



UNIVERSIDAD CARLOS III DE MADRID

working
papers

Working Paper 03-16
Economics Series 04
March 2003

Departamento de Economía
Universidad Carlos III de Madrid
Calle Madrid, 126
28903 Getafe (Spain)
Fax (34) 91 624 98 75

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

Ricardo Mora¹ and Javier Ruiz-Castillo²

Abstract

In many countries, recruiting and promotion procedures in the public sector would appear to leave less room for gender discrimination than in the private sector. Using data for Spain in 1977 and 1992, this paper explores the consequences of these practices for gender segregation in those occupations where there is a private and a public sector of a minimum size. In particular, an additive index based on the entropy concept is used to compare occupational gender segregation in the private *versus* the public sector. It is found that gender segregation in the private sector is 14% larger than in the public sector in 1977 and 32% larger in 1992. During the 1977-1992 period, gender segregation in the public sector remains basically constant but increases by 15% in the private sector. The additive decomposability property of the index is used to highlight the role of public hiring procedures and other socio-economic factors in differences of gender segregation across occupations.

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

¹ R. Mora, Departamento de Economía, Universidad Carlos III de Madrid; E.mail: ricmora@eco.uc3m.es. Phone: (34) 91 624 9576

² J. Ruiz-Castillo, Departamento de Economía, Universidad Carlos III de Madrid. E.mail: jrc@eco.uc3m.es. Phone: (34) 91 624 9588

* We wish to acknowledge the excellent work done by the Research Assistant Neus Herranz, who acknowledges financial support from the *Ministerio de Educación y Ciencia*, 2001-2002. Javier Ruiz-Castillo and Ricardo Mora acknowledge financial support from the Spanish *Instituto de la Mujer*, Project Number 16/97. Ricardo Mora acknowledges financial support from DGI, Grant BEC2000-0170. This paper has been presented in the September 2002 meeting of the network "*Living Standards, Inequality, and Taxation*", in Lubeck, financed by the European Communities (Contract #ERBCHRXCT980248).

I. INTRODUCTION

Starting from the seminal work by Bergman (1974), economists have been interested in the problem of occupational segregation by gender, that is, the tendency of women to be segregated into low pay and low-status occupations. One of the possible explanations of this fact is that women might suffer some form of discrimination based either on the tastes of employers, coworkers or customers along the lines studied by Becker (1957).

This paper is concerned with the following question. 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. Therefore, it would appear that in the public sphere there is less room for gender discrimination. Consequently, it might be expected that the extent of gender segregation induced by occupational choices in the public sector is smaller than in the private sector. On the other hand, in many countries an important part of the increase in female participation in the labor market during recent decades has taken place through the public sector. If public hiring procedures are associated to lesser degrees of gender segregation, then we might expect that this trend in female labor market participation contributes to a decrease in the magnitude of gender segregation in the economy as a whole.

Most previous studies of gender segregation share two characteristics. They refer to the employed population and they measure the gender segregation induced along a

single dimension, namely, the gender segregation induced by occupational choices.^{1,2} Instead, this paper focus 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.

To investigate an issue that involves a pair of classification variables, the sector and the occupation, a segregation index with the property of additive decomposability is needed. Naturally, the empirical answer to the question we are interested in would depend on the segregation index used.³ This paper uses the index developed in Mora and Ruiz-Castillo (2002a), that has its origin in the family of income inequality indexes introduced by Theil (1971), and is based on the entropy concept used in information theory.

The index's structure facilitates the decomposition of gender segregation into 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 the occupational choices within

¹ For the only study we know of that investigates the gender segregation of the entire population of legal working age, including the employed, the unemployed and the non-student individuals out of the labor force, see Mora and Ruiz-Castillo (2003b).

² In 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 on the gender segregation induced by occupational choice, 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.* (2002).

³ Unfortunately, the index of gender segregation most frequently used in the literature, the index of dissimilarity of Duncan and Duncan (1955), has not been exploited in this direction. For other limitations of

each of the two sectors.⁴

More importantly for our purposes, overall gender segregation can be conveniently expressed as the weighted average of the gender segregation in each sector. The magnitude of interest, that is, the difference between the two sectors' gender segregation in a given moment of time, can be accounted for three factors. These factors capture the effect of, respectively, the differences between the two sectors in 1) the proportion of females, 2) the gender composition across occupations, and 3) the demographic importance of each occupation, or occupational mix. In addition, the evolution over time of gender segregation in a given sector can be similarly accounted for changes in 1) the proportion of females in total employment, 2) the gender composition across occupations, and 3) the occupational mix in the sector in question.

The relevance of the approach is illustrated with an empirical application using labor force survey data from Spain for 1977 and 1992. During this period, there was a sizeable increase, both in absolute and relative terms, in public sector employment, as well as an increase in the female labor market participation and in the proportion of women who hold a public sector job.

The empirical analysis indicates that in order to understand both the structure of gender segregation in a given moment in time and the evolution of this phenomenon in Spain, it is necessary to subdivide the divisible economy into two parts. Part A contains most of the white collar, professional and managerial occupations where the public

the dissimilarity index, see Zoloth (1976) and Hutchens (1991).

⁴ For an alternative decomposition using the Gini-Segregation Index, see Silber (1989), Deutsch et al. (1994), and Sections 7.4 and 7.5 of Flückiger and Silber (1999). In the decomposition based in the Gini-

sector is important, as well as an occupation including the domestic service. More than 80% of women are concentrated in this first part. Together with the remaining white collar, professional and managerial occupations, part B of the economy contains all agricultural and blue collar occupations. Most male, private and total employment is concentrated in this second part. The main findings are the following.

(i) In both years there is significantly less gender segregation in the public than in the private sector: 14% in 1977 and 32% in 1992. This is the consequence of the complex interaction of several factors working in different directions. Nevertheless, there is evidence in both years that differences in recruiting and promotion procedures between the public and the private sector -operating through gender composition effects in part A of the economy- partly accounts for this result. However, in part B of the economy gender segregation indexes are smaller in the private than in the public sector. The occupational mix effects in parts A and B of the economy tend to increase and decrease, respectively, the gender segregation in the public relative to the private sector.

(ii) Gender segregation in the public sector has remained basically constant from 1977 to 1992. As in the static case, the asymmetry of gender composition and occupational mix effects in both parts of the economy is a distinctive feature in the dynamic decomposition. In particular, during this period gender segregation induced by occupational choices in the public sector decreases in the occupations especially affected by public hiring procedures in part A of the economy, but increases in the occupations in part B.

Segregation index, the overall segregation is decomposed into three terms: a between-group term, a

The rest of the paper contains four Sections and an Appendix. Section II is devoted to the measurement of segregation. Section III refers to the structure of gender segregation in 1977. Section IV studies the evolution of gender segregation during the 1977-1992 period, and the structure of gender segregation in 1992. Section V 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.

II. THE MEASUREMENT OF SEGREGATION

In this section, the index of segregation and its two decompositions are presented.⁵ 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 groups, indexed by G_i , $i = 1, 2$, where 1 and 2 denote 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 $F_i = \sum_{j \in G_i} F_{ij}$ and $T_i = \sum_{j \in G_i} T_{ij}$ be the number of females and people in sector i , and let $T = \sum_i T_i$ be the total number of people in the employed population. Let $W = F/T$ be the proportion of females in the population, $W_i = F_i/T_i$ the proportion of females in sector i , and $w_{ij} = F_{ij}/T_{ij}$ the proportion of females in occupation j within sector i .

within-group term and an interaction term.

⁵ See Mora and Ruiz-Castillo (2003a) for a full discussion.

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 female labor participation 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 in the occupation j within sector i , provides a reasonable overall measure of occupational segregation:

$$I = \sum_i \sum_{j \in G_i} (T_{ij}/T) I^{ij}.$$

This bounded⁶ measure of overall gender segregation 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 $(W_i, (1 - W_i))$ is given by

⁶ The 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.

$$I^i = W_i \log (W_i/W) + (1 - W_i) \log ((1 - W_i)/(1 - W)). \quad (2)$$

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

$$I^B = \sum_i (T_i/T) I^i. \quad (3)$$

Equation (3) can be interpreted as the *between-group* (direct) gender segregation induced at the sector level.

On the other hand, 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

$$I_i = \sum_{j \in G_i} (T_{ij}/T_i) I_{ij}. \quad (5)$$

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 .⁷

On the other hand, taking into account equations (3) and (5), it can be seen that

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

where $I(i) = I^i + I_i$ (9)

is the gender segregation in sector i . Equation (8) indicates that overall gender segregation I is the weighted average of gender segregation in each sector, with weights equal to their relative demographic importance in the economy as a whole. For our purposes, the magnitude of interest, denoted by Δ , is the difference between the gender segregation indexes in the two sectors:

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

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). Therefore, for later reference the term $(I^1 - I^2)$ will be denoted by FMLPROP. The index I_i measures the occupational segregation within sector i (see equation 5). Therefore, the term

$$(I_1 - I_2) = \sum_j (T_{1j}/T_1) I_{1j} - \sum_j (T_{2j}/T_2) I_{2j}$$

is seen to depend on two factors: differences in gender composition across

⁷ As 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, the corresponding decomposition will not be used in the

occupations in both sectors, which manifest themselves via differences in the segregation indexes I_{1j} and I_{2j} ; and differences between the two sectors in the occupational mix, or in the demographic importance of each occupation with respect to total employment, (T_{1j}/T_1) and (T_{2j}/T_2) . Consequently, given some reference demographic weights α_j , the term $(I_1 - I_2)$ can be decomposed as follows:

$$I_1 - I_2 = \text{GENCOM} + \text{OCUPMIX}, \quad (10)$$

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

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

Therefore, as pointed out in the Introduction, we have

$$\Delta \equiv I(1) - I(2) = \text{FMLPROP} + \text{GENCOM} + \text{OCUPMIX}. \quad (11)$$

Equation (11) indicates that the difference between the two sectors' gender segregation in a given moment of time can be accounted for in terms of three factors: 1) FMLPROP, which captures the effect of differences in the proportion of females employed in each sector; 2) GENCOM, which is equal to the weighted sum of the differences across occupations between the sectors' gender segregation indexes themselves; and 3) OCUPMIX, caused by the differences between the occupations' actual demographic shares in each sector and the reference weights α_j used to aggregate the gender composition effects into a single term.

sequel.

III. THE GENDER SEGREGATION IN THE PRIVATE VERSUS THE PUBLIC SECTOR IN 1977

III. 1. Descriptive Statistics

As explained in the Appendix, the data for this paper comes from the Spanish EPA (*Encuesta de Población Activa*), a labor force survey representative of the household population living in residential housing. 1977 is the first year for which micro-economic data is available in electronic support. 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 in the shorter and less interesting period -in terms of public and female employment growth- starting in 1993. Therefore, the period studied is 1977-1992.

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. For expositional reasons, the 14 occupations that make up the divisible economy (fully described in the Appendix) can be conveniently classified into three main categories: 9 *male occupations*, where the female participation rate is below 20%; 4 *female occupations*, where the proportion of females is above 50%, and 1 *integrated occupation*, where the proportion of females is about 40%. In turn, each of these categories can be further divided into a maximum of four groups, depending on whether they contain agricultural, blue collar, white

collar, or professional and managerial occupations.

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. As can be observed in column 1, in 1977 about two thirds of total employment is concentrated in male occupations, 20% in female occupations, while the remaining 14% is in the only integrated occupation. 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 in the distribution of total employment between the two sectors are as follows: in the private sector, the percentages in male and female occupations are 70.6% and 16%, respectively (see column 2), while these figures are 49.1% and 33,4% in the public sector (see column 3).

Table 1 around here

The occupations where the proportion of public sector jobs in 1977 is above average are the following six (see column 4 in Table 1): (i) Occupation 14 (mainly consisting of teachers), easily explained by the fact that the majority of primary and secondary education in Spain, and practically all of College education, are public. (ii) Occupations 13 and 8 (nurses, physicians and other long list of health technicians and qualified professionals), partly explained by the incidence 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 10 (mostly employees in administrative jobs) and 11 (mostly concierges, cleaning, beauty, and food service personnel, as well as telephone operators).

In Spain, openings in certain occupations within the public sector are filled through publicly advertised examinations, open to anyone with the appropriate educational credentials. Moreover, relative to the private sector, working conditions in these public occupations offer a degree of flexibility that might be particularly attractive to many women. This should serve as an important incentive for women to work in the public sector.

The first four columns in Table 2 present some descriptive statistics for 1977 on the distribution of female employment and the proportion of females by occupations. Columns 1 and 2 show that, in 1977, as many as 86% of women in the public sector are concentrated in integrated or female white collar and professional occupations where the public sector is important (occupations 10, 11, 13, and 14), as opposed to 64% in the private sector. The remaining women are employed in the male occupations (1-9) and, particularly in the private sector, in occupation 12 consisting of domestic service, typists and other operators. The attraction that public hiring procedures and job characteristics exert on women, is also reflected in the fact that, whereas the female proportion in the private sector, W_1 , is only 19.4%, the proportion reaches 30.1% in the public sector. The question is, does this imply that gender segregation is smaller in the public sector?

Table 2 around here

III. 2. Gender Segregation in the Private *versus* the Public Sector in 1977

The first question to investigate is whether the distinction between the private and the public sector adds anything significant to the explanation of gender segregation in the divisible part of the economy. That is to say, we want to know whether the overall gender segregation, I , is significantly different from the within-group term, I^W . It turns out that this is not the case, because $I = 34.84$,⁸ its bootstrapped 5% confidence interval is equal to (33.73, 36.12), and $I^W = 34.09$ (32.98, 35.36).⁹ In other words, 97.7% of the gender segregation observed in Spain in 1977 must be attributed to occupational choices within the two sectors, an effect captured in the within-group term I^W .

This leads to the really interesting question, namely, whether gender segregation is significantly different in the private and the public sectors. The central result is that the gender segregation in the private sector is $I(1) = 35.76$, while in the public sector it is $I(2) = 31.3$. The difference $\Delta = 35.76 - 31.30 = 4.46$ (with a bootstrapped 2.5% lower bound of 1.30) indicates that gender segregation is significantly greater in the private sector.

Recall from equation (9) that $I(i) = \bar{I} + I_i$, $i = 1, 2$. The index \bar{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 , while I_i measures the occupational segregation within sector i (see the definitions in equations 3 and 5,

⁸ To facilitate the reading of the paper, all gender segregation indices have been multiplied by 100.

respectively). Therefore,

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

Let us first examine the term $(I^1 - I^2)$, previously denoted by FMLPROP. It turns out that $W_1 = 19.4$, $W_2 = 30.1$ and $W = 21.6$. Therefore, the difference in absolute terms between W_2 and W is considerably larger than between W_1 and W . Taking also into account the non-linearity of the log function that enters into every gender segregation index of the entropy type, it is not surprising that the direct gender segregation in the public sector is larger than in the private one, so that $\text{FMLPROP} = 0.21 - 2.78 = -2.57$. This negative value is offset by the difference between the within-group terms: $I_1 - I_2 = 35.55 - 28.52 = 7.03$. Hence, it can be concluded that the larger gender segregation induced in the public sector by a high female proportion is offset by the larger gender segregation induced in the private sector by occupational choices.

Next, we should study the role of gender composition and occupational mix effects in this result. Recall from equation (10) that, given some reference demographic weights α_j ,

$$I_1 - I_2 = \text{GENCOM} + \text{OCUPMIX},$$

where

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

⁹ Bootstrapped values are based on 5,000 replications of the empirical distribution with replacement.

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

As will be seen below, results are strongly dependent on whether reference weights α_j are made equal to the occupations' demographic importance in the private or the public sector, i. e. equal to (T_{1j}/T_1) or (T_{2j}/T_2) , respectively. For brevity, detailed results are presented only for weights equal to the mean of the occupations' demographic importance in each sector, i. e. $\alpha_j = (1/2) [(T_{1j}/T_1) + (T_{2j}/T_2)]$. In this case,

$$\begin{aligned} GENCOM_j &= (1/2) [(T_{1j}/T_1) + (T_{2j}/T_2)] [I_{1j} - I_{2j}], \\ OCUPMIX_j &= (1/2) [(T_{1j}/T_1) - (T_{2j}/T_2)] (I_{1j} + I_{2j}). \end{aligned} \quad (12)$$

The term GENCOM captures differences in gender composition across occupations in both sectors, which manifest themselves via differences in the segregation indexes I_{ij} . In turn, each I_{ij} captures the gender segregation induced by the discrepancy between W_i and w_{ij} (see the values of W_1 and w_{1j} , as well as those of W_2 and w_{2j} in columns 3 and 4 in Table 2, respectively). On the other hand, OCUPMIX captures differences in the occupational mix between the two sectors (see the values of (T_{1j}/T_1) and (T_{2j}/T_2) in columns 2 and 3 in Table 1, respectively).

The detailed information to analyze the term $I_1 - I_2$ is in Table 3. The first five columns, which refer to the gender composition effects, present the weights α_j , the

indexes I_{1j} and I_{2j} , their difference, and the $GENCOM_j$ term, respectively. In view of equation (12), the next column presents the term $OCUPMIX_j$. The final column gives the total effect, namely, the term $TOTAL_j = GENCOM_j + OCUPMIX_j$.

Table 3 around here

As pointed out in the Introduction, to facilitate the exposition of results it is convenient to subdivide the divisible economy into two parts. Part A contains the integrated and all female occupations (10 – 14), while part B contains all the male occupations (1 – 9).

III.2.A. Gender Composition Effects

In all occupations in part A, gender segregation is greater in the private sector. The sum of $GENCOM_j$ terms for these occupations is equal to 16.3. In occupations 10, 11, 13, and 14, where it was seen that the weight of the public sector is above average, this is surely the result of the public system of filling job openings. The explanation for the high $GENCOM_j$ value in occupation 12 (domestic service, typist and other operators), lies in the fact that, as can be seen in columns 3 and 4 in Table 2, the discrepancy between female proportions in the private sector ($w_{1,12} = 94.7$ versus $W_1 = 19.4$) is much greater than in the public one ($w_{2,12} = 83.2$ versus $W_2 = 30.1$). This gives rise to a very high difference $I_{1,12} - I_{2,12} = 108.1$ ¹⁰ (see columns 2, 3 and 4 in

¹⁰ While weighted gender segregation indexes are bounded between 0 and 1, each unweighted direct segregation index is bounded only from below.

Table 3).

On the other hand, in part B of the economy the sum of $GENCOM_j$ terms is - 11.4, indicating greater gender segregation in the public than in the private sector. First, in the male agricultural and blue collar occupations (1-4), where the more objective public system plays no special role, the $GENCOM_j$ terms are all negative and add up to - 8.0. Second, it might be argued that in the male white-collar occupation 5 (security personnel, including the police, and employees in passenger transport, including those from the public rail system) there is an in-built preference for males. It appears that in the public sector such preference offsets public recruiting procedures, so that the $GENCOM_j$ term is equal to - 2.1. Finally, in all male professional and managerial occupations (6-9), the $GENCOM_j$ terms are negative but very close to 0. Therefore, in this group gender segregation seems to be essentially the same in both sectors.

The net result is that the overall $GENCOM$ effect is equal to 4.9, indicating that the gender segregation induced by occupational choices within the private sector is greater than within the public sector.

III.2.B. Occupational Mix Effects

The sign of the occupational mix effects is also closely related to the partition of the economy into parts A and B. Except in occupation 12, where the weight of the

domestic service employed in the private sector is very important, the demographic share of the remaining occupations in part A of the economy is larger in the public than in the private sector (see columns 2 and 3 in Table 1). Consequently, $OCUPMIX_j$ values for these occupations are negative. As was seen before, occupations 5 and 8, which belong to part B, are among those for which the weight of the public sector is also greater than average. Therefore, they also produce a negative $OCUPMIX$ contribution. In the remaining 7 male occupations in part B of the economy (particularly occupation 2, including, among others, construction workers, drivers, iron and steel workers, and machine operators), the greater weight of the private sector leads to positive $OCUPMIX$ values. The net $OCUPMIX$ effect is equal to 2.2.¹¹

It can be concluded, first, that gender composition factors, heavily influenced by differences in the way people are selected for first entrance and promotion in the public and the private sector in the integrated and female occupations, give rise to less gender segregation in the public sector. Second, when the reference weights are equal to the mean of the demographic importance of each occupation in the private and the public sectors, the occupational mix effects work in the same direction. Third, these two effects offset the role of differences in the proportion of females in the

¹¹ It should be emphasized that the results on $GENCOM$ and $OCUPMIX$ depend very much on the weighting scheme used. For instance, when $\alpha_j = (T_{2j}/T_2)$, $GENCOM = 10.8$ and $OCUPMIX = - 3.7$. Alternatively, when $\alpha_j = (T_{1j}/T_1)$, $GENCOM = - 1$ and $OCUPMIX = 8$. But even in these cases, the important result is the following. For the text reference weights, the sum of the $GENCOM_j$ values for the group of integrated and female occupations where the weight of the public sector is above average (10, 11, 13, and 14), is equal to 13.1. For the two alternative weight schemes in this note, this figure is 18.5 and 7.7, respectively. On the other hand, recall that regardless of the weighting scheme used to disentangle the role of gender composition and occupational mix effects in the term $I_1 - I_2$, the end result is that in 1977 this term is equal to 7 index points.

employed population in both sectors, which indicate that there is more gender segregation in the public sector. Overall, the gender segregation in the private sector in 1977 is 14.2% greater than in the public sector.

IV. INTERTEMPORAL COMPARISONS

IV. 1. Changes in Total and Female Employment

As reported in Mora and Ruiz-Castillo (2003a), from 1977 to 1992 the employment population in the whole economy consisting of 29 occupations increases by only 2%, approximately. By activity sectors, this period is characterized by the decline of agriculture and industrial activities, and a terciarization of the economy in which the public sector plays a major role.¹²

A comparison of columns 1 and 5 in Table 1, indicates that the same pattern is observed in the divisible economy that is the object of study in this paper. 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, public jobs in the divisible economy, which represented 20.7% of total employment in the divisible economy in 1977, represent 29% of total employment in 1992. Finally, the list of occupations where the percentage of public jobs relative to total employment is above average

¹² Whereas employment in the private sector actually decreases by 600,000 persons, in the public sector there is an increase of 847,000 jobs. As a consequence, the percentage represented by the public sector

remains the same, namely, occupations 14, 13, 5, 8, 10, and 11 (see columns 4 and 8 in Table 1). But as a consequence of the growth of the public sector during this period, the percentage of total employment in these occupations grows from 39.5% in 1977 to 50.4% in 1992.¹³

As reported in Mora and Ruiz-Castillo (2003a), the proportion of females in the employed population in the whole economy consisting of 29 occupations increases by more than 5 points, from 28.6 to 32.9. In the divisible economy, this crucial parameter increases even more, from 21.6 in 1977 to 33.9 in 1992. As can be seen in the last row in Table 2, this magnitude goes from 19.4 to 29.1 in the private sector (see columns 3 and 7), and from 30.1 to 45.8 in the public sector (see columns 4 and 8), respectively.

IV. 2. Changes in Gender Segregation

In this scenario of increased female participation, this subsection will study two issues: the evolution of gender segregation in the public sector, and the comparison of gender segregation in the private and the public sector at the end of the period, in 1992.

IV.2.A. The Evolution of Gender Segregation in the Public Sector

To study the first issue, denote by $\Delta' \equiv I_{92}(2) - I_{77}(2)$ the difference in the public sector's gender segregation between 1992 and 1977. Using the ideas developed

increases from 10.8 to 17.4 per cent.

in Section II, and taking as reference weights the mean of the proportion of total employment in the public sector in 1977 and 1992, i. e. $\beta_j = (1/2)[(T_{2j92}/T_{292}) + (T_{2j77}/T_{277})]$, this difference can be accounted for the following three terms:

$$\Delta' = (I_{292}^2 - I_{277}^2) + (I_{292} - I_{277}) = \text{FMLPROP} + \text{GENCOM} + \text{OCUPMIX},$$

where $(I_{292}^2 - I_{277}^2) = \text{FMLPROP}$,

$$(I_{292} - I_{277}) = \text{GENCOM} + \text{OCUPMIX},$$

$$\text{GENCOM} = \sum_j \text{GENCOM}_j = \sum_j \beta_j (I_{2ij92} - I_{2ij77}), \quad (13)$$

$$\text{OCUPMIX} = \sum_j \text{OCUPMIX}_j$$

$$= \sum_j (1/2)[(T_{2j92}/T_{292}) - (T_{2j77}/T_{277})] (I_{2j92} + I_{2j77}). \quad (14)$$

The term $\text{FMLPROP} = (I_{292}^2 - I_{277}^2)$ is due to the difference between the female proportions in the public sector and the divisible economy as a whole in the two years under comparison, that is, the difference between W_k and W_{2k} , $k = 1992, 1977$.

The term $(I_{292} - I_{277})$ depends on two factors: differences in gender composition across occupations in the public sector in the two years, which manifest themselves via differences in the segregation indexes I_{2j92} and I_{2j77} (not shown here, but available on request); and differences in the occupational mix in the public sector in

¹³ 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.

the two years, T_{2j92}/T_{292} and T_{2j77}/T_{277} (see columns 3 and 7 in Table 1, respectively).

It turns out that $\Delta' = I(2)_{92} - I(2)_{77} = -0.18$, with a 5% confidence interval equal to $(-3.44, 2.76)$, indicating that changes in gender segregation have not been significant during the period.¹⁴ This is in spite of the fact that, because of the distance $W_{292} - W_{92} = 45.8 - 33.9$ is considerably larger than the distance $W_{277} - W_{77} = 30.1 - 28.6$, the term $FMLPROP = (I^2_{92} - I^2_{77}) = 4.35 - 2.79 = 1.56$ is positive, indicating that the direct gender segregation in the public sector is greater in 1992 than in 1977. This positive value is offset by the difference between the within-group terms $I_{292} - I_{277} = 26.8 - 28.5 = -1.74$. The detailed information to analyze the role of gender composition and occupational mix effects in this result is in Table 4.

Table 4 around here

The first two columns in Table 4 refer to the terms $GENCOM_j$ and $OCUPMIX_j$, defined in equations 13 and 14, respectively, while column 3 refers to the term $TOTAL_j$ that is equal to the sum of the first two.

Although, as we have seen, the more interesting $GENCOM$ term is close to zero, this hides a fundamental asymmetry. In all occupations in part A of the economy (occupations 10-14), the proportion of females has increased a minimum of 7 percentage points (occupation 14) or a maximum of 15 percentage points

¹⁴ In contrast, the value for the private sector is 5.21 with a 5% confidence interval equal to $(3.35, 7.07)$.

(occupation 10). However, in all cases this is offset by the increase in the proportion of females in the public sector in 1992, so that the corresponding $GENCOM_j$ values are negative. The sum of these values for this set of integrated and female occupations is $-0.2 - 4.8 = -5.0$. Thus, in occupation 12 (domestic service, typist and other operators), as well as in the remaining occupations in part A that are all especially affected by public procedures (10, 11, 13, and 14), gender segregation decreases in 1992.¹⁵ However, this effect is offset by the increase in gender segregation in all male occupations (except occupation 8) in part B of the economy, yielding a total $GENCOM$ value of only 0.84.

The asymmetric behavior in both parts of the economy is also present in the occupational mix effects. Total employment in all male occupations in part B of the economy has declined, causing the corresponding $OCUPMIX_j$ terms to be negative. This offsets the opposite effect in the integrated and female occupations in part A, so that the total $OCUPMIX$ term is equal to -2.6 . The net result is a negative $TOTAL$ term equal to -1.7 .

IV.2.B. Gender Segregation in the Private versus the Public Sector in 1992

Even if gender segregation in the public sector is slightly smaller in 1992 than in 1977, it remains to be investigated whether in 1992 gender segregation is again smaller in the public than in the private sector. For this purpose, the decomposition

¹⁵ As a matter of fact, in occupation 8 (physicians and other long list of qualified professionals), where the weight of the public sector is above average, $GENCOM_j$ is also negative. Thus, of all the occupations

used in equation (11) will be used:

$$\Delta \equiv I(1) - I(2) = \text{FMLPROP} + \sum_j \text{GENCOM}_j + \sum_j \text{OCUPMIX}_j.$$

As already indicated, the proportion of females in total employment in the divisible economy is now equal to $W = 33.9$, while this rate in the private and the public sector is 29.1 and 45.8, respectively. These differences cause now $\text{FMLPROP} = (I^1 - I^2)$ to be equal to $0.78 - 4.35 = -3.57$ (*versus* -2.57 in 1977). However, as in 1977, this negative value is offset by the difference between the within-group terms, $I_1 - I_2 = 40.2 - 26.8 = 13.4$ (*versus* 7 in 1977). Therefore, $\Delta = I(1) - I(2) = 40.97 - 31.12 = 9.85$ (with a bootstrapped 2.5% lower bound of 7.54), indicating that in 1992 gender segregation is again significantly greater in the private than in the public sector.

The remaining of this section is devoted to the detailed analysis of the term $(I_1 - I_2) = \sum_j \text{GENCOM}_j + \sum_j \text{OCUPMIX}_j$. Using again as reference weights the mean of the occupations' demographic importance in each sector, i. e. $\alpha_j = (1/2) [(T_{1j}/T_1) + (T_{2j}/T_2)]$, the relevant information is in Table 5.

Table 5 around here

The overall GENCOM effect is only equal to 0.6 (*versus* 4.9 in 1977), indicating that in 1992 the gender segregation induced by occupational choices is practically equal in the private and the public sector. However, the pattern of GENCOM_j values in 1992 is

where the public sector is important, only in occupation 5 the GENCOM_j term is positive indicating that gender segregation has increased during the period.

exactly the same as in 1977 (compare column 5 in Tables 3 and 5).

In the integrated and all female occupations (10-14) in part A of the economy, gender segregation is greater in the private sector. In particular, in occupations 10, 11, 13, and 14, where the weight of the public sector is above average for the divisible economy as a whole, the sum of $GENCOM_j$ values is equal to 14.6 (*versus* 13.2 in 1977). This can be again partly attributed to the public system of filling job openings. Due to the fact that, as in 1977, the female proportion in the private sector in occupation 12 (domestic service, typist and other operators) in 1992 is well above that proportion for the private sector as a whole, the $GENCOM_{12}$ value is also positive and of a rather large order of magnitude.

On the other hand, as in 1977, in the male agricultural and blue collar occupations (1-4) in part B of the economy, where the more objective public system plays no special role, gender segregation is systematically greater in the public sector. The same is again the case in the male white-collar occupation 5 (security personnel, including the police, and employees in passenger transport, including those from the public rail system) where there is an in-built preference for males. Finally, in all male professional and managerial occupations (6-9), the $GENCOM_j$ terms have negative values, that are greater in absolute terms than in 1977. Thus, the $GENCOM$ values in part B of the economy add up to - 14.9 index points, indicating that gender segregation in 1992 is significantly smaller in the private than in the public sector.

As far as the impact of occupational mix differences between the two sectors, the pattern in 1992 is exactly the same as in 1977. Namely, except occupation 5

(security personnel, including the police, and employees in passenger transport, including those from the public rail system), all male occupations in part B of the economy –especially blue collar occupations- are more important in the private sector. Consequently, the corresponding $OCUPMIX_j$ values are positive. Instead, except occupation 12, the remaining occupations in part A of the economy -especially occupations 13 and 14, are more important in the public sector and yield negative $OCUPMIX$ values. The difference between the two years is that in 1992 the overall $OCUPMIX$ value is 12.8 *versus* only 2.2 in 1977. As pointed out before, this makes the $TOTAL$ value equal to 13.4 in 1992 (*versus* only 7 in 1977), which is large enough to offset the negative $FMLPROP$ term.

V. CONCLUSIONS

It can be argued that, in many countries, recruiting and promotion procedures in the public sector are less discriminatory than in the private sector. This paper has studied the consequences of this fact on occupational gender segregation in Spain in 1977 and 1992, two years for which comparable data were available. For this purpose, attention has been focused on those occupations with a public sector of a certain minimum size in what has been called the divisible economy. Moreover, an additively separable index of gender segregation based on the entropy concept has been used.

Two major questions have been investigated. (1) Is gender segregation in the public sector in 1977 and 1992 smaller than in the private sector? (2) The period 1977-1992 in Spain has been characterized by an expansion of the public sector and an

important increase in female labor participation. Much of that increase has taken place through the public sector. The question is, has gender segregation decreased in this sector during this period? The first lesson is that the answers to these questions depend on a variety of factors working in opposite directions. The additive separability property of the measurement instrument used in the paper has made possible to clearly distinguish among them.

About 3/4 of total employment in Spain is concentrated in the private sector. However, public hiring procedures and other job characteristics explain why women are particularly attracted to the public sector. Consequently, the discrepancy between the proportion of females employed in each of the two sectors and in the divisible economy as a whole is considerably larger in the public than in the private case. In the paper's measurement framework, this means that direct gender segregation in the public sector is larger than in the private sector.

Beyond this regularity, well established in both 1977 and 1992, the interesting question is whether gender segregation *within* the public sector is smaller than *within* the private sector. It has been found that, in both years, the answer is positive and that this factor offsets the difference in direct gender segregation. Thus, as far as question (1) is concerned, it can be concluded that overall gender segregation in the private sector is significantly larger than in the public sector. The order of magnitude is 14% in 1977 and 32% in 1992.

Differences in gender segregation within sectors can be accounted for two factors: differences in gender composition across occupations, which is the more

important element from a normative point of view; and differences between the occupations' demographic shares that are used as aggregation weights for gender segregation from the occupational to the sector level. However, the paper has shown that it is necessary to probe further into the problem. The reason is that it cannot be expected that hiring public procedures operate uniformly and with the same strength in all occupations. The following considerations had lead to an interesting distinction in this respect.

First, where do we expect the public sector to be important? The answer is, in the service sector, i.e. in white collar, professional and managerial occupations, rather than in agricultural and industrial, blue-collar occupations. Second, in what type of occupations is a large female presence more likely? The answer is, again, in white collar, professional and managerial occupations, rather than in agricultural or industrial ones in many of which physical strength and other factors may favor males over females. Given these regularities, it has been useful to distinguish between two types of occupations. On one hand, integrated and female occupations –part A of the economy– and, on the other hand, male occupations –part B. Together with an occupation dominated by domestic service that basically takes place in the private sector, part A of the economy contains most of the white collar, professional and managerial occupations where the proportion of public sector jobs is above average. Clearly, publicly advertised examinations, open to anyone with the appropriate educational credentials, are bound to have the greatest impact through this last set of occupations. Part B contains the rest of the white collar, professional and managerial occupations, as well as all agricultural

and blue collar ones. The important empirical result is that, as expected, in both years gender composition effects in part A of the economy indicate that gender segregation is smaller in the public than in the private sector. Interestingly, gender composition effects in part B of the economy work in the opposite direction.

The asymmetry between the two parts of the economy is extended to the occupational mix effects. The reason is that most of the occupations where the public sector is relatively more (less) important are concentrated in part A (part B) of the economy. Reference weights are equal to the mean of the occupations' demographic importance in each sector. Therefore, occupational mix effects in parts A and B of the economy tend to increase and decrease, respectively, the gender segregation in the public relative to the private sector.

As has been pointed out, the proportion of females in the public sector during the period 1977-1992 has increased more than the proportion of females in the employed population. In the paper's measurement framework, this means that direct gender segregation in the public sector has increased during the period. However, this has been offset by a comparable decrease in the gender segregation that has taken place within the public sector. In accounting for this decrease, the distinction between gender composition and occupational effects has again been useful. In turn, these effects have been seen to work in opposite directions in the two parts of the economy. It is important to emphasize that the gender segregation induced by occupational choices in the public sector has decreased in the occupations especially affected by public hiring procedures in part A of the economy, but has increased in the occupations in part B. The end result is

that, in spite of the expansion of the public sector, gender segregation in this sector has remained essentially constant during this period.

DATA APPENDIX

As indicated in the Introduction, the Spanish data for this study comes from EPA (*Encuesta de Población Activa*), a labor force survey conducted by the Spanish *Instituto Nacional de Estadística*. 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 7 consecutive quarters; thus, one eighth 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. The period studied is 1977 – 1992.

The time period starts in 1977, the first year for which microeconomic data is available in electronic support. 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 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.¹⁶

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 in order to be meaningfully partitioned by sector. Given that we are limited by a relatively small sample size, a

¹⁶ Because EPA is a labour force survey rather than a census, there are a relatively low number of two-digit occupations and industries. In Herranz *et al.* (2002) occupations are taken as the basic partition and are combined with two-digit industries to obtain an initial list of 106 occupational categories.

¹⁷ In 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.

search for the smallest possible set of occupations is called for.

Herranz *et al.* (2003) explore how far it is possible to aggregate an initial list of occupations without reducing the gender segregation value too much. Using an algorithm based on the bootstrap, that paper shows that a 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, and the direct gender segregation induced by occupational choices is 27.0 in 1977 and 27.4 in 1992.

According to 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 the private and the public sector need to be considered. In each of the selected occupations, the percentage of public sector jobs in total employment in both years is set equal, at least, to 7.5%. This criterion is fulfilled by 14 of the 29 available occupations.¹⁸ Their description can be found below.

The selected occupations, which constitute what is called the divisible economy, represent 39.4% of total employment and 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.

LIST OF OCCUPATIONS

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

MALE

Agriculture

- 1 Fish and game workers

¹⁸ In 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. An exception was made with another occupation in which public employment was 11.5 in 1992 and 4.9 in 1977. This occupation was included in the divisible economy.

Forestry workers

Blue collar

- 2** 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
- 3** Mechanics, machinists, watchmakers and other precision mechanics
Shoemakers in repair services
- 4** Plumbers, welders, sheet metal workers

White collar

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

Professional and managerial

- 6** Companies Directors and managers
Owners or managers of commercial establishments in wholesale trade
Head of sales and head buyers
Inspectors of transport and communication services
Operator of agricultural or fishing enterprises
Directors and managers of commercial establishments
Owners or managers of commercial establishments in other industries
Members of governmental branches
- 7** Owners or managers of hotel, restaurant services in restaurants
Head clerks and office managers
Directors and managers of hotel in restaurant services
- 8** 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
- 9** Draftsmen and engineering technicians
Architects and engineers
Pilots and Officers of air and maritime navigation

INTEGRATED

White collar

- 10** Employees in administrative services in non-classified areas in other services
Employees in administrative services in non-classified areas in agriculture and mining
Employees in administrative services in non-classified areas in wholesale trade
Employees in administrative services in non-classified areas in hotels and restaurants
Supervisors of domestic service personnel

FEMALE

White collar

- 11** Concierges, building supervisors, and cleaning service personnel in other services
Hair stylists and beauty treatment personnel
Concierges, building supervisors, and cleaning service personnel in trade and transport,
Chefs, cooks, and food service personnel in other industries
Dry cleaning and laundry service employees
Telephone and telegraph operators
Concierges, building supervisors, and cleaning service personnel in agriculture and mining
- 12** Domestic service personnel and other like personnel
Stenographers, typists, and key-punch operators
- 13** Medical, veterinary, and pharmaceutical assistants and technicians
Employees in accounting, cashier, and teller positions in trade and miscellaneous repair

Professional and managerial

- 14** Teachers
Professionals or technicians in non-classified areas

REFERENCES

- Becker, G. (1957), *The Economics of Discrimination*, Chicago: Chicago University Press.
- Bergmann, B. (1974), "Occupational Segregation, Wages and Profits When Employers Discriminate by Race or Sex", *Eastern Economic Journal*, **1**: 103-110.
- Blau, F., P. Simson, and D. Anderson (1998), "Continuing Progress? Trends in Occupational Segregation Over the 1970s and 1980s", *Feminist Economics*, **4**: 29-71.
- Deutsch, J, Y. Flückiger, and J. Silber (1994), "Measuring Occupational Segregation", *Journal of Econometrics*, **61**: 133-146.
- England, P. (1981), "Assessing Trends in Occupational Sex Segregation, 1900-1976", en I. Berg, ed., *Sociological Perspectives on Labor Markets*, Academic Press.
- Duncan, O. And B. Duncan (1955), "A Methodological Analysis of Segregation Indexes", *American Sociological Review*, **20**: 210-217.
- Flückiger, Y. and J. Silber (1999), *The Measurement of Segregation in the Labor Force*, Heidelberg: Physica-Verlag.
- Herranz, N., R. Mora and J. Ruiz-Castillo (2003), "An Algorithm to Reduce the Occupational Space in Gender Segregation Studies", Working Paper 03-14, Economic Series 03, Universidad Carlos III.
- Hutchens, R. M. (1991), "Segregation Curves, Lorenz Curves and Inequality in the Distribution of People Across Occupations", *Mathematical Social Sciences*, **21**: 31-51.
- Mora, R. and J. Ruiz-Castillo (2003a), "Additively Decomposable Segregation Indices. The Case of Gender Segregation by Occupations and Human Capital Levels in Spain", Working Paper 03-15, Economic Series 04, Universidad Carlos III.
- Mora, R. and J. Ruiz-Castillo (2003b), "Gender Segregation: From Birth To Occupation", Universidad Carlos III, mimeo.
- Silber, J. (1989), "Factor Components, Population Subgroups and the Computation of the Gini Index of Inequality," *Review of Economics and Statistics*, **LXXI**: 107-115.
- Theil, H. (1971), *Principles of Econometrics*, New York: John Wiley and Sons.
- Zoloth, B. (1976), "Alternative Measures of School Segregation", *Land Economics*, **52**: 278-298.

Table 1. Descriptive Statistics for the Total Population In the Partition By Sector and Occupations, 1977 and 1992

OCCUPATION	1977				1992			
	Total employment	Private	Public	Percentage Public/Total	Total employment	Private	Public	Percentage Public/Total
MALE	66.1	70.6	49.1		56.9	64.6	38.1	
Agriculture								
1.	2.5	2.6	2.1	17.8	1.2	1.5	0.6	13.4
Blue Collar	40.5	46.1	19.3		31.6	39.5	12.1	
2.	29.1	33.2	13.4	9.5	22.8	28.4	9.2	11.7
3.	7.7	8.8	3.3	9.0	5.7	7.4	1.7	8.7
4.	3.7	4.0	2.5	14.1	3.0	3.8	1.2	11.3
White Collar								
5.	5.7	4.1	11.8	42.7	6.8	4.8	11.5	49.4
Prof. And Manag.	17.4	17.8	15.9		17.4	18.8	14.0	
6.	6.3	7.6	1.5	4.9	5.6	7.0	2.2	11.5
7.	4.5	4.4	4.5	20.9	3.7	4.3	2.2	17.5
8.	3.5	2.6	6.7	40.3	5.3	4.6	7.0	38.2
9.	3.2	3.2	3.1	20.4	2.8	2.9	2.5	26.3
INTEGRATED								
White Collar								
10.	14.3	13.5	17.5	25.3	15.7	13.7	20.4	37.6
FEMALE	19.6	16.0	33.4		27.4	21.7	41.5	
White Collar	14.1	13.5	16.4		18.8	17.8	21.4	
11.	8.2	7.9	9.7	24.4	9.3	9.0	10.0	31.3
12.	3.8	4.4	1.4	7.5	4.8	6.1	1.7	9.9
13.	2.1	1.3	5.3	52.3	4.7	2.7	9.7	59.8
Prof. And Manag.								
14.	5.5	2.5	17.0	64.3	8.6	3.9	20.1	67.7
TOTAL	100.0	100.0	100.0	20.7	100.0	100.0	100.0	29.0

Table 2. Female Employment and Female Proportions In the Private and the Public Sectors In the Partition By Occupations, 1977 and 1992

OCCUPATION	1977				1992			
	Female Employment		W _{1j}	W _{2j}	Female Employment		W _{1j}	W _{2j}
	Private	Public			Private	Public		
MALE	15.5	11.0			15.5	11.0		
Agriculture								
1.	0.0	0.0	0.7	0.8	0.0	0.0	0.9	0.0
Blue Collar	2.9	0.5			2.9	0.5		
2.	1.8	0.5	0.5	0.3	1.8	0.5	1.9	2.4
3.	0.7	0.0	2.4	0.0	0.7	0.0	2.9	0.4
4.	0.4	0.0	0.5	1.1	0.4	0.0	3.0	1.2
White Collar								
5.	1.5	2.5	4.4	1.9	1.5	2.5	8.9	10.1
Prof. And Manag.	11.0	7.9			11.0	7.9		
6.	2.0	0.4	2.8	7.3	2.0	0.4	8.2	7.7
7.	3.5	1.6	17.9	17.4	3.5	1.6	23.9	31.9
8.	5.0	5.6	15.3	15.8	5.0	5.6	31.1	36.4
9.	0.6	0.4	3.5	3.8	0.6	0.4	6.1	7.2
INTEGRATED								
White Collar								
10.	24.9	25.8	37.6	42.8	24.9	25.8	52.6	58.0
FEMALE	59.7	63.3			59.7	63.3		
White Collar	52.1	36.3			52.1	36.3		
11.	24.4	15.2	70.7	58.9	24.4	15.2	79.0	69.5
12.	20.6	3.2	94.7	83.2	20.6	3.2	97.4	89.1
13.	7.1	17.9	73.2	75.5	7.1	17.9	78.4	84.5
Prof. And Manag.								
14.	7.6	27.0	65.6	54.7	7.6	27.0	56.1	61.4
TOTAL	100.0	100.0	W₁ = 19.4	W₂ = 30.1	100.0	100.0	W₁ = 29.1	W₂ = 45.8

Table 3. Differences in Within-group Gender Segregation Across Occupations in the Private and the Public Sector. 1977

OCCUPATION	Pesos (1)	I_{1j} (2)	I_{2j} (3)	$I_{1j} - I_{2j}$ (4)	GENCOM (5) (1) x (4)	OCUPMIX (6)	TOTAL (7) = (5) + (6)
MALE	59.8				- 11.4	9.1	- 2.2
Agriculture							
1.	2.3	26.6	46.0	-19.4	-0.5	0.2	-0.3
Blue Collar	32.7				- 7.5	10.1	2.5
2.	23.3	27.5	49.2	-21.7	-5.1	7.6	2.5
3.	6.1	19.9	51.6	-31.7	-1.9	2.0	0.0
4.	3.3	27.8	44.1	-16.3	-0.5	0.5	0.0
White Collar							
5.	8.0	14.3	40.3	-26.0	-2.1	-2.1	-4.2
Prof. And Manag.	16.8				- 1.3	1.1	- 0.2
6.	4.5	18.5	22.7	-4.3	-0.2	1.3	1.1
7.	4.5	0.1	6.1	-6.0	-0.3	0.0	-0.3
8.	4.7	0.8	7.9	-7.1	-0.3	-0.2	-0.5
9.	3.2	16.6	33.1	-16.5	-0.5	0.0	-0.5
INTEGRATED							
White Collar							
10.	15.5	12.8	5.2	7.6	1.2	-0.4	0.8
FEMALE	24.7				15.1	- 6.8	8.4
White Collar	15.0				9.8	- 0.1	9.8
11.	8.8	88.8	25.7	63.2	5.6	-1.1	4.5
12.	2.9	195.8	87.7	108.1	3.1	4.3	7.4
13.	3.3	97.4	63.1	34.3	1.1	-3.3	-2.1
Prof. And Manag.							
14.	9.7	72.8	18.9	53.9	5.3	-6.7	-1.4
TOTAL	100.0	35.6	28.5		4.9	2.2	7.0

**Table 4. Change in Gender Segregation Within the Public Sector
From 1977 to 1992**

OCCUPATION	GENCOM	OCUPMIX	TOTAL
MALE	5.8	-5.8	0.0
Agriculture			
1.	0.6	-1.1	-0.5
Blue Collar	4.1	-4.5	-0.4
2.	2.6	-2.5	0.1
3.	0.8	-1.1	-0.3
4.	0.6	-0.8	-0.2
White Collar			
5.	0.4	-0.1	0.3
Prof. And Manag.	0.7	-0.1	0.6
6.	0.5	0.3	0.8
7.	0.0	-0.1	-0.1
8.	-0.4	0.0	-0.3
9.	0.6	-0.3	0.3
INTEGRATED			
White Collar			
10.	-0.2	0.1	0.0
FEMALE	-4.8	3.1	-1.7
White Collar	-2.6	2.7	0.1
11.	-0.9	0.1	-0.8
12.	-0.4	0.2	-0.2
13.	-1.2	2.4	1.2
Prof. And Manag.			
14.	-2.2	0.4	-1.8
TOTAL	0.8	-2.6	-1.7

Table 5. Differences in Within-group Gender Segregation Across Occupations in the Private and the Public Sector. 1992

OCCUPATION	Pesos (1)	I _{1j} (2)	I _{2j} (3)	I _{1j} - I _{2j} (4)	GENCOM (5) (1) x (4)	OCUPMIX (6)	TOTAL (7) = (5) + (6)
MALE	51.4				- 14.9	15.9	1.0
Agriculture							
1.	1.0	43.4	88.4	-45.0	-0.5	0.6	0.1
Blue Collar	25.8				- 9.7	15.5	5.8
2.	18.8	38.6	72.4	-33.8	-6.3	10.6	4.3
3.	4.5	34.4	84.7	-50.2	-2.3	3.4	1.1
4.	2.5	34.1	79.2	-45.1	-1.1	1.5	0.4
White Collar							
5.	8.2	17.8	43.5	-25.7	-2.1	-2.1	-4.2
Prof. And Manag.	16.4				- 2.6	1.9	- 0.7
6.	4.6	19.3	51.0	-31.7	-1.5	1.7	0.2
7.	3.3	1.0	5.8	-4.8	-0.2	0.1	-0.1
8.	5.8	0.1	2.6	-2.5	-0.1	0.0	-0.2
9.	2.7	24.2	52.9	-28.8	-0.8	0.1	-0.6
INTEGRATED							
White Collar							
10.	17.1	17.4	4.3	13.1	2.2	-0.7	1.5
FEMALE	31.6				13.2	- 2.3	10.9
White Collar	19.6				11.3	0.1	11.4
11.	9.5	76.9	16.5	60.4	5.7	-0.5	5.2
12.	3.9	157.2	60.2	97.0	3.8	4.9	8.7
13.	6.2	75.0	46.6	28.4	1.8	-4.3	-2.5
Prof. And Manag.							
14.	12.0	22.8	7.0	15.8	1.9	-2.4	-0.5
TOTAL	100.0	40.2	26.8		0.6	12.8	13.4