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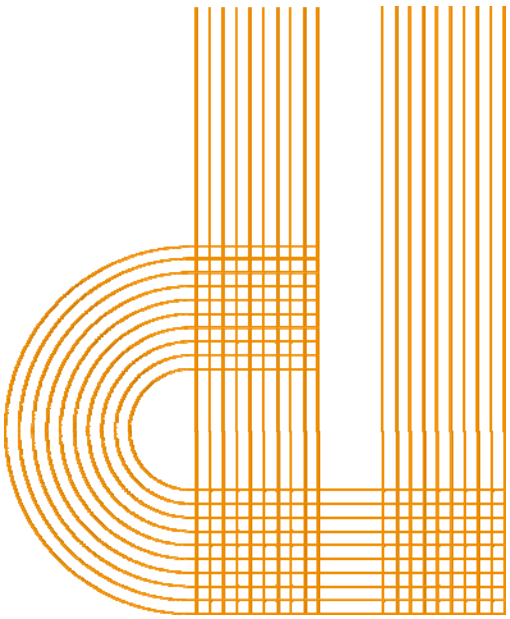

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The Evolution of Occupational Segregation in the U. S., 1940-2010: Gains and Losses of Gender-Race/Ethnicity Groups[*]

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Abstract

The aim of this paper is twofold: a) to explore the evolution of occupational segregation of women and men of different racial/ethnic groups in the U. S. during the period 1940-2010 and b) to assess the consequences of segregation for each of them. For that purpose, this paper proposes a simple index that measures the monetary loss or gain of a group derived from its overrepresentation in some occupations and underrepresentation in others. This index has a clear economic interpretation. It represents the per capita advantage (if the index is positive) or disadvantage (if it is negative) of the group, derived from its segregation, as a proportion of the average wage of the economy. Our index is a helpful tool not only for academics but also for institutions concerned with inequalities among demographic groups because it makes it possible to rank them according to their segregation nature.

JEL Classification: J15; J16; J71; D63

Keywords: occupational segregation; local segregation; race; ethnicity; gender; wages; U.S.

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1. Introduction

The literature on occupational segregation in the United States has traditionally focused on segregation by gender and more recently has turned its attention to segregation by race and ethnicity. With respect to gender, several papers document a reduction in segregation in the second half of the 20th century and stagnation at the beginning of the 21st century (Beller, 1985; Bianchi and Rytina, 1986; Levanon et al., 2009; Blau et al., 2013). Segregation between Blacks and non-Blacks also decreased in the second half of the past century, while segregation between Hispanics and non-Hispanics increased (Queneau, 2009). But segregation by race/ethnicity does not affect women and men equally, female groups have fewer differences in segregation than male groups (Spriggs and Williams, 1996; Reskin et al., 2004; Alonso-Villar et al., 2012). On the other hand, segregation by gender does not affect all racial/ethnic groups in the same way; it seems to be more prevalent for Hispanics and less so for Asians when compared to other groups (Hegewisch et al., 2010; Mintz and Krymkowski, 2011).

When exploring segregation by race, analyses that focus on the male population or that aggregate women and men may obscure the particular situation of some gender-race groups. The same problem may arise when one is concerned with segregation by gender and jointly considers various racial groups. Because both gender and race/ethnicity contribute to shaping and maintaining inequalities in the labor market (Browne and Misra, 2003), more attention should be given to their intersection, a topic that so far has received little attention in the occupational segregation literature.

The aim of this paper is twofold: a) to explore the evolution of segregation of women and men of different racial/ethnic groups in the U.S. during the period 1940—2010 and b) to assess it in terms of the monetary losses/gains of these groups associated with their segregation. For that purpose, we develop a methodology with which to address substantive questions that have not been answered thus far. The analysis involves twelve gender-race/ethnic groups across a 70-year period, paying special attention to women and men of the largest racial/ethnic groups: Whites, Blacks, Hispanics, and Asians.

This paper contributes to the literature on occupational segregation by race/ethnicity and gender, both empirically and methodologically. First, it explores the distinctive situation of each of these groups using recent tools that make it possible to determine the

segregation of each group without comparing it with all alternative groups. Pair-wise comparisons become cumbersome when there are many groups in the analysis and make it difficult to summarize the situation of a group. The approach we follow here, which was proposed by Alonso-Villar and Del Río (2010), involves comparing the distribution of the target group across occupations with the occupational structure of the economy. These measures are labeled local segregation measures to distinguish them from overall or aggregate segregation measures. This approach offers a summary statistic of the situation of the group, which is especially helpful for cross-time analysis because the evolutions of various pair-wise comparisons may not coincide. For example, Kaufman (2010) found that segregation between Black women and either Black men or White women decreased in the 1980s while segregation between Black women and White men increased. In such a situation, it does not seem possible to conclude whether Black women in 1990 were more or less segregated than they were in 1980. However, using local segregation measures, one would find that the segregation of Black women actually decreased in that period (Alonso-Villar and Del Río, 2013). Our approach will allow us to answer the following questions: Did segregation decrease for all groups of women in the second half of the 20th century? Is the recent evolution of White women (men) similar to that of minority women (men)?

Second, this paper also measures overall or aggregate segregation in our twelve-group context—it quantifies the simultaneous discrepancies that exist among all groups. Was overall segregation by gender and race/ethnicity in 2010 lower than it was several decades ago? Overall segregation in this multigroup context implies accounting not only for disparities between women and men of the same race (as can be done by employing a binary segregation measure such as the index of dissimilarity) but also for differences between women of a given race and men of a different race and for differences within the same gender group across races. All differences considered simultaneously.

This is an important matter because when dealing with segregation by race, scholars usually consider only two groups: Blacks and Whites. This Black-White segregation is what is usually contrasted with segregation by gender to determine whether segregation by race is higher or lower than segregation by gender. However, by using multigroup overall segregation measures, one can simultaneously include not only three or more races/ethnicities in the analysis—which seems pertinent in a multiracial society like the U.S.—but also gender. By doing so, one can measure how much overall segregation

changes when one of these dimensions, either race/ethnicity or gender, is removed from the analysis, as this paper does. This is not possible with binary segregation measures. To measure overall segregation, this paper uses the mutual information index (Frankel and Volij, 2011).

Third, an important methodological contribution of the paper involves the assessment of segregation. Segregation measures quantify how uneven the distributions of social groups across occupations are, but the situation of a group of people mainly concentrated in highly paid occupations is clearly different from that of another group concentrated in low-paid ones. To explore the nature of segregation that a group experiences, this paper defines a novel index that measures the monetary loss or gain of a group for being overrepresented in some occupations and underrepresented in others, as a proportion of the average wage of the economy. Is the segregation of Asian women more serious than that of White or Black women? Should one care more about the segregation of Hispanic men than about that of their female counterparts? Are the consequences of segregation more severe for women than they are for men of the same race/ethnicity? This index also allows us to quantify the proportion of each group's (wage) earning gap that arises from its occupational segregation. Our analysis reveals that in 2010 occupational segregation still accounted for the majority of the earnings gap for most gender-race/ethnicity groups, which is line with other studies that emphasize the role played by occupations in generating social stratification (Peterson and Morgan, 1995; Mouw and Kalleberg, 2010).

The paper is structured as follows. Section 2 presents the measures that will be used in our empirical analysis and introduces the data. In particular, it proposes an index with which to quantify the monetary loss/gain of a target group derived from its occupational segregation and explains how it relates to the total earning gap. Section 3 offers the evolution of overall segregation by gender, overall segregation by race/ethnicity, and overall segregation by both gender and race/ethnicity from 1940 to 2010. It also shows the evolution of segregation for our gender-race/ethnicity groups (local segregation) and the contribution of each to overall segregation. Section 4 uses the new index to assess the occupational sorting of these groups. Section 5 concludes.

2. Methodology and Data

2.1 Segregation Measures

The index of dissimilarity is a well-known segregation measure that has been extensively used to quantify occupational segregation by gender. Moreover, to compute segregation in a multigroup context, scholars often employ it to measure disparities between pairs of groups. However, these pair-wise comparisons become cumbersome when there are many groups, especially if one is interested in trends over a seventy-year period.

Alternatively, to summarize the performance of each group, one could compare the distribution of that group across occupations with the occupational structure of the economy. This means that, for example, Black women are segregated so long as they are overrepresented in some occupations and underrepresented in others, whether those latter occupations are filled by White women, Hispanic women, Black men, White men, or any other group. This approach was formally developed by Alonso-Villar and Del Río (2010), who defined several segregation measures in a multigroup context and explored their properties. These measures, labeled local segregation measures to distinguish them from overall segregation measures, allow one to quantify the segregation of a group. In our empirical analysis, we use one of those measures:

$$\Phi_1^g(c;t) = \sum_j \frac{c_j^g}{C^g} \ln\left(\frac{c_j^g / C^g}{t_j / T}\right) \quad , \qquad (1)$$

where c_j^g denotes the number of individuals of group g in occupation j, t_j is the number of jobs in that occupation, $C^g = \sum_j c_j^g$ is the size of group g in the economy, and $T = \sum_j t_j$ is the total number of jobs in the economy. This index ranges from a minimum of 0 to a maximum of $\ln(T)$.[1]

In a multigroup context, apart from calculating the segregation of a group, one might also be interested in determining overall segregation. The literature offers several measures with which to summarize the simultaneous discrepancies that exist among all groups (Silber, 1992; Boisso et al. 1994; Reardon and Firebaugh, 2002; Frankel and

[1] This index has been used to quantify segregation in the U.S. (Alonso-Villar et al., 2012, 2013).

Volij, 2011).[2] As in the two-group case, no segregation exists if every group is evenly distributed among occupations (i.e., if the population share of the group in each occupation, $\frac{c_j^g}{C^g}$, is the same for all groups). As shown by Alonso-Villar and Del Río (2010), several of these overall segregation measures can be written as weighted averages of local segregation measures applied to each of the mutually exclusive groups into which the whole population is partitioned, with weights equal to their share on the total workforce. In particular, the mutual information index, $M = \sum_g \frac{C^g}{T} \ln(\frac{T}{C^g}) - \sum_j \frac{t_j}{T} \left[\sum_g \frac{c_j^g}{t_j} \ln(\frac{t_j}{c_j^g}) \right]$, borrowed from the information theory and characterized by Frankel and Volij (2011) in terms of basic segregation properties, can be written as the weighted average of index Φ_1^g for each of the groups:

$$M = \sum_g \frac{C^g}{T} \Phi_1^g . \qquad (2)$$

Consequently, using the segregation of each group and its demographic weight in the economy, it is possible to quantify the contribution of each group to overall segregation:

$$\text{Contribution of group g} = \frac{\frac{C^g}{T} \Phi_1^g}{M}, \qquad (3)$$

as we will do in our empirical analysis.

Ceteris paribus, overall segregation increases as the distribution of a group across occupations departs from that of the whole population. This component captures the local segregation of each group. Likewise, overall segregation also increases with the population shares of those groups whose distributions lie further away from that of the whole population.

2.2 Assessing Segregation: Our Proposal

But segregation alone does not permit us to assess the position of a group in the labor market because it depends not only on whether the group has access to any type of occupation but also the "quality" of occupations that the group tends to fill or not to fill.

[2] For studies applying these measures to explore occupational segregation by race/ethnicity and/or gender in the U.S., see Watts (1995) and Gradín et al. (2014).

Thus, for example, Hegewisch et al. (2010) document that median earnings in 2009 were higher for male-dominated than for female-dominated occupations in either low-, medium-, or high-skilled occupations.

To deal with this issue, this paper proposes a simple index, Γ, that measures the monetary loss or gain that a group experiences as a consequence of its underrepresentation in some occupations and its overrepresentation in others. In other words, this index assesses the segregation of the group according to occupational wages. To build this index, we first compare the share of the group in each occupation, $\frac{c_j^g}{C^g}$, with the employment share of that occupation, $\frac{t_j}{T}$, which represents the share the group would have if there were it no segregation. If this difference is positive, this means that the group is overrepresented there; otherwise it is underrepresented. Next, we quantify how much in earnings the group gains (respectively, loses) for being overrepresented (respectively, underrepresented) in that occupation. For that purpose, we take into account the (average) wage of that occupation, w_j. Since the index is aimed at assessing the occupational segregation of a group, it only accounts for wage disparities that arise from differences across occupations, while salary differences within occupations are disregarded.

Once we aggregate the losses and gains for all occupations and express them as a proportion of the average wage of occupations, $\bar{w} = \sum_j \frac{t_j}{T} w_j$, we have a summary statistic of the position of the group. Namely,

$$\Gamma = \sum_j \left(\frac{c_j^g}{C^g} - \frac{t_j}{T} \right) \frac{w_j}{\bar{w}} . \qquad (4)$$

To explain why this index is useful to rank various demographic groups or a group across time, note that $\sum_j C^g \left(\frac{c_j^g}{C^g} - \frac{t_j}{T} \right) w_j = \sum_j \left(c_j^g - C^g \frac{t_j}{T} \right) w_j$ can be thought of as the total sum of the gains and losses that the group has as a consequence of its underrepresentation in some occupations ($c_j^g < C^g \frac{t_j}{T}$) and overrepresentation in others

($c_j^g > C^g \frac{t_j}{T}$). Therefore, $\sum_j \left(\frac{c_j^g}{C^g} - \frac{t_j}{T} \right) w_j$ represents the (per capita) loss/gain of each member of the group derived from the occupational segregation of the group. This expression would allow making comparisons among groups of different sizes in a given year but would not be suitable to compare either groups among economies that differ in their occupational wages or a group across time. However, by dividing this expression by the average wage of occupations, $\overline{w}$, it is possible to obtain the loss/gain of each member of the group as a proportion of that average wage.[3]

The interpretation of this index is very intuitive. A value of 0.1 means that the group has a per capita gain of 10% of the average wage of the economy due to its uneven distribution across occupations. On the contrary, a value of -0.1 implies that the consequences of segregation are negative for the group since it has a per capita loss of 10% of the average wage of the economy. Note that the losses/gains of all mutually exclusive groups into which the economy can be partitioned, when weighted by the demographic shares of the groups, add up to zero since the advantages of some groups with respect to the average wage must exactly offset the disadvantages of the others. For exposition purposes, in our empirical implementation, the values of the index are given multiplied by 100.

This index satisfies several good properties. It is equal to zero when either the group has no segregation or all occupations have the same wage. In other words, given that this index aims at quantifying the consequences of segregation, if all occupations offer the same wage or if the group is evenly distributed across occupations, the index should reflect that there are no penalties or advantages for the group. In addition, the index increases when some individuals of the group move from one occupation to another that has a higher wage, while it decreases if the opposite holds. Moreover, the index is unaffected by the size of the group, so that if, for example, the group doubles in each occupation, the index does not change. This makes it suitable for comparing different demographic groups. Likewise, the index is unaffected by the number of total workers in the economy (so long as the occupational structure of the economy does not change) or the monetary units in which wages are measured, which makes it appropriate to

[3] This average wage actually coincides with the average wage of the economy since the wage of each occupation is determined by the average wage of the individuals working there.

compare a group across time or across countries. This index does not take distributive issues into account, however. It cares not about where the changes occur but about the magnitude of losses/gains. Moving into an occupation that has an additional wage of $1 has the same effect on the index, whether the occupation left behind was low paid or high paid.

As mentioned above, our index does not measure the whole earning gap of a group since it neglects wage inequalities that exist within occupations. However, we can determine the share of the earning gap that our index does take into account. Note that the whole earning gap the group has as a consequence of both its uneven distribution across occupations and its within-occupation wage discrepancy with respect to other groups can be written as $C^g \sum_j \frac{c_j^g}{C^g} w_j^g - C^g \sum_j \frac{t_j}{T} w_j$, where w_j^g is the average wage the group receives in occupation *j* (which can differ from the average wage of that occupation, denoted by w_j). By writing this earning gap as a proportion of the total wage revenues that the group would have if there were no segregation and no within-occupation wage disparities with respect to other groups, i.e., as a proportion $C\overline{w}$, we can determine the per capita earning gap ratio of the group (denoted by *EGap*):[4]

$$\begin{aligned}
\text{EGap} &= \left(C^g \sum_j \frac{c_j^g}{C^g} w_j^g - C^g \sum_j \frac{t_j}{T} w_j \right) \frac{1}{C^g \overline{w}} = \\
&= \left(C^g \sum_j \frac{c_j^g}{C^g} w_j^g - C^g \sum_j \frac{c_j^g}{C^g} w_j + C^g \sum_j \frac{c_j^g}{C^g} w_j - C^g \sum_j \frac{t_j}{T} w_j \right) \frac{1}{C^g \overline{w}} = \qquad (5) \\
&= \underbrace{\left[\sum_j c_j^g \left(w_j^g - w_j \right) \right] \frac{1}{C^g \overline{w}}}_{\Delta} + \underbrace{\sum_j \left(\frac{c_j^g}{C^g} - \frac{t_j}{T} \right) \frac{w_j}{\overline{w}}}_{\Gamma}.
\end{aligned}$$

This per capita earning gap ratio can be decomposed in two terms: one associated with the occupational segregation of the group, represented by Γ, and the other associated with within-occupation wage disparities with respect to other groups, denoted by Δ. Therefore, by dividing Γ by *EGap*, we can calculate the contribution of segregation to the earning gap ratio of the group.

[4] Note that this per capita earning gap ratio is the differential between the average wage of the group and the average wage of the economy, expressed as a proportion of the latter.

2.3 Data

Our dataset comes from the IPUMS (Integrated Public Use Microdata Series) samples covering the period 1940-2010 (Ruggles et al., 2010). This dataset offers harmonized information assigning uniform codes to variables, which makes long-term comparisons possible. These data are based on the decennial censuses for the period 1940-2000 and the 2005-2007 and 2008-2010 American Community Surveys for the period 2000-2010 (in the 2000s, we use the 2005-07 and 2008-10 samples separately to take into account the Great Recession).

The Census Bureau has reorganized its occupational classification system several times, but IPUMS brings two consistent long-term classifications: the 1950 classification, available for the whole period, and a modified version of the 1990 classification, available from 1950 onwards. For the period 1940-1980, we calculate segregation using the codes of the 1950 classification system, which accounts for 269 occupations. For the period 1980-2010, we use instead the 1990-based classification, which accounts for 389 occupations, since although the 1950 classification is available for the whole period, the Minnesota Population Center recommends the 1990-based classification from 1980 onwards (for 1980 we use the two classifications, which makes it possible to assess the break in the series).

This paper considers six mutually exclusive groups of workers composed of the four major single-race groups that do not have a Hispanic origin, plus Hispanics of any race and others: Whites, African Americans or Blacks, Asians (Chinese, Japanese, and other Asians or Pacific Islanders), Native Americans (American Indians and Alaskan natives), Hispanics, and "other race" (those non-Hispanics reporting some other race or more than one race).[5] Since occupational segregation is a gendered phenomenon, this paper crosses the above groups with sex to finally obtain twelve mutually exclusive groups.

For 1990, 2000, 2005-07, and 2008-10, we proxied the wage of each occupation by the average wage per hour (calculated from the information provided by the IPUMS).[6] Due

[5] The residual category "other race" is different each year. In particular, multiple-race responses were allowed since 2000. Regarding Hispanic origin, there is a break between 1970 and 1980 (before 1980, the origin was imputed by IPUMS).

[6] We have trimmed the tails of the hourly wage distribution to prevent data contamination from outliers. Thus, we computed the trimmed average in each occupation eliminating all workers whose wage is either zero or situated below the first or above the 99th percentile of positive values in that occupation.

to data limitations, for 1940, 1960, and 1970 we instead used the average wage per week. For 1980, we used both wages per week and per hour to make the time series consistent with either previous or subsequent years. The average wage of each occupation was not available for 1950.

3. Segregation Trends

3.1 Overall Segregation Trends by Gender and/or Race/Ethnicity

Figure 1 displays overall segregation trends over the period 1940-2010 according to the *M* index. One of the time series corresponds to the analysis of segregation by gender (2 groups), another refers to segregation by race/ethnicity (6 groups), and the other results from the combination of both dimensions (12 groups).

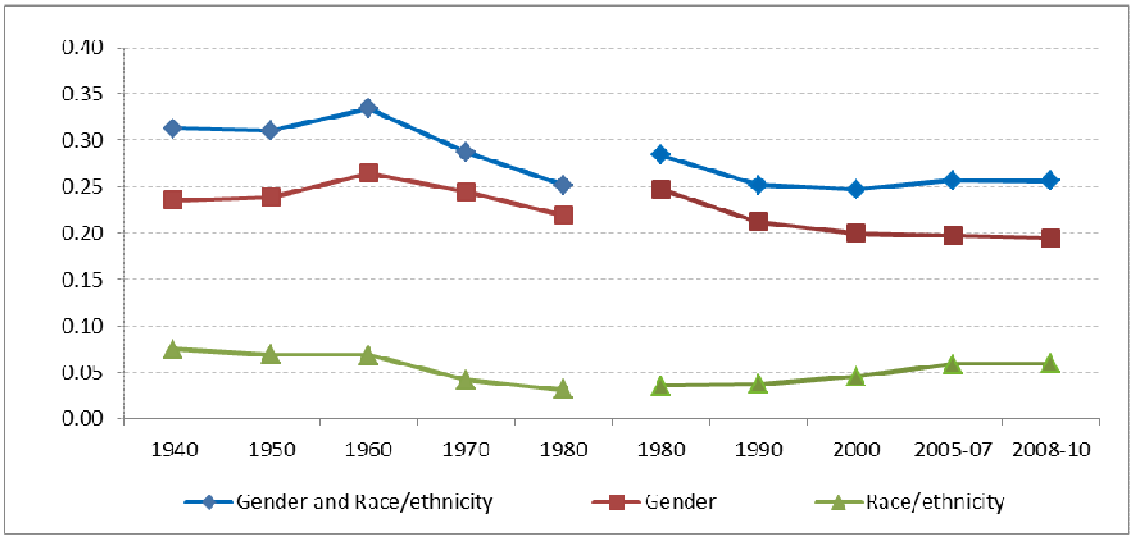

Figure 1. Overall segregation by gender, by race/ethnicity, and by gender and race/ethnicity (index *M*), 1940-2010

Segregation by Gender

Segregation by gender increased up to 1960, decreased during the next four decades, and experienced only a very small reduction during the 2000s. This trend is consistent with that found in previous works for shorter periods of time using the index of dissimilarity (Blau and Hendricks, 1979; Blau et al., 2013).[7]

[7] Hegewisch et al. (2010) found a similar evolution when analyzing Whites, Blacks, and Hispanics separately although, in this case, no further progress is observed between mid-1990s and 2009. Asians, however, do improve at the beginning of the 2000s.

Segregation by Race/Ethnicity

The evolution of overall segregation by race/ethnicity is different from that of gender: it fell from 1940 to 1980 and has increased ever since. Comparisons with previous works are in this case more difficult. On the one hand, they are based on pair-wise comparisons and, therefore, do not offer summary statistics of total segregation. On the other hand, they do not consider the wide range of races used here since most scholars have traditionally dealt with employment segregation between Blacks and Whites, and only recently have they included Hispanics and/or Asians in their analyses (Tomaskovic-Devey and Stainback, 2007; Queneau, 2009; Mintz and Krymkowski, 2011).

Segregation by Gender and Race/Ethnicity

Our analysis shows that when crossing gender and race/ethnicity, overall segregation peaks in 1960, slides until 2000, and increases slightly from 2000 to 2007, remaining stable afterwards.[8] The evolution of this time series resembles that of gender more than that of race/ethnicity. In any case, the reductions observed from 1960 to 1980 occurred along both gender and race/ethnicity lines. The reduction from 1980 to 1990 seems to have been due exclusively to gender integration, while the slight rise observed in the early 2000s seems to be the consequence of growing differences among racial/ethnic groups.

These results are consistent with those papers that claim that civil rights legislation was behind the progress of minorities during the 1960s and 1970s (Conrad, 2005; Tomaskovic-Devey and Stainback, 2007; Kurtulus, 2012). Once political pressures for racial equality weakened, segregation by race/ethnicity was augmented. The only progress came from the sex desegregation that occurred perhaps as consequence of entry to the workforce of new cohorts of women with higher educational achievements than their predecessors (Blau et al., 2013) and as result of political pressure for gender equality, "which did not start effectively until the 1970s, continued through the 1990s" (Tomaskovic-Devey et al., 2006, p. 585). This may have somehow offset racial segregation leading to a fall in gender-race/ethnicity segregation in the 1980s. To the extent that gender desegregation stalled in the 2000s while segregation by race/ethnicity

[8] This evolution is in line with that obtained by Watts (1995) for the period 1983-1992 using the I_p index proposed by Silber (1992) and considering 6 rather than 12 groups.

continuously rose since 1990, no further reductions in overall segregation by gender and race/ethnicity occurred afterwards. In fact, it has slightly increased in the past decade.

When comparing the above series it is hardly surprising to see that segregation by gender is higher than segregation by race/ethnicity since several works based on pair-wise comparisons have already documented this fact using estimates of Black-White segregation within sex groups and sex segregation within racial groups (King, 1992; Blau et al., 2001; Kaufman, 2010). The most startling result here is the extent of those differences, something that can be easily determined in our multigroup approach. Thus, when adding the gender dimension to the racial/ethnic analysis, the segregation index rises by more than 317%, while when adding race/ethnicity to the gender analysis, segregation increases by 33% at most; i.e., most of the differences that we observe in the distribution of our 12 groups across occupations arise from gender. However, as mentioned above, gender does not affect all races equally. If these intersections were not considered in the analysis, the real experience of the groups would not be properly quantified; therefore, overall segregation would be underestimated. In subsequent sections, we explore the distinctive segregation of the groups.

3.2 Linking Overall Segregation and Local Segregation

Table 1 documents the contribution of each of the 12 groups to overall segregation according to expression (3).

	1940	1950	1960	1970	1980	1980	1990	2000	2005-07	2008-10
White men	23.5	25.0	28.3	32.1	35.4	35.9	34.9	31.6	27.8	27.6
African American men	12.0	11.1	9.5	7.3	6.0	6.1	5.8	4.9	4.6	4.6
Asian men	0.5	0.5	0.4	0.6	1.1	1.1	1.7	2.7	3.2	3.4
Native American men	0.3	0.3	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.3
Hispanic men	1.2	1.7	2.1	2.2	3.8	3.8	6.4	9.5	13.7	13.7
Men from other races		0.1	0.1	0.1	0.0	0.1	0.1	0.6	0.4	0.5
White women	44.6	44.9	43.1	43.5	40.5	39.5	36.2	33.5	30.9	29.6
African American women	17.0	15.2	14.4	11.3	8.5	8.5	7.9	7.5	7.8	7.7
Asian women	0.1	0.1	0.3	0.6	1.1	1.2	1.9	2.4	2.8	3.3
Native American women	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.3
Hispanic women	0.6	1.0	1.4	1.9	3.0	3.3	4.5	5.9	7.6	8.4
Women from other races		0.0	0.1	0.1	0.1	0.1	0.1	0.7	0.6	0.7

Table 1. Contribution of each gender-race/ethnicity group to overall segregation (expressed as a percentage), 1940-2010

Changes in the contribution of a group across time depend on variations in the segregation level and demographic weight of the group and also on how the product of these two components varies in comparison with those of the other groups. The segregation levels of the groups, which are discussed in more detail at the end of this section, are shown in Figure 2 for the largest racial/ethnic groups and in Table A2 in the appendix for all groups. The demographic weights are given in Table A1 in the appendix.

Contributions of White Women and Men

White women and men are the groups with the highest contributions to overall segregation due to their large demographic weights. The evolutions of these groups have been rather different, however. The contribution of White women to index *M*, which is larger than that of men, diminished over time (from almost 45% in 1940 to 30% in 2008-10). This decrease was stronger in the second period, 1980-2010, because both the segregation level of the group and its demographic weight decreased. The contribution of these two factors was similar (53% and 47% of the decrease, respectively).[9]

On the contrary, White men increased their contribution to overall segregation from 23% in 1940 to 35% in 1980 as a consequence of their increasing segregation, which more than offset the demographic weight reduction experienced by this group. But since 1980, the contribution of White men decreased to 28% in 2008-10—due to their lower representation among workers.

Contributions of Minority Women and Men

The contribution of Black women decreased sharply between 1940 and 2008-10, from 17% to below 8%, due to the marked reduction in segregation experienced by this group during the first period, 1940-1980. The demographic weight of this group did not contribute to this reduction, though, because the group share actually increased in both periods. On the contrary, Hispanic women increased their contribution throughout the whole period—despite the strong reduction in segregation that this group experienced

[9] To calculate which part of the change in the contribution of a group is due only to changes in segregation, we compare the contribution of that group in the first year with the contribution it would have had in a counterfactual distribution in which the segregation level of the groups were equal to those of the second year but their demographic weights were those of the first year. To calculate which part of the change is instead due to demographic factors, we compare the contribution of the group in that counterfactual with its contribution in the second year.

up to 1990—due to their higher presence among workers. We also observe that the contribution of this group was traditionally much smaller than that of its Black counterpart, while in 2008-10, it was slight higher (above 8%).

Like Black women, Black men also experienced a remarkable reduction in their contribution to overall segregation during this period—from 12% in 1940 to 5% in 2008-10. This reduction was especially intense in the first period (1940-1980) although, as opposed to their female counterparts, this was not only due to a segregation reduction but also to the fact that men did lose population share (the contributions of these two factors to the decrease were 50% each). On the contrary, the contribution of Hispanic men increased notably, reaching almost 14% in 2008-10. This increase was stronger in the second period (after 1980) and was due to both an increase in segregation and demographic weight (which contributed by 23% and 77%, respectively).

With respect to Asians, women and men increased their contribution to overall segregation—representing around 3% in 2008-10—due to their growing share in the labor force. This rise was more intense in the second period (the contribution of the demographic factor was 91% for males and accounted for the full increase among women). Finally, the contributions of Native American women and men, together with men and women from other races, were very small during the period, with values similar to those of their population shares.

Local segregation

As mentioned above, the contribution of a group to overall segregation depends on several factors. We end this section by analyzing just one of them—the segregation level of the groups—focusing on the largest racial/ethnic groups (Figure 2).

Between 1940 and 1980, segregation strongly decreased for all groups of women (especially for Black women) and increased for White men (although not for other men).[10] From 1980 on, segregation decreased only slightly for female groups, and this

[10] The rise in segregation by gender between 1940 and 1960—as documented by Blau and Hendricks (1979) for 1950-1960 and shown in Figure 1—seems to be mainly due to a rise in the segregation of White men—who accounted for more than 60% of workers—and also Black men because the segregation of White women—who accounted for almost 30% of workers—and that of other minority women and men actually fell during this period.

integration process came to a halt in 2000.[11] The evolution of Black men was similar to that of their female counterparts,[12] while that of Hispanic men departed from that of Hispanic women, given the segregation of men has been increasing steadily for several decades, which makes them the group with the highest segregation at present.

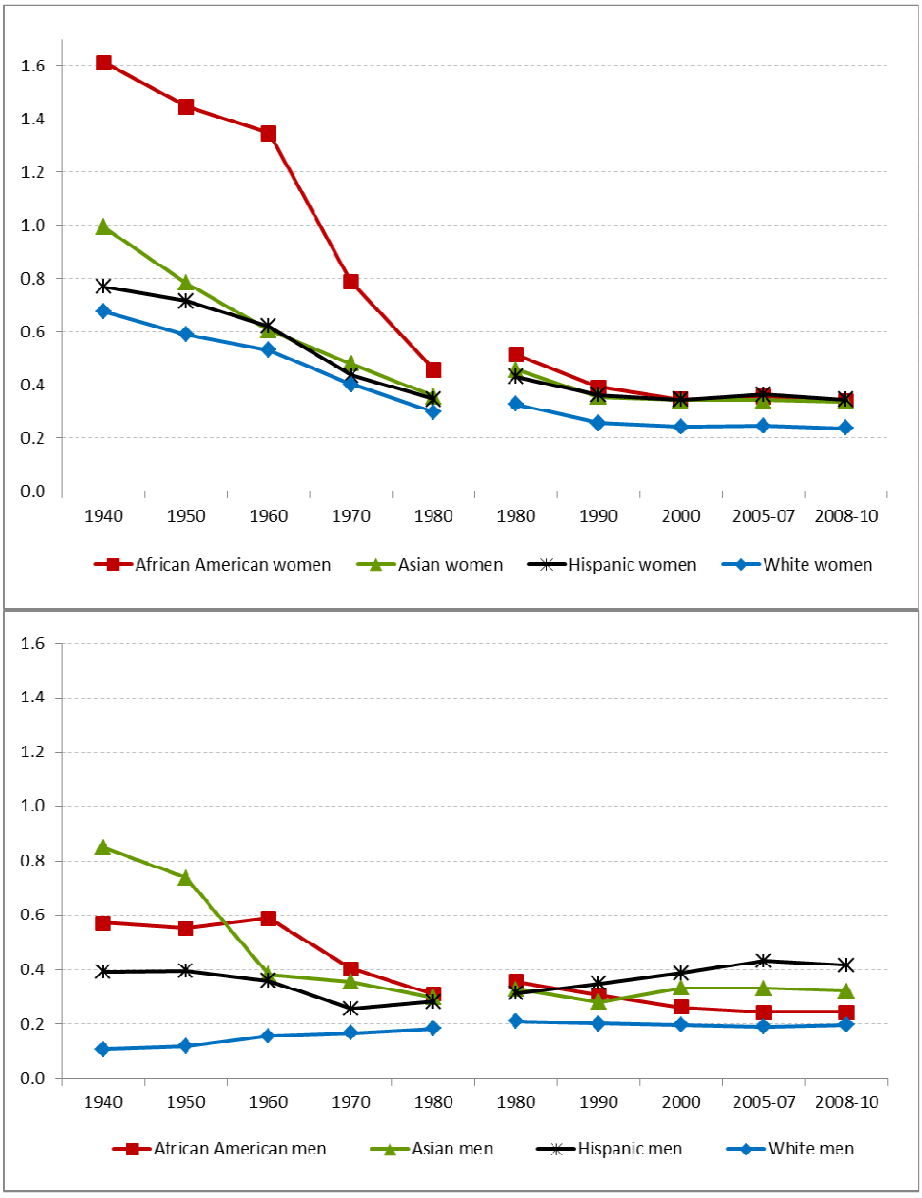

Figure 2. Segregation of the largest gender-race/ethnic groups (Φ_1^g), 1940-2010

In the 2000s, White men were still more evenly distributed across occupations than the remaining groups, while White women had a segregation level which was similar to that of Black men but below those of minority women and men. The segregation of Asian

[11] The evolution of the segregation of Black women reported in Figure 2 was previously shown by Alonso-Villar and Del Río (2013), who undertook an in-depth analysis of this particular group.
[12] Queneau (2009) also documented a decrease in the segregation between Blacks and non-Blacks between 1983 and 2002, although this study did not distinguish between women and men.

men is between that of Hispanic and Black men, while the segregation of Asian women is quite close to that of other minority women. Despite the high segregation of Asian women and men, in the next section we will show that, as opposed to other minorities, these groups are advantaged when considering the wages of the occupations they tend to fill.

The analysis also suggests that, in the 2000s, differences in segregation along race/ethnic lines were more marked among men, while there were barely differences among minority women. This finding is in line with those obtained in other studies for earlier periods (Reskin et al., 2004; Spriggs and Williams, 1996; Alonso-Villar et al., 2012).

4. Assessing Segregation: Occupational Attainment

So far we have documented the contributions of the different gender-race/ethnicity groups to overall segregation, the segregation level of each group, and the evolution of each group over time. Now we assess the consequences of segregation for each group according to index Γ and show how important occupational sorting is to explain their earning gaps.

Figure 3. Decomposition of the per capita earning gap ratio (*Egap**100) for the largest groups in terms of segregation (Γ*100) and within-occupation wage disparities (Δ*100), 2008-10

Figure 3 displays the decomposition of the per capita earning gap ratio of the four largest racial/ethnic groups in 2008-10 (the corresponding values for the 12 groups are

given in Table A3 in the appendix). This chart shows that segregation explains the majority of the per capita earning gap ratio for African American, Asian, and Hispanic women and men. But 74% of the negative earning gap of White women is associated with the salary disadvantage that this group faces within occupations[13] while the positive earning gap of White men arises from occupational segregation and within-occupation wage advantages in equal shares.

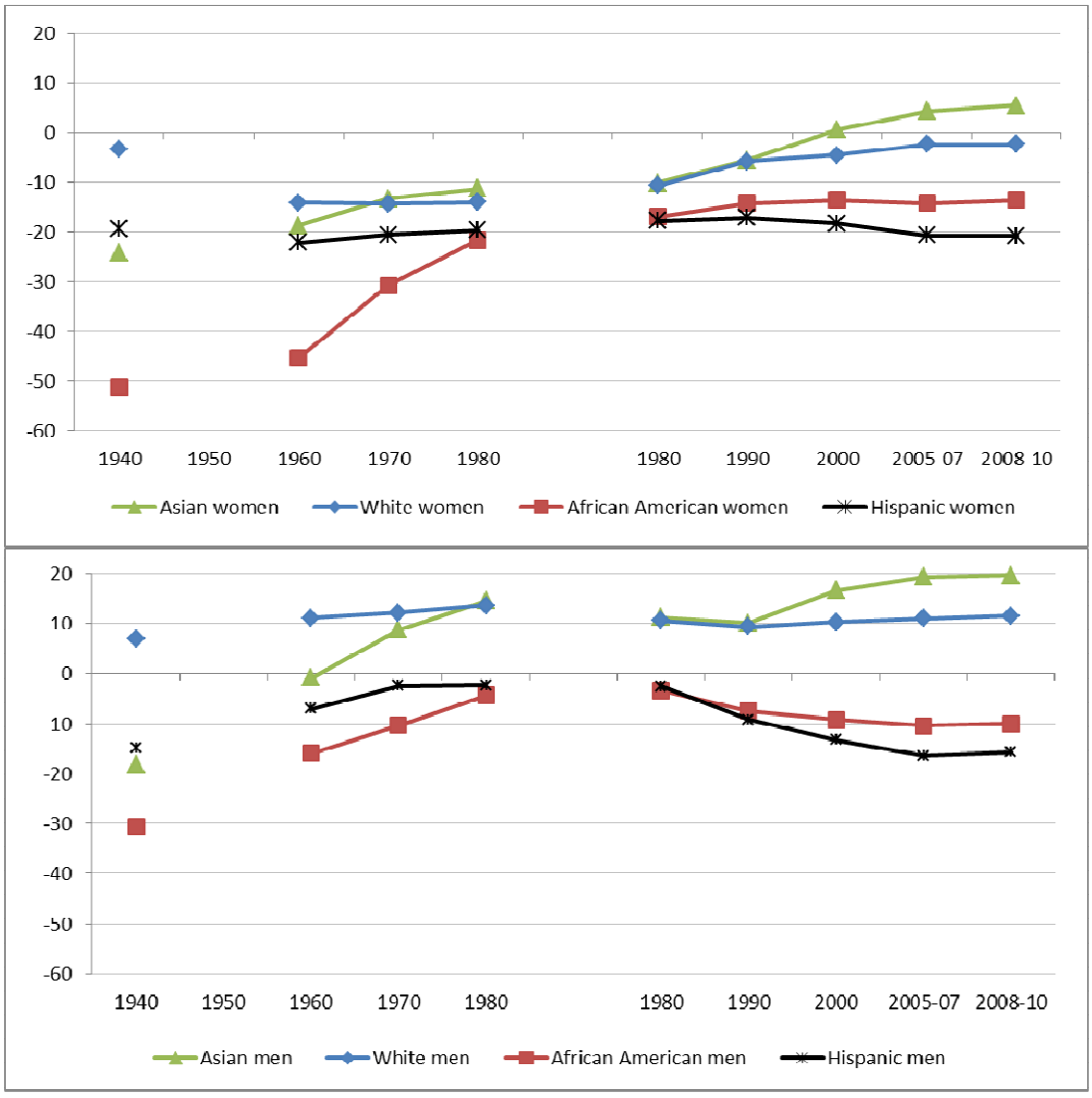

Figure 4. Gains/losses of the largest gender-race/ethnic groups (Γ*100), 1940-2010

[13] This percentage had been increasing since 1980 (when it was 54%) because the reduction in the earning gap of White women due to segregation has been larger than the reduction in their salary disadvantage within occupations. Petersen and Morgan (1995) documented the important role of occupational segregation in explaining the wage gap of women in the early 1980s although they did not distinguish them by race.

The Consequences of Segregation for Men

Figure 4 documents the evolution of Γ for the largest groups (the values of this index for the 12 groups are given in Table A4 in the appendix). This chart reveals that all groups of men improved between 1940 and 1980 in terms of occupational attainment. Asian men caught up with White men in 1980, where both groups had a value around 11, which means that their uneven distributions across occupations brought them an 11% gain above the average hourly wage of the economy. Black and Hispanic men also caught up with each other in 1980 but at a negative value (around -3), which gives evidence of their disadvantaged positions.

From 1990 on, important divergences appear among male groups. Asian men increasingly improved (reaching an advantage of 20% in 2008-10), surpassing even White men (12%), who no longer make up the most advantaged group (this group's index has barely changed since 1980). On the contrary, the indexes of Black men and especially Hispanic men have markedly decreased (reaching -10 and -16, respectively, in 2008-10), which suggests a worsening for these two groups.

Exploring the effects of affirmative action on the occupational advancement of minorities, Kurtulus (2012) found that Black men benefited from it, which may explain why when enforcement of affirmative action weakened in the 1980s, integration fell for this group. On the contrary, Kurtulus did not find evidence that Hispanic men benefited from affirmative action. As we explain later on, the recent evolution of Hispanic men may be affected by the group's immigration profile.

The Consequences of Segregation for Women

Figure 4 also reveals that all groups of women improved from 1960 until 1990, which is consistent with the progress along gender lines mentioned in the previous section. Apart from the rise in education (Blau et al., 2013), civil rights legislation may have been behind these advances. Kurtulus (2012) claims that affirmative action played an important role in the advancement of Black, Hispanic, and White women into management, professional, and technical occupations during the 1970s and early 1980s, while the impact was smaller in the 1990s.

Since 1990, only Asian and White women have improved in terms of occupational attainment, especially the former, perhaps as a consequence of their advantage on

educational grounds. A central finding of this paper is that since 2000 the index has been positive for Asian women. In 2008-10, they had a per capita gain of 5% of the average wage of the economy. This advantage is, however, lower than that of either White men (12%) or Asian men (20%).

Regarding White women, it is startling the decline of the index in the period 1940-1960 and its stagnation between 1960 and 1980, especially if we take into account the strong segregation reduction that this group experienced (Figure 2). The intensification of their disadvantage during the first period (index Γ falls from -3 to -14) was due to both a decrease in the relative weight of this group in some occupations with wages above or near the average wage (teachers, operatives, and forepersons) and a drop in the relative wage of occupations in which White women were highly represented (bookkeepers, secretaries, and other clerical workers). This pattern is also observed during the period 1960-1980, although it was offset by a higher representation of White women in occupations with wages above the average (accountants and auditors, professional and technical workers, and managers, officials, and proprietors). Since 1980 the index has been closer and closer to zero. In 2008-10, the index shows a disadvantage of 2% of the average wage. Therefore, this group has a better position in terms of occupational attainment than Black men but worse than White men and either Asian men or women. The situation is much worse for Black and especially Hispanic women, whose positions have worsened in the past decade (their values in 2008-10 were -14 and -21, respectively), despite the dramatic advances of the former until 1980.[14]

Consequently, the slight reduction in gender segregation seen in the 2000s has not equally affected all racial/ethnic groups of women. The progress of women in the past decade was mainly concentrated among Asians and Whites. Our results for previous decades are consistent with the findings on relative earnings shown by Cotter et al. (1999). These authors document stagnation for White women´s earnings as a proportion of White male earnings in the 1960s and 1970s and improvements in the 1980s; strong improvements for Black women in the late 1960s and 1970s; and larger increases for White women than for Black and Hispanic women between 1980 and 1995.

[14] As mentioned above, this index only cares for wage disparities that arise from working in different occupations while wage disparities or discrimination within occupations is left aside. In fact, as Figure 3 shows, the situation of Black and Hispanic women is worse when taking wage disparities into account (their per capita earning gap ratios are, -21 and -32, respectively). Conrad (2005) documents the widening wage gap of Black women, with respect White women, between 1980 and 2000 derived from the persistent discrimination and the racial gap in education that still remains.

Further Discussion

Our analysis shows that despite segregation being higher for Asian men than for Black men in 2008-10 (Figure 2), the assessment of that segregation seems to be positive for Asians but negative for Blacks. Something similar happens to Asian women, whose level of segregation in 2008-10 was similar to that of other minority women although the assessment of that segregation is positive for them and negative for the other minorities. In addition, despite Hispanic men having a higher level of segregation than Hispanic women, the situation of women seems to be worse.

The high value of index Γ for Asian women and men could be the result of their high educational achievements. Notwithstanding important differences in education among Asian subgroups,[15] the proportion of Asians holding a bachelor's degree is significantly higher than that of non-Asians. As documented by Xie and Goyette (2004), this may have facilitated their access to high-skilled occupations, such as scientific, medical, and engineering jobs, from 1960 to 2000. Other scholars also document the occupational advantage of particular Asian subgroups. Woo et al. (2012) find occupational advantages for second-generation South Asian women and men when comparing them with their White counterparts due not only to the high educational level of this group but also to its concentration on science, technology, engineering, and medical studies.

If we repeat the analysis shown in Figure 3 stratifying by educational attainment—that is, if we explore individuals of each educational level separately—new findings appear (see Table A3 in the appendix which considers four levels: less than high school, high school diploma, some college, and bachelor's degree; see also Figure 5, which depicts the gains and losses of those having a bachelor's degree as a proportion of their education-specific average wage).

The occupational attainments of Asian women disappear when comparing them with their educational peers (Γ is always negative, although close to zero for those with a bachelor's degree). Therefore, the good position of the whole group of Asian women appears to be mainly driven by their largest proportion of bachelor's degrees. The case of Asian men is a bit different; the index for those with university degrees is positive

[15] The proportion of Asian Indians who have bachelor's degrees or higher education is more than twice as much as that of Vietnamese (Allard, 2011). Kim and Mar (2007) also document wide differences among Asian groups in terms of poverty and unemployment rates.

and high, around 11, although lower than the one shown before for the whole group of Asian men (almost 20). Consequently, the occupational attainments of Asian men seem to be the result of both their education achievements and their intense concentration in some of the highest paid jobs.

The low value of Γ for Hispanics could also be the result of their (lower) educational achievements (and their immigration profile). As Duncan et al. (2006) documented, when controlling for years of schooling and English proficiency, Hispanics barely lag behind Whites in terms of employment and earnings. Alonso-Villar et al. (2012) and Gradín (2013) also pointed out that these factors are an important source of occupational segregation for Hispanics. Our analysis by educational level shows that this is the case for Hispanic men—Γ substantially increases when comparing them with their peers in education (it is either positive or less negative). On the contrary, Γ is negative and high for Hispanic women at all educational levels.

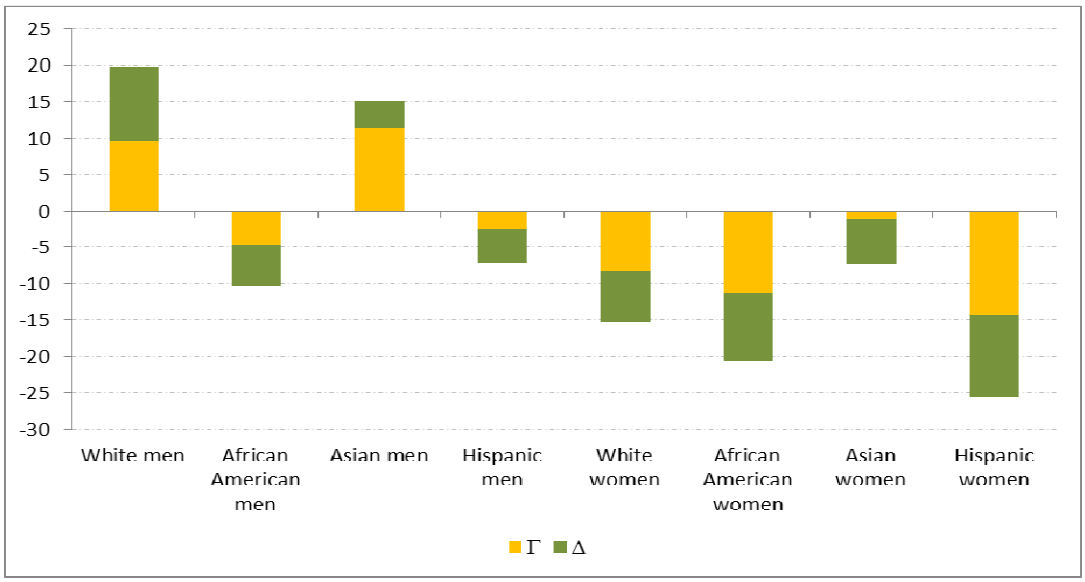

Figure 5. Decomposition of the per capita earning gap ratio (*Egap**100) for the largest groups in terms of segregation (Γ*100) and within-occupation wage disparities (Δ*100), 2008-10: Individuals with a bachelor's degree

The pattern of Hispanic women is shared by Black and White women (although to a different extent). The occupational sorting of these groups seems to disadvantage them at each educational level while, as shown above, segregation appears not to be a problem for Asian women having a bachelor's degree (perhaps due to their

concentration in some types of study).[16] Regarding male groups, segregation brings important advantages for White men at all educational levels. Only in the case of individuals having a bachelor's degree is the advantage slightly surpassed by that of Asian men. As opposed to Hispanic men, the low occupational attainments of Black men do not seem a consequence of their educational achievements. An interesting finding is that when focusing on individuals having less than a high school diploma, all male groups gain from their occupational sorting while all female groups have losses.

5. Conclusions

Our analysis has not only shown the evolution of occupational segregation in the U.S. by gender, race, and ethnicity during a seventy-year period, 1940-2010, but has also assessed it by quantifying the monetary gains/losses of the various groups. For that purpose, we have developed an index that measures the per capita advantage or disadvantage of a group, derived from its segregation, as a proportion of the average wage of the economy. Our index seems a helpful tool not only for academics but also for institutions concerned with inequalities by gender, race, ethnicity, and migration status, among others, because it makes it possible to rank different groups in an economy or a target group across time according to their segregation nature.

This study has revealed that when adding the gender dimension to the analysis of segregation by race/ethnicity, segregation more than triples, while segregation increases by only one-third the other way around. The segregation reduction that most female groups experienced between 1940 and 1990 did not allow any of them to reach a neutral position in the labor market; the consequences of segregation were negative for them, as also happens in terms of earnings, as noted by Cotter et al. (2003).

Things started to change for Asian women in 2000 but not for other women. Overlooking differences by ancestry (Kim and Mar, 2007), in 2010, the segregation of Asian women brought them a per capita advantage of 5% of the average wage of the economy, while the segregation reduction for White women only allowed them to reach a 2% disadvantage. The situation was much worse for other female groups. The disadvantage of Black and Hispanic women in 2010 was marked (14% and 21% of the

[16] The earnings gap for this subgroup is mainly explained by the within component (Figure 5), which suggests that although they are not particularly concentrated in bad occupations, they are penalized within them.

average wage, respectively), and these groups did not improve in the last decade. Regarding male groups, our study has revealed that the position of Whites has barely changed since 1980, their advantage in 2010 being about 12% of the average wage. As in the case of their female counterparts, Asians have been the more advantaged male group since 2000, reaching an index value of 20% in 2010. On the contrary, Hispanic and Black men´s situations have worsened since 1980; in 2010, they had a per capita disadvantage of 16% and 10%, respectively. The analysis has also shown that the occupational sorting of women is still worse than that of men of the same race/ethnicity.

Although the causes of these disadvantages are beyond the aim of this paper, which has mainly focused on gross differences among groups, the analysis undertaken stratifying by educational attainments suggests that the advantage of Asian women was due to their higher education achievements. When comparing them with their peers in education, they have a negative index, even those having a bachelor's degree (although in this case it is close to zero). The advantage of Asian men also decreases when comparing them with their peers, but the index for those having a bachelor's degree is instead clearly positive. Education does not seem to explain either the negative value of the index for female groups (and Black men) or the positive value for White men. Moreover, when focusing on individuals with less than a high school diploma, segregation brings positive results to all men's groups and negative results to all women's. Among those with a bachelor's degree, situations for all women except Asians are worse than those for any male group. A startling finding is that the disadvantage for White women with a bachelor's degree is larger than that for Asian women (and also larger than that for any male group). This is an issue that deserves further research attention. Introducing spatial variation in the losses/gains of the groups would also help to approach the real experience of groups (Cohen and Huffman, 2003; Cotter et al., 2003; Alonso-Villar et al., 2013).

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Appendix

	1940	1950	1960	1970	1980	1990	2000	2005-07	2008-10
White men	67.8	64.7	60.4	54.7	48.3	43.5	39.8	37.3	35.6
African American men	6.6	6.2	5.4	5.2	4.9	4.7	4.6	4.9	4.8
Asian men	0.2	0.2	0.4	0.5	0.9	1.5	2.0	2.5	2.7
Native American men	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.3	0.3
Hispanic men	1.0	1.3	1.9	2.4	3.4	4.6	6.0	8.1	8.4
Men from other races		0.0	0.1	0.0	0.1	0.0	0.9	0.7	0.8
White women	20.7	23.6	27.2	31.2	34.3	35.5	34.1	32.3	31.9
African American women	3.3	3.3	3.6	4.1	4.7	5.1	5.4	5.6	5.9
Asian women	0.0	0.1	0.2	0.3	0.8	1.3	1.8	2.1	2.5
Native American women	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.3
Hispanic women	0.3	0.4	0.7	1.2	2.2	3.1	4.3	5.4	6.2
Women from other races		0.0	0.0	0.0	0.0	0.0	0.7	0.6	0.7

Table A1. Demographic weight of gender-race/ethnicity groups, 1940-2010

	1940	1950	1960	1970	1980	1980	1990	2000	2005-07	2008-10
White men	0.108	0.120	0.157	0.169	0.184	0.211	0.202	0.197	0.191	0.198
African American men	0.572	0.554	0.588	0.404	0.310	0.357	0.308	0.263	0.245	0.245
Asian men	0.850	0.738	0.382	0.357	0.298	0.329	0.281	0.333	0.332	0.322
Native American men	0.727	0.825	0.724	0.430	0.315	0.360	0.341	0.315	0.337	0.311
Hispanic men	0.393	0.396	0.359	0.258	0.283	0.315	0.350	0.388	0.433	0.417
Men from other races		1.366	0.745	0.569	0.220	0.273	0.349	0.171	0.169	0.154
White women	0.675	0.590	0.530	0.400	0.297	0.327	0.257	0.243	0.246	0.237
African American women	1.612	1.447	1.347	0.786	0.456	0.514	0.391	0.344	0.357	0.338
Asian women	0.992	0.783	0.605	0.478	0.357	0.457	0.354	0.342	0.343	0.338
Native American women	0.918	1.561	0.951	0.583	0.313	0.368	0.285	0.268	0.292	0.281
Hispanic women	0.768	0.714	0.620	0.435	0.346	0.430	0.362	0.344	0.364	0.345
Women from other races		2.133	0.847	0.869	0.352	0.424	0.382	0.242	0.254	0.233

Table A2. Local segregation of gender-race/ethnicity groups (Φ_1^g), 1940-2010

	Total population			Less than High School			High School			Some College			Bachelor's Degree		
	Γ	Δ	EGap	Γ	Δ	EGap	Γ	Δ	EGap	Γ	Δ	EGap	Γ	Δ	EGap
White men	11.5	10.9	22.4	11.8	8.1	19.9	10.4	8.2	18.6	9.6	8.1	17.7	9.7	10.2	19.8
African American men	-10.1	-2.5	-12.6	1.8	3.5	5.3	-1.8	-1.4	-3.2	-2.4	-1.0	-3.5	-4.7	-5.6	-10.3
Asian men	19.6	9.9	29.5	1.3	9.9	11.2	-3.2	2.9	-0.2	-0.6	5.1	4.4	11.4	3.7	15.1
Native American men	-5.4	-6.0	-11.4	11.6	-0.9	10.6	5.7	-5.9	-0.3	5.1	-2.4	2.7	-1.0	-5.7	-6.7
Hispanic men	-15.7	-6.2	-21.9	3.9	-1.1	2.7	-0.4	-5.9	-6.3	-0.2	-2.1	-2.3	-2.5	-4.6	-7.1
Men from other races	1.6	-1.4	0.2	4.1	4.0	8.2	3.2	-0.4	2.8	2.5	-1.3	1.2	3.9	-3.2	0.7
White women	-2.4	-6.6	-9.0	-9.4	-5.8	-15.2	-6.2	-4.8	-11.0	-4.2	-4.9	-9.0	-8.3	-7.0	-15.3
African American women	-13.7	-7.5	-21.2	-11.5	-0.9	-12.3	-12.6	-4.8	-17.4	-10.4	-5.4	-15.8	-11.4	-9.2	-20.6
Asian women	5.4	-0.6	4.8	-10.0	4.6	-5.4	-13.3	-0.9	-14.2	-9.0	1.6	-7.5	-1.1	-6.2	-7.3
Native American women	-15.0	-13.4	-28.4	-8.6	-9.1	-17.6	-10.5	-9.6	-20.1	-10.2	-8.7	-18.8	-12.9	-16.7	-29.6
Hispanic women	-20.9	-10.7	-31.6	-12.1	-6.3	-18.3	-13.1	-8.6	-21.7	-11.7	-7.8	-19.5	-14.3	-11.3	-25.6
Women from other races	-8.0	-10.0	-18.0	-11.8	-3.0	-14.9	-11.1	-5.5	-16.6	-9.5	-7.5	-17.0	-8.9	-12.6	-21.5

Table A3. Decomposition of the per capita earning gap ratio of each group (*Egap**100) in terms of segregation (Γ*100) and within-occupation wage disparities (Δ*100), 2008-10

	1940	1960	1970	1980	1980	1990	2000	2005-07	2008-10
White men	6.95	11.09	12.13	13.61	10.58	9.35	10.30	11.00	11.52
African American men	-30.61	-15.99	-10.31	-4.36	-3.39	-7.41	-9.19	-10.43	-10.08
Asian Men	-18.24	-0.77	8.76	14.49	11.18	10.08	16.61	19.27	19.60
Native American men	-29.40	-13.87	-2.75	3.27	2.18	-3.45	-6.23	-7.19	-5.35
Hispanic men	-14.82	-7.00	-2.47	-2.34	-2.55	-9.21	-13.22	-16.42	-15.72
Men from other races		0.72	9.28	7.11	5.60	-4.60	-0.65	-1.61	1.63
White women	-3.48	-14.18	-14.36	-14.13	-10.70	-5.80	-4.59	-2.42	-2.37
African American women	-51.28	-45.47	-30.84	-21.74	-16.97	-14.26	-13.70	-14.31	-13.72
Asian women	-24.27	-18.79	-13.38	-11.33	-10.21	-5.66	0.53	4.28	5.41
Native American women	-26.22	-32.17	-24.05	-18.80	-15.59	-14.01	-13.46	-14.29	-15.02
Hispanic women	-19.46	-22.23	-20.60	-19.74	-17.87	-17.17	-18.38	-20.77	-20.87
Women from other races		-18.63	-19.02	-15.49	-12.19	-14.46	-10.32	-9.36	-7.97

Table A4. Gains and losses of the gender-race/ethnicity groups (Γ *100), 1940-2010