economy). Perhaps a classification of occupations at a finer scale would permit one to find out more differences between the distributions of men and women across salary classes, since at two-digit level we find that the average salary per hour of male workers is always higher than that of females, which suggests the existence of segregation inside each of these groups of occupations. However, the Spanish data does not allow this analysis since the Earning Survey does not offer information at three-digit level.

5. Final remarks

When focusing on occupational segregation by gender, the indexes commonly used in the literature quantify the differences between the female and male distributions across occupations, i.e., they measure overall segregation. This paper has studied not only overall segregation but also the segregation of several population subgroups. In doing so, the distribution of any target group is compared with the distribution of overall employment across occupations. This allows measuring not only female segregation but also male segregation (and the segregation of any particular subgroup of women and men, as well).

We have shown that female segregation explains between 50 and 60 per cent of overall gender segregation (depending on the index being used), even though the demographic weight of this group in the labor force is 41 per cent. This means that the distribution of male workers across occupations is more equalitarian, even though it is far from being homogeneous.

The study of several population subgroups has allowed us to go further in the analysis of the differences between the two sexes by considering other relevant characteristics of the labor market. Thus, within the female group, we found that the young, and especially the

[16] For each class of occupations a different benchmark is considered. In particular, the distribution of high-paid jobs across occupations, rather than that of total employment, is the benchmark for the third class.

elderly, are the ones suffering the highest occupational segregation, while regarding males, segregation is higher for young workers, who clearly depart from the other two age groups. Our study about the effect of human capital on occupational segregation indicates that individuals having intermediate-education levels suffer lower segregation than those with higher education, both for women and men, which suggests that an increase in human capital does not necessarily reduce segregation. Therefore, even though the female labor force in Spain has experienced an important increase in its educational level in recent years, policy intervention seems to be essential in order to reduce the gender gap.

When classifying individuals by type of contract (permanent versus temporary), we found that this partition is more important to explain male segregation than female segregation. In this vein, the contribution of temporary jobs to the occupational segregation of male workers is much higher than expected, while for females there are almost no differences between their contribution and their demographic weight. On the contrary, part-time jobs have more power to explain the occupational segregation of female workers than that of males, since the former tend to concentrate in the most feminized occupations of the economy, while for men part-time jobs are more evenly distributed across occupations independently of the degree of masculinization. This finding is in line with that recently obtained by Bardasi and Gornick (2008) for a sample of OECD countries. In particular, they conclude that occupational differences between part- and full-time jobs explain a large portion of the wage gap between both types of female workers. Similar results have also been obtained in the Spanish labor market (Pagán, 2007). All of the above suggests that part-time jobs of women and men should be studied separately and in more detail by further research given its implications in terms of occupational segregation and wage differentials.

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Appendix

A simple analysis of local segregation curves in a binary context

The following examples illustrate that even in the binary case, one cannot conclude either which group suffers more segregation, or the relative position of their local segregation curves, by just knowing their weights in the economy. Thus, these examples show that even though male workers represent over fifty percent of the labor force, the occupational segregation curve of this group does not dominate that of female workers (their curves cross). As a consequence, the use of local segregation indexes becomes necessary.

Example 1:

	Females	**Males**	**Total**
Occupations			
1	20	130	150
2	40	130	170
3	147	3	150
Total	207	263	470

Table A1. Distribution of workers across occupations (example 1)

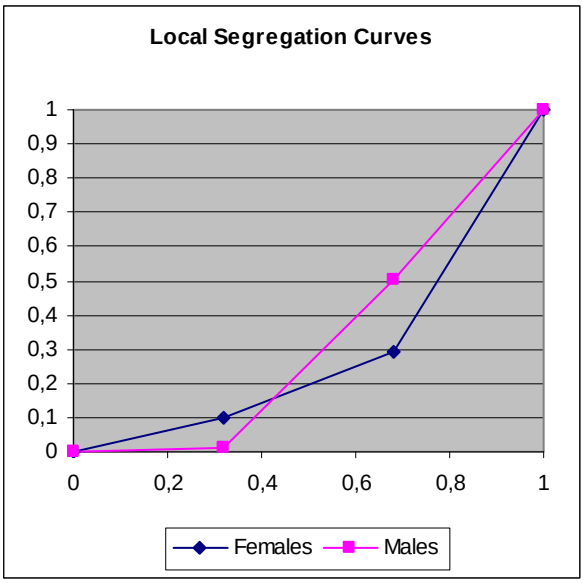

Figure A1. Female and male segregation curves in example 1.

In this example, male represent 56% of total employment, and that the slope of the female segregation curve is higher than that of males both at the origin and at the end. When calculating the entropy family of local segregation indexes, we observe that:

$$\Phi_1(c^F;t) = 0.3314 < \Phi_1(c^M;t) = 0.3326$$

$$\Phi_2(c^F;t) = 0.3563 > \Phi_2(c^M;t) = 0.2207 .$$

Therefore, according to index Φ_1 men are more segregated than women, but according to index Φ_2, the opposite holds.

Example 2:

	Females	**Males**	**Total**
Occupations			
1	20	160	180
2	160	70	230
3	70	30	100
Total	250	260	510

Table A2. Distribution of workers across occupations (example 2)

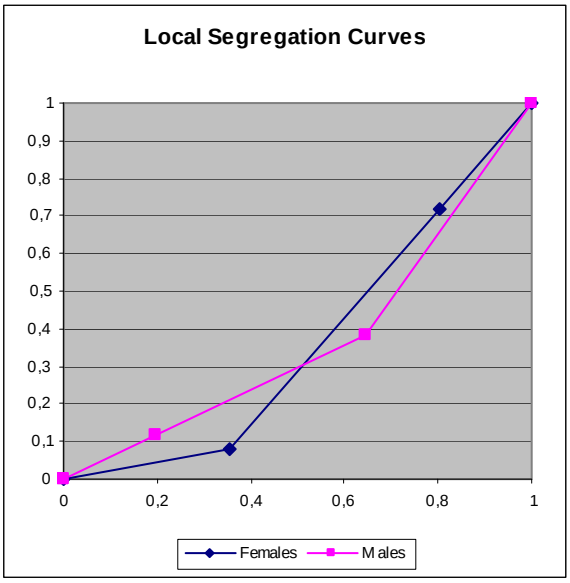

Figure A2. Female and male segregation curves in example 2.

In this case, the slope of the female segregation curve is lower than that of males both at the origin and at the end. Note that even though the proportion of male workers is higher than that of females (51% against 49%), we cannot conclude that the male group has lower segregation. In fact, when calculating the entropy family of local segregation indexes, we observe that:

$$\Phi_1(c^F;t) = 0.2050 > \Phi_1(c^M;t) = 0.1420$$

$$\Phi_3(c^F;t) = 0.1440 < \Phi_3(c^M;t) = 0.1678 .$$

Therefore, according to index Φ_1 women are more segregated than men, but according to index Φ_3, the opposite holds.

	Employment ratio (%)	Female employment ratio (%)
The 10 most-feminized occupations		
91. Domestic employees and other indoor cleaning personnel	6.59	93.73
51. Personnel services workers	3.97	86.67
27. Professions associated with a 1st cycle university degree in natural and health sciences, except in optics, physiotherapy and related services	1.08	84.21
28. Professions associated with a 1st cycle university degree in teaching	1.92	75.92
44. Assistant clerks (with customer service tasks not classified previously)	2.76	74.88
45. Employees in direct contact with the public in travel agencies, receptionists, telephone operators	1.05	74.30
43. Assistant clerks (without customer service tasks not classified previously)	2.07	73.33
46. Cashiers, tellers and other similar personnel in direct contact with the public	1.23	72.48
53. Retail workers and the like	5.00	70.70
32. Technicians in child education, flight instructors, vehicle navigation and driving	0.22	67.12
The 10 most-masculinized occupations		
70. Work site managers and foremen	0.58	0.63
71. Workers at structural construction works and the like	5.13	0.97
75. Welders, auto body workers, metal structure fitters, blacksmiths, tool manufacturers	1.69	1.16
73. Metallurgy and mechanical workshop foremen	0.24	1.22
76. Mechanics and adjusters for electric and electronic machinery and equipment	2.57	1.44
85. Locomotive machinist, operators of agricultural machinery and mobile heavy equipment, and seamen	1.32	1.71
72. Workers dedicated to finishing constructions and the like (painters and related workers)	3.76	1.98
96. Construction laborers	2.41	3.07
74. Extractive industry workers	0.14	3.61
86. Drivers of vehicles for urban or road transport	3.81	3.61

Table A3. The most- and least-feminized occupations: Employment share in each occupation, and proportion of female workers, with respect to total employment, in each occupation.

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