How Much of the Gender Gap in Earnings is Associated with Occupational Segregation?

Prepared for 2013 Annual Meeting of the Population Association of America

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1. Introduction

In the United States and elsewhere, gender stratification of the labor market has two notable characteristics: firstly, that men and women tend to work in different occupations, called *occupational sex segregation*; and secondly, that men tend to earn more money, commonly referred to as the *gender gap in earnings*. As women's participation in the labor force in the United States has steadily increased over the past few decades, the changes in both occupational sex segregation and the gender gap in earnings have attracted intense scholarly attention. While occupational sex segregation and the gender gap in earnings have declined dramatically since the enactment of the Civil Rights Act of 1964, the onsets and patterns of change in these two characteristics differ. Decline in occupational sex segregation began in the late 1960s, continued to decline between 1970 and 1980, but has remained stagnant since the mid-1980s (Tomaskovic-Devey, Zimmer, Stainback, Robinson, Taylor, and McTague 2006). Meanwhile the gender gap in earnings began to decline in the early 1980s, and is continuing to do so today (DeNavas-Walt, Proctor, and Smith 2011).

Despite these dramatic changes in both occupational sex segregation and the gender gap in earnings, remarkable disparities between men and women in the workplace persist. In 2010, occupational sex segregation – measured by the index of occupational dissimilarity (Cotter, Herman, and Vanneman 2004) – was about 0.51, indicating that nearly 51 percent of occupations are sex segregated (Hegewisch, Liepmann, Hayes, and Hartmann 2012). Furthermore, the gender gap in earnings – measured by the female-to-male earnings ratio – was 0.77 (U.S. Bureau of Labor Statistics 2011), indicating that female workers earned on average 23 percent less than male workers in 2010. In short, the gender inequality in wages has narrowed somewhat over the past three decades, yet it has not disappeared (Weeden, Kim, Di Carlo, and Grusky 2007).

While the onsets and patterns of decline in occupational sex segregation and in the gender gap in earnings differ, the persistence of both indicators of gender inequality articulates the importance of understanding the relationship between these indicators, in order to alleviate the existing gender inequality in the United States. The key question is whether and how much the earnings gap can be attributed to occupational sex segregation (Petersen and Morgan 1995). Occupational sex segregation and the gender gap are linked because men very often work in higher-paying occupations. The extent to which occupational sex segregation contributes to the gender gap in earnings in the United States is an important question, as wages are substantially lower in occupations with a higher proportion of women (Macpherson and Hirsch 1995), and it has significant implications for public policy. That is, if women are underrepresented in occupations with higher wages, rather than having lower wages within the same occupations, then policy aim should be to amend the unequal gender distribution across occupations rather than to equalize the wages within occupations. Furthermore, occupations are central to modern stratification systems and therefore the widening occupational differentials is important in understanding wage inequality in the United States (Mouw and Kalleberg 2010), understanding the effects of occupational sex segregation on the gender gap in earnings is increasingly more important.

To determine the extent to which occupational segregation accounts for the gender gap in wages, studies have used various methods to project how much the gender gap would narrow if the labor market were desegregated by equalizing the proportion of male and female workers in each occupation. These studies examining the effects of occupational sex segregation on economic inequality appear to confirm that differences between occupations are the primary source for the growing wage inequality in many different forms (Mouw and Kalleberg 2010;

Weeden, Kim, Di Carlo, and Grusky 2007). Specifically, previous studies have found that occupational sex segregation is an important factor for understanding the gender gap in earnings (Petersen and Morgan 1995; Tomaskovic-Devey and Skaggs 2002; Tomaskovic-Devey 1993) (see Tam (1997) for exception). That is, we can attribute the gender gap in earnings to the disproportionate distribution of men and women across occupational categories. However, what is less certain is the extent of occupational sex segregation's impact on the gender gap in earnings. Studies utilizing different methods, from a direct decomposition method to multivariate regression method, have yielded different effect sizes, ranging from 8 to 64 percent (Cotter, Defiore, Hermsen, Kowalewski, and Vanneman 1995; England 1992; Petersen and Morgan 1995). Although these studies have advanced our understanding of the effects of occupational sex segregation on the gender gap in earnings, they have also broken down the gender gap in average wages to investigate the contribution of occupational sex segregation to the wage differential without investigating the gender-based inequality in the dispersion of wages.

But there are in fact two gender gaps, and both could be functions of occupational segregation. The better-known gender gap is the gap in average earnings. The lesser-known gap is the greater inequality among men's wages than among women's wages in which there is a greater disparity among male workers than among female workers. For a more complete understanding of the association between gender and wage inequality in the United States, investigating the contribution of occupational sex segregation to gender wage differentials in terms of variances as well as averages is important. This study is apparently the first to estimate the contribution of occupational sex segregation to both gender gaps in the United States.

The first section of this study reviews key articles investigating the gender gap in average earnings in the United States using standard mean decomposition. We discuss the findings on the

contribution of occupational sex segregation on the gender gap in average earnings in the United States, and to the extent of how large the contribution of occupational sex segregation is on the gender gap. The second section discusses the data and methods of our own investigation. The third section investigates the contribution of occupational sex segregation on the variance of gender gap in earnings in the United States in 2000-2008 using both mean decomposition and variance decomposition (Nau and Firebaugh 2012). We compare the changes in the gender gap in average earnings in its mean and variances concurrently. In the last section, we discuss the implications of investigating the contributions of occupational sex segregation on the gender gap in average earnings.

2. Literature Review

Occupational Sex Segregation

Occupational sex segregation refers to the unequal distribution of workers based on sex, where men and women tend to work in different occupations. It is a multifaceted phenomenon that has at least two dimensions, the horizontal dimension and the vertical dimension (Charles and Grusky 2004). The horizontal dimension reflects the tendency for women to be overrepresented in non-manual occupations (i.e., white-collar jobs); and the vertical dimension reflects the tendency for men to get better jobs within both non-manual and manual occupations (Tomaskovic-Devey et al. 2006). Occupational sex segregation is one of the most important aspects of the labor market because it can have important consequences at both macro- and micro- levels. At the micro-level, it creates labor market rigidity and economic inefficiency (Anker 1997). Persistent occupational sex segregation wastes human resources and contributes to economic inefficiency as individuals work in occupations where they can't maximize their

potential. At the micro-level, it negatively affects women's status and income, thereby contributing to sex income inequality.

In the United States, occupational sex segregation declined significantly from 1972 to the mid-1980s, at a rate of nearly one percent per year (Beller 1985; Jacobs 1989). However, occupational sex segregation has stagnated since the mid-1980s, and has remained remarkably steady since then (Cotter, Herman, and Vanneman 2004; Jacobs 2001). In 1972, occupational sex segregation – measured by the index of occupational dissimilarity (Cotter, Herman, and Vanneman 2004) – was approximately 0.68. This index of occupational dissimilarity measures the relative separation or integration of groups across all occupations, where 1 represents complete segregation and 0 represents complete integration. The index of occupational dissimilarity value of 0.68 in 1972 indicates that 68 percent of male workers would need to move to another occupation to make male workers and female workers evenly distributed across all occupations. From 1972 to 1980, the index of occupation dissimilarity declined from 0.68 to 0.62; then it declined from 0.62 to 0.54 from 1980 to 1990. In 2010, this value has declined only to 0.51 (Hegewisch, Liepmann, Hayes, and Hartmann 2012). Therefore while the earnings gap has declined dramatically from 1970 to the mid-1980s, there has been little to no change since the mid-1980s (Tomaskovic-Devey et al. 2006). Such stagnation in the gender gap in earnings in the United States has attracted intense scholarly attention (Beller 1985; Jacobs 2001).

[INSERT FIGURE 0A]

Characteristics of occupational sex segregation in 2011 are also informative in understanding the prevalence of occupational sex segregation in the United States. In 2011, the most common 20 occupations for females employed nearly 42 percent of all full-time employed women whereas the most common 20 occupations for males employed nearly 32 percent of all

full-time employed men. Furthermore, 10 of these most common 20 occupations constituted at least 75 percent of work force for both men and women. About 39.5 percent of all full-time employed women worked in occupations which are at least 75 percent female; about 44.5 percent of all full-time employed men worked in occupations which are at least 75 percent male (Hegewisch, Liepmann, Hayes, and Hartmann 2012).

Occupational Sex Segregation and the Gender Gap in Earnings

The United States has experienced considerable decline in the gender gap in earnings since the early 1980s. Prior to 1980, female-to-male earnings ratio had remained around 0.60, which indicates that female workers earned 40 percent less than male workers. This indicator, however, has been continuing to increase. From 1980 to 1990, the gender gap in earnings has experienced remarkable decline as the female-to-male earnings ratio has increased from 0.60 to 0.72. In other words, the gender gap in earnings, measured as the ratio of female-to-male earnings, has improved by approximately one percentage point per year since the early 1970s (O'Neill and Solomon 1993). From 1990 to 2000, the female-to-male earnings ratio increased from 0.72 to 0.76; and from 2000 to 2010, the female-to-male earnings ratio increased from 0.76 to 0.78. The declining trend of the gender gap in earnings signifies that the gender gap in wage inequality has narrowed somewhat over the past three decades, yet it has not disappeared (Weeden, Kim, Di Carlo, and Grusky 2007). Looking at the gender gap in earnings using a different indicator also demonstrates the persistence of gender inequality: the median annual earnings were 42 percent higher for men than for women in 2007. After adjusting for the fact that men tend to work more hours, the median hourly wages reveals that men currently earn 23 percent more than women (Blank 2011).

[INSERT FIGURE 0B]

The rapid changes in female labor force participation coupled with the slower changes in the gender gap have inspired a rigorous scholarly investigation of the factors contributing to the persisting gender inequality in earnings (England, Farkas, Kilbourne, and Dou 1988; Marini 1989; Tomaskovic-Devey and Skaggs 2002; Treiman and Hartmann 1981). Scholars have particularly focused on the effects of occupational sex segregation on the gender gap in earnings in the United States (Petersen and Morgan 1995; Tam 1997; Tomaskovic-Devey and Skaggs 2002; Tomaskovic-Devey 1993). Understanding the association between occupational sex segregation and the gender gap in earnings has important policy implications, especially in helping policy makers identify whether the gender gap in earning in the United States is primarily driven by "allocative discrimination" or by "valuative discrimination" (Petersen and Morgan 1995). Allocative discrimination refers to the process by which men and women are differentially allocated to occupations. Valuative discrimination refers to the process by which women have lower wages than men despite the equal skill requirements and other factors. That is, understanding the association between occupational sex segregation and the gender gap in earnings will shed light on whether the gender gap is driven by differential access to occupations versus the devaluation of women's work, and understanding the underlying process that accounts for the gender gap in earnings will help to design more effective public policy in order to alleviate such gender inequality.

Most previous studies have found that a large portion of the gender gap in earning in the United States is attributable to occupation sex segregation. For example, in their study of about 870,000 male and female employees, Peterson and Morgan (1995) find that occupational sex segregation (i.e., disproportionate distribution of men and women over occupational categories)

accounts for nearly 64 % of the gender gap in earnings in the United States. Similarly, other studies have found that occupational sex segregation is attributable to the gender gap in earning in the United States, although how much it matters varies significantly across studies. Previous studies have estimated the effect of occupational sex segregation on the gender gap in earnings to range from 8% to 43% (see Cotter et al. 1995; England 1992). Goldin (1990) suggests that once some unspecified "correction" is applied, the effect of occupational sex segregation on the gender gap in earnings is reduced to roughly 19% (Cotter et al. 1995). In short, while there is consensus that occupational sex segregation affects the gender wage gap; the extent of its effect on the gender wage gap is somewhat inconclusive. In addition, previous studies have focused on investigating the contribution of occupational sex segregation on gender wage differential without looking at gender-based inequalities in the dispersion of wages. The current study aims to fill this gap in the literature.

2. Data and Methods

2.1. Data

We used the occupational wage data that Mouw and Kalleberg (2010) used to investigate the sources of change in wage inequality from 1983 through 2008. Using the 2000 occupational codes and data from 2000 through 2008, we use the logged hourly wages as the outcome variable to investigate the contribution of occupational sex segregation on the gender gap in average earnings in the United States. The logged hourly wages are cross-classified by sex and by 496 3-digit occupations; and the original data on sex, wages, and occupation are from the outgoing rotation groups of the Current Population Surveys (CPS). Wage data are not available for the self-employed, and the Mouw and Kalleberg hourly wages weighted by hours usually includes

part-time workers. We restricted the sample to the working age population (i.e., those ages 18-65 who report hourly wages in the CPS). For this age group, labor force earnings are the primary source of income by far in America. Not surprisingly, then, change in earnings has been the primary source of rising income inequality in the U.S. over recent years (Blank 2011). For more details about the sample, see Mouw and Kalleberg (2010).

There have been significant changes in the occupation codes between1980 and 2000; while the 1980 Standard Occupational Classification organized occupations into a hierarchical structure, the 2000 Standard Occupational Classification has organized the occupations according to "job families" (Deane and Shin 2000). Due to such discrepancies in the categorization of occupation codes between 1980 and 2000, we restrict our analysis to data from 2000 to 2008.

2.2. Method

We use variance decomposition methods to estimate the statistical contribution of occupational segregation to the difference in the mean and variance of earnings of male and female workers in the United States. To determine the contribution of occupational sex segregation to the difference in the mean and variance of earnings, we project how much the differences would change if we eliminated occupational desegregation while holding the sex-specific occupation means and variances constant. These projections are possible because the overall earnings mean for women is a function of the occupation means for women weighted by the proportion of women in each occupation; the same applies for men. Thus the difference in the overall earnings mean for men and women is a function of the earnings means of female and male workers in each occupation and their proportions in each occupation. Statistically, then, we

can project how much the gender gap in means would change if we desegregated occupations – that is, if we equalized the proportions of women and men in each occupation – while holding the mean earnings for women and men constant in each occupation.

The basic logic is the same for estimating the contribution of occupational segregation to the gender difference in earnings variance. In the case of earnings variance, however, our procedures also assume that desegregation does not change the sex-specific variance in earnings for each occupation (as well as the sex-specific mean in earnings for each occupation). The variance decomposition we use, then, describes how much the gender gaps would change if the means and variances remained unchanged when we equalize the sex composition of occupations. Of course, if occupational sex composition causally affects wages (Petersen and Morgan 1995; Tomaskovic-Devey and Skaggs 2002) but see (Tam 1997), then change in the sex composition of occupations is likely to alter the occupation-specific wage means and variances; therefore one should not assume that our projections capture the independent causal contribution of occupational segregation to gender differences in earnings. We pursue instead a descriptive goal of determining the amount of the gender gap in earnings that is associated with differences in the sex composition of occupations.

2.2.1. Decomposing the First Gender Gap: Difference in Average Earnings

For any population subdivided into c= 1, 2, …, C exclusive categories, the mean of a continuous variable Y is the weighted sum of the Y-means for the categories:

$$\overline{Y} = \sum_c \pi_c \overline{Y}_c$$

where $\overline{Y}_c$ is the mean of the cth category and π_c is the proportion of the population in the cth category. Therefore the difference in the means for two populations M and F subdivided into the same categories is

$$\overline{Y}_M - \overline{Y}_F = \sum_c (\pi_{cM}\overline{Y}_{cM} - \pi_{cF}\overline{Y}_{cF}) \quad (1)$$

Letting Y denote earnings, M and F denote male and female workers, respectively, and c denote occupation; then equation 1 describes the gender earnings gap as a function of the occupation-specific earnings of men and women weighted by the proportion of male and female workers in the occupations. We want to determine how much of the overall difference, $\overline{Y}_M - \overline{Y}_F$, is associated with occupational sex segregation, that is, differences in the sex mix of the occupations. From visual inspection alone we observe that when average earnings are the same for men and women in every occupation, then $\overline{Y}_{cM} = \overline{Y}_{cF}$ and occupational sex segregation is associated with all the gender gap in earnings. Generally, of course, average earnings are not the same for men and women in every occupation, so we must separate out the part of the gender gap that is associated with occupational segregation from the part that is associated with differences in the earnings of men and women in the same occupation.

To separate out the part of the gender gap associated with occupational segregation, based on equation 1 we first determine how large the gap would be if we equalized the gender mix of the occupations while holding the occupation means constant. This is the gender gap in earnings that we would observe under the counterfactual of no occupational sex segregation, with $\overline{Y}_{cM}$ and $\overline{Y}_{cF}$ fixed. Then, by subtracting this "segregation-free" gender gap from the original gender gap ($\overline{Y}_M - \overline{Y}_F$), we obtain the part of the gender gap that is associated with occupational sex segregation.

For the segregation-free gender gap, imagine that we desegregated occupations by redistributing male workers to match the occupational distribution of female workers. Then π_{cM} changes to π_{cF} in equation 1, and the new gender gap is:

Gender gap with occupations desegregated based on moving male workers

$$= \sum_c \pi_{cF}(\overline{Y}_{cM} - \overline{Y}_{cF}) \quad (2)$$

So the part of the gender gap associated with occupational segregation is equation 1 minus equation 2:

Gender gap minus desegregated gender gap based on moving male workers

= the part of the gap associated with men disproportionately in "male occupations"

$$= \sum_c (\pi_{cM}\overline{Y}_{cM} - \pi_{cF}\overline{Y}_{cF}) - \sum_c \pi_{cF}(\overline{Y}_{cM} - \overline{Y}_{cF}) = \sum_c (\pi_{cM} - \pi_{cF})\overline{Y}_{cM} \quad (3)$$

where the gender gap is desegregated by changing the occupational proportions of male workers. This is the part of the gender gap that would disappear, $\overline{Y}_c$ constant, if men were redistributed across occupations in the same proportion as women are. In that sense, then, if can be thought of as the portion of the gender gap that is attributable to the fact that men disproportionately work in "male occupations."

Now imagine that we desegregated occupations by redistributing female workers to match the occupational distribution of male workers, rather than vice versa. Then π_{cF} changes to π_{cM} in equation 1, resulting in $\sum_c \pi_{cF}(\overline{Y}_{cM} - \overline{Y}_{cF})$ for the gender gap desegregated this way. When we assume desegregation based on changing the occupational proportions of female workers, we obtain a somewhat different estimate of the part of the gender gap associated with occupational segregation:

Gender gap minus desegregated gender gap based on moving female workers

= the part of the gap associated with women disproportionately in "female occupations"

$$= \sum_c (\pi_{cM}\overline{Y}_{cM} - \pi_{cF}\overline{Y}_{cF}) - \sum_c \pi_{cM}(\overline{Y}_{cM} - \overline{Y}_{cF}) = \sum_c (\pi_{cM} - \pi_{cF})\overline{Y}_{cF} \quad (4)$$

This can be thought of as the portion of the gender gap that is attributable to the fact that women disproportionately work in "female occupations."

Alternatively, we could desegregate by redistributing female and male workers across occupations to match the average of π_{cF} and π_{cM}. Under that counterfactual, the part of the gender gap in earnings associated with occupational segregation is the mean of equations 3 and 4:

Gender gap minus desegregated gender gap based on average gender mix

= midpoint estimate of the part of the gap associated with occupational segregation

$$\sum_c (\pi_{cM} - \pi_{cF}) \left(\frac{\overline{Y}_{cM} + \overline{Y}_{cF}}{2} \right) \quad (5)$$

2.2.2. Decomposing the Second Gender Gap: Difference in Earnings Inequality

Earnings are more unequal for male workers in the United States due to the vertical dimension of sex segregation, where men hold jobs in manual and non-manual fields. Because the variance of logged earnings is a measure of earnings inequality, we can write this gender gap as the difference between the variance in men's and women's logged earnings:

$$\text{gender gap in earnings inequality} = \sigma_M^2 - \sigma_F^2$$

where σ_M^2 is the variance in logged earnings for male workers and σ_F^2 is the variance in logged earnings for female workers.

A group variance, like a group mean, can be expressed as the weighted sum of the characteristics of the group's constituent categories. Specifically, for any population subdivided

into c= 1, 2, …, C exclusive categories, the variance of a continuous variable Y can be partitioned into within-category and between-category components as follows (Firebaugh 2012):

$$\sigma^2 = \sum_c \pi_c \sigma_c^2 + \sum_c \pi_c \bar{y}_c^2 \qquad (6)$$

where π_c is the proportion of the population in category c, as before; σ_c^2 is the variance in Y within category c; and $\bar{y}_c^2$ is $(\overline{Y}_c - \overline{Y})^2$, the deviation of the category mean from the overall group mean, squared. Thus the gender gap in earnings inequality – the difference in the variance of logged earnings for male and female workers – is:

$$\sigma_M^2 - \sigma_F^2 = \sum_c (\pi_{cM} \sigma_{cM}^2 + \pi_{cM} \bar{y}_{cM}^2) - \sum_c (\pi_{cF} \sigma_{cF}^2 + \pi_{cF} \bar{y}_{cF}^2) \qquad (7)$$

From this point we proceed as before. First we determine how large the gender gap would be if we equalized the gender mix of the occupations while holding the other elements (σ_c^2 and $\bar{y}_c^2$) constant for women and men. Then, by subtracting this "segregation-free" gender gap from the original gap $\sigma_M^2 - \sigma_F^2$, we obtain the portion of the difference in earnings inequality that is associated with occupational sex segregation.

Again results can vary, depending on how the occupations are desegregated. For our analysis of gender gaps below we obtain the midpoint estimate first, that is, we assume that female and male workers are redistributed so that the new gender mix for each occupation is the average of the old gender mix (as in equation 5). Then, to place an interval around those projections, we desegregate based on changing the occupational proportions of female workers only, then males only. For the gender gap in earnings inequality, the relevant equations are (see Appendix):

<u>Midpoint estimate of the part of inequality gap associated with occupational segregation</u>

$$= \sum_c \bar{\pi}_c [(\sigma_{cM}^2 + \bar{y}_{cM}^2) - (\sigma_{cF}^2 + \bar{y}_{cF}^2)], \qquad \text{where } \bar{\pi}_c = (\pi_{cF} + \pi_{cM})/2 \qquad (8)$$

The part of the gap associated with men disproportionately in "male occupations"

$$= \sum_{c} (\pi_{cM} - \pi_{cF})(\sigma_{cM}^2 + \bar{y}_{cM}^2) \quad (9)$$

The part of the gap associated with women disproportionately in "female occupations"

$$= \sum_{c} (\pi_{cM} - \pi_{cF})(\sigma_{cF}^2 + \bar{y}_{cF}^2) \quad (10)$$

Positive values in the partitioning equations (equations 3-5 and 8-10) indicate that the difference in variance would decline if we desegregated – so occupational segregation in fact accounts for some of the gender gap – whereas negative values indicate that the gender gap would increase under desegregation.

3. Results

Both gender gaps – gender gaps in average earnings and inequality variance – have decreased in the United States from 2000 to 2008. There has been a significant decrease in total variance of wages for women and men. For example, the total variance in 2000 was 0.067 where was it decreased to nearly half – 0.035 in 2008 (see Table 1). Using standard ANOVA decomposition, we find that the majority of the sex differential in wage is attributable to greater within-occupation inequality for men. In addition, we find that relative within-occupation inequality has slightly increased from 2000 to 2008 (i.e., from 60.6% to 68.4%). On the other hand, approximately one-third of the total difference is attributed to greater between-occupation wage inequality for men. In 2000, between-occupation wage inequality account for 39.4% of the total differences whereas this decreased to only 31.6% in 2008 (See Figure 1a). This pattern illustrates that the occupation-specific wage means are more unequal for men than for women, yet the standard ANOVA decomposition does not tell us the possible mechanism of why the occupation-specific wage means are more unequal for men than for women. The occupation-

specific wage means may differ if men and women in the same occupation have different means; or if men and women work in different occupations where men work in occupations with greater inequality in the average wage. To investigate why the occupation-specific wage means are more unequal for men, we employ the composition-extracting decomposition (Nau and Firebaugh 2012).

[INSERT TABLE 1 & FIGURE 1]

Similar to the patterns with standard ANOVA decomposition, the majority of the sex differential in wage is attributable to greater within-occupation inequality for men. We also find that relative within-occupation inequality has slightly increased from 2000 to 2008, rising from 58.5% to 64.7%. Results of the decomposition shed some light on the possible mechanisms by which the occupation-specific wage means are more unequal for men.

Decomposition results show that about one-fifth of the sex differential in wage inequality is due to the fact that occupation-specific means vary more for men than women (see Table 1, between-occupation component in bottom panel). In 2000, nearly 20% of the sex differential in wage inequality is attributable to different occupation-specific means, where men work in occupations characterized by greater inequality. However, between 2000 and 2008, the between-occupation wage inequality decreased significantly. On the other hand, another one-fifth of the sex differential in wage inequality is due to occupational sex segregation (see Table 1, composition component in bottom panel). In 2000, nearly 21.5% of the sex differential in wage inequality is attributable to occupational sex segregation, and this pattern has persisted from 2000 to 2008 (see Figure 1b).

The observed gender gap is reported in the first line of each panel in Table 2a and Table 2b. Note that both gender gaps narrowed from 2000 to 2008, with the gender gap in hourly (log)

wages declining by about 18 percent (from 0.217 to 0.178) and the gender gap in wage variance declining by nearly half. The next three lines in the table report the projected gender gap if men and women were redistributed across occupations to equalize the proportion of men and women who worked in each occupation. There are essentially three ways to equalize this proportion. One way is to rearrange both men and women to match the midpoint occupational mix in each occupation – the second line in the top and bottom panels (i.e., "desegregated gap, mix occ mix"). A second way is to rearrange women across occupations to match the occupational distribution of men. That is the third line in the table, "desegregated gap, men's occupational mix." A third way is to rearrange men to match the occupational distribution of women – called "desegregated gap, women's occupational mix", the last line in the top and bottom panels.

Two findings stand out in Table 2. The first notable finding is that, in every year occupational sex segregation accounts for a significant portion – but never the majority – of the gender gap in average wages. This is the case whether we desegregate using the occupational mix of men or of women or of the midpoint of men and women: results for mean wage gap do not depend on whether we choose men's or women's occupational mix. For 2000 wages, for example, the observed gap of 0.217 would be projected to be 0.150 using the occupational mix of men, that is, it would be reduced by 31%. So, using this method for estimating the contribution of occupational segregation, we conclude 31% is due to segregation. The other criteria (women's mix, and midpoint) give the same results (28% and 29%). In short, we get consistent results no matter what criterion we use for changing the occupational mix when examining the gender gap in average wages. Despite the overall decline in the gender gap in average earnings from 2000 to 2008, percentages are consistent over time for the contribution of

segregation to the gender gap in average wage. That is, the contribution of occupational segregation has remained steadily at about 30%.

[INSERT TABLE 2 & FIGURE 2]

The second notable finding is that the effect of desegregation on the gender gap in wage variance heavily depends on how we desegregate. For example, in 2000, if we eliminate occupational segregation by using the midpoint to equalize the proportion of women and men in each occupation (i.e., "desegregated gap, midpoint occupational mix"), we would eliminate 21% of the sex differential in wage inequality. If we were to redistribute women workers to match the occupational distribution of men (i.e., "desegregated gap men's occupational mix"), gender differences in wage inequality would decline dramatically and, in some years, virtually disappear. In 2000, for example, the gender gap would narrow from 0.067 to 0.026 – reducing the gender gap in wage variance by nearly 62 percent. On the other hand, if we eliminate segregation by changing the occupation mix of men to match that of women (i.e., "desegregated gap women's occupational mix"), then we would reduce the sex differential in wage inequality by -19%
In other words, if we change the occupation mix of men to match that of women, we would then increase the sex differential in wage inequality. Notably, in 2008, the gender difference in wage inequality virtually disappears when we redistribute women workers to match the occupational distribution of men (i.e., "desegregated gap men's occupational mix").

4. Discussion

Gender stratification of the labor market in the United States is influenced by two notable characteristics: occupational sex segregation and the gender gap in earnings. In the past few decades, there have been significant changes in both occupational sex segregation and the gender

gap in the earnings. With the enactment of the Civil Rights Act of 1964, occupational sex segregation started to decline immediately. Since then, occupational sex segregation experienced remarkable decline between 1970 and the mid-1980s (Tomaskovic-Devey et al. 2006). About a decade later, the gender gap in earnings also started to experience significant decline. The gender gap is continuing to decline up to date (DeNavas-Walt, Proctor, and Smith 2011); and the gender gap in wage inequality, meanwhile, has narrowed somewhat over the past three decades, yet it has not disappeared (Weeden, Kim, Di Carlo, and Grusky 2007).

In addition to significant changes in occupational sex segregation and the gender gap in earnings in the United States, one question that drives considerable scholarly attention is whether and how much the earnings gap can be attributed to occupational sex segregation (Petersen and Morgan 1995). Occupational sex segregation and the gender gap are linked because men very often work in higher-paying occupations. Furthermore, Petersen and Morgan (1995) have proposed two distinct mechanisms for the persistent gender gap in earnings: allocative discrimination and valuative discrimination. Understanding the association between occupational sex segregation and the gender gap in earnings will shed light on whether the gender gap is driven by differential access to occupations versus the devaluation of women's work.

In short, understanding the underlying process that accounts for the gender gap in earnings is important as it will help design more effective public policy to alleviate such gender inequality. While previous studies have used various methods to understand the association between occupational sex segregation and the gender gap in earnings (Petersen and Morgan 1995; Tomaskovic-Devey and Skaggs 2002; Tomaskovic-Devey 1993), these studies have done so without investigating the gender-based inequality in the dispersion of wages.

Our study extends prior research by investigating the contribution of occupational sex segregation to both gender gaps in the United States: the gender gap in average earnings and the greater inequality among men's wages than among women's wages. We found that considerable amounts of the gender inequality in average earnings and in the dispersion of wages are attributable to within-occupation differences. This finding echoes the valuative discrimination mechanism proposed by Petersen and Morgan (1995), in which women have lower wages than men despite the equal skill requirements and other factors. That is, women's lower wages reflect the devaluation of women's participation in the labor force. In addition, we found that in every year occupational sex segregation accounts for a significant portion of the gender gap in average wages. From 2000 to 2008, nearly over one-fifth of the gender gap in earnings can be attributable to occupational sex segregation. This finding echoes the allocative discrimination mechanism proposed by Petersen and Morgan (1995) in which men and women are differentially allocated to occupations, and occupations with predominately male workers have higher wages than occupations with predominately female workers.

We also found that the effect of desegregation on the gender gap in wage variance depends on how we desegregate. When we redistributed women workers to match the occupational distribution of men, gender differences in wage inequality declined dramatically or virtually disappeared. However, if male workers were redistributed to match the occupational distribution of female workers, then gender differences in wage inequality increased significantly. These findings indicate that two different mechanisms – valuative discrimination and allocative discrimination – are at work perpetuating the gender gap in earnings.

In summary, this study is the first to examine the contribution of occupational sex segregation to both gender gaps in the United States: the gender gap in average earnings and the

greater inequality among men's wages than among women's wages. The findings of our study suggest that public policy to alleviate the gender gap in earnings in the United States should focus on both valuative discrimination and allocative discrimination mechanisms. That is, women often are segregated to occupations that contain predominately other female workers, and even when they are in the same occupations with men, their work is valued less than men's. These mechanisms are not mutually exclusive, yet they work together to produce the persistent gender gap in earnings in the United States.

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Table 1. Contribution of Occupational Segregation to the Differences in Wage Inequality for U.S. Women and Men, 2000-2008.

	Year	Total Variance (σ^2_m - σ^2_f)	Within-occupation	Between-occupation	Composition component
ANOVA Decomposition					
	2000	0.067	60.6%	39.4%	unknown
	2001	0.063	58.7%	41.3%	unknown
	2002	0.065	64.4%	35.6%	unknown
	2003	0.050	62.3%	37.7%	unknown
	2004	0.048	60.9%	39.1%	unknown
	2005	0.041	64.1%	35.9%	unknown
	2006	0.037	68.2%	31.8%	unknown
	2007	0.034	63.4%	36.6%	unknown
	2008	0.035	68.4%	31.6%	unknown
Composition-extracting Decomposition					
	2000	0.067	58.5%	20.0%	21.5%
	2001	0.063	57.9%	17.5%	24.6%
	2002	0.065	55.5%	18.6%	25.9%
	2003	0.050	53.1%	20.1%	26.8%
	2004	0.048	50.6%	16.7%	32.8%
	2005	0.041	53.8%	15.6%	30.7%
	2006	0.037	65.0%	14.0%	21.0%
	2007	0.034	67.8%	11.0%	21.2%
	2008	0.035	64.7%	13.4%	21.9%

Note: Based on hourly wages (logged) for women and men for 496 3-digit occupations.
Component-extracting decomposition percentages use the moving averages.
Source: Current Population Survey, see Mouw and Kalleberg (2010).

Table 2. Contribution of Occupational Segregation to the Difference in Wage Inequality for U.S. Women and Men, 2000-2008: Three Estimates.

2a. Mean Decomposition

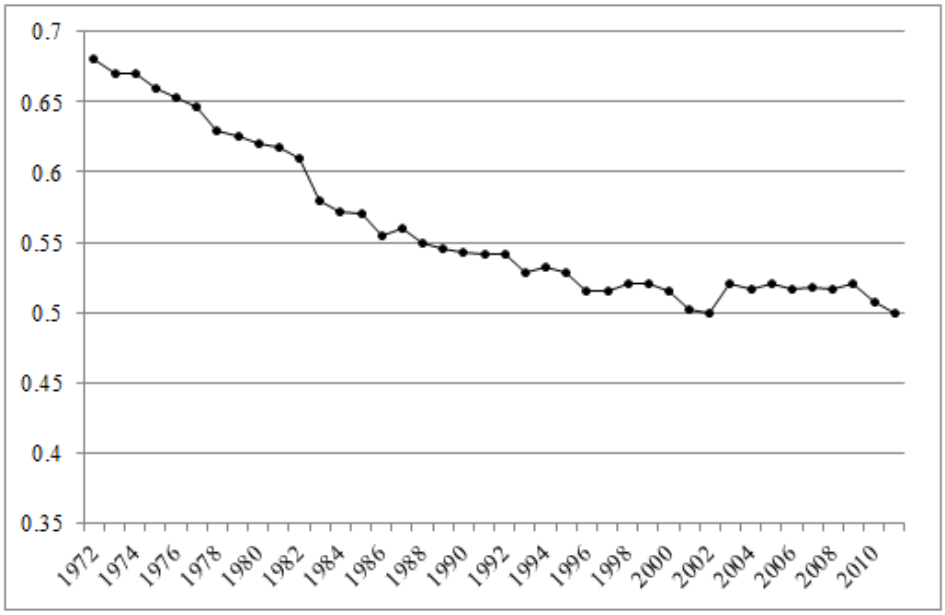
	2000 gap	Due to seg	2002 gap	Due to seg	2004 gap	Due to seg	2006 gap	Due to seg	2008 gap	Due to seg
Observed Gender Gap in Means	0.217		0.204		0.190		0.179		0.178	
Desegregated Gap, Midpoint Occ Mix	0.153	29%	0.146	28%	0.137	28%	0.130	27%	0.127	29%
Desegregated Gap, Men's Occ Mix	0.150	31%	0.141	31%	0.137	28%	0.120	33%	0.050	28%
Desegregated Gap, Women's Occ Mix	0.157	28%	0.151	26%	0.136	28%	0.141	21%	0.051	29%

2b. Variance Decomposition (Moving Averages)

	2000 gap	Due to seg	2002 gap	Due to seg	2004 gap	Due to seg	2006 gap	Due to seg	2008 gap	Due to seg
Observed Gender Gap in Means	0.067		0.065		0.048		0.037		0.035	
Desegregated Gap, Midpoint Occ Mix	0.053	21%	0.055	15%	0.043	10%	0.029	22%	0.028	20%
Desegregated Gap, Men's Occ Mix	0.026	61%	0.038	41%	0.031	35%	0.004	89%	0.001	97%
Desegregated Gap, Women's Occ Mix	0.080	-19%	0.072	-11%	0.055	-15%	0.054	-46%	0.054	-54%

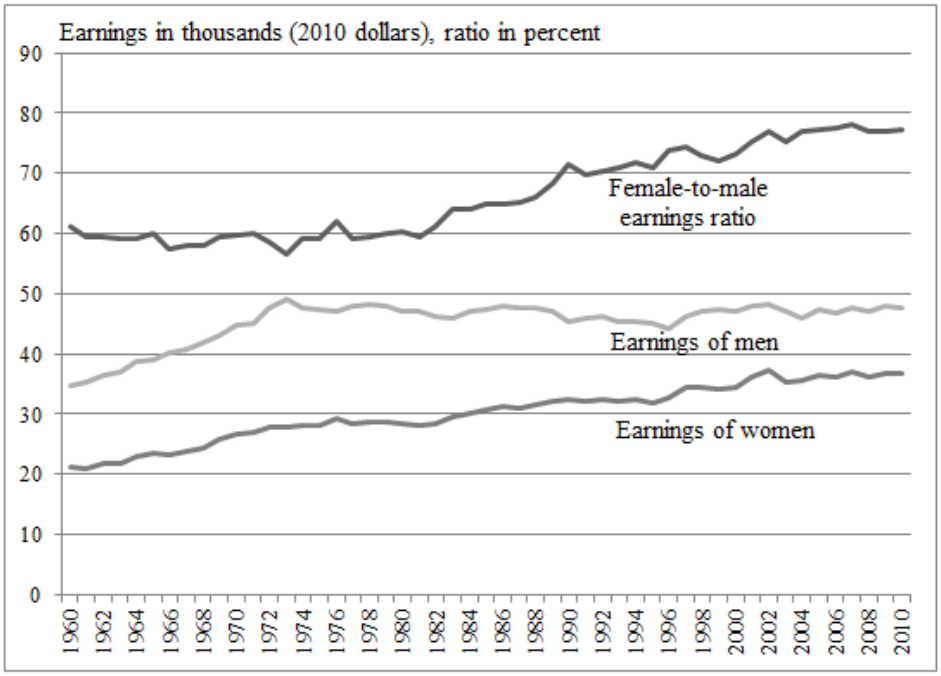
Note: Based on hourly wages (logged) for women and men for 496 3-digit occupations.
Component-extracting decomposition percentages use the moving averages.
Source: Current Population Survey, see Mouw and Kalleberg (2010).

Figure 0A. Index of Occupational Dissimilarity, 1972-2011.



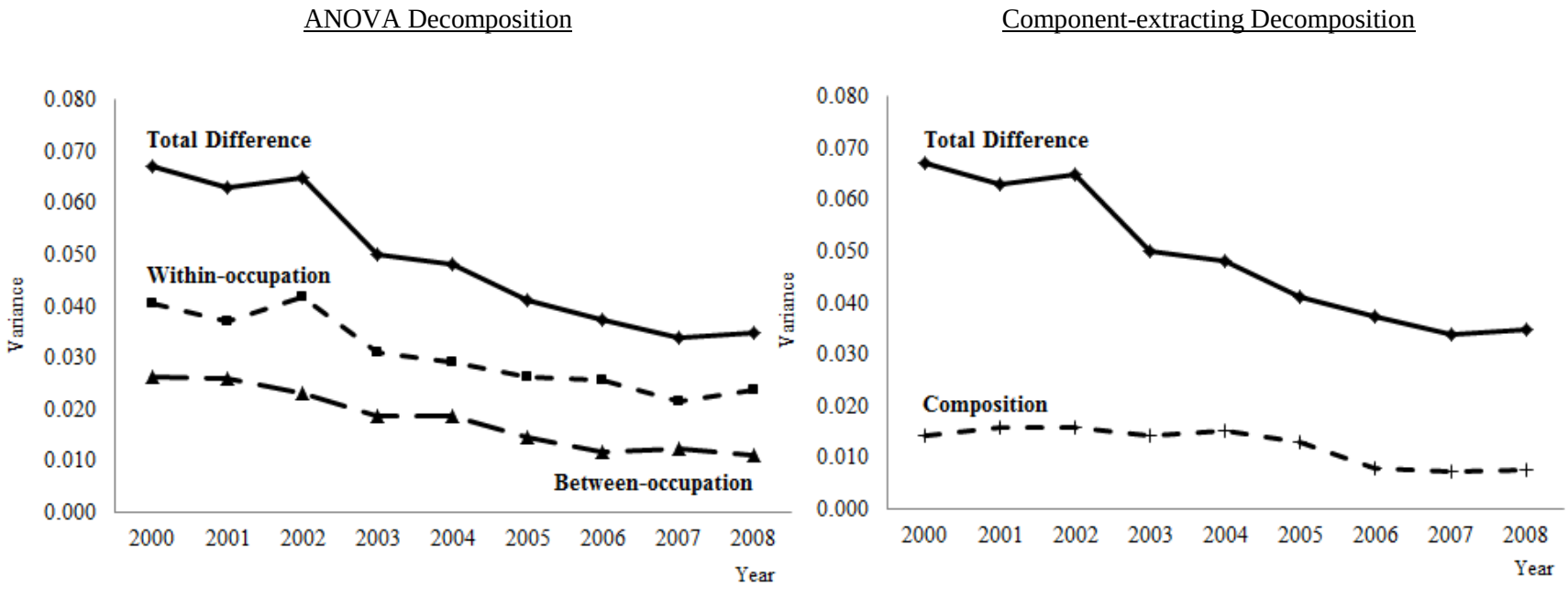
Note: Based on all workers age 25-65.
Source: Hegewisch, Liepmann, Hayes, and Hartmann (2012)

Figure 0B. Female-to-Male Earnings Ratio and Median Earnings of Fill-Time, Year-Round Workers 15 Years and Older by Sex: 1960-2010



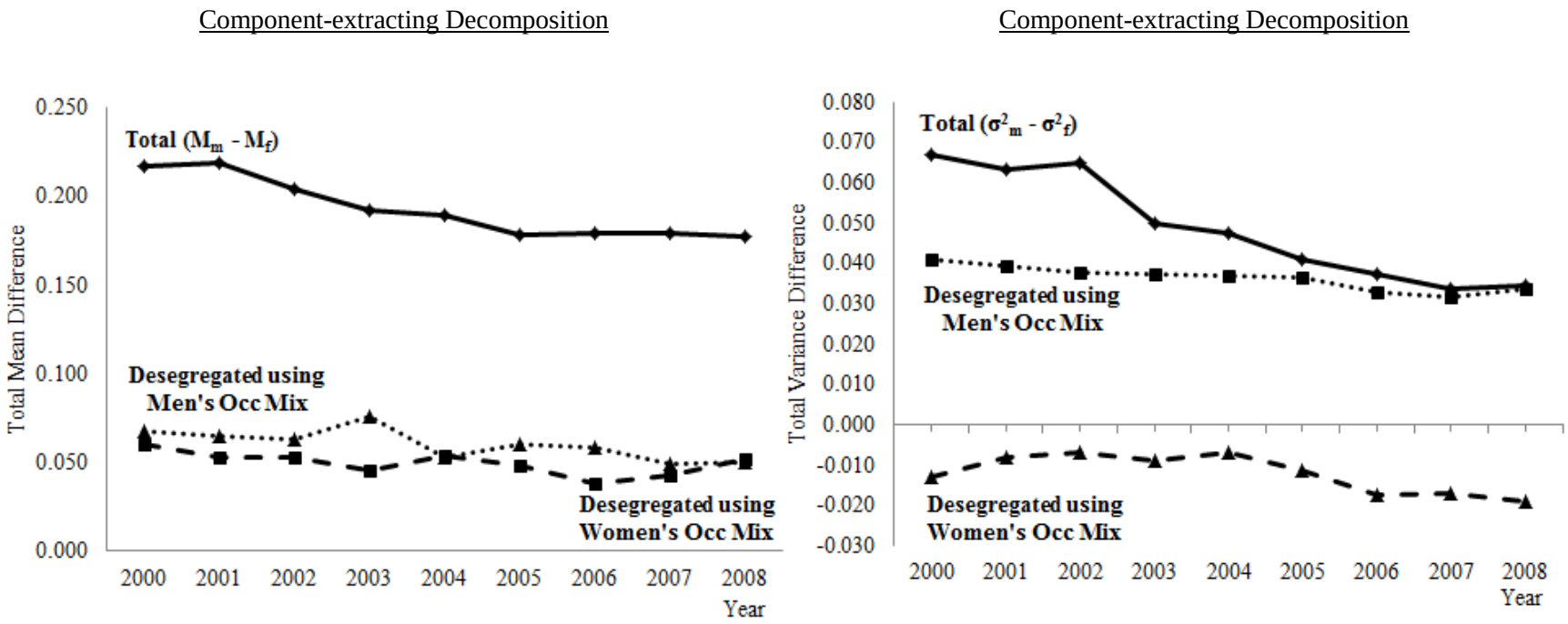
Source: DeNavas-Walt, Proctor, and Smith (2011), Figure 2.

Figure 1. Contribution of Occupational Segregation to the Differences in Variance of Wages for U.S. Women and Men, 2000-2008.



Note: Based on hourly wages (logged) for women and men for 496 3-digit occupations. Component-extracting decomposition percentages use the moving averages.
Source: Current Population Survey, see Mouw and Kalleberg (2010).

Figure 2. Contribution of Occupational Segregation to the Differences in Wage Inequality for U.S. Women and Men, 2000-2008 : Three Estimates.



Note: Based on hourly wages (logged) for women and men for 496 3-digit occupations.
Component-extracting decomposition percentages use the moving averages.
Source: Current Population Survey, see Mouw and Kalleberg (2010).