Segregación ocupacional por género: Un análisis empírico de la Colombia urbana (1986-2004)

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Occupational Segregation by Gender: An Empirical Analysis for Urban Colombia (1986-2004)*

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Keywords

JEL classification

Abstract

This paper examines the evolution of gender segregation indexes by occupation in the urban labour markets of Colombia between 1986 and 2004 and presents a decomposition of their changes over time using a technique proposed by Deutsch et al. (2006). We find that a substantial proportion of the reduction in segregation indexes for this country is driven by changes in both, the employment structure of occupations and the increasing female labour participation observed over these years while changes in the gender composition of occupations have favoured mainly government employees and those with university education.

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Segregación ocupacional por género: un análisis empírico de la Colombia urbana (1986-2004)

Resumen

Este artículo examina la evolución de los índices de segregación por género según el tipo de ocupación en el mercado laboral urbano de Colombia entre 1986 y 2004. También presenta un desglose de sus cambios a lo largo del tiempo, usando una técnica propuesta por Deutsch et al. (2006). Se encuentra que una proporción considerable de la reducción en los índices de segregación en este país es impulsada por los cambios tanto en la estructura de empleo para las ocupaciones como en la creciente participación laboral femenina que se observó durante esos años; mientras que los cambios en la composición por género han favorecido principalmente a los empleados gubernamentales y a quienes tienen educación universitaria.

Segregação ocupacional por gênero: analise empírico para a Colômbia urbana (1986-2004)

Resumo

Este artigo examina a evolução dos índices de segregação de gênero por ocupação no mercado de trabalho urbano na Colômbia entre 1986 e 2004 e apresenta uma decomposição das mudanças ao longo do tempo usando a técnica proposta por Deutsch et al. (2006). Achamos que uma proporção substancial da redução nos índices de segregação para este país é impulsionada por mudanças tanto na estrutura do emprego das ocupações quanto no acréscimo da participação no trabalho feminino observado ao longo destes anos, enquanto mudanças na composição de gênero das ocupações favoreceram principalmente os empregos estatais e aqueles com ensino universitário.

Introduction

Gender discrimination in the labour market has several dimensions. The more widely studied is the gender wage gap itself, while others, such as occupational gender segregation, have merited less attention in the empirical literature. This may be explained by methodological problems arising from the appropriate choice of the occupational aggregation level, as well as changes to the classifications of occupations over time. Despite these difficulties, differences in the pattern of jobs performed by men and women, and their evolution over recent decades are still an important issue in the study of labour markets.

The existing literature suggests substantial and persistent gender differences in the distribution of jobs typically performed by men and women in all regions of the world although, the degree of occupational horizontal segregation by gender has exhibited a substantial decrease in recent decades (Deutsch, Morrison, Piras, & Ñopo, 2002; Tzannatos, 1999; Baunach, 2002; Anker et al., 2003; Semyonov & Jones, 1999). There is less agreement, however, on how to measure occupational segregation. It has been found that the Duncan & Duncan (1955) Dissimilarity Index and other absolute difference measures are sensitive to the number of occupations used in their computation (Melkas & Anker, 1997). Another problem with conventional measures of segregation is that they are influenced by increases in the number of men and women entering the labour force and by the extent of female labour force participation. Blackburn & Harman (2005) found that in some developed countries, such as Sweden and Finland, high levels of occupational gender-based segregation co-exist with high degrees of gender equality and low levels of the gender wage gaps. As argued by Semyonov & Jones (1999), in the gender analysis of occupations, nominal (or horizontal) segregation as measured by dissimilarity indexes is conceptually different from occupational inequality (or vertical segregation) and may be influenced differently by the labour market structure and the level of socio-economic development. From a statistical point of view, all of this suggests that measures of occupational segregation are sensitive not only to changes in female labour participation but also to changes in the structure of occupations. This is problematic from a policy analysis perspective, since changes in segregation indexes over time may not be entirely explained by changes in the gender composition of particular occupations.

This paper is devoted to enhancing understanding about the evolution of horizontal gender-based occupational segregation over time through an empirical

application using data from urban areas of Colombia over the period 1986 to 2004.[1] In addition to the conventional Duncan & Duncan (1955) Dissimilarity Index, this paper presents other measures of horizontal occupational segregation by gender comprising the Gini coefficient based on the distribution of jobs by gender (see Deutsch et al., 1994) and the Karmel & MacLachlan (1988) index of labour market segregation. In order to address some of the biases mentioned above on segregation measures, we implemented a decomposition technique proposed by Deutsch et al. (2006) in which in the effect of changes in 'net segregation', in other words, changes in the share of women within particular occupations, is separated from changes in 'gross segregation' in both the gender composition of the overall labour force and the structure of occupations. Although this study is focused on only one country, it exploits the advantage of having compatible data from household micro-level data surveys covering 19 years on 82 occupational groupings. The remainder of the paper is organized as follows. The next section presents a review of the existing literature on gender segregation in the labour market and its measurement. The third describes the data, while the fourth provides some contextual background on Colombia. The fifth section reports the empirical results using three different measures of horizontal gender-based occupational segregation in urban Colombia and presents an analytical decomposition of their changes between 1986 and 2004. The final section offers some concluding remarks.

Literature review

Gender-based occupational segregation: some basic concepts

A precise definition of occupational gender segregation should distinguish between three overlapping concepts: exposure, concentration and segregation (Blackburn & Jarman, 2005). Exposure is related to the degree of social contact and interaction that one gender group has with those from the other in the labour sphere.

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[1] The choice of this period was dictated by a change in the methodology in the sampling design of the Colombian household surveys in subsequent years, which makes unfeasible the comparability of the series for a longer period.

A high degree of occupational segregation by gender implies that male workers enjoy a low exposure to women. Concentration relates to the composition of the labour force by gender and is measured in one or more occupations. By definition, concentration can only be equal for men and women in the case that both gender groups are equally represented in absolute numbers. Segregation relates to the existence of a differentiated pattern of occupations predominantly performed by either women or men. Gender-based occupational segregation is clearly linked to gender inequality in the labour market. In this context, horizontal and vertical dimensions should be distinguished. Semyonov & Jones (1999) suggest that horizontal and vertical segregation should be interpreted as two different theoretical concepts. Based on data from a cross-sectional analysis of 56 countries, they conclude that the structural characteristics of the labour market affect both dimensions of gender segregation in different ways. For instance, while increasing female labour participation tends to be associated with lower levels of horizontal segregation, they find that in those countries where women comprise a large proportion of the labour force, their access to 'high-status' occupations appears more restricted.

Blackburn & Jarman (2005) note the paradoxical case for some developed countries (e.g., Sweden and Finland) of high levels of horizontal segregation by gender co-existing with high degrees of gender equality and small gender pay gaps. In short, they explain that although women and men enjoy equal access to education and training opportunities, female career paths tend to specialize in female-dominated jobs where their access to managerial positions is higher. In this way, high levels of horizontal segregation may be possible with high levels of gender equality in terms of gender pay gaps and female representation in managerial positions.[2]

Measuring occupational segregation: methodological issues

The dissimilarity index (hereafter, *DI*) is the most popular measure of horizontal occupational segregation in the literature (Anker et al., 2003; Anker & Melkas, 1997; Blackburn & Jarman, 2005; Mulekar et al., 2007; Silber, 1989; Karmel &

2   For an earlier discussion about gender occupational segregation in Nordic countries, see Melkas & Anker (1997).

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MacLachlan, 1988). It was originally proposed by Duncan and Duncan (1955) to analyse the degree of geographical segregation of non-white communities in the United States. The Duncan and Duncan or dissimilarity index, *DI*, is defined by the following formula:

$$DI = \frac{1}{2} \sum_{i=1}^{n} \left| \frac{F_i}{F} - \frac{M_i}{M} \right|, \qquad i = 1,2,...,n \qquad (1.1)$$

where *n* is the number of occupations, F_i and M_i are the number of female and male workers in occupation *i* respectively, and *F* and *M* refer to the total number of female and male workers. This measure may be interpreted as the percentage of women and men who have to move to different occupations (activities) in order to generate a completely even distribution of jobs by gender group.

Despite its popularity, the *DI* has some methodological weaknesses. In particular, the index is sensitive to the number of categories used in its computation (Blackburn et al., 2001). For instance, the *DI* will increase, *ceteris paribus*, with the number of employment occupations. This entails obvious difficulties in trying to compare the degree of occupational segregation based on a crude measure of the *DI* across countries with different classification systems of occupations or in the case of time-series analyses when a given classification system incorporates new occupations. One way in which this problem is addressed in the literature consists of limiting the computation to a small number of categories. For example, in a cross-sectional comparison of employment segregation by gender, Tzannatos (1999) uses six economic activities for the 61 countries included in the analysis, while Semyonov & Jones (1999) deploy seven major occupational categories to compare 56 countries. If the data are highly disaggregated, more sophisticated procedures have been suggested by, among others, Blackburn et al. (2001), Blackburn & Jarman (2005) and Anker (2003).

Another caveat with the *DI* is that it equally weights each occupation regardless of its share in total employment (Silber, 1989). Alternative measures have been suggested to incorporate in a more adequate way the heterogeneity of the occupations' relative weights by the use of concepts developed from the income inequality literature (see Silber (1989) for a detailed discussion). Specifically, these measures take advantage of the fact that the *DI* was developed originally from the concept of the segregation curve, which, in the case of gender occupational segregation, is a

graphical representation of the cumulative proportions of female and male workers in each occupation. The segregation curve is analogous to the Lorenz curve in the income distribution literature. A number of measures have been formulated, but, in the current paper, we use a Gini coefficient based on the distribution of jobs by gender. Formally, the Gini coefficient of the distribution of jobs by gender is given by the following expression:

$$GI = \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \frac{M_i}{M} \frac{M_j}{M} \left| \frac{F_i/M_i - F_j/M_j}{F/M} \right| \qquad (1.2)$$

where M_i and F_i are defined as in (1.1). It should be noted that because the weights used in the computation of GI are implicitly the shares of each occupation in total female employment, it represents a weighted relative mean of deviations of the male/female ratios from an average gender distribution of jobs within occupations. It follows that because the DI is a simple average of mean deviations from occupational gender ratios, GI and DI should yield similar results (Deutsch et al., 1994, p. 134). However, GI has the advantage of being less sensitive to changes in the weights of different occupations over time.

An additional problem with the DI relates to the practical feasibility of its interpretation. In the hypothetical scenario that the female (or male) labour force was re-distributed as suggested by the index, it would mean a change in the underlying structure of the labour force, either in terms of occupations or economic activities. In order to address this problem, Karmel & MacLachlan (1988) have formulated an index of the proportion of people required to change jobs in order to obtain the same distribution of jobs for men and women without altering the underlying occupational structure. This index may be expressed as:

$$KM = \sum_{i=1}^{n} \left| a \frac{M_i}{T} - (1-a) \frac{F_i}{T} \right| \qquad (1.3)$$

where a ($=F/(M+F)$) represents the female participation in the labour force and $T = M + F$. This index dominates the traditional DI expressed in (1) because it takes into account that men and women have different participation rates in the labour force (Deutsch et al., 2002, p. 22). Thus, the KM index is less sensitive to changes

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in female labour force participation, which is typically increasing over time and has the potential of biasing the conventional *DI* downwards. It is possible to derive an alternative measure of *KM* in which the female labour participation may be held constant over time, so the changes in horizontal gender occupational segregation between different periods may be netted out from changes in the overall gender composition of the labour force. Assume two periods of time $t=1,2$ and their corresponding shares of female employment such that $a_1 < a_2$. Assume also that their corresponding indexes for the two periods are such as $KM_1 > KM_2$. Then, we have:

$$KM_1 = \sum_{i=1}^{n} \left| a_1 \frac{M_i}{T} - (1-a_1) \frac{F_i}{T} \right| \tag{1.3a}$$

represents the index for t=1 and

$$KM_2 = \sum_{i=1}^{n} \left| a_2 \frac{M_i}{T} - (1-a_2) \frac{F_i}{T} \right| \tag{1.3b}$$

is the corresponding index for $t=2$. We may also estimate an alternative segregation measure, KM^*, for $t=2$ in which the share of female employment is held constant at the level of period 1 such as

$$KM_2^* = \sum_{i=1}^{n} \left| a_1 \frac{M_i}{T} - (1-a_1) \frac{F_i}{T} \right|. \tag{1.3c}$$

Thus, the total differential of employment segregation between $t=1$ and $t=2$ as measured by *KM* would be

$$\Delta = KM_2 - KM_1 \tag{1.4}$$

and the differential net of changes in female labour force participation would be

$$\Delta^* = KM_2^* - KM_2. \tag{1.5}$$

Therefore, controlling for changes in female labour force participation makes the *KM* index amenable to inter-temporal decompositions in which changes in the level of female labour force participation may be an important factor in the evolution of occupational segregation.[3]

One of the methodological difficulties in the measurement of gender occupational segregation relates to the comparability of different classifications under which the data on occupations are collected over time. Even if an occupational classification remains unaltered over a long period, comparisons between different estimates of the same segregation measure for two or more periods are uncertain without reference to their variability. A similar concern applies when judging differences in dissimilarity indexes for different socio-demographic groups within the same population. Deutsch et al. (1994) suggest a bootstrap technique to compute standard errors and confidence intervals for the segregation measures (see also Deutsch et al., 2002). The technique consists of drawing several random samples (i.e., 500) with replacement from the original sample for each year to compute for every sample a corresponding segregation measure. Subsequently, the distribution of bootstrapped segregation measures is used to compute relevant confidence intervals. In this empirical application, we implement this technique in order to assess differences between different groups of the labour force in terms of age, education and labour market segment (i.e., formal and informal workers). For this purpose, we draw 500 samples of size equal to the original sample for every one of the years included in this study to obtain standard errors and 99 per cent confidence intervals. This enables statistical inference about differences in segregation measures both over time and between the particular labour force groups outlined above.

Data

The data used are derived from household surveys gathered in the seven main metropolitan areas of Colombia on a quarterly basis between 1986 and 2000 and on a monthly basis between 2001 and 2004. These cities represent, on average over this period, around 36 per cent of the national population and almost one-half of

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[3]   For computational convenience, it should be noted that $KM_2 = 2a_2(1-a_2)DI_2$ (see Karmel and MacLachlan, 1988, p. 189). Then it follows that $KM^*_2 = 2a_1(1-a_1)DI_2$ where a_1 is the female labour force participation rate for period 1.

the country's urban inhabitants. These surveys provide micro-level data on more than 100,000 individuals within the labour force (aged between 15 and 65 years) per year and include information about occupations using a consistent classification of 82 categories over the entire period (see Appendix 1.1).[4] At the two-digit level, it is identical to the International Standard Classification of Occupations ISCO-68. The Colombian classification of occupations was created by the National Learning Service –SENA and the International Labour Organisation in 1968 (DANE, 2000).

Background

Colombia has undertaken an intensive process of market-oriented reforms since 1990. This process of economic reform in Colombia has also been accompanied by some progressive developments with an emphasis on the incorporation of gender and women's issues into Colombian legislation. The introduction of market-oriented reforms in Colombia initiated in 1990 ushered in a restructuring of the state through decentralization of state functions, privatisations, and the introduction of private enterprises for the provision of social services. We do not aim formally to provide any conjectures about the effects of those reforms on the overall size of government employment. However, our data suggest that the number of people working for the government in urban Colombia has decreased either in absolute numbers or relative to total employment between 1986 and 2004. The number of government employees contracted in most of the years after 1991 when the reforms were initiated, while its share of total employment in urban Colombia fell from 11.7 per cent to 6.3 per cent over this period. By gender, the reductions in government employment affected mainly the male labour force while women increased participation in the public sector from 41 per cent of all government jobs in 1986 to around 50 per cent after 2000.[5] To some extent, these results suggest that the constitutional reforms implemented in Colombia after 1991 designed to enforce an inclusive policy for women at all levels of public administration of this country have led to a more egalitarian composition of government employment by gender. However, they also suggest that retrenchment in the public sector has hit

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4   The Table A1.2 in Appendix 1.1 shows the number of observations per sampling wave.

5   Ibid.

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hardest on male employment in urban Colombia, probably as a result of austere fiscal policies or institutional reforms.

Empirical results

Occupational dissimilarity indexes by gender in urban Colombia, 1986-2004

Horizontal gender-based occupational segregation has exhibited a marked decline in Colombia between 1986 and 2004. During this period, the *DI* for the entire labour market decreased 8.7 per cent during this period, while the *GI* and *KM* estimate contracted by 5.9 and 3.8 per cent, respectively. We also computed *KM** (see expression (1.3c)) in order to generate a counterfactual outcome for *KM* in which female labour force participation is held constant at the level of 1986 over the whole period. The results not only confirm a reduction in occupational segregation but also suggest that in holding female labour force participation constant at the 1986 level for all years, the extent of gender occupational segregation would be lower than that suggested by the original *KM* index (see Figure 1.1). This finding may be regarded as counterintuitive. However, it may merely reflect the fact that the increasing share of women into the labour force requires a larger proportion of people to move from jobs in order to have the same distribution of occupations across gender groups (see section 4, above).

The 99 per cent confidence intervals constructed through the bootstrap technique indicate that all segregation measures for 2004 are statistically different from those based on estimates for 1986 with negligible standard errors in all cases. For instance, the estimate for the *DI* for 2004 for all workers (0.4999) lies outside the corresponding confidence interval for the same index in 1986 (0.5501 and 0.5506), which allows us to infer that the index in 2004 is significantly lower than that observed in 1986. The same consideration is valid for differences in segregation indicators estimated across different groups of the labour force (see Table 1.1).[6] It must be noted that the degree of association between the three dissimilarity measures

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6   Estimates of bootstrapped standard errors and confidence intervals of segregation indices for all years are available from the authors.

is very high, as is generally the case in the literature, and reveals similar patterns of change for most of the years. The correlation coefficients between DI and GI and KM are 0.999 and 0.953, while the coefficient between KM and GI is 0.965.

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To establish whether the pattern observed above is valid for all groups in the labour force, dissimilarity indicators were estimated separately for the formal and informal segments of the labour market, by educational level, selected age groups and, government and private-sector workers (see Table 1.1).

Figure 1.1. Indexes of occupational segregation by gender in urban Colombia, total labour force, 1986-2004
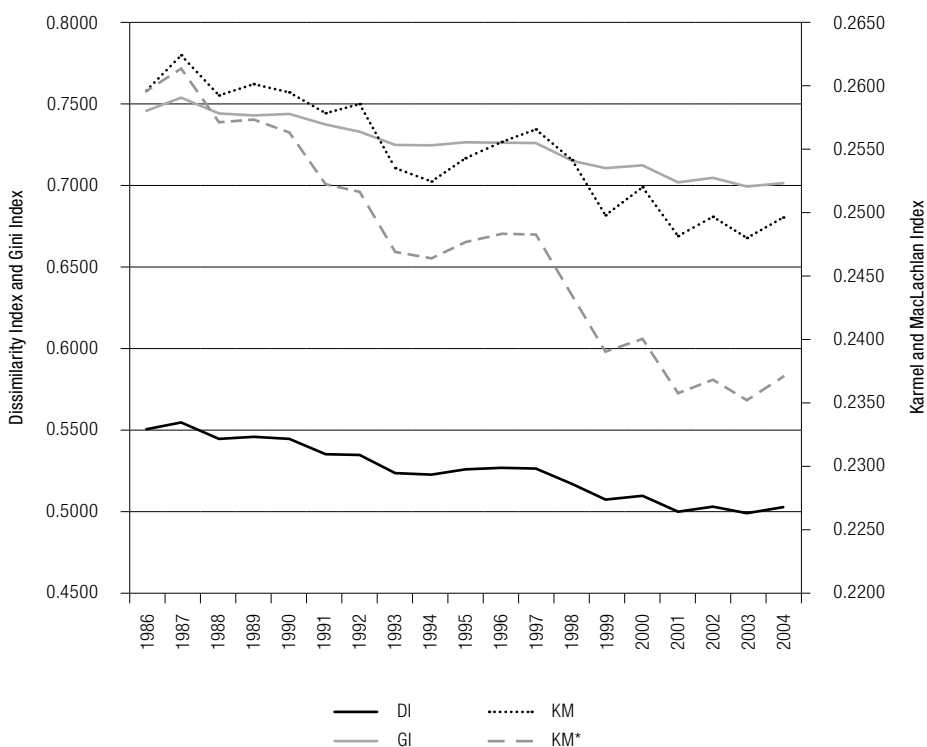
Source: own calculations based on household surveys micro-data for seven main metropolitan areas.

In the first case, we defined the formal segment as comprising waged workers and skilled self-employed workers. We consigned to the informal (or atypical employment) segment of the labour market all other workers (i.e., unskilled self-employed workers, family workers without remuneration and domestic servants). According to the *KM* index, horizontal occupational segregation by gender is highest in the informal sector in all observed years (see panel *a* in Figure 1.2). However, the same estimates also reveal that the extent of horizontal gender occupational segregation has decreased in both the formal and informal segments of the labour market in urban Colombia. According to the *KM* index, the reduction of the latter is 6.8 per cent compared to a contraction of about 4.1 per cent in the former between 1986 and 2004.

We also investigate the effects of the demographic structure by dividing the labour force into three different age groups: 15 to 30 years old (the youngest group), 31 to 45 years old (the middle-age group) and, 46 to 65 years old (the oldest group). According to the *KM* index for 1986-2004, occupational segregation has decreased mainly amongst the youngest workers (15 to 30 years old) while exhibiting a substantial increase amongst the oldest. In the first case, the reduction was about 10 per cent, while in the second it grew by 6.2 per cent. Those in the mid-range of age (31 to 45 years old) recorded a slight reduction (0.7 per cent) over this period. As in the cases documented above, the differences between age groups are statistically significant using the bootstrapped standard errors. Overall, trends by age groups indicate a reduction in the dispersion of segregation levels and a clear reduction amongst the youngest workers in particular (see Panel b in Figure 1.2).

"According to the *KM* index, horizontal occupational segregation by gender is highest in the informal sector in all observed years. However, the same estimates also reveal that the extent of horizontal gender occupational segregation has decreased in both the formal and informal segments of the labour market in urban Colombia".

Figure 1.2. Karmel and MacLachlan Index of occupational segregation by gender in urban Colombia, selected groups of the labour force, 1986-2004

a) Informal and formal employment
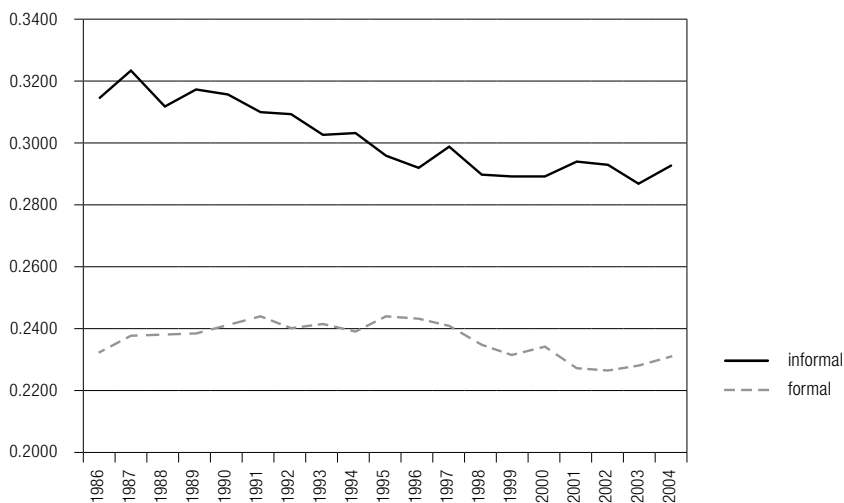
b) Age groups

Source: own estimates based on household surveys micro-data for seven main metropolitan areas.

c) Educational levels

d) Government and private sector
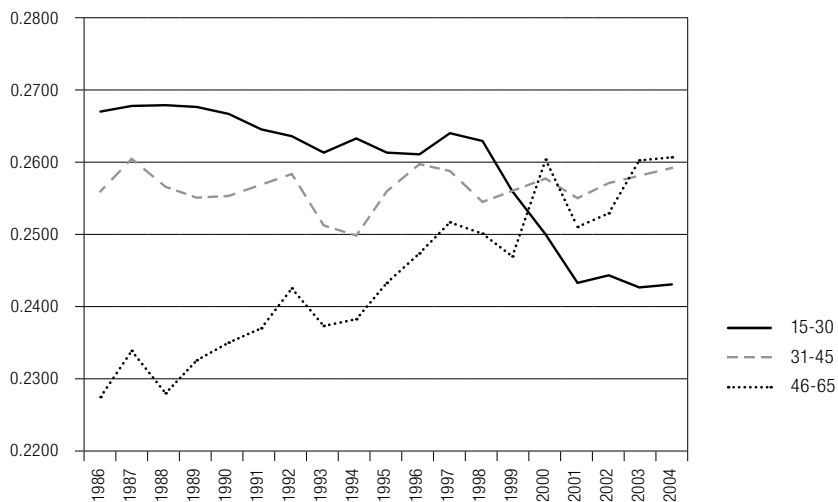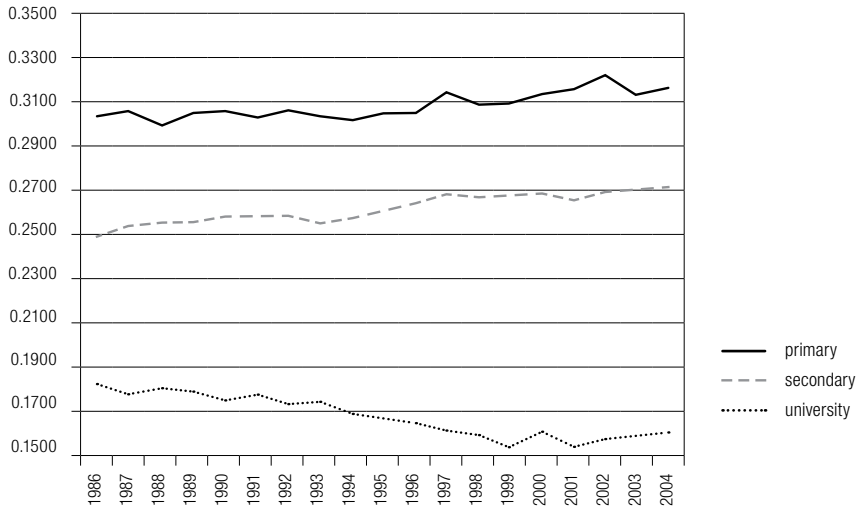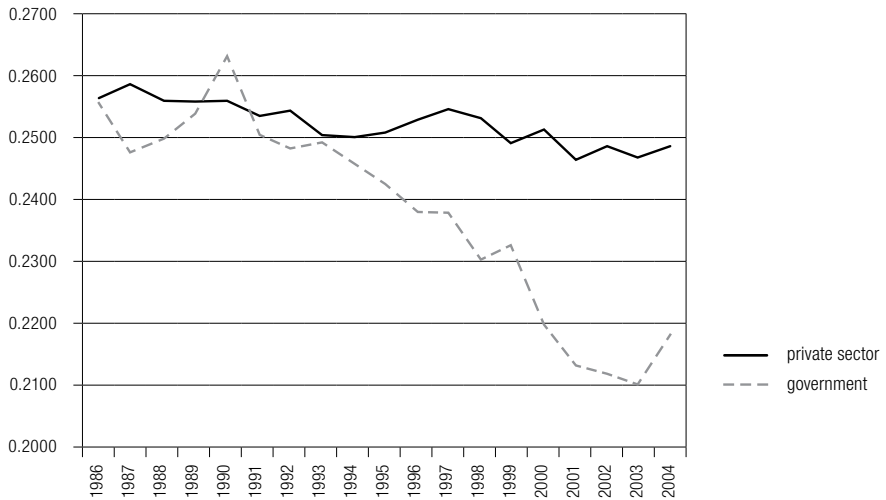
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"According to all the indexes computed in this study, gender occupational segregation has exhibited a more marked decline amongst government workers compared to the rest of the labour force between 1986 and 2004".

The composition of the labour force in urban Colombia also recorded important transformations in terms of its educational structure. We thus calculated the same set of horizontal segregation measures for three schooling levels: workers with five or less years of schooling (i.e., primary education), workers with six to 11 years of schooling (i.e., secondary education), and workers with 12 or more years of schooling (i.e., university education). This particular disaggregation of the labour force provides the widest differences in the horizontal occupational segregation indexes by gender and suggests that since the mid-1980s, education has been a key factor in the evolution of occupational gender differences in the labour market of urban Colombia. On the one hand, estimates of the *KM* index for all years suggest an inverse relationship between educational levels and occupational segregation. As can be seen in Panel c of Figure 1.2, the *KM* index is the lowest for workers with university education and the highest among those with primary or less over all the years (see also Table 1.1 for other indexes). On the other, the reduction of segregation indicators alluded to above for the whole labour force is concentrated solely among those workers with university education. All of this suggests that increasing educational levels amongst female workers and, in particular, the rising proportion of those with university education appear as one of the main driving forces behind the reduction in gender-based occupational segregation in urban Colombia.

As previously noted, our data suggest a re-structuring of government employment in urban Colombia in which women, after 2000, have steadily increased their share of public sector jobs to around 50 per cent (see Panel d on Figure 1.2). According to all the indexes computed in this study, gender occupational segregation has exhibited a more marked decline amongst government workers compared to the rest of the labour force between 1986 and 2004. For instance, the *KM* index fell by 15.6 per cent in the former case compared to a reduction of 5.3 per cent for the latter case over this period. All other indexes suggest a similar pattern of change (see Table 1.1 above). Interestingly, our measures of gender occupational

Table 1.1. Measures of dissimilarity in the distribution of occupations by gender and groups of the labour force in Urban Colombia: 1986 and 2004

Groups of the labour force	Year	Dissimilarity Index			Gini			Karmel and MacLachlan		
		Mean	Standard Error	[99% Confidence Interval]	Mean	Standard Error	[99% Confidence Interval]	Mean	Standard Error	[99% Confidence Interval]
All workers	1986	0.5504	0.0001	0.5501 0.5506	0.7458	0.0001	0.7456 0.7460	0.2597	0.0001	0.2595 0.2598
	2004	0.4994	0.0001	0.4991 0.4997	0.7011	0.0001	0.7009 0.7014	0.2448	0.0001	0.2446 0.2449
Informal workers	1986	0.6305	0.0002	0.6300 0.6310	0.8139	0.0001	0.8136 0.8143	0.3150	0.0001	0.3148 0.3152
	2004	0.5891	0.0002	0.5886 0.5896	0.7937	0.0003	0.7930 0.7943	0.2936	0.0001	0.2934 0.2939
Formal workers	1986	0.5215	0.0001	0.5212 0.5219	0.7081	0.0001	0.7028 0.7034	0.2320	0.0001	0.2318 0.2321
	2004	0.4690	0.0002	0.4686 0.4694	0.6366	0.0001	0.6362 0.6370	0.2225	0.0001	0.2223 0.2227
Private sector	1986	0.5466	0.0001	0.5463 0.5469	0.7456	0.0001	0.7453 0.7458	0.2563	0.0001	0.2562 0.2565
	2004	0.4973	0.0001	0.4970 0.4976	0.7011	0.0001	0.7008 0.7014	0.2428	0.0001	0.2426 0.2429
Government employees	1986	0.5305	0.0007	0.5286 0.5324	0.7129	0.0003	0.7121 0.7136	0.2557	0.0003	0.2548 0.2566
	2004	0.4362	0.0005	0.4348 0.4376	0.6097	0.0005	0.6084 0.6109	0.2157	0.0003	0.2150 0.2164
15 to 30 years old	1986	0.5477	0.0002	0.5473 0.5481	0.7572	0.0001	0.7568 0.7575	0.2670	0.0001	0.2669 0.2672
	2004	0.4860	0.0002	0.4855 0.4864	0.6702	0.0002	0.6697 0.6706	0.2403	0.0001	0.2400 0.2405
31 to 45 years old	1986	0.5446	0.0002	0.5441 0.5452	0.7384	0.0002	0.7380 0.7388	0.2559	0.0001	0.2557 0.2562
	2004	0.5169	0.0004	0.5159 0.5179	0.7187	0.0002	0.7182 0.7191	0.2540	0.0002	0.2536 0.2545
46 to 65 years old	1986	0.5630	0.0005	0.5615 0.5644	0.7609	0.0002	0.7603 0.7615	0.2275	0.0002	0.2268 0.2281
	2004	0.5154	0.0003	0.5147 0.5161	0.7414	0.0002	0.7409 0.7419	0.2416	0.0001	0.2412 0.2419
Primary education	1986	0.6426	0.0002	0.6422 0.6431	0.8375	0.0001	0.8372 0.8378	0.3032	0.0001	0.3030 0.3034
	2004	0.6385	0.0002	0.6379 0.6392	0.8285	0.0002	0.8281 0.8290	0.3119	0.0001	0.3115 0.3122
Secondary education	1986	0.5274	0.0002	0.5270 0.5278	0.7194	0.0001	0.7190 0.7197	0.2489	0.0001	0.2487 0.2491
	2004	0.5474	0.0002	0.5470 0.5478	0.7314	0.0001	0.7310 0.7317	0.2677	0.0001	0.2675 0.2679
University education	1986	0.3862	0.0004	0.3852 0.3871	0.5392	0.0003	0.5383 0.5401	0.1821	0.0002	0.1817 0.1826
	2004	0.3167	0.0003	0.3160 0.3173	0.4778	0.0003	0.4771 0.4786	0.1561	0.0001	0.1557 0.1564

Source: own calculations based on household survey data for labour force aged between 15 and 65 years in the seven main metropolitan areas. See text for definitions of different groups of the labour force.

segregation for government employees appear to be lower than those of the private sector after 1992, when most of the constitutional reforms towards more egalitarian participation of women in government positions were put in place.[7]

Decomposition of changes in segregation indexes over time

As suggested above, the *DI* and other segregation measures may be sensitive to changes in both the structure of occupations and the gender composition of the labour force. From an analytical point of view, this represents a major problem since a reduction in occupational segregation indexes may be possible without any changes in the gender (or ethnic) composition of particular occupations. In addressing this problem, Deutsch et al. (2006) proposed a generalisation of a decomposition technique originally introduced by Karmel & MacLachlan (1988) to identify what portion of a given change in a segregation index may be due to changes in 'net' segregation. This includes changes in the gender/ethnic ratios of particular occupations and what part of the change may be driven by 'gross' segregation, which is due to changes in both the gender/ethnic composition of the overall labour force and the structure of occupations. According to Deutsch et al. (2006), a change in a segregation measure over time may be defined as:

$$\Delta I = I_v - I_p \qquad (1.6)$$

where I_v and I_p represent, respectively, the indexes for the final and initial periods. These two indexes can be drawn from segregation matrices whose typical element in its internal structure, p_{ij}, represents the ratio T_{ij}/T where T_{ij} is the number of individuals in occupation i from gender j and T is the total number of workers. The margins of this matrix are defined by $p_i=T_i/T$ and $p_j=T_j/T$, which denote, respectively, the horizontal margins (or occupation shares) and the vertical margins (or gender shares).

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7   It should also be mentioned that Colombia endorsed the International Convention on the Elimination of all Forms of Discrimination against Women (CEDAW) since 1982. The status of ratification can be verified at United Nations Human Rights Office of the High Commissioner – "Status of Ratification Interactive Dashboard".

The total variation ΔI may be expressed in terms of the variations in 'net' and 'gross' segregation:[8]

$$\Delta I = f(\Delta m, \Delta is) \qquad (1.7)$$

where Δm and Δis represent, respectively, changes in the margins and in the internal structure of the segregation matrix. By applying the concept of the Shapley decomposition from the income distribution literature, Deutsch et al. (2006) propose that the change in a segregation index as in (1.6) and (1.7) may be expressed as

$$\Delta I = \Delta C_m + \Delta C_{is} \qquad (1.8)$$

where ΔC_m represents the contribution of changes in the margins, or gross segregation, and ΔC_{is} represents the contribution changes in the internal structure, or net segregation. Deutsch et al. (2006) demonstrate that these two components can also be expressed as

$$\Delta C_m = \left(\frac{1}{2}\right) f(\Delta m) + \left(\frac{1}{2}\right) [f(\Delta m, \Delta is) - f(\Delta is)] \qquad (1.9)$$

and

$$\Delta C_{is} = \left(\frac{1}{2}\right) f(\Delta is) + \left(\frac{1}{2}\right) [f(\Delta m, \Delta is) - f(\Delta m)] \qquad (1.10)$$

where Δm denotes the change in the margins, Δis represents the change in the internal structure. According to Deutsch et al. (2006), the numeric solution for (1.8) to (1.10) can be achieved through the derivation of a set of matrices, which are obtained through the interaction of both the margins and the internal structure of P and V. In order to spell out this more clearly, let S be a matrix which has the internal structure of matrix P and the margins of matrix V. This matrix can be obtained by successive iterations (see Deming and Stephan, 1940), in which the first step is to multiply all elements p_{ij} by the ratios v_i/p_i to obtain a matrix X. Then, the elements

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8   As explained by Deutsch et al. (2006), this technique could be applied to more than two groups of the labour force, although our presentation here refers to the conventional gender dichotomous approach.

of X are multiplied by the ratios $v_{.j}/x_{.j}$ where $v_{.j}$ and $x_{.j}$ are the vertical margins of the matrices V and X to obtain a matrix Y. After several iterations, the resultant matrix will converge to a matrix S with the internal structure of P and the margins of V. Similarly, a matrix W with the internal structure V and the margins of P may be obtained if we invert the process from V to P. Other necessary matrices are:

- matrix L with the internal structure of P, the vertical margins of P and the horizontal margins of V;
- matrix K with the internal structure of P, the vertical margins of V and the horizontal margins of P;
- matrix C with the internal structure of V, the vertical margins of V and the horizontal margins of P and;
- matrix F with the internal structure of V, the vertical margins of P and the horizontal margins of V (see Deutsch et al. (2006) for details on the derivation).

Thus, the contribution of changes in internal structure, as in equation (1.8) above, can be conveniently re-expressed as

$$\Delta C_{is} = \left(\frac{1}{2}\right)(I_w - I_p) + (I_v - I_s) \tag{1.11}$$

while in the case of the contribution to changes in the margins, this could be as

$$\Delta C_m = \left(\frac{1}{2}\right)[(I_s - I_p) + (I_v - I_w)]. \tag{1.12}$$

However, from a policy perspective, it is interesting to differentiate between the specific contribution of changes in female labour force participation and those from changes in the structure of occupations. In other words, this is

$$\Delta C_m = C_h + C_t \tag{1.11}$$

where C_h and C_t represent the contributions from changes in the structure of occupations and gender totals, respectively. This could be expressed in terms of the index values I obtained from their corresponding matrix denoted by the subscript. Therefore, C_h and C_t can be estimated as

$$C_h = \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)[(I_l - I_p) + (I_s - I_k)] + [(I_v - I_c) + (I_f - I_w)] \tag{1.12}$$

and

$$C_t = \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)[(I_k - I_p) + (I_s - I_l)] + [(I_v - I_f) + (I_c - I_w)] \qquad (1.13)$$

which together satisfy (1.11). To sum up, a change on a segregation index between two periods of time can be decomposed as

$$\Delta I = C_{is} + C_h + C_t \qquad (1.14)$$

which can be more explicitly divided into (i) changes in the gender composition of occupations, C_{is}, (ii) changes in the labour market structure of occupations, C_h, and (iii) changes in female/male shares into the labour force, C_t.

Using the methods described above, we programmed the decomposition described in expression (1.14) in Mata, a matrix programming language in Stata, for the three segregation indexes already used in this paper between 1986 and 2004 but, for the sake of brevity, we focus the analysis on the *KM*. [9]

For the labour force as a whole (see Table 1.2), we find that just 17.1 per cent of the variation in the index for all workers originated in changes of net segregation while the remaining 82.9 per cent comes from changes in gross segregation. The same decomposition results indicate that increasing female labour participation explains, by itself, 1.5 times the total variation in the *KM* index, a change that was just partially offset by changes in the structure of jobs. Decomposition results for the *DI* and Gini also indicate sizeable contributions of female labour participation to the total variation of these indexes (see Appendix 1.2). These findings confirm that the increasing share of women workers in the labour force is actually driving most of the reduction in the segregation indexes reported in this study for all workers in urban Colombia.

A broadly similar result is found between formal and informal workers, where the variations in the *KI* are mainly driven by gross segregation. In the former, changes in female labour force participation and occupations' structure represent by themselves more than twice the reduction in the *KI*. In contrast, changes in the net segregation operate in the opposite direction. In fact, decomposition results for the other two indexes (see Appendix 1.2) reveal an increase in net segregation for formal workers. All of this suggests that, even though the reduction in segregation indexes is

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9   Decomposition results for Gini and KM indices are reported in Appendix 1.2.

the largest amongst formal workers, this result is driven by changes in the margins, which mask an increase in net segregation for this segment of employment.

On the other hand, the reduction in segregation measures for informal workers was modest compared to that of the formal sector. Our decomposition results indicate again that most of this reduction in the *KM* index is driven by changes in the margins, with more than half coming from increases in female labour participation. To sum up, while all indexes suggest a reduction in gender-based occupational segregation for both segments of the labour force, a closer inspection of the decomposition analysis indicates that the gender composition of particular occupations is roughly the same over these 19 years. In order to take this issue further, we have to determine whether this result holds for all groups of the labour force.

Table 1.2. Shapley decomposition of changes in Karmel and MacLachlan (1988) index between 1986 and 2004 in urban Colombia (seven largest metropolitan areas)

Groups of the labour force	(1) Female/ male labour participation	(2) Occupations' structure	(3) (1 + 2) Margins	(4) Internal structure: net segregation	(5) Gross change between 1986 and 2004
All workers	-0.023	0.010	-0.012	-0.003	-0.015
	151.7%	-68.8%	82.9%	17.1%	100.0%
Formal workers	-0.006	-0.015	-0.020	0.011	-0.009
	58.1%	153.7%	211.8%	-111.8%	100.0%
Informal workers	-0.012	-0.008	-0.020	-0.001	-0.021
	57.1%	37.6%	94.7%	5.3%	100.0%
Primary education	-0.007	-0.013	-0.020	0.028	0.009
	-75.3%	-149.1%	-224.4%	324.4%	100.0%
Secondary education	0.006	0.002	0.009	0.010	0.019
	33.7%	11.8%	45.5%	54.5%	100.0%
University education	-0.007	-0.007	-0.014	-0.012	-0.026
	26.6%	28.0%	54.6%	45.4%	100.0%
Government workers	-0.004	-0.013	-0.017	-0.023	-0.040
	10.4%	32.5%	43.0%	57.0%	100.0%
Private sector workers	-0.004	-0.009	-0.013	-0.001	-0.014
	27.7%	66.4%	94.1%	5.9%	100.0%

Groups of the labour force	(1) Female/ male labour participation	(2) Occupations' structure	(3) (1 + 2) Margins	(4) Internal structure: net segregation	(5) Gross change between 1986 and 2004
Aged 15 to 30 years old	-0.015	-0.017	-0.032	0.005	-0.027
	54.7%	64.8%	119.5%	-19.5%	100.0%
Aged 31 to 45 years old	0.003	-0.003	0.000	-0.002	-0.002
	-154.3%	158.3%	4.0%	96.0%	100.0%
Aged 46 to 65 years old	0.015	-0.001	0.015	0.000	0.014
	107.1%	-4.1%	103.0%	-3.0%	100.0%

Source: own calculations based on household survey data for labour force aged between 15 and 65 years in the seven main metropolitan areas. *: as a percentage of the mean value of the indexes.

By educational levels, it should be noted that the *KI* reported a significant reduction only amongst those workers with university education. In this group of workers, we observe a sizeable contribution of net segregation, which by itself represents almost one half of the variation in the *KM* index between 1986 and 2004 (a result that is confirmed by the other two indexes, see Appendix 1.2). For those with primary and secondary education, the decomposition of changes in the *KM* index suggests that, in both cases, the gender ratio of particular occupations became more segregated, leading to an increase in net segregation between 1986 and 2004. In other words, decomposition results by educational levels indicate that only in the case of workers with a university education, there was a substantial change towards a more egalitarian gender composition of occupations over these years. As explained in the previous section, this was incidentally the group of the labour force with the lowest indexes of occupational segregation by gender for all years reviewed in this study.

The division of the labour force between government and private sectors suggests that changes in net segregation explain 57.0 per cent of the variation of the *KM* index in the former compared to just 5.9 per cent in the latter. It should be remarked that the reduction in net segregation amongst government

"It should be noted that the *KI* reported a significant reduction only amongst those workers with university education".

workers is the largest one of all subgroups of the labour force in urban Colombia between 1986 and 2004, not only for the *KM* but also for the other two indexes. This is in line with the interpretation reported above regarding the effects of the gender legislation in Colombia, which is, presumably, more enforceable in government institutions. In contrast, the reduction in the *KM* index amongst workers in the private sector is dominated by changes in gross segregation, with more than one-quarter of it coming from increased female labour force participation and nearly two thirds from changes in the structure of occupations. In other words, just 5.9 per cent of the reduction in this index amongst workers outside government is explained by changes in the gender composition of particular occupations or net segregation.

> "The only age group with a reduction in segregation is represented by those between 31 and 45 years old, in which most of the variation can be explained in terms of an improvement in the gender ratio of particular occupations".

Finally, the division of the labour force by age groups indicates that although the most significant reduction in the *KM* index was reported for the youngest (15 to 30 years old), this variation is driven entirely by changes in gross segregation. This means that while the gender composition of occupations for this group became more segregated between 1986 and 2004, changes in the overall structure of occupations and the increasing labour force participation of women acted in the opposite direction to reduce the *KM* index across these two years. For those aged 46 and 65 years old, the slight increase in the *KM* index was driven mainly by changes in female labour participation, which suggests that a substantial proportion of women entering the labour force within this age group did so in female-dominated occupations. The only age group with a reduction in segregation is represented by those between 31 and 45 years old, in which most of the variation can be explained in terms of an improvement in the gender ratio of particular occupations. It is also interesting to observe in this age group that the effect of the increasing participation of women in the labour force contributed to raising the index. Presumably, as a result of more women joining female-dominated occupations, an effect that was offset by changes in the structure of occupations in which less segregated occupations are increasing their share into the overall employment structure. To some extent, this

finding is in line with our analysis from the alternative *KM* index in section 5.1, according to which the level of segregation would be higher for all years if female labour participation remained at the level of 1986. All of this suggests again that an increasing proportion of women in the labour market imply a proportionally larger reallocation of workers from both genders to keep the level of segregation measures at the same level.

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Conclusions

According to the measures used in this study, gender occupational segregation has exhibited a statistically significant reduction in urban Colombia between 1986 and 2004. The use of datasets with a harmonised classification of occupations for the whole period provided an opportunity to implement a set of segregation measures that, in one way or another, overcame some of the more conventional difficulties in the measurement of occupational segregation by gender. In addition, the use of bootstrapped standard errors yielded a statistical basis to verify that most of the observed changes between 1986 and 2004, as well as the differences in point estimates between different groups of the labour force in terms of age, education, and type of employment (formal and informal), are statistically significant.

From a methodological point of view, the implementation of different segregation measures such as the alternative version of *KM* in which changes in female labour force participation are held constant allows us to make some interesting qualifications about the observed trends in urban Colombia between 1986 and 2004. Even though conventional dissimilarity indexes suggest a reduction in occupational segregation by gender for all age groups, once the effects from the rising share of women in the labour force are controlled for, it is evident that an important proportion of those women entering the labour force are doing so into highly segregated occupations. Results disaggregated by education also reveal that only in the case of workers with a university education is there an unambiguous reduction in the extent of horizontal gender-based occupational segregation as measured by the indexes used in this study. However, from all subdivisions of the labour force presented here, the largest reduction in the *KM* and *DI* was found amongst government workers.

The decomposition of the changes in occupational segregation measures between 1986 and 2004 indicates that the main underlying force in the reduction

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of gender occupational segregation indexes for all workers during this period was the increasing female labour participation. The same decomposition results (and the level of indexes by themselves) suggest that the majority of women in urban Colombia are still employed in female-dominated occupations and that a substantial proportion of those entering the labour force are doing so into these types of jobs. This explains why horizontal segregation measures by gender remain so persistently high in the urban areas of Colombia. We have found convincing evidence that the lowest levels of occupational segregation are found amongst workers with university education and those employed by the government.

The decomposition results indicate that those are the groups in which a less segregated gender composition of individual occupations (net segregation) played a major role in the reduction of segregation indexes. In the case of government workers, we find suggestive evidence that the introduction of gender equality legislation at the beginning of the 1990s and its interaction with a more regulated institutional environment to enforce these provisions in the public sector are fundamental forces behind this result. In the case of workers with university education, the reduction in the indexes is less pronounced than in the case of government workers, but they remain as the least segregated in terms of gender. The increased access of women to university education has favoured their access to a wider variety of occupations in which academic credentials, rather than gender roles, are more relevant. It is also true that more educated workers, in general, are more likely to be aware of and eventually demand their gender rights.

All of this suggests that institutions play a differentiated role in the level of horizontal gender segregation amongst some groups within the labour force. All horizontal segregation indexes are consistently lower amongst those with university education and those in government jobs. Interestingly, the differences in point estimates between government employees and the rest of the labour force are rather small before 1991. However, subsequently, the level of segregation in the former exhibited a substantial reduction only equalled by workers with university education. To some extent, this evidence is consistent with the fact that the new Colombian constitution enacted in 1991 mandated an inclusive employment policy for women in all levels of public administration. In the same vein of analysis, it becomes clear why all measures of gender occupational segregation are the highest amongst informal workers, given the unregulated nature of this segment of the labour market.

We were able to provide an optimistic story about the evolution of horizontal occupational segregation in urban Colombia, as far as the formal and the informal or atypical employment segments of the labour market are concerned. However, we do not provide any conjectures about the extent of vertical segregation and the access of women to managerial and decision-making positions within the occupation. In this respect, the story may be somehow less favourable, in particular among vulnerable groups such as unskilled older workers outside the formal sector.

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Appendix 1.1

Table A1.1. Colombian Classification of Occupations   37

1 – Physical Scientists and Related Technicians
2 - Architects, Engineers and Related Technicians
3 - Engineering Technicians, Surveyors, Draughtsmen
4 - Aircraft and Ships' Officers
5 - Life Scientists and Related Technicians
6 - Medical, Dental, Veterinary and Related Workers
7 - Professional Nurses, Optometrists, Physiotherapists and Medical X-ray Technicians
8 - Statisticians, Mathematicians, Systems Analysts and Related Technicians
9 – Economists
11 – Accountants
12 - Jurists, Lawyers and Judges
13 – Teachers
14 - Workers in Religion
15 - Authors, Journalists and Related Writers
16 - Sculptors, Painters, Photographers and Related Creative Artists
17 - Composers and Performing Artists
18 - Athletes, Sportsmen and Related Workers
19 - Professional, Technical and Related Workers n.e.c.
20 - Legislative Officials and Government Administrators
21 - General Managers
30 - Production Managers (except farm)
31 - Government Executive Officials
32 - Stenographers, Typists and Card- and Tape-Punching Machine Operators
33 - Bookkeepers, Cashiers and Related Workers
34 - Computing Machine Operators
35 - Transport and Communications Supervisors
36 - Transport Conductors
37 - Mail Distribution Clerks
38 - Telephone and Telegraph Operators
39 - Clerical and Related Workers n.e.c.
40 - Managers (Wholesale and Retail Trade)
41 - Working Proprietors (Wholesale and Retail Trade)
42 - Sales Supervisors and Buyers

43 - Technical Salesmen, Commercial Travellers and Manufacturers' Agents

44 - Insurance, Real Estate, Securities and Business Services Salesmen and Auctioneers

45 - Salesmen, Shop Assistants and Related Workers

49 - Sales Workers n.e.c.

50 - Managers (Catering and Lodging Services)

51 - Working Proprietors (Catering and Lodging Services)

52 - Housekeeping and Related Service Supervisors

53 - Cooks, Waiters, Bartenders and Relaters Workers

54 - Maids and Related Housekeeping Service Workers n.e.c.

55 - Building Caretakers, Charworkers, Cleaners and Related Workers

56 - Launderers, Dry-Cleaners and Pressers

57 - Hairdressers, Barbers, Beauticians and Related Workers

58 - Protective Service Workers

59 - Service Workers n.e.c.

60 - Farm Managers and Supervisors

61 - Farmers

62 - Agricultural and Animal Husbandry Workers

63 - Forestry Workers

64 - Fishermen, Hunters and Related Workers

70 - Production Supervisors and General Foremen

71 - Miners, Quarrymen, Well Drillers and Related Workers

72 - Metal Processers

73 - Wood Preparation Workers and Paper Makers

74 - Chemical Processers and Related Workers

75 - Spinners, Weavers, Knitters, Dyers and Related Workers

76 - Tanners, Fellmongers and Pelt Dressers

77 - Food and Beverage Processers

78 - Tobacco Preparers and Tobacco Product Makers

79 - Tailors, Dressmakers, Sewers, Upholsterers and Related Workers

80 - Shoemakers and Leather Goods Makers

81 - Cabinetmakers and Related Woodworkers

82 - Stone Cutters and Carvers

83 - Blacksmiths, Toolmakers and Machine-Tool Operators

84 - Machinery Fitters, Machine Assemblers and Precision Instrument Makers (except Electrical)

85 - Electrical Fitters and Related Electrical and Electronics Workers

86 - Broadcasting Station and Sound Equipment Operators and Cinema Projectionists

87 - Plumbers, Welders, Sheet Metal and Structural Metal Preparers and Erectors

88 - Jewellery and Precious Metal Workers

89 - Glass Formers, Potters and Related Workers

90 - Rubber and Plastics Product Makers	
91 - Paper and Paperboard Products Makers	
92 - Printers and Related Workers	
93 - Painters (buildings, construction, etc)	
94 - Production and Related Workers n.e.c.	
95 - Bricklayers, Carpenters and Other Construction Workers	
96 - Stationary Engine and Related Equipment Operators	
97 - Material-Handling and Related Equipment Operators, Dockers and Freight Handlers	
98 - Transport Equipment Operators	
99 - Labourers and workers n.e.c.	

Source: adapted from DANE (2000).

Table A1.2. Number of observations for labour force individuals per survey wave

Year	Number of observations
1986	109.121
1987	115.708
1988	117.106
1989	117.641
1990	99.320
1991	103.313
1992	107.462
1993	110.439
1994	114.372
1995	109.861
1996	11.207
1997	109.367
1998	106.337
1999	99.220
2000	100.634
2001	103.123
2002	103.425
2003	104.924
2004	100.696

Source: own calculations based on household survey data for labour force aged
between 15 and 65 years in the seven main metropolitan areas.

Appendix 1.2

Table A1.2.1. Shapley decomposition of changes in Gini segregation index (Deutch et al., 1994) between 1986 and 2004 in urban Colombia (seven largest metropolitan areas)

Groups of the labour force	(1) Female/ male labour participation	(2) Occupations' structure	(3) (1 + 2) Margins	(4) Internal structure: net segregation	(5) Gross change between 1986 and 2004
All workers	-0.043	-0.002	-0.045	0.001	-0.045
	97.3%	4.2%	101.5%	-1.5%	100.0%
Formal workers	-0.038	-0.043	-0.081	0.015	-0.066
	57.2%	65.1%	122.3%	-22.3%	100.0%
Informal workers	-0.007	-0.005	-0.013	-0.008	-0.020
	35.4%	26.8%	62.2%	37.8%	100.0%
Primary education	-0.032	-0.033	-0.065	0.056	-0.009
	360.6%	367.5%	728.1%	-628.1%	100.0%
Secondary education	-0.005	-0.006	-0.011	0.023	0.012
	-42.0%	-51.7%	-93.7%	193.7%	100.0%
University education	-0.018	-0.015	-0.033	-0.028	-0.061
	29.7%	24.7%	54.4%	45.6%	100.0%
Government workers	-0.039	-0.048	-0.087	-0.016	-0.103
	38.0%	46.5%	84.6%	15.4%	100.0%
Private sector workers	-0.025	-0.025	-0.050	0.006	-0.044
	55.9%	56.6%	112.5%	-12.5%	100.0%
Aged 15 to 30 years old	-0.040	-0.041	-0.081	-0.006	-0.087
	46.4%	47.3%	93.7%	6.3%	100.0%
Aged 31 to 45 years old	-0.006	-0.008	-0.013	-0.007	-0.020
	27.9%	39.0%	67.0%	33.0%	100.0%
Aged 46 to 65 years old	-0.012	-0.012	-0.024	0.005	-0.019
	61.2%	63.3%	124.5%	-24.5%	100.0%

Source: own calculations based on household survey data for labour force aged between 15 and 65 years in the seven main metropolitan areas.

Table A1.2.2. Shapley decomposition of changes in Duncan & Duncan (1955) segregation index between 1986 and 2004 in urban Colombia (seven largest metropolitan areas)

Groups of the labour force	(1) Female/ male labour participation	(2) Occupations' structure	(3) (1 + 2) Margins	(4) Internal structure: net segregation	(5) Gross change between 1986 and 2004
All workers	-0.047	0.001	-0.046	-0.005	-0.051
	91.4%	-2.0%	89.4%	10.6%	100.0%
Formal workers	-0.034	-0.041	-0.075	0.022	-0.053
	64.3%	78.2%	142.5%	-42.5%	100.0%
Informal workers	-0.024	-0.016	-0.039	-0.002	-0.041
	56.8%	37.8%	94.5%	5.5%	100.0%
Primary education	-0.028	-0.034	-0.062	0.058	-0.004
	686.2%	818.8%	1505.1%	-1405.1%	100.0%
Secondary education	0.000	-0.002	-0.001	0.021	0.020
	2.0%	-7.9%	-6.0%	106.0%	100.0%
University education	-0.025	-0.020	-0.045	-0.025	-0.069
	35.3%	29.1%	64.3%	35.7%	100.0%
Government workers	-0.018	-0.031	-0.049	-0.046	-0.094
	18.8%	32.6%	51.4%	48.6%	100.0%
Private sector workers	-0.022	-0.025	-0.047	-0.002	-0.049
	44.6%	51.5%	96.1%	3.9%	100.0%
Aged 15 to 30 years old	-0.035	-0.038	-0.072	0.011	-0.062
	56.2%	60.8%	117.0%	-17.0%	100.0%
Aged 31 to 45 years old	-0.010	-0.014	-0.024	-0.004	-0.028
	35.1%	50.0%	85.1%	14.9%	100.0%
Aged 46 to 65 years old	-0.020	-0.027	-0.047	-0.001	-0.048
	42.4%	56.0%	98.4%	1.6%	100.0%

Source: own calculations based on household survey data for labour force aged between 15 and 65 years in the seven main metropolitan areas.