

GENDER SEGREGATION BY OCCUPATIONS IN THE PUBLIC AND THE PRIVATE SECTOR. THE CASE OF SPAIN

RICARDO MORA
JAVIER RUIZ-CASTILLO
Universidad Carlos III Madrid

In many countries, non-discriminatory recruiting procedures, as well as other job characteristics, make public sector employment especially attractive to women. In the first empirical paper comparing gender segregation in the public and the private sectors, an additively decomposable segregation index based on the entropy concept is applied to Spanish data for the 1977-1992 period. It is found that during this period the gender segregation related to sector choices is larger in the public sector. But this is offset by the fact that gender segregation induced by occupational choices is larger within the private sector. The difference in occupational gender segregation between the two sectors is mainly accounted for gender composition effects in 1977 and occupational mix effects in 1992.

Keywords: Additively decomposable entropy indexes, gender segregation, public sector hiring procedures.

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1. Introduction

There are several reasons that help explain why some people are drawn to employment in the public rather than the private sector. Job tenure, the organization of work along clearly established hierarchical lines,

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and the important role of seniority in promotion are attractive features of public employment for many people of both genders. However, there are other reasons that make the public sector especially attractive to women. First, public organisms are heavy demanders of administrative and other white collar and professional skills in which women can easily compete with men. In particular, in many countries the public sector plays an important role in the provision of certain educational and health services in which women have been traditionally considered to have a comparative advantage. Second, relative to the private sector, working conditions in public jobs often offer a degree of flexibility that permit women to make participating in the labor market compatible with domestic burdens. Last but not least, in many countries openings in certain occupations within the public sector are filled through publicly advertised examinations, open to anyone with the appropriate educational credentials—a system of job provision that leaves little room for gender discrimination by the employer.

In spite of these differences, the literature on occupational gender segregation has implicitly treated all occupations as homogeneous across sectors.¹ To our knowledge, the comparison of this phenomenon in the private and the public sector has not yet been attempted. In our view, such a study must begin by recognizing that in most countries the public sector is not present in all occupations while the Armed Forces are exclusively public. Correspondingly, this paper focuses on what is called the *divisible economy*, that is, the subset of occupations that can be meaningfully divided into a private and a public sector of a minimum size. Employed people in the divisible economy are assumed to make two choices: whether to work in the private or the public sector, and which occupation to work in among those available in the divisible economy.

For the reasons mentioned above, in most countries the female share of total employment in the public sector can be safely expected to be larger than in comparable private sector jobs. There is little doubt that such asymmetry in the female share of employment by sector would tend to increase the overall gender segregation in the divisible economy as a whole. But regardless of the size of the female share in a

¹The seminal article on (residential) segregation is Duncan and Duncan (1955). For recent contributions to gender segregation, see the special issues of the *Journal of Econometrics*, 1994, 61(1), and *Demography*, 1998, 35(4), as well as the treatise by Flückiger and Silber (1999).

given population, by occupational gender segregation is generally understood the tendency of men and women to be differently distributed across occupations. We can think of gender patterns in labor market outcomes as the result of voluntary choices that reflect differences in individual preferences, as well as technological constraints that favor some gender skills over others in certain economic activities. But gender segregation may also be a mechanism for social enforcement of wage and other forms of gender discrimination. Therefore, the main question addressed in this paper, namely whether on balance these forces work differently within the public and the private sector, is an interesting topic from the point of view of both positive and normative economics.

Most previous studies in the existing literature measure the gender segregation of the entire employed population along a single dimension, namely, the gender segregation induced by occupational choices.² To investigate an issue that involves a pair of classification variables, the sector and the occupation, an appropriately decomposable segregation index is required. In this context, a segregation index is said to be additively decomposable if it can be expressed as the sum of two components: a *between-group* term, which captures the contribution of sector choices to gender segregation, and a *within-group* term, which captures the effect that motivates this paper, namely, the gender segregation induced by occupational choices within each of the two sectors.³

This paper uses an entropy based segregation index, first introduced by Theil and Finizza (1971) and Fuchs (1975), that has been recently extended to the multidimensional case by Herranz *et al.* (2003) and Mora and Ruiz-Castillo (2003a). As shown in Mora and Ruiz-Castillo (2003b): 1) this index satisfies twelve desirable properties discussed during the last two decades in the literature on gender segregation for

²On a few occasions, some authors have classified all existing jobs according to two dimensions in order to study different structural aspects of gender segregation in a given moment of time; for instance, the effect of aggregation from three- to two-digit occupations on gender segregation, or the relative importance of the gender segregation induced by either the occupational or the industrial choice –see Sections 7.2 to 7.5 in Flückiger and Silber (1999) and Herranz *et al.* (2003).

³For an alternative decomposition into three terms using the Gini-Segregation Index, see Silber (1989), Boisso *et al.* (1994), Deutsch *et al.* (1994), and Sections 7.4 and 7.5 of Flückiger and Silber (1999). For the decomposition of the Karmel and MacLachlan (1988) segregation index into three terms see Borghans and Groot (1999).

the single-dimensional case; 2) it can be motivated as a monotonic transformation of the log-likelihood ratio test for, first, the equality of the male and female employment distributions across occupations, and, second, the equality of the female employment shares by occupation; and 3) so far it is the only index of gender segregation that is additively decomposable in the sense previously indicated.

More importantly for our purposes, the structure of the index allows the overall gender segregation to be conveniently expressed as the weighted average of the gender segregation in each sector. The magnitude of interest, that is, the difference between the occupational gender segregation within the private and the public sector in a given moment of time, will be seen to depend on three factors, namely, the difference between the two sectors in: 1) the female share in total employment; 2) the occupational mix, that is, the demographic importance of each occupation; and 3) the gender composition across occupations. Some authors argue that rigorous pair-wise comparisons of gender segregation must be made independent from changes in the share of employment by gender (composition invariance), and from changes in the occupational structure (occupational invariance).⁴ Following a well-known strategy, it will be shown how to isolate the third factor, i.e. the gender composition across occupations, holding constant a reference female employment share and a reference set of demographic weights.⁵

The relevance of the approach is illustrated with an empirical application using labor force survey data from Spain for the 1977-1992 period. Spain is an interesting country for our purposes. All the features that make the public sector especially attractive to women and, in particular, its recruiting (and promotion) methods, are already present in the period prior to 1977. Thus, at that date the female share of employment in the divisible economy in the private and the public sector is 19.4 and 30.1, respectively. These features remain in place from 1977 to 1992. The novelty is that during this period there is a sizeable increase in public sector employment, as well as in the female labor market participation and in the proportion of women who hold a private or a public sector job: in 1992 the female share of employment

⁴See, in particular, Blackburn *et al.* (1995), and Charles (1992).

⁵For examples of this strategy, see Fuchs (1975), Blau and Hendricks (1979), Jonung (1984), and Beller (1985). For a criticism of this, see Watts (1992), and for a full discussion, see Mora and Ruiz-Castillo (2003b).

in the private and the public sector become 29.1 and 45.8, respectively. Against this background, the paper investigates in detail the differences in gender segregation between and within the private and the public sectors in 1977 and 1992, as well as the evolution of these phenomena during the entire period.

The main findings are the following.

(i) During the 1977-1992 period, the overall gender segregation in the private sector is slightly increasing and it is always greater than in the public sector.

(ii) Since the female employment share in the public sector is greater than in the private sector, the direct gender segregation induced by sector choice throughout the period is greater in the public sector. In contrast, gender segregation induced by occupational choices is always larger within the private sector and the gap between the two sectors slightly increases over time.

(iii) In particular, the occupational gender segregation within the private sector in 1977 and 1992 is 25% and 50% larger than within the public one, respectively. Gender composition effects account for 69% and 5% of the gap in within-group gender segregation at those dates. The remaining 31% and 95% can be essentially attributed to differences in the occupational mix by sector.

The rest of the paper contains four Sections and an Appendix. Section 2 is devoted to the measurement of segregation. Section 3 describes the data and studies the evolution of overall gender segregation during the 1977-1992 period in each sector and also in the divisible economy as a whole. Section 4 analyzes in detail the difference in occupational gender segregation within both sectors. Section 5 summarizes and discusses the main results. The description of the data and the list of occupations used in the paper are relegated to the Appendix.

2. The measurement of segregation

In this section, the index of segregation is presented.⁶ Consider an economy in which employed people in an occupation can be grouped in terms of a second characteristic, say whether they work in the private or the public sector. Let there be J occupations, indexed by $j = 1, \dots, J$, classified into 2 sectors, $i = 1, 2$, where 1 and 2 denote

⁶See Mora and Ruiz-Castillo (2003a, 2003b) for a full discussion.

the private and the public sector, respectively. Let F_{ij} and T_{ij} be the number of females and people of both genders, respectively, in occupation j within sector i . Let $F_i = \sum_j F_{ij}$ and $T_i = \sum_j T_{ij}$ be the number of females and people in sector i , and let $F = \sum_i F_i$ and $T = \sum_i T_i$ be the total number of females and people in the employed population. Let $w_{ij} = F_{ij}/T_{ij}$, $W_i = F_i/T_i$, and $W = F/T$ be the female share of total employment in occupation j within sector i , in sector i , and in the population as a whole, respectively.

The population is said to be segregated in occupation j in sector i whenever w_{ij} differs from W . In information theory, the expression

$$I_{ij} = w_{ij} \log(w_{ij}/W) + (1 - w_{ij}) \log((1 - w_{ij}) / (1 - W)) \quad [1]$$

is known as the expected information of the message that transforms the proportions $(W, (1 - W))$ to a second set of proportions $(w_{ij}, (1 - w_{ij}))$. The value of this expected information is zero when the two sets of proportions are identical; it takes larger and larger positive values when the two sets are more different. The index I_{ij} provides what is called a *direct* measure of gender segregation in occupation j in sector i in relation to the entire employed population. When the female share in total employment is low (W small), the presence of an all-female occupation j in sector i ($w_{ij} = 1$) intuitively implies a large value of I_{ij} . The weighted average of the I_{ij} s, with weights proportional to the number of people T_{ij} in occupation j within sector i , provides a reasonable overall measure of occupational segregation:

$$I = \sum_i \sum_j (T_{ij}/T) I_{ij}.$$

This bounded measure of overall gender segregation⁷ can be decomposed into two components: a *between-group* term and a *within-group* term. The expected information of the message that transforms the proportions $(W, (1 - W))$ into the proportions $(W_j, (1 - W_i))$ in sector i is given by

$$I_i = W_i \log(W_i/W) + (1 - W_i) \log((1 - W_i) / (1 - W)). \quad [2]$$

Consider the weighted average of the I_i s with weights proportional to the number of people in each sector, that is,

$$I^B = \sum_i (T_i/T) I_i. \quad [3]$$

⁷The entropy of the distribution characterized by the proportions $(W, (1 - W))$ is defined by $E = W \log(1/W) + (1 - W) \log(1/(1 - W))$. As shown in Mora and Ruiz-Castillo (2003a), I can take values in the interval $[0, E]$, and E in turn is normalized in the unit interval by taking logs in base 2.

Equation [3] can be interpreted as the *between-group* (direct) gender segregation induced at the sector level. In the second place, the expected information of the message that transforms the proportions $(W_i, (1 - W_i))$ into the proportions $(w_{ij}, (1 - w_{ij}))$ is given by

$$I^{ij} = w_{ij} \log(w_{ij}/W_i) + (1 - w_{ij}) \log((1 - w_{ij}) / (1 - w_i)) \quad [4]$$

The occupational segregation within sector i as a whole is defined by

$$I^i = \sum_j (T_{ij}/T_i) I^{ij}. \quad [5]$$

Thus, the *within-group* gender segregation in the partition by sector can be defined as

$$I^W = \sum_i (T_i/T) I^i. \quad [6]$$

As shown in Mora and Ruiz-Castillo (2003a), it turns out that

$$I = I^B + I^W. \quad [7]$$

This is a useful decomposition, where the term I^W measures the gender segregation induced by occupational choices within both sectors, the impact of the sector choice being kept constant in I^B .⁸

On the other hand, taking into account equations [3] and [6], it can be seen that

$$I = \sum_i (T_i/T) I(i), \quad [8]$$

where $I(i) = I_i + I^i$ is the overall gender segregation in sector i . Equation [8] indicates that the gender segregation in the divisible economy, I , is the weighted average of gender segregation in each sector, $I(i)$, with weights equal to their relative demographic importance in the economy as a whole, T_i/T .

Consider now the difference between the overall gender segregation indexes in the two sectors, denoted by Δ :

$$\Delta \equiv I(1) - I(2) = (I_1 - I_2) + (I^1 - I^2). \quad [9]$$

The index I_i measures the direct segregation induced by the discrepancy between the proportion of females in the economy, W , and the proportion of females in sector i , W_i (see equation [2]). For later reference, the term $(I_1 - I_2)$ will be denoted by Δ^B .

⁸As shown in Mora and Ruiz-Castillo (2003a), the index has a commutative property where the role of the variables i and j can be reversed. However, such property will not be used in the sequel.

The index I^i measures the occupational gender segregation within sector i (see equation [5]). The main magnitude of interest for our purposes, denoted by Δ^W , can be written as:

$$\Delta^W \equiv I^1 - I^2 = \sum_j (T_{1j}/T_1) I^{1j} - \sum_j (T_{2j}/T_2) I^{2j}.$$

This expression is seen to depend on two factors. First, differences in the two sectors' occupational mix, that is, in the demographic importance of each occupation with respect to total employment in each sector, (T_{1j}/T_1) and (T_{2j}/T_2) , $j = 1, \dots, J$. Second, differences in the within-group segregation indexes I^{1j} and I^{2j} for each j . Consequently, given some reference demographic weights α_j , the term Δ^W can be expressed as follows:

$$\Delta^W = \text{OCUPMIX} + \sum_j \alpha_j [I^{1j} - I^{2j}], \quad [10]$$

$$\text{OCUPMIX} = \sum_j [(T_{1j}/T_1) - \alpha_j] I^{1j} + [(\alpha_j - (T_{2j}/T_2))] I^{2j}.$$

Recall now that, in every sector i and occupation j , $I^{ij} = w_{ij} \log(w_{ij}/W_i) + (1 - w_{ij}) \log((1 - w_{ij})/(1 - W_i))$ -see equation [4]. Therefore, in this framework the difference between I^{1j} and I^{2j} in an occupation j can be attributed to two factors: the difference between the sector female shares, W_1 and W_2 , and the difference between the gender composition in that occupation, w_{1j} and w_{2j} . Thus, even if $w_{1j} = w_{2j}$ for all j , the fact that $W_1 \neq W_2$, will cause the algebraic term in equation [10] to be non-zero. To separate these two effects, in this paper the proportion of females in the divisible economy, W , will be taken as the reference female share. Then, taking into account that $I_{ij} = w_{ij} \log(w_{ij}/W) + (1 - w_{ij}) \log((1 - w_{ij})/(1 - W))$ -see equation [1]- the algebraic expression in equation [10] can be written as

$$\sum_j \alpha_j [I^{1j} - I^{2j}] = \text{FEMSHARE} + \text{GENCOM}$$

$$\text{FEMSHARE} = \sum_j \alpha_j [(I^{1j} - I_{1j}) + (I_{2j} - I^{2j})]$$

$$\text{GENCOM} = \sum_j \alpha_j [I_{1j} - I_{2j}].$$

Therefore, as pointed out in the Introduction, we have

$$\Delta^W = \text{FEMSHARE} + \text{OCUPMIX} + \text{GENCOM}. \quad [11]$$

Equation [11] indicates that the difference between the occupational gender segregation within the two sectors in a given moment of time

can be accounted for three factors: 1) FEMSHARE, which captures the effect of the discrepancy between the actual female employment shares in the two sectors and in the divisible economy; 2) OCUPMIX, caused by the differences between the occupations' actual demographic shares in each sector and the reference weights α_j , and 3) GENCOM, which is attributable to the differences in the gender composition across occupations, holding constant the reference female share W and the demographic weights α_j .

3. The evolution of gender segregation in the divisible economy

As explained in the Appendix, the data for this paper comes from the second quarter of the Spanish EPA (*Encuesta de Población Activa*), a labor force survey representative of the household population living in residential housing. Because this survey is available in electronic support from the third quarter of 1976, the period studied here starts in 1977. In 1993 and 1994 there are fundamental changes in the National Classification of Occupations (NCO) and in the National Classification of Industries (NCI), making it impossible to compare the 1977 data with the data collected starting in 1993. Therefore, the period studied is 1977-1992.⁹

In many occupations the role of the public sector is either very small or inexistent. On the contrary, the Armed Forces are exclusively public. It is clear that a comparison of occupational gender segregation in the two sectors would be distorted by these cases. Therefore, this paper refers to what is called the divisible economy, namely, the subset of the 29 available occupations that can be meaningfully divided into a private and a public sector of a minimum size. The 14 occupations that make up the divisible economy and the criteria used to identify them are fully described in the Appendix.

From 1977 to 1992, the employed population in the divisible economy grows by 17.18%, while the share of public jobs goes from 20.7% in 1977 to 29% in 1992.¹⁰ In 1977, the female share in total employment,

⁹The period starting in 1993 to the present covers a considerably shorter period and is less intense in terms of public employment growth.

¹⁰Instead, the employed population in the larger economy consisting of 29 occupations increases by only 2%, approximately, but, whereas employment in the private sector actually decreases by 600,000 persons, in the public sector there is an increase of 847,000 jobs (see Mora and Ruiz-Castillo, 2003a). As reported in the Appendix,

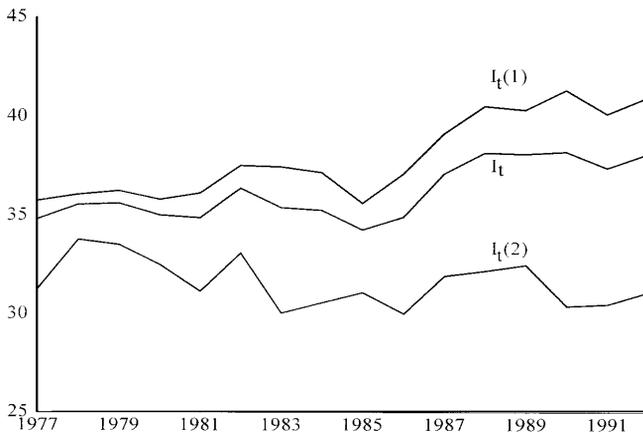
$W_{77} = 21.6$, is even lower than in the economy as a whole, 28.6. In 1992, this crucial parameter, which undergoes a 15% increase in the larger economy, grows by as much as 57% in the divisible economy where it reaches the value $W_{92} = 33.9$. In this scenario of increased total employment, increased weight of the public sector, and increased female labor participation in the divisible economy, the first question to be asked is how overall gender segregation has evolved during this period.

According to equation [8], gender segregation in a given year t , I_t , can be expressed as the weighted average of the overall gender segregation in the private and the public sectors, $I_t(1)$ and $I_t(2)$, respectively:

$$I_t = (T_{1t}/T_t) I_t(1) + (T_{2t}/T_t) I_t(2) .$$

As can be seen in Figure 1, the overall gender segregation in the private sector slightly increases during this period, while it remains essentially constant in the public sector. The gender segregation in the divisible economy increases from 34.8 to 38.1, or 9.4% in 15 years.¹¹ As already pointed out, the importance of the public sector increases during the period, from $(T_{277}/T_{77}) = 20.7$ to $(T_{292}/T_{92}) = 29.0$. Therefore, the gap between I_t and $I_t(1)$ slightly grows with time.

FIGURE 1
Evolution of overall gender segregation by sector: 1977-1992



Note: $I_t = (T_{1t}/T_t)I_t(1) + (T_{2t}/T_t)I_t(2)$ where
 I_t = Overall gender segregation in the divisible economy in a given year t .
 $I_t(1)$ = Overall gender segregation in the private sector in a given year t .
 $I_t(2)$ = Overall gender segregation in the public sector in a given year t .

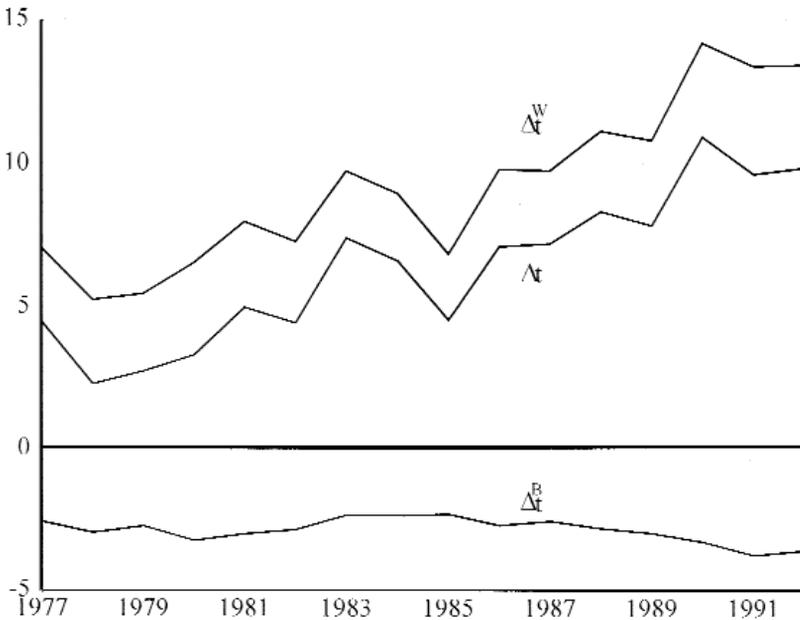
¹¹To facilitate the reading of the paper, all gender segregation indices have been multiplied by 100.

The next question is how to account for the difference between the private and the public sector overall gender segregation. Denote this difference in a given year t by $\Delta_t = I_t(1) - I_t(2)$. Recall that, for each i and t , $I_t(i) = I_{it} + I_t^i$. The index I_{it} measures the direct gender segregation induced by the discrepancy between the female shares in the divisible economy and the i -th sector, W_t and W_{it} , respectively. The index I_t^i measures the occupational gender segregation within sector I , induced by the discrepancy between W_{it} and the set of female shares in each occupation, w_{ijt} , $j = 1, \dots, J$. Therefore, as shown in equation [9], Δ_t can be written as:

$$\Delta_t = \Delta_t^B + \Delta_t^W,$$

where $\Delta_t^B = I_{1t} - I_{2t}$, and $\Delta_t^W = I_{1t} - I_{2t}$. The evolution of Δ_t , Δ_t^B , and Δ_t^W is depicted in Figure 2.

FIGURE 2
Evolution of the differences in between and within sector gender segregation: 1977-1992



Note: $\Delta_t = \Delta_t^B + \Delta_t^W$ where
 $\Delta_t = I_t(1) - I_t(2)$: Difference between the private and the public sector overall gender segregation in a given year t .
 $\Delta_t^B = I_{1t} - I_{2t}$: Difference between the private and the public sector between-group gender segregation induced by the sector choice in a given year t .
 $\Delta_t^W = I_t^1 - I_t^2$: Difference between the private and the public sector within-group gender segregation induced by occupational choices in a given year t .

As argued in the Introduction, there are many reasons for the public sector to be especially attractive to women. Since such reasons have been present in Spain before 1977, it comes as no surprise that the female share in the private and the public sector at that date is $W_{177} = 19.1$ and $W_{277} = 30.1$, respectively. However, during the 1977-1992 period this share goes through a similar relative increase in both sectors: from 19.1 to 29.1 in the private sector and from 30.1 to 45.8 in the public sector, or a 50% and a 52% increase, respectively, relative to 1977. Since, for any year t , the employment share in the private sector is larger than in the public one, $(T_{1t}/T_t) > (T_{2t}/T_t)$, the difference in absolute terms between W_{2t} and W_t must be larger than that between W_{1t} and W_t . Thus, the direct gender segregation in the public sector is larger than in the private one and Δ_t^B is negative for any t . The magnitude of the term Δ_t^B , however, remains fairly constant during the period. Given that the overall gender segregation is increasingly larger in the private than in the public sector (see Figure 1), the difference between the within-group gender segregation in the two sectors, Δ_t^W , also increases with t in Figure 2.

As pointed out in the Introduction, the main question that motivates this study is whether occupational choices induce different degrees of gender segregation in both sectors of the divisible economy. Having verified that gender segregation within the private sector is larger than within the public one, the next issue is to examine which forces account for this result. A detailed answer for 1977 and 1992 is provided in the next section.

4. The occupational gender segregation within the private and the public sector, 1977 and 1992

4.1 Descriptive statistics

The first four columns in Table 1 present some descriptive statistics for 1977 on the distribution of total employment in the divisible economy and in each sector, as well as the percentage of public jobs by occupations. The last 4 columns present the same information for 1992. The 14 occupations that make up the divisible economy are classified into two main groups, according to whether the share of public sector jobs in total employment in 1977 is above or below its average value $(T_{277}/T_{77}) = 20.7$ for the economy as a whole (see columns 4 and 8 in Table 1). Occupations in the first and the second group are referred to as *public* or *private* occupations, respectively. From a second point

of view, occupations are classified into 5 *female* and 9 *male* occupations according to whether the female share of total employment in 1977 is above or below the value $W_{77} = 21.6$ for the economy as a whole.¹² In turn, each of these occupational categories can be further divided for expositional purposes into, at most, four groups, depending on whether they contain agricultural, blue collar, white collar, or professional and managerial occupations.

TABLE 1
The distribution of total employment across occupations
by sector, 1977 and 1992

Occupation	Type ^a	1977				1992			
		Total ^b	Private Sector ^c	Public Sector ^d	Share of Public ^e	Total ^b	Private Sector ^c	Public Sector ^d	Share of Public ^e
PUBLIC		39.3	31.8	68.1	35.8	50.3	38.8	78.8	45.3
Female		30.1	25.0	49.6	34.0	38.3	29.3	60.2	45.6
1.	PM	5.5	2.5	17.0	64.3	8.6	3.9	20.1	67.7
2.	WC	2.1	1.3	5.3	52.3	4.7	2.7	9.7	59.8
3.	WC	14.3	13.5	17.5	25.3	15.7	13.7	20.4	37.6
4.	PM	8.2	7.9	9.7	24.4	9.3	9.0	10.0	31.3
Male		9.2	6.7	18.6	41.8	12.1	9.5	18.6	44.4
5.	WC	5.7	4.1	11.8	42.7	6.8	4.8	11.5	49.4
6.	PM	3.5	2.6	6.7	40.3	5.3	4.6	7.0	38.2
PRIVATE		60.7	68.2	31.9	10.9	49.7	61.2	21.2	12.4
Female		3.8	4.4	1.4	7.5	4.8	6.1	1.7	9.9
7.	WC	3.8	4.4	1.4	7.5	4.8	6.1	1.7	9.9
Male		56.9	63.8	30.5	11.1	44.8	55.1	19.6	12.7
8.	PM	6.3	7.6	1.5	4.9	5.6	7.0	2.2	11.5
9.	BC	7.7	8.8	3.3	9.0	5.7	7.4	1.7	8.7
10.	BC	29.1	33.2	13.4	9.5	22.8	28.4	9.2	11.7
11.	BC	3.7	4.0	2.5	14.1	3.0	3.8	1.2	11.3
12.	AG	2.5	2.6	2.1	17.8	1.2	1.5	0.6	13.4
13.	PM	3.2	3.2	3.1	20.4	2.8	2.9	2.5	26.3
14.	PM	4.5	4.4	4.5	20.9	3.7	4.3	2.2	17.5
TOTAL		100.0	100.0	100.0	20.7	100.0	100.0	100.0	29.0

Note: See the Appendix for the list of occupations.

^a PM: Professional and Managerial; WC: White Collar; BC: Blue Collar; AG: Agriculture.

^b $100(T_1/T)$; ^c $100(T_1/T_1)$; ^d $100(T_2/T_2)$; ^e $100(T_2/T_1)$.

The public occupations are the following six: (i) Occupation 1 (consisting mainly of teachers), easily explained by the fact that the majority of primary and secondary education in Spain, and practically all College education, are public. (ii) Occupations 2 and 6 (nurses, physicians and a long list of other health technicians and qualified professionals),

¹²The same classification into public, private, female, and male occupational categories results after applying similar criteria to 1992 data.

partly explained by the impact of the public health system and the presence of professionals of different sorts as civil servants in the public administration. (iii) Occupation 5 (security personnel, including the police, and employees in passenger transport, including those from the public rail system). (iv) Occupation 3 (mostly employees in administrative jobs) and 4 (mostly concierges, cleaning, beauty, and food service personnel, as well as telephone operators).

As can be observed in column 1, in 1977 about 40% and 65% of total employment is concentrated in public and male occupations, respectively. From another perspective, 43% of total employment is in agricultural or blue-collar occupations, 34% in white-collar occupations, and the remaining 22% is in professional and managerial occupations. The main differences between the two sectors in the distribution of total employment are the following: in the private sector, the percentages in agricultural and blue collar occupations, as opposed to white collar and female professional and managerial, are 48.7% and 33.6%, respectively (see column 2), while these figures are 21.4% and 62.7% in the public sector (see column 3).

4.2 Gender segregation within the public and the private sector, 1977

The first four columns in Table 2 present the distribution of female employment and the female share of total employment in both sectors in 1977. Columns 1 and 2 show that, in 1977, as many as 92.6% of women in the public sector are concentrated in public occupations, as opposed to 70.6% in the private sector. The remaining women are employed in the private male occupations (8-14), as well as in occupation 7, consisting of domestic service, typists and other operators. As already shown, whereas the female proportion in the private sector is only 19.4, that share reaches 30.1 in the public sector.

The starting point of the analysis is that in 1977 the occupational segregation is larger within the private sector than within the public one: $\Delta_{77}^W = I^1 - I^2 = 35.55 - 28.52 = 7.03$.¹³ Recall from equation

¹³Sampling error can potentially be the source of changes in gender segregation indexes. In this case, upper (95%) and lower (5%) bootstrap bounds from 5,000 empirical sample replications are equal to 8.93 and 4.71, respectively.

TABLE 2
The female labor force distribution and female shares across occupations by sector, 1977 and 1992

Occupation	Type ^a	1977				1992			
		Female Labor Force Distribution		Female Shares		Female Labor Force Distribution		Female Shares	
		Private Sector ^b	Public Sector ^c	Private Sector ^d	Public Sector ^e	Private Sector ^b	Public Sector ^c	Private Sector ^d	Public Sector ^e
PUBLIC		70.6	92.6	43.2	40.9	70.4	93.9	52.8	54.6
Female		67.6	88.3	52.5	53.6	63.9	85.8	63.5	65.3
1.	PM	8.3	31.0	65.6	54.7	7.6	27.0	56.1	61.4
2.	WC	4.8	13.4	73.2	75.5	7.1	17.9	78.4	84.5
3.	WC	26.0	24.9	37.6	42.8	24.9	25.8	52.6	58.0
4.	PM	28.6	19.1	70.7	58.9	24.4	15.2	79.0	69.5
Male		3.0	4.3	8.6	7.0	6.4	8.1	19.8	20.1
5.	WC	0.9	0.7	4.4	1.9	1.5	2.5	8.9	10.1
6.	PM	2.0	3.5	15.3	15.8	5.0	5.6	31.1	36.4
PRIVATE		29.4	7.4	8.4	7.0	29.6	6.1	14.1	13.1
Female		21.4	3.8	94.7	83.2	20.6	3.2	97.4	89.1
7.	WC	21.4	3.8	94.7	83.2	20.6	3.2	97.4	89.1
Male		7.9	3.6	2.4	3.6	9.1	2.9	4.8	6.7
8.	PM	1.1	0.4	2.8	7.3	2.0	0.4	8.2	7.7
9.	BC	1.1	0.0	2.4	0.0	0.7	0.0	2.9	0.4
10.	BC	0.9	0.1	0.5	0.3	1.8	0.5	1.9	2.4
11.	BC	0.1	0.1	0.5	1.1	0.4	0.0	3.0	1.2
12.	AG	0.1	0.1	0.7	0.8	0.0	0.0	0.9	0.0
13.	PM	0.6	0.4	3.5	3.8	0.6	0.4	6.1	7.2
14.	PM	4.1	2.6	17.9	17.4	3.5	1.6	23.9	31.9
TOTAL		100.0	100.0	19.4	30.1	100.0	100.0	29.1	45.8

Note: See the Appendix for the list of occupations.

^a PM: Professional and Managerial; WC: White Collar; BC: Blue Collar; AG: Agriculture.

^b $100(F_{1j}/F_{1j})$; ^c $100(F_{2j}/F_{2j})$; ^d $100(F_{1j}/T_{1j})$; ^e $100(F_{2j}/T_{2j})$.

[11] that, given some reference female share and demographic weights, W and α_j , respectively, we have

$$\Delta_{77}^W = \text{FEMSHARE} + \text{OCUPMIX} + \text{GENCOM},$$

where

$$\text{FEMSHARE} = \sum_j \text{FEMSHARE}_j = \sum_j \alpha_j [(I^{1j} - I_{1j}) + (I_{2j} - I^{2j})]$$

$$\begin{aligned} \text{OCUPMIX} = \sum_j \text{OCUPMIX}_j = \sum_j [(T_{1j}/T_1) - \alpha_j] I_{1j} + \\ + [(\alpha - (T_{2j}/T_2))] I_{2j}, \end{aligned}$$

$$\text{GENCOM} = \sum_j \text{GENCOM}_j = \sum_j \alpha_j [I_{1j} - I_{2j}].$$

The term FEMSHARE measures the effect of the discrepancy between the actual female employment shares in the two sectors and in the divisible economy. In the private sector, $W_1 = 19.4 < W = 20.6$. Therefore, in female occupations with high values of w_{1j} , the index I^{1j} that captures the discrepancy between W_1 and w_{1j} is larger than the index I_{1j} that captures the discrepancy between W and w_{1j} . In the public sector, with $W_2 = 30.1 > W = 20.6$, the opposite is the case, that is $I^{2j} < I_{1j}$ in female occupations. Consequently, $\text{FEMSHARE}_j = \alpha_j[(I^{1j} - I_{1j}) + (I_{2j} - I^{2j})] > 0$ for such occupations. An analogous argument yields that $\text{FEMSHARE}_j < 0$ for all male occupations. Thus, the sign and magnitude of FEMSHARE is strongly dependent on the choice of reference weights. Total employment in male occupations is larger in the private sector, while the opposite is the case for female occupations (see columns 2 and 3 in Table 1). Thus, choosing α_j equal to (T_{1j}/T_1) or (T_{2j}/T_2) would tend to reduce or increase FEMSHARE, respectively.¹⁴ However, when $\alpha_j = (1/2)[(T_{1j}/T_1) + (T_{2j}/T_2)]$, the FEMSHARE term equals 0.1 (with 95% and 5% bootstrap bounds equal to 0.4 and -0.1, respectively). This is a convenient result that permits accounting for Δ_{77}^W only in terms of OCUPMIX and GENCOM. The first four columns of Table 3 present the results of the decomposition of Δ_{77}^W for this choice of demographic weights. In this case:

$$\begin{aligned} \text{FEMSHARE}_j &= (1/2) [(T_{1j}/T_1) + (T_{2j}/T_2)][(I^{1j} - I_{1j}) + (I_{2j} - I^{2j})] \\ & \qquad \qquad \qquad [12] \\ \text{OCUPMIX}_j &= (1/2) [(T_{1j}/T_1) - (T_{2j}/T_2)](I_{1j} + I_{2j}) \\ \text{GENCOM}_j &= (1/2) [(T_{1j}/T_1) + (T_{2j}/T_2)](I_{1j} - I_{2j}) \end{aligned}$$

The sign of the occupational mix effects is closely related to the partition of the economy into private and public occupations. The comparison of columns 2 and 3 in Table 1 indicates that $(T_{1j}/T_1) > (T_{2j}/T_2)$ for all private occupations, while $(T_{1j}/T_1) < (T_{2j}/T_2)$ for all public occupations. Therefore, OCUPMIX_j would be positive or negative according to whether occupation j is private or public, respectively. As can be seen in column 2 of Table 3, the net result is that $\text{OCUPMIX} = 2.2$ (with 5% and 95% bounds equal to 0.6 and 3.7, respectively).

¹⁴As a matter of fact, FEMSHARE is equal to - 4.8 or 5.1 in these two cases, respectively.

TABLE 3
The differences in within-group gender segregation across occupations by sector, 1977 and 1992

Reference Demographic Weights: $\alpha_j = (1/2) [(T_{1j}/T_1) + (T_{2j}/T_2)]$

Occupation	Type ^a	1977				1992			
		Femshare ^b	Occupmix ^c	Gencom ^d	Total ^e	Femshare ^b	Occupmix ^c	Gencom ^d	Total ^e
PUBLIC		7.2	-13.6	3.6	-2.9	10.2	-10.0	-0.8	-0.6
Female		9.0	-11.4	4.2	1.7	12.7	-7.9	-1.0	3.7
1.	PM	2.7	-6.7	2.6	-1.4	2.8	-2.4	-0.9	-0.5
2.	WC	1.4	-3.3	-0.3	-2.1	2.9	-4.3	-1.2	-2.5
3.	WC	2.2	-0.4	-1.0	0.8	3.4	-0.7	-1.2	1.5
4.	PM	2.7	-1.1	2.8	4.5	3.5	-0.5	2.2	5.2
Male		-1.8	-2.3	-0.6	-4.7	-2.5	-2.1	0.2	-4.3
5.	WC	-1.5	-2.1	-0.6	-4.2	-2.3	-2.1	0.2	-4.2
6.	PM	-0.3	-0.2	0.0	-0.5	-0.2	0.0	0.0	-0.2
PRIVATE		-7.0	15.8	1.2	10.0	-10.2	22.8	1.4	14.0
Female		1.5	4.3	1.6	7.4	2.2	4.9	1.6	8.7
7.	WC	1.5	4.3	1.6	7.4	2.2	4.9	1.6	8.7
Male		-8.5	11.5	-0.5	2.6	-12.4	18.0	-0.2	5.4
8.	PM	-0.7	1.3	0.5	1.1	-1.4	1.7	-0.1	0.2
9.	BC	-1.2	2.0	-0.7	0.0	-1.7	3.4	-0.6	1.1
10.	BC	-4.7	7.6	-0.4	2.5	-6.9	10.6	0.5	4.3
11.	BC	-0.6	0.5	0.1	0.0	-0.9	1.5	-0.2	0.4
12.	AG	-0.5	0.2	0.0	-0.3	-0.4	0.6	-0.1	0.1
13.	PM	-0.5	0.0	0.0	-0.5	-0.8	0.1	0.1	-0.6
14.	PM	-0.3	0.0	0.0	-0.3	-0.3	0.1	0.1	-0.1
TOTAL		0.1	2.2	4.7	7.0	0.0	12.8	0.6	13.4
		(-0.1,0.4)	(0.6,3.7)	(1.9,7.1)	(4.7,8.9)	(-0.2,0.2)	(11.8,14.1)	(-1.4,2.4)	(11.6,15.1)

Note: Upper (95%) and lower (5%) bootstrap bounds from 5,000 empirical sample replications with replacement are shown in parenthesis for the totals. See the Appendix for the list of occupations.

^a PM: Professional and Managerial; WC: White Collar; BC: Blue Collar; AG: Agriculture.

^b Femshare = $\sum_j \alpha_j [(I^{1j} - I_{1j}^f) + (I_{2j} - I^{2j})]$.

^c Occupmix = $\sum_j [(T_{1j}^f/T_1) - \alpha_j] I^{1j} + I(\alpha_j - (T_{2j}/T_2)) I^{2j}$.

^d Gencom = $\sum_j \alpha_j [I_{1j}^f - I_{2j}^f]$.

^e Total = $\Delta^W = \text{Femshare} + \text{Occupmix} + \text{Gencom}$.

The term GENCOM, which measures the segregation attributable to the differences in the gender composition across occupations, holding constant the reference female share W and the demographic weights α_j , is the most important one. As emphasized in the Introduction, a public and a private job in the same occupation might entail differences along a number of dimensions, such as the job provision system, job tenure, the role of seniority in promotions, working conditions, etc. However, these factors will bring about differences in gender segregation as measured by GENCOM only if they vary across occupations within the public sector. On the other hand, a public and a private

job in the same occupation would typically share a significant number of required qualifications. Thus, a nurse, a physician or an administrative worker in the public sector would be more likely to find a job with similar characteristics in the private sector. From this point of view, we should not expect major differences in the GENCOM term. Under the assumptions that (a) all public jobs share the same distinguishing characteristics with respect to private jobs, and that (b) the remaining forces that induce occupational gender segregation operate similarly in both sectors, the distribution of female employment shares across occupations must be similar in the public and the private sector. This situation would manifest itself through a set of $GENCOM_j$ terms equal to zero. Whether this is the case or not will be studied in the sequel.

In the female and private occupation 7, the female employment share reaches the very high value of 94.7 (see column 3 in Table 2). Therefore $I_{17} > I_{27}$ and $GENCOM_7 = 1.6$. Interestingly enough, occupation 1 (mostly teachers) and 4 (mostly concierges, cleaning, beauty, and food service personnel, as well as telephone operators) are more female in the private than in the public sector. Given a common reference female share, this tends to increase the GENCOM term for these occupations. This effect is partially offset by what happens in occupation 2 (nurses, and other health technicians) and 3 (mostly administrative jobs), where the female employment share is larger in the public than in the private sector. Female occupations as a group have an aggregate GENCOM value of 5.7 (with 5% and 95% bounds equal to 1.9 and 7.1, respectively).

Among the male occupations, only private occupation 8 (high-status white collar employees), has a significantly positive GENCOM term. In public occupation 6 (professionals of different sorts), as well as agricultural occupation 12 and the remaining professional and managerial occupations 13 and 14, the female share practically coincides in the two sectors, so that their GENCOM terms are equal to zero. On balance, male occupations have an aggregate GENCOM value of -1 . The net result is that for the divisible economy $GENCOM = 4.7$, indicating that, relative to the reference female share, the gender segregation generated by occupational choices within the private sector is larger than the one induced in the public one.

4.3 *Gender segregation within the public and the private sector, 1992*

As reported in Mora and Ruiz-Castillo (2003a), the period 1977-1992 is characterized by the decline of agriculture and industrial activities, and a tertiarization of the economy in which the public sector plays a major role. A comparison of columns 1 and 5 in Table 1 indicates that the evolution by sector resembles what took place in the economy as a whole. Male agricultural and blue-collar occupations decline by 10 percentage points, whereas white collar and professional and managerial occupations increase by 7 and 3 percentage points, respectively. On the other hand, it has already been shown that the share of public jobs in the divisible economy increased from 20.7% of total employment in 1977 to 29% of total employment in 1992. As a consequence of the public sector growth, the percentage of total employment in public occupations grows from 39.3% in 1977 to 50.3% in 1992, in spite of the fact that the list of public occupations remains the same.¹⁵

These trends also affect the distribution of total employment within the two sectors. Consider the reduction throughout the period of employment among the group of eight private occupations. In the private sector, the employment share falls by 7.5 percentage points in the blue collar and agricultural occupations while it slightly increases in the white collar and the professional and managerial occupations resulting in an overall drop of 7.0 percentage points (see columns 2 and 3 *versus* 6 and 7 in Table 1). In contrast, employment in the public sector falls by 8.6 percentage points in blue collar and agricultural occupations and by 1.9 percentage points in the remaining occupations, leading to an overall fall of 10.7 percentage points. Of course, the reduction of the employment share in private occupations appears as an increase of the employment share in public occupations. However, this increase is reflected as an increase in both female and male occupations (of 4.3 and 2.8 percentage points, respectively) in the private sector, whereas all of the increase goes to female occupations in the public sector.

Against this background, the magnitude to be accounted for in 1992 is $\Delta_{92}^W = I^1 - I^2 = 40.2 - 26.8 = 13.4$ (with upper and lower bounds equal to 11.6 and 15.1, respectively). The relevant information about

¹⁵ As pointed out in the Appendix, in 1977 the divisible economy represents 39.4% of total employment and 75.6% of all public sector jobs in the economy as a whole. But, as a result of these trends, these figures grow to 52.6% and 87.8%, respectively, in 1992.

FEMSHARE, OCUPMIX and GENCOM is in the last four columns of Table 3.

First of all, notice that, as in 1977, the choice of demographic weights $\alpha_j = (1/2)[(T_{1j}/T_1) + (T_{2j}/T_2)]$ yields a value of FEMSHARE near zero which is not statistically significant. In the second place, also as in 1977, $OCUPMIX_j > 0$ for private occupations and $OCUPMIX_j < 0$ for public occupations. However, as already pointed out, the decline in employment in private occupations in 1992 is relatively larger in the public sector (compare columns 2 and 3 *versus* columns 6 and 7 in Table 1). This is reflected in larger OCUPMIX values in all private occupations (see columns 2 and 5 in Table 3). On the other hand, total employment in occupation 1 increases in both sectors but (T_{11}/T_1) and (T_{21}/T_2) get closer together, so that $OCUPMIX_1$ goes up from -6.7 in 1977 to -2.4 in 1992. These and other minor changes help explain why the high value of OCUPMIX accounts for more than 95% of the magnitude Δ_{92}^W .

Relative to the reference female share of total employment, $W = 33.9$, and given the demographic weights α_j , the GENCOM term in 1992 is near zero, 0.58, and not statistically significant (bootstrap 5% and 95% bounds equal to -1.4 and 2.4, respectively). Three points deserve to be noted. First, consider public female occupations 2, 3 and 4 where the female employment share has increased more in the public than the private sector (compare columns 3 and 4 with columns 7 and 8 in Table 2). Naturally, GENCOM goes down in all these cases (see column 3 and 7 in Table 3). Occupation 1 constitutes a unique case in which w_{11} goes down at the same time that w_{21} goes up. Consequently, $GENCOM_1$ exhibits the largest decrease, from 2.6 to -0.9. The aggregate GENCOM value for all public female occupations decreases from 4.2 in 1977 to -1.0 in 1992. Second, in occupations 6, 7, 9, 13 and 14 the female share increases in both sectors, but by a larger amount in occupations 6 and 14 than in occupations 7, 9 and 13. Naturally, in all these cases GENCOM remains essentially constant. Finally, in occupations 5 and 10, where large female share increases take place in both sectors, they are nevertheless larger in the public one. As the two occupations are male occupations with female employment shares well below the overall one, their joint GENCOM value grows from -1 to 0.7.

In brief, differences in occupational choices within the private and the public sector account for less than 5% of Δ_{92}^W . In addition, most of the

change in Δ_{92}^W relative to Δ_{77}^W stems from the increase in the OCUP-MIX term. In other words, in 1992 the difference in within-group gender segregation between the private and the public sector arises almost fully from differences in the distribution of total employment across occupations, rather than from differences in gender composition as in 1977.

5. Conclusions

To our knowledge, this is the first empirical study in which a careful comparison of occupational gender segregation within the private and the public sectors has been carried out. For this purpose, the paper focus on the subset of occupations with a private and a public sector of minimum size that constitute what has been called the divisible economy. To study the gender segregation induced by sector and occupational choices, an additively decomposable index of gender segregation based on the entropy concept has been applied to Spanish data for 1977-1992, a period for which comparable data are available. Female (male) occupations are those for which the female employment share is above (below) average, while public (private) occupations are those for which the public employment share is above (below) average. During this period, in the Spanish divisible economy there are 6 public occupations, 4 of which are female and 2 are male, as well as 8 private occupations, 1 of which is female and the remaining 7 are male.

In many countries, less-discriminatory recruiting and promotion procedures, along with other job characteristics, help explain why women are particularly attracted to the public sector. It is therefore not surprising that, for those countries, the female share of employment in the public sector is usually considerably larger than in the private sector. In 1977 in Spain, for example, the female employment share in the private, the public, and the divisible economy are equal to 19.1, 30.1, and 21.6, respectively. Within the paper's measurement framework, this discrepancy means that, for that year, gender segregation attributed to sector choice is larger in the public sector than in the private one.

The period between 1979 and 1992 in Spain can be characterized as a period of increasing total employment in the divisible economy, increasing public sector's weight, and increasing female labor participation. Yet, the female share of employment in both sectors and the economy as a whole increase by a similar percentage close to 50%: in 1992, the female employment share in the private, the public, and

the divisible economy becomes 29.1, 45.8, and 33.9, respectively. As a result, the difference between the public and the private sector in the gender segregation due to the sector choice remains positive but essentially constant during this period.

Beyond this regularity, the interesting question is the relationship between the gender segregation due to occupational choices *within* each sector. It turns out that the occupational gender segregation within the private sector is always greater than within the public one, and the difference between the two magnitudes slightly increases during the period. Because this effect offsets the previous one, overall gender segregation is always larger in the private sector and the gap between the two values raises from 4.45 index points, or 14.23%, in 1977 to 9.85 index points, or 31.65%, in 1992.

The decomposability properties of the entropy index, permit expressing the differences in within-group gender segregation in a given moment in time in terms of three factors capturing, respectively, the differences between sectors in: 1) female employment shares, 2) the occupational mix, that is, the distribution of employment across occupations, and 3) the gender composition. This decomposition is computed at the beginning and at the end of the period, taking as reference the female employment share for the divisible economy and the unweighted mean of the frequencies of employment across occupations for the private and the public sector. For such reference demographic weights, differences in female employment shares between the two sectors have nearly no explanatory power.

In 1977, the occupational gender segregation within the private sector is 7.0 index points, or 25%, larger than gender segregation within the public one. Differences in gender composition account for 4.7 index points, or 69%, of that disparity in within-group gender segregation. In 1992, the gap between the two sectors' within-group gender segregation is equal to 13.4 index points, or 50% of the occupational gender segregation within the public sector at that date. However, this larger disparity is accounted for by different factors than in 1977; in particular, differences in gender composition account for only 5% of the difference in within-group gender segregation between the two sectors in 1992.

In brief, which are the consequences for gender segregation that can be attributed to the differences in job provision and working conditions

that were emphasized in the Introduction? First, as expected these differences do attract women in large numbers towards the public sector. Second, in both sectors women are largely confined into female occupations. But whereas the share of female employment is larger in the private than in the public sector in occupations 7 (domestic service, typists and other operators) and 4 (concierges, cleaning, beauty, and food service personnel, as well as telephone operators), the opposite is the case in occupations 1 (mainly teachers), 2 (mainly nurses, as well as employees in accounting, cashier, and teller positions) and 3 (employees in administrative services). These two effects essentially offset each other and give rise, on balance, to a GENCOM effect close to zero.

Which policy lessons can be extracted from this evidence? In the first place, it appears that there is plenty of room in both sectors to practice a policy of affirmative action with the aim of reducing gender segregation by increasing the presence of women (men) in traditional male (female) occupations. In the second place, if the present heterogeneity of working conditions were to diminish, for example by a policy that improves women's access to jobs in the private sector, then the female share of employment would likely be more equal in the two sectors. This effect would bring about a reduction in overall gender segregation in the divisible economy by reducing its between-group component. Moreover, provided occupational choices within sectors remain constant, the increase (decrease) of the female share of employment in the private (public) sector would tend to diminish (increase) within-group gender segregation in that sector. But little can be said *a priori* about the consequences of changes in overall employment shares on the distribution of people across occupations and, therefore, on the impact of occupational segregation within the two sectors.

To conclude, it is worth emphasizing that previous studies of gender segregation in Spain have referred to the entire employed population, including what might be called the divisible and the non-divisible economies.¹⁶ Making use of the decomposability properties of the index, the methodology developed in this paper could be extended to study both the structure at a given moment in time and the intertemporal evolution of gender segregation induced by the following factors: the choice of employment in the divisible *versus* the non-divisible econ-

¹⁶See Sánchez (1993), Otero and Gradín (2001), Dolado *et al.* (2002), Herranz *et al.* (2003), Mora and Ruiz-Castillo (2003a).

omy, the choice between the private and the public sector in the divisible economy, and the occupational choice both within the non-divisible economy and within the private and the public sectors. In particular, it would be interesting to see whether gender composition effects during the post-94 period have any explanatory role of the differences in within-group gender segregation in the three sectors. Finally, this extended framework could be used to investigate differentials in gender segregation among countries with public sectors of varying size.

Appendix 1. Data

As indicated in the text, the Spanish data for this study comes from the EPA (*Encuesta de Población Activa*), a labor force survey conducted by the Spanish *Instituto Nacional de Estadística* since the third quarter of 1976. The EPA consists of about 50,000 household observations per quarter, representative of the Spanish household population living in private residential housing. It investigates the relationship with economic activity and other characteristics of every household member over 14 years of age. The EPA is a rotating panel in which each household is interviewed during 6 consecutive quarters; thus, one seventh of the sample is renewed every quarter.

In this paper, data from the second quarter is taken as representative of the year as a whole, so that the time period studied starts in 1977. Due to changes in the official National Classifications of Occupations and Industries that took place in 1993 and 1994, respectively, the period covered is 1977-1992. According to the EPA, the employed population in 1977 and 1992 is, approximately, 12,148,346 and 12,361,738 people, respectively. There are 71,864 and 62,332 individual observations in 1977 and 1992, respectively, which can be classified according to the two-digit National Classifications of Occupations and Industries available at the time. Because the EPA is a labour force survey rather than a census, there is a relatively low number of two-digit occupations and industries. In Herranz *et al.* (2003) occupations are taken as the basic partition and are combined with two-digit industries to obtain an initial list of 106 occupational categories.

It is clear that the use of more detailed categories leads to larger index values, since broader categories mask some of the segregation within them (England, 1981). Consequently, researchers have always sought

to work with the largest possible occupation's space.¹⁷ However, the idea that, *ceteris paribus*, the larger the number of occupations the better, has been questioned because of the possible bias due to small cell size (Blau *et al.*, 1998): random allocations of individuals across occupations may generate relatively high levels of gender segregation purely by chance. Moreover, when the number of occupations is very large, results on segregation are difficult to interpret. Finally, in this paper occupations must be large enough to be meaningfully partitioned by sector. Given that we are limited by a relatively small sample size, a search for the smallest possible set of occupations is called for.

Herranz *et al.* (2003) explore how far it is possible to aggregate a large list of occupations without reducing the gender segregation value too much. Using an algorithm based on the bootstrap, that paper shows that the initial set of 106 occupations for 1977 and 1992 can be aggregated into a common list of 29 occupational categories. The proportion of females in the employed population in these two years grows from 28.6% to 32.9%, while the direct gender segregation induced by occupational choices increases only from 27.0 in 1977 to 27.4 in 1992.

According to the EPA, in 1977 there are 1,306,739 jobs in the public sector, representing 10.8% of total employment. Since a considerable expansion in the public sector has taken place during this period, in 1992 there are 2,153,569 jobs in this sector, representing 17.4% of total employment. In this paper, only those occupations that can be meaningfully divided into a private and a public sector need to be considered. Their description can be found below under the heading LIST OF OCCUPATIONS. For expositional purposes, occupations are sorted attending three criteria. First, according to the share of public employment, occupations can be PUBLIC or PRIVATE occupations. A PUBLIC occupation has a share of public employment above average for the divisible economy in 1977. Second, according to the female share, occupations can be Female or Male occupations. A Female occupation has a female share above average for the divisible economy in 1977 (the same classification turns out if we apply these two criteria to the 1992 data). Finally, occupations can be classified at most into four major categories according to the type of occupation (i.e. Professional and Managerial, White Collar, Blue Collar, and Agriculture).

¹⁷In empirical studies using Census data, the occupational space typically reaches several hundred categories. For instance, in the U.S. Blau *et al.* (1998) work with 470 occupations from the 1970, 1980, and 1990 Census.

The criterion chosen to identify the occupations belonging to the divisible economy is the percentage of public jobs over total employment. In particular, in any occupation from the divisible economy the percentage of public jobs over total employment should reach at least 7.5% both in 1977 and in 1992. The only exception to this rule was an occupation (number 8 in the list below) for which public employment was 11.5% in 1992 but only 4.9% in 1977. In spite of this, this occupation was nevertheless included in the divisible economy because the violation of the requirement in 1977 was by a relatively small margin and also because even in 1977 its share of public jobs was higher than the share of public jobs of another occupation (number 7) which was included in the divisible economy.¹⁸

The selected 14 occupations, which constitute what is called the divisible economy, represent 39.4% of total employment and include 75.6% of all public sector jobs in 1977. These figures grow to 52.6% and 87.8%, respectively, in 1992. The proportion of females in the private sector, the public sector, and the employed population as a whole in 1977 are 19.4%, 30.1%, and 21.6%, respectively. In 1992, these figures are 29.1%, 45.8%, and 33.9%, respectively. The index of direct gender segregation induced by occupational choices in the divisible economy in 1977 and 1992 is 34.61 and 37.89, respectively.

¹⁸In another occupation the percentage of public employment in 1977 was 16%, but this figure decreased to 1% in 1992. Therefore, this occupation was excluded from the analysis.

Appendix A2. List of occupations

The 14 occupations used in this paper can be described as follows.

A2.1. Public

Female

PM: Professional and Managerial

- 1 Teachers
Professionals or technicians in non-classified areas

WC: White Collar

- 2 Medical, veterinary, and pharmaceutical assistants and technicians
Employees in accounting, cashier, and teller positions in trade and miscellaneous repair
- 3 Employees in administrative services in non-classified areas in other services, agriculture and mining, wholesale trade, and hotels and restaurants
Supervisors of domestic service personnel
- 4 Concierges, building supervisors, and cleaning service personnel in other services, trade and transport, agriculture and mining
Hair stylists and beauty treatment personnel
Chefs, cooks, and food service personnel in other industries
Dry cleaning and laundry service employees
Telephone and telegraph operators

Male

WC: White Collar

- 5 Personnel in protection and security services
Foremen and overseers
Mailroom workers and office assistants
Engineers, inspectors, and conductors in passenger transport

PM: Professional and Managerial

- 6 Physicians, veterinarians, and pharmacists
Legal professionals
Professional musicians and show business professionals
Statisticians, mathematicians, computer analysts, and other like technicians
Economists
Chemists, physicists, and geologists
Writers and journalists
Biologists and agricultural and forestry specialists
Sports professionals

A2.2. Private

Female

WC: White Collar

- 7 Domestic service personnel and other like personnel
Stenographers, typists, and key-punch operators

Male

PM: Professional and Managerial

- 8 Company directors and managers
Owners or managers of commercial establishments in wholesale trade,
and other industries
Head of sales and head buyers
Inspectors of transport and communication services
Operator of agricultural or fishing enterprises
Directors and managers of commercial establishments
Members of governmental branches

BC: Blue Collar

- 9 Mechanics, machinists, watchmakers and other precision mechanics
Shoemakers in repair services
- 10 Construction workers and bricklayers
Drivers, other transport personnel
Electricians in other industries
Iron and steel workers
Miners and quarry workers.
Machine operators, radio & TV station operators, and sound-system
operators
Stonemasons
Chemical laboratory workers in other industries

- 11 Plumbers, welders, sheet metal workers

AG: Agriculture

- 12 Fish and game workers
Forestry workers

PM: Professional and Managerial

- 13 Draftsmen and engineering technicians
Architects and engineers
Pilots and Officers of air and maritime navigation
- 14 Owners or managers of hotel, restaurant services in restaurants
Head clerks and office managers
Directors and managers of hotel in restaurant services

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Resumen

Los procedimientos no discriminatorios de contratación y otros aspectos de las condiciones laborales hacen que en muchos países el sector público resulte especialmente atractivo para las mujeres. Este es primer trabajo empírico que compara la segregación por género en el sector privado y en el público. Para ello se aplica un índice aditivamente descomponible basado en el concepto de entropía a los datos españoles del período 1977-1992. Se encuentra que, durante este período, la segregación relacionada con la elección del sector es mayor en el sector público. Pero esto se compensa por el hecho de que la segregación inducida por la elección de ocupación es mayor dentro el sector privado. La diferencia de la segregación ocupacional entre los dos sectores se debe, sobre todo, a las diferencias en la distribución del empleo por género y ocupaciones en 1977, y a las diferencias entre el tamaño de las ocupaciones en ambos sectores en 1992.

Palabras clave: Índices de entropía aditivamente descomponibles, segregación por género, procedimientos de contratación públicos.

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