The Effect of the Gender Composition of Occupations on the Gender Wage Differential

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ABSTRACT

Previous research on gender issues in the labor force has concluded that there still remains a disparity between men’s and women’s wages, the gender wage differential. While there are a number of factors contributing to this wage gap, occupational segregation continues to be one of the most important determinants of the differential. This paper builds upon previous research by looking specifically at the effect of the proportion of women within an occupation and its effect on the gender wage differential in an occupation. Using a mathematical and empirical analysis of the relationship between gender composition and wage differentials, this paper uncovers an indirect effect of the proportion of women on the gender wage differential. This indirect effect serves as a counteracting force to the direct effect of increasing proportion of women in an occupation on wages within that occupation and gives some evidence for a slowly improving situation for women in the U.S. labor force. This paper also shows how the changes in proportions of women within occupations and wage differentials within occupations have been uneven across occupations over time.

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Throughout much of history, social norms have relegated women to the role of the subservient, passive sex. It was even believed that women were not worthy of education because their minds were not capable of higher though and enlightenment. It is not surprising therefore that today, even as a dramatic number of women have entered the labor force in the past century, women have not yet attained a comparable status to men in the working world. While women have come a long way to reach the position that they currently hold in the labor market, many still feel that they have yet to attain equality with men in the professional environment. Women are believed to face a narrower set of job opportunities due to discriminatory attitudes, or perhaps the widespread hiring and promotion practices that come as a result of this history of discrimination, even if employers do not intentionally discriminate. Such discriminatory attitudes coming from employers, co-workers, husbands, and even children are reflected in the form of lower promotion probabilities and wages as well as barriers to entry into many occupations.

There have been great strides made by women over time which have worked directly to discourage discriminatory practices by taking away the rationale behind them. Not too long ago, women were extremely limited in their career choices: nursing, teaching, or secretarial jobs were their only options for employment. Working women today face a much different labor market. Now it is common to see female doctors, lawyers, scientists, and business executives, professions which used to be reserved for men. Women hold more non-traditional jobs, have increased their earnings relative to men, and even own their own businesses. They are also increasingly investing in human capital.

In fact, women now earn a greater number of associate, bachelor, and master’s degrees than their male counterparts. In the academic year 2001-2002, 57 percent of bachelor’s degrees
and 59 percent of master’s degrees were awarded to women. (Economist, 1) Women are increasingly represented as both doctors and lawyers, and are working towards improving their representation in finance as well. More and more women are being promoted to senior positions in Fortune 500 companies, but even though the percentage of women in these top positions is rising, women still only account for about 3 percent of the jobs at the very pinnacle of these companies (CEO, President, and Chairman). (Economist, 2) It is clear, therefore, that despite all this good news about women’s progress in the workplace and they still have a long way to go. Whether in politics, business, the professions or academia, the top layer of jobs is almost exclusively male. This may not be surprising in countries where few women work, but in the United States where women now comprise 47 percent of the labor force (2003 figure), this reality is astonishing.

Much of this barrier to equality is a result of women’s ever-pressing dilemma of how to appropriately combine work and family. Employers assume that women are less committed to their careers, unwilling to work long hours, and lacking the right training and job skills precisely due to their dual role in the home and the workplace and the supposed limitations that puts on women. While there are obvious problems with this viewpoint, the best argument to disprove it is that with an ever-growing number of women getting their undergraduate degrees and pursuing higher education, many women are just as qualified for jobs as man are. Add to this the fact that many women are equally as committed to pursuing a career as men, and most of the reasoning for prejudice against women holds no merit. If so many women are equally as qualified, skilled, able, and determined as men, why do we not see women equally represented within occupations? Perhaps this is due to historical patterns of discrimination. Even if employers are no longer discriminatory, a history of discriminatory practices could lead employers to make different
assumptions and decisions about the job placement of women. With women underrepresented in the highest paying male dominated positions, it is no surprise that a gender wage differential still exists.

The United States has seen a dramatic decrease in this gender wage gap over the past few decades. While there are many factors that have contributed to this decrease, including greater educational attainment of women, increasing labor market experience and participation by women, and changing attitudes towards females in the workplace, this paper will focus on the effects of changes in the gender composition of occupations on the gender wage differential. While women have made tremendous progress in entering into occupations previously held mainly by males, this study shows that this progress has been uneven across occupations. There seems to be evidence of segregation by sex in the labor market which plays a significant role in determining the gap between men’s and women’s wages. The aim of this paper is thus to describe the evolution of the gender wage gap over time and how the proportion of females within each occupation has played a role in determining the wage differential.

**Review of Relevant Literature**

Previous research on the gender wage differential focuses on how the wage gap has narrowed over the past few decades, what factors led to this decrease in the differential, where the sources of continuing disparities come from, and how they can possibly be remedied through policy initiatives. Blau and Kahn (1994) explore this first issue of why the wage gap has closed in their study of the decreasing male-female wage gap and the increasing level of labor market inequality. When analyzing the gender wage differential, most economists focus on male-female differences in skills and on the different treatment of equally qualified men and women
Research on these gender-specific factors suggests that women are on average less skilled than men and are located in lower-paying occupations. This implies that the overall wage-structure can also have a weighty impact on the gender wage gap. In terms of inequality, the high returns to skill in the U.S. produce a high wage inequality, which places a substantial penalty on being below average in the wage distribution (as many women are). Faced with this rising inequality, women’s relative skills and treatment have to improve simply in order for the wage gap to stay constant; much greater gains are necessary for the gap to be diminished. This study points out how remarkable it is that women were able to narrow the wage differential in spite of this adverse labor market environment.

To highlight the role of wage structure in explaining the trends in the wage gap over time, Blau and Kahn’s (1994) paper uses a framework which identifies male “comparables” for the women in the labor market in terms of measured and unmeasured characteristics and the same factors determine the relative rewards of women and the comparable males. Women will be more penalized by increases in the prices of measured skills due to their lower level of experience and employment in low-paying occupations. In addition, men and women seem to be imperfect substitutes in the labor market due to their considerable differences in occupations and pay differences that exist for equally qualified men and women. Thus, while rising skills prices do potentially increase the wage gap, these changing prices will not affect each gender in the same way. This study then uses a decomposition model to find that in wage regressions that control for industry, occupation, unionism, and other observable factors, measurable characteristics account for over 90 percent of the closing of the gender gap over the 1975-1987 period.
The results of this paper imply that women were indeed making large improvements in their status in the labor market during the 70s and 80s. Adverse trends in the wage structure worked to widen the gender-log wage gap, so if there had been no gender-specific improvements during this period, the wage differential would have actually increased. However, women were able to improve their relative qualifications (occupational status and experience) and also profited from a significant decline in the unexplained portion of the gender wage gap. This result is usually viewed as reflecting either an improvement in women’s unmeasured labor market skills or a waning of the discrimination against them. It is conceivable that women enhanced their unmeasured skills since they improved their measured skills relative to men during this time. Also, it is possible that rationale for discrimination weakened as women increased their labor force attachment and other job skills. One additional factor that could have contributed to the gender-specific effect favoring women would be shifts in the composition of demand that favored female workers over males. Changes in labor demand benefited such women relative to men at lower skill levels but men relative to women at higher skill levels. If this gender-twist occurred, one should see a faster closing of the wage gap at the lower-end of the skill distribution than at the top, which is in fact observed. This makes sense due to the fact that industry and union representation effects were more complimentary to women at the bottom and that there was more unexplained improvement in relative pay for low-skill women than other women.

In an updated study also by Blau and Kahn (2000), the important gains that women have made in terms of the gender wage gap, the sources of these gains and the significant gender differences that remain in the U.S. today are examined. The paper’s primary conclusions on this issue are that in any given year the gender wage ratio tends to decline with age but that over time
this ratio has decreased with every age group. In addition, women have been increasingly entering male occupations. Women have had notably greater success in entering previously male white-collar and service occupations than blue-collar categories. There has also been a tendency for some jobs to change from predominantly male to predominantly female as women enter them. However, data taken from the Census or CPS are likely to understate the full extent of occupational segregation of women because employers’ job categories are far more detailed than those used by the Census. As a result, Census listings likely combine individual job categories that are predominantly male with some that are predominantly female, leading to apparently integrated occupations. This paper also mentions that women tend to accumulate less labor market experience than men and have lower incentives to invest in education. Furthermore, exclusion of women from male jobs causes crowding into female jobs and depresses wages.

Blau and Kahn’s (2000) model makes the prediction that differences in wages are due to firstly to human capital attainments and secondly to occupation, industry, and unionism. Adjusting the gap for all these variables raised the gender wage ratio to 88.2%. The remaining unexplained portion of the gap may be due to discrimination. Also, the authors suspected that having a child often means that a woman withdraws from the labor force, breaking her tie to her employer and foregoing any returns to firm-specific training as well as rewards for her good job match, which could further explain the wage gap.

This conclusions of this new study found that rising inequality and higher rewards to skills retarded female-male wage convergence but this was more than offset by improvements in gender-specific factors. The gap in full-time experience decreased over time, the relative proportion of women employed as professionals and managers increased and the relative representation of women in clerical and service jobs has decreased. The decline in the
The unexplained portion of the gender wage gap is due to either or both an upgrade in women’s unmeasured labor skills or a decrease in labor market discrimination.

To dive into this issue of how occupational segregation plays into the decline of the gender wage gap even further, Antonji and Blank’s (1999) contribution to the *Handbook of Labor Economics* reviews the issue of wage differentials by gender, focusing on the key question of whether occupational and industry differences between men and women’s employment that contribute to the wage gap represent preferential choices or constraints. Occupational segregation can arise for a variety of reasons. One possibility is harsher employer discrimination in certain occupations. A second possibility is that men and women select into different occupations, either because of social norms or legal and institutional constraints. A third possibility is that gender differences in pre-labor market human capital investments and in non-labor market activities lead to differences in comparative advantage across occupations.

This chapter of the *Handbook* does not develop its own model to explore job segregation by sex, but it does cite the work of Schumann et al. (1994) who studied assignment of job points to occupations. Job points are used to define compensation systems. Schumann’s paper concludes that job points are much more determined by the gender composition of the occupation than by its human capital requirements. Also, this chapter cites the work of Paulin and Mellor (1996) who indicate that occupations with a higher percent of women also have lower promotion probabilities. This chapter cautions that compensating differentials to remedy such situations in a competitive, non-discriminatory labor market and may actually work against women if preferences of women for certain job attributes boost competition for the jobs women prefer.
Antonji and Blank show that existing research indicates that the characteristics of the jobs women fill have a substantial effect on their wages and on the gender wage gap. Occupational crowding models attribute these affects to discriminatory barriers in the labor market. Models of gender taste differentials ascribe these affects to differential market choices that reflect individual worker preferences. The problem is that these theories of discrimination and choice are not easily separable. Historical occupational discrimination may encourage women to develop a different set of preferences. Thus, this distinction between choice and constraint is one of the most difficult and controversial topics in the discussion of the gender wage gap.

To provide a specific example of how occupational segregation is present in the U.S. labor market today, Bertrand and Hallock (2001) look at this issue of gender compensation differentials by looking only at the gender differences among top executives in a large set of U.S. corporations. The paper’s primary conclusions on this issue are that women in this sample earn less than men and that most of this gender gap is explained by the fact that women manage smaller companies and are less likely to be CEO, President, or Chair of their company. This gap is significantly reduced if one allows for the younger average age and lower average seniority of female executives.

For a statistical model, Bertrand and Hallock use the Oaxaca Decomposition which separates observable skills between men and women and the part that is still unexplained. This decomposition model found that most of the total gap in compensation by gender for top managers was due to observable differences. The predictions that the model/analysis makes are that there is a scarcity of women in the top four occupations: Chair, CEO, Vice Chair, President; that industry controls have no effect; and that women and men are similar with respect to labor force attachment and career commitment but differ significantly with respect to age and
seniority. Thus relative youth and low seniority of women are important determinants of the gender wage gap.

Through their study, Bertrand and Hallock conclude that glass ceiling is somewhat porous and some women are involved in top management of US firms, however females are underrepresented in large corporations. There appears to be significant sex segregation by occupation (few women are CEO or President, etc.) but not by industry. As far as results that were promising for women, the fraction of women in top management has tripled, the fraction of firms with at least one female executive has tripled, female executives have improved their relative earnings to men substantially, and these executives are steadily gaining access to larger US corporations.

Another issue that stems out of this concern about the representation of women at the top is how the government can help them get there. Comparable worth policy has been developed to address this issue, and its merits as well as the theory it is founded on are discussed in Sorensen’s (1989) study. Sorenson’s paper looks at whether the crowding hypothesis, the foundation for comparable worth policy, holds true in reality. Proponents of comparable worth policy argue that occupational segregation is a major cause of the earnings disparity between men and women. They argue that due to occupational segregation certain jobs become labeled as “women’s work”, which leads to lower pay simply because women do the work. Therefore, “women’s work” is undervalued and leads to a labor force where women earn less than men. A theoretical explanation for this condition is the crowding hypothesis, which posits that since employers discriminate against women by excluding them from “men’s work”, relatively few women are hired into these occupations and the rest are crowded into “women’s work” occupations. The inflated supply of women in “women’s work” jobs reduces wages within these
jobs. In sum, because of discrimination, women and men are segregated into different occupations with those doing “women’s work” earning less than those doing “men’s work”, even though all workers are equally qualified for both jobs.

This study takes data from the 1984 Panel Study of Income Dynamics and the May/June Current Population Survey to conduct its analysis of the crowding hypothesis and comparable worth. Three different models are estimated: a human capital model augmented by the gender composition of a worker’s occupation, an earnings model with a wider array of explanatory variables thought to influence earnings, and a third model that additionally includes 42 industry dummy variables. The results of this study found that occupational segregation plays a larger role in the gender wage gap than industrial segregation, and also that the unexplained component is smaller than earlier research because it captures the crowding effect as well as productivity-related characteristics.

Sorensen’s paper used empirical studies of earnings equations which included gender composition of occupations as an explanatory factor to review the gender wage gap. These studies found evidence supporting the crowding hypothesis, yet the magnitude of the crowding effect varied, explaining from 0 to 42 percent of the pay differential between men and women. Such variation was mainly due to different explanatory variables included in each analysis. Using the first model, crowding explains about 1/3 of the wage gap; with the second model, 27 percent; and finally the third with industry controls, 20 to 23 percent. Since the last model included industry controls, its results are a more appropriate estimate of the crowding phenomenon that comparable worth policies aim to eliminate. Thus, this study finds that a national comparable worth policy could diminish the gender wage gap by 20 to 23 percent, if
implemented effectively, which seems to support the use of comparable worth policy but also realize that it will not solve all the problems that women face in the labor market today.

Wootton’s (1997) study examines exactly what the differences in occupational employment by gender are by evaluating trends over the mid-80s and mid-90s, focusing on the degree of these differences according to factors and age. Looking at data over the past two decades, this study finds that the gender distribution of many occupations has shifted significantly, but also that despite these shifts, women and men still tend to be concentrated in different occupations. Women are largely overrepresented in clerical and service occupations, while men are disproportionately represented in operator, craft, and laborer jobs. The most progress for women has been made into those occupational categories in which employment has been expanding. This is due to the greater demand for workers in more rapidly growing occupations and the fact that this growth could lower barriers to entry, such as gender-based discrimination.

To analyze the degree occupational differences between men and women over time and by observable factors, Wootton uses a measure called the dissimilarity/difference index. This index measures the degree of difference in the distribution of men and women across occupations. Applying this index to data, the rate of occupational desegregation through the mid-90s is found to have been slower than during the 70s and 80s. Looking at education, college graduates had a lower degree of occupational gender differences than did high school graduates. In terms of age, the index found less occupational difference between the sexes for younger cohorts, who should be benefiting from the recent increases in educational attainment of women, improvement in employment opportunities due to changes in laws, and changes in attitudes about gender roles.
To dig deeper into the analysis of occupational trends, this paper decomposed the difference index into changes attributable to shifts in the occupational mix of the economy (“occupational mix effect”) and changes attributable to the distribution of women and men within occupations (“gender composition effect”). Decomposing the change resulted in a finding that the majority of the decline in occupational segregation from the mid-80s to mid-90s was due to the gender composition effect. Thus, much of the decline in job segregation in this period occurred as a result of both women’s and men’s employment shifting from occupations dominated by one gender to more integrated occupations. In sum, while occupational differences between men and women continued to decline between 1985 and 1995, while at a slower rate than previously, significant differences in occupational employment by sex still exist, and the degree of these differences varies by factors such as education and age.

Macpherson and Hirsch provide a different view of this issue of occupational segregation and the gender composition of occupations, arguing that gender composition is not a direct cause of low wages in jobs dominated by women. This paper does confirm that the wages of both men and women are significantly lower in predominately female occupations. They note that the magnitude and relationship between wages and gender composition remain in some state of argument. There is no agreement on the wage composition relationship using longitudinal analysis, where individual changes are regressed on changes in gender composition, which is why this study chose to use such a longitudinal analysis to examine how male and female wages vary with gender composition of occupations. Using data from 132 monthly CPS Outgoing Rotation files from 1983 to 1993, Macpherson and Hirsch looked at whether the wage-composition relationship found in previous studies is due to occupational characteristics, quality sorting on gender composition, taste differences, or other factors correlated with the proportion
of women in an occupation. Their results conclude that predominately female occupations pay lower wages to women and men largely because of their skill-related characteristics and quality sorting on gender composition. This is due to past and present occupational discrimination that has led to an equilibrium where the unmeasured skills of women and men increase with the proportion of males in a given job. Measured job characteristics, such as job attachment and training, matter, but are not as important as unmeasured individual skills and preferences.

The conclusions of this study suggest that occupational wage differences correlated with gender are small enough that they should not be a major focus of public policy, such as comparable worth policy. After controlling for gender composition, as well as personal and job characteristics, a large portion of the wage gap remains unexplained. While gender composition may be relatively unimportant as a cause of low wage rates, occupational characteristics and individual skills correlated with gender composition are important. Narrowing of the gender wage gap will occur if there continues to be narrowing of differences in experience, industry structure, and occupation characteristics between jobs dominated by females and males. This paper ends with the suggestion that renewed attention should be given to how and why the labor market sorts women and men into jobs with different characteristics and productivities and a continuing investigation into the sources of the wage gap that remains large, independent of the gender composition of occupations.

Looking at the same issue but with a different conclusion, Boraas and Rodgers’ (2003) study addresses the issue of how the share of women in an occupation contributes to the gender wage gap and finds that the proportion of women in an occupation is one of the biggest determinants of the gender wage differential. Although the negative relationship between wages and an occupation’s percentage of women has decreased in magnitude since 1989, occupations
that are predominately composed of females are still found to have lower average wages for both men and women employed in that occupation. The human capital and occupational crowding theories have been suggested as possible explanations for this relationship between wages and the gender composition of occupations, as have job attributes, preferences, and discrimination.

The analysis of the gender wage differential in this study is based on data from the Outgoing Rotation Group Files of the 1989, 1992, and 1999 Current Population Survey. Boraas and Rodgers (2003) use the Oaxaca-Blinder decomposition model, which separates the portion of the gap resulting from different characteristics of men and women from the portion that is unexplained by these characteristics. In all years of the analysis, education and age work to decrease the wage gap, but these factors are outweighed by the percentage of women in an occupation. Furthermore, as the concentration of females within an occupation increases, the negative impact on wages grows more slowly.

This paper shows that the share of women in an occupation continues to be one of the largest contributors to the gender wage differential, due to the fact that women have a higher likelihood of being employed in occupations dominated by females, which generally have below average wages. By estimating the size of the negative effect that employment in female-dominated occupations has on the wages of men and women, this study finds that the relationship has weakened for both sexes since 1989. However, a women working in a female occupation as opposed to a male occupation is more adversely affected in terms of wages than a man working in a female occupation compared to a male occupation. This could be the result of the adverse consequences of occupational crowding, which is the idea that limited occupational choice created crowding in certain jobs, putting downward pressure on the wages of workers in these occupations. Such limited occupational choices could be due to discrimination, but they
also could reflect the choices of men and women who need a job that fits their personal family obligations. In this case, the wage and gender composition relationship would reflect the existence of a compensating differential.

Boraas and Rodgers’ (2003) study is perhaps the most closely related to this paper, as it also concludes that the proportion of females within an occupation is one of the most important determinants of the gender wage gap. However, Boraas and Rodgers’ reasoning behind this conclusion, that women are generally found in “women’s work” occupations and therefore have lower wages, is different from the approach of this paper. This paper does supports Boraas and Rodgers’ and other previous research, which show how women are crowded into certain low-paying occupations either due to occupational segregation or choice, causing men and women within such female-dominated jobs to face lower average wages, as explained in the research presented earlier. The average wage within a given occupation can be defined as:

$$\bar{w} = p_f w_f + (1 - p_f)w_m$$

Rearranging this equation,

$$\bar{w} = p_f (w_f - w_m) + w_m$$

$$\bar{w} = -(w_m - w_f) p_f + w_m$$

$$(w_m - w_f)$$ is the gender wage gap, which is negative by definition since $w_m > w_f$, resulting in a gap. It can be seen from this equation that if there were no women in the labor force, the average wage would simply be the male wage. However, when women enter the workforce, they face a “penalty” equal to $$- (w_m - w_f) p_f$$ just for being female.

Let us call the gender wage gap $GAP(p_f)$, or the wage gap as a function of the proportion of women within an occupation, since the gap depends on this proportion. Rewriting the equation again,
\[ \bar{w} = -GAP(p_f)p_f + w_m \]

Then, taking the derivative of this equation with respect to \( p_f \) results in the following:

\[ \frac{\partial \bar{w}}{\partial p_f} = -GAP - p_f \left[ \frac{\partial (w_m - w_f)}{\partial p_f} \right] \]

Therefore when \( p_f \) increases, two things happen to the average wage. First there is a direct effect \([-GAP]\), which means that the size of the above mentioned “penalty” that women face increases as \( p_f \) increases. However, \( GAP \) also depends on \( p_f \), resulting in an indirect effect through \( p_f \)’s effect on the “penalty”. This indirect effect is the second part of the derivative,

\[ -p_f \left[ \frac{\partial (w_m - w_f)}{\partial p_f} \right] \]

While previous literature has focused on the direct effect of \( p_f \) on the average wage, it has neglected the indirect effect that \( p_f \) has on the gender wage gap. The indirect effect will be the focus of this paper.

The relationship between the proportion of women and the gender wage gap (the indirect effect) could be positive or negative. There are a few possible theories explaining a positive relationship. First, discriminatory attitudes toward women in the workplace would discourage employers from hiring women, either because of their own distaste for working with women or because of their employees’ distaste for working with women. Men employed in such a job environment would have to be paid a compensating differential to work with more women, thereby increasing male pay relative to female pay as more women are hired into such occupations. To understand this theory more clearly, take the example of a man working in a 10 person firm, where the firm is composed of 9 women and 1 man. Compare this to a man working in another firm where the gender composition is 9 men and 1 woman. In the presence
of discriminatory tastes, a man working in the first type of firm would require more compensation than a man working in the second type of firm.

A second theory explaining a positive relationship between the proportion of women and the wage differential relates to women’s average ability. Within an occupation, in a case where there is discrimination, only the most able women are hired into the best jobs. Employers cannot afford to pass up highly qualified employees, even if they are female. High caliber women are more valuable to a firm than they are detrimental in terms of the extra compensation that men require to work with them. Therefore, occupations with the lowest proportion of women in them have the smallest wage gap. The few women working in them are of high ability and earn nearly as much as men. However, as discriminatory attitudes change or legislation such as affirmative action is enacted, firms are required to hire more women. Simply because employers will now be “fishing” from the entire ability distribution of women rather than just the upper portion of it, the average ability of women within these occupations will decrease. Thus as firms hire more women than before, the ability composition of women within occupations will change for the worse because of the relatively limited supply of high ability women. The entry of more women will bring down the average wages of women within an occupation, to the extent that wages affect ability, causing the gap between men’s and women’s wages to increase. This theory of course assumes that (a) women do not take men’s jobs or (b) that they do take men’s jobs, but this job replacement does not affect the gender wage gap. In other words, the theory assumes that job sorting of men and women is not a zero-sum game.

On the other hand, there are theories which explain a negative relationship between the proportion of women in an occupation and the gender wage gap in that occupation, suggesting that as the proportion of females in an occupation increases, the wage gap in that occupation
decreases. The first of these theories relates to the effect of legislation, such as affirmative action and the Equal Pay Act, which work hand in hand to reduce the wage gap. Affirmative action requires employers in certain male-dominated occupations to hire women. Thus, through the affirmative action channel women are allowed to enter into “male” occupations, causing \( p_f \) in these occupations to increase. Once women have entered male jobs, the enforcement of further legislation such as the Equal Pay Act creates a channel through which women can raise their wages within such occupations. By mandating equal pay for equal work, some women who were once employed at lower wages in “women’s” jobs will now enjoy higher wages equal to men’s wages in “men’s” jobs. Affirmative action brings about an increase in \( p_f \), and once women enter, the Equal Pay Act helps \( w_f \) to increase. Therefore, this theory needs both affirmative action and the Equal Pay Act to explain a positive relationship between \( p_f \) and the wage gap.

Another theory supporting this negative relationship between the share of women within an occupation and the gender wage gap relates to the bargaining power of women. This is similar to a union bargaining theory, wherein workers get higher wages by working collectively to bargain with their employer for pay raises. In the case of women, whereas 1 woman in a firm of 1000 men may not have much, if any, influence over the determination of her salary, as women enter these male dominated occupations, they begin to gain empowerment as a group. By exploiting their increased representation within an organization, women can bargain for higher, more equal pay, which again would work to decrease the gender wage differential.

**Data**

To test these theories and determine the true relationship, positive or negative, between the proportion of women within an occupation and the gender wage differential in an occupation,
this paper uses data from the past 28 years to illustrate the change in the gender wage gap and proportion of women in occupational sectors over time. For this analysis, data was taken from the March version of the Current Population Survey from 1968 to 1995. Observations were eliminated if the individual in the sample was under the age of 18 or over the age of 65, and also if an individual's reported wages were less than zero or equal or greater than the topcode on wages for each year ($50000 for 1968 to 1981, $75000 for 1982 to 1984, and $99999 for 1985 to 1995, in nominal terms). Wages were adjusted using the Consumer Price Index to facilitate comparison of wages across years. Since the recodes for occupations varied across years, occupational categories were once again recoded into 22 categories so that occupation \( i \) in 1968 would be the same as occupation \( i \) in 1995. The variables used in this analysis from the Current Population Survey were occupation, year, wagesal and sex, which were then manipulated into the newly classified 22 occupations, year, proportion of women and men in each occupation, real wage and log real wage to conduct the regressions. See Table 1 for a summary of the occupation recodes.

**Methodology**

Previous literature used a few different models to examine the wage-gender composition relationship. Decomposing the wage gap has become a popular way to identify sources of the gender wage gap and their contributions. Boraas and Rodgers (2003) use the decomposition framework of Johnson and Solon (1986) to find the source of the relationship between wages and the concentration of women within an occupation and its decline. To decompose the effect of various control variables on the relationship between the concentration of women within an occupation and the wages of individuals in that occupation, Johnson and Solon found the
difference between simple and multiple regression estimates of the coefficient on the percentage of women in each occupation:

\[ \hat{y} - \bar{y} = -\sum_{j=1}^{k} \hat{\beta}_j b_{jF} \]

where \( \hat{y} \) is the wage concentration of women within occupations relationship in the full specification, \( \bar{y} \) is the wage concentration of women within occupations relationship in the bivariate specification, the \( \beta_j \)'s are the estimated coefficients on the \( k \) control variables, and the \( b_{jF} \)'s are the coefficients on the percent female from the regression of each of the control variables on the percent female in an occupation. This model identifies the factors that explain why the wages of women and men are lower in occupations that have a larger share of women.

Wootton (1997) also employed a decomposition model in her study of gender differences, but she decomposed a difference index. A difference index is a summary measure of occupational differences between men and women over time and by various characteristics such as education and age. The index measures the degree of difference in the distribution of men and women across occupations. Values of the index range from 0 to 100, where the number denotes the percent of women or men who would have to change jobs for the employment distribution of each gender to be the same. This is the same as achieving representation in each occupation that is proportional to each gender’s share of total employment. Since women make up about 47 percent of the workforce, as mentioned earlier, the difference index identifies the proportion of women who would need to switch jobs in order for women to hold 47 percent of employment in every occupation.

To identify what has caused the decline in occupational differences between men and women over time, Wootton decomposes the difference index into three parts: (1) changes in the occupational mix of the economy (“occupation mix effect”) and (2) changes in the distribution of
men and women within occupations ("gender composition effect"), and (3) and interaction between these two effects. Wootton found that most of the decline in occupational segregation is a result of the changes in gender composition within occupations.

Macpherson and Hirsch (1995), on the other hand, employ a longitudinal wage change model to conduct their study and then decompose this wage model. They estimate the relationship between wages and gender composition by the following equation:

\[
\ln W_{if} = \sum \beta_{ik} X_{ikf} + \Theta_{if} FEM_{if} + \epsilon_{if}
\]

\[
\ln W_{im} = \sum \beta_{ik} X_{ikm} + \Theta_{im} FEM_{im} + \epsilon_{im}
\]

where \( f \) and \( m \) denote male and female; \( \ln W_i \) is the natural log of hourly earnings for individual \( i \); \( X_k \) is an intercept and variables, indexed by \( k \), measuring personal and/or job characteristics and region; \( \beta_k \) is a constant and coefficients corresponding to variables in \( X \); \( FEM \) is the ratio of women to total employment in the worker’s occupation, and \( \theta \) is its coefficient; and \( \epsilon \) is an error term. The logarithmic gender wage gap, \( \ln W_m - \ln W_f \), can then be decomposed:

\[
\ln W_m - \ln W_f = \left[ \sum (p_m \beta_m + p_f \beta_f) (\bar{X}_m - \bar{X}_f) \right] + \left[ (p_m \Theta_m + p_f \Theta_f) (FEM_m - FEM_f) \right] + \left[ \sum (p_m - p_f) (\bar{X}_m + p_m \bar{X}_m) \right] + \left( \Theta_m - \Theta_f \right) (p_f FEM_m + p_m FEM_f) \]

where \( p_m \) and \( p_f \) are the proportion male and female in a sample. The decomposition uses sample proportions to weight the regression coefficients to approximate a nondiscriminatory wage structure. The first and second terms in brackets are the “explained” portion of the wage gap, the former being that accounted for by differences in the \( X \)'s, and the latter by differences in gender composition. The third term in brackets represents the “unexplained” portion of the gender wage gap, reflecting difference in the coefficients on the \( X \)'s and \( FEM \).

The model used in this paper also uses a log wage model similar to Macpherson and Hirsch to uncover the effect of the gender composition of an occupation on the gender wage differential within that occupation. To examine elasticity effects, the model used here uses a logarithm of the real wages of men and women and logarithm of the proportion of women in each occupation. A basic model of the log gender wage differential can be expressed as:

\[ \ln w_m - \ln w_f = \beta_0 + \beta_1 \ln p_f \]  

where \( \ln w_m - \ln w_f \) the log gender wage is differential, \( \beta_0 \) is an intercept, \( \ln p_f \) is the log proportion of women and \( \beta_1 \) is its coefficient. To include controls for occupational categories (see Table 1) and year (1968-1995), dummies for both occupation and year were added to the log gender wage differential equation:

\[ \ln w_m - \ln w_f = \beta_0 + \beta_1 \ln p_f + \beta_2 \text{occd} + \beta_3 \text{yrd} \]  

where \( \text{occd} \) is the dummy for occupation and \( \text{yrd} \) is the dummy for year. To add further dimension to the model, a variable was created to account for the effect of changes in trends over time:

\[ \ln w_m - \ln w_f = \beta_0 + \beta_1 \ln p_f + \beta_2 p\text{timetrend} + \beta_3 \text{timetrend} + \beta_4 \text{occd} + \beta_5 \text{yrd} \]  

where \( \text{timetrend} \) reflects changes in trends over time and \( p\text{timetrend} \) is the interaction between the proportion of women in an occupation and changes over time. The most important coefficient in this model is \( \beta_1 \), which will reveal the elasticity effect of the gender composition within an occupation \( (p_f) \) on the gender wage gap in an occupation \( (w_m - w_f) \).

**Results**

Using the first log wage equation with the fewest control variables (1) and applying the CPS data, the estimated coefficient on \( p_f \) is -0.056. This regression result indicates that an increase in
the proportion of women within an occupation decreases the wage differential within that occupation. More specifically, a 1% increase in the proportion of women in an occupation decreases the gender wage gap in that occupation by 0.056%.

When more control variables (dummies for occupation and year) are added to the log wage equation (2), the coefficient on $p_f$ increases in magnitude to -0.079. Therefore, this regression result still means that the gender wage gap within an occupation decreases as $p_f$ increases, but the effect is found to be even stronger when one takes into account the effect of occupational categories and year.

To more fully explore this effect of time, the last step is to regress the same CPS data using equation (3), which includes the variable $timetrend$. These regression results reveal a similar coefficient on $p_f$ of about -0.079 and also a coefficient on $timetrend$ equal to -0.015. In terms of an elasticity effect, after controlling for occupation and year, a 1% increase in the proportion of women within an occupation decreases the gender wage gap in an occupation by 0.079%. Furthermore, the gender wage gap within an occupation decreases an additional 0.015% with each additional year from 1968 to 1995.

In order to see how the gender wage differential and the proportion of women within each occupational category change over time, refer to Charts 1 and 2. Chart 1 is a graph of the log gender wage differential vs. year, by occupation. It is clear from looking at these graphs that while the gender wage gap has decreased in every occupational category, the degree of change has not been constant across occupations. For example, in the occupation category that includes administration, management, and officials, the log gender wage differential has fallen from about 0.8 to 0.4 during the period 1968-1995. On the other hand, the occupation category that includes all teachers except those who teach college has seen a decrease in the log gender wage
differential of only about 0.15 (from 0.55 to 0.4). Now, looking at the same occupations on Chart 2, which shows graphs of the proportion of women within an occupation vs. year for each occupational category, this variation in the narrowing of the gender wage differential makes more sense. For administration, management, and officials, the proportion of women within these occupations grew from 0.15 to 0.45 from 1968-1995. In contrast, for non-college level teachers, the proportion of women within this occupation grew only from about 0.7 to 0.75. Since the regression results indicated that an increase in the proportion of women worked to decrease the gender wage gap within that occupation, it makes sense that if the increase in $p_w$ was smaller, that the corresponding decrease in the wage differential would also be smaller. This is in fact what we observe by looking at administration, management and officials compared to teachers.

This is only part of what the regression results can reveal about the effect of a change in the proportion of women within an occupation on the gender wage gap within that occupation. Referring back to the derivative of average wage with respect to $p_f$ that was mentioned earlier:

$$\frac{\partial \bar{w}}{\partial p_f} = -GAP - p_f \left[ \frac{\partial (w_m - w_f)}{\partial p_f} \right]$$

we can now apply the coefficient estimate on $p_f$ to this equation to see the overall effect. First, we know that a gender wage gap exists, so $GAP$, or $(w_m - w_f)$, is positive. This makes the first part of the derivative, or the direct effect of $p_f$ on the average wage, negative ($-GAP<0$). Now looking at the indirect effect of $p_f$ (its effect on $GAP$) we can look at the second part of the derivative. The regression results found that as $p_f$ increases within an occupation, that the gender wage differential within that occupation, $(w_m - w_f)$, decreases. This is exactly the same thing as saying that $\left[ \frac{\partial (w_m - w_f)}{\partial p_f} \right]$ is negative, because it is the derivative of the gender wage differential
with respect to the proportion of women. Since the proportion of women in an occupation cannot be negative ($p_f$ cannot be less than zero), this makes the whole second part of the derivative, $-p_f \left[ \frac{\partial (w_m - w_f)}{\partial p_f} \right]$ positive. Put simply, (-) (positive $p_f$) (negative $\left[ \frac{\partial (w_m - w_f)}{\partial p_f} \right]$) turns out to positive overall. Thus the answer to the aforementioned question, whether the relationship between gender composition and the wage differential within an occupation is negative or positive has been determined: the relationship is negative. In other words, the indirect effect of $p_f$ within an occupation on the wage differential within that occupation is negative: as the proportion of women within an occupation increases, the gender wage gap in that occupation decreases.

Conclusions

The result that the indirect effect is negative has important implications. Specifically, looking once more at the derivative of average wage with respect to $p_f$,

$$\frac{\partial \bar{w}}{\partial p_f} = -GAP - p_f \left[ \frac{\partial (w_m - w_f)}{\partial p_f} \right]$$

one can see that if the direct effect (-$GAP$) were the only part of this derivative, that the average wage would decrease a lot when the proportion of women increases. However, this paper has uncovered the indirect effect of $p_f$ on the gender wage gap, which was proven through empirical evidence to have a positive sign (the relationship is negative but combined with the negative sign in front of $p_f \left[ \frac{\partial (w_m - w_f)}{\partial p_f} \right]$), the whole term becomes positive). What the positive nature of this indirect effect means is that if there were no such counterbalancing force to the negative direct effect of $p_f$ on wages (-$GAP$), the situation for women’s wages in the labor force would be much
worse. Now that this indirect effect is revealed, it can be seen that while occupational segregation is still a problem for women and creates adverse effects in the labor force such as crowding into “male” and “female” occupations, the results of this analysis give some hope that increasing the representation of women in certain occupations can actually help to reduce the wage differential within these occupations. These results also give evidence for the theories mentioned earlier explaining the negative relationship between $p_f$ and the wage gap: the bargaining theory and the affirmative action/Equal Pay Act theory.

It is clear that the narrowing of the gender wage differential has not been constant across occupations, and also that women’s progress in entering male-dominated occupations and achieving a more even gender mix has been varied across occupations. Women still have a long way to go in terms of completely erasing the gap between men’s and women’s wages, but the uncovering of this indirect effect of $p_f$ on the wage gap gives promise that the situation for women is better than would could be without the indirect effect. As time moves forward and women increase the power of their voices, legislation improves its impact, and women gain more experience and increasingly penetrate male-dominated occupations, women’s power and status in the U.S. labor force should continue to progress due to this counterbalancing indirect force, albeit very slowly.
Table 1: Summary of Occupation Recodes

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<tr>
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<td>8 9</td>
<td>1 2 3 4 5</td>
<td>1 2 3 11</td>
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<td>6 7</td>
<td>6 7 14 16 18 19</td>
<td>9 12 14 15</td>
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<td>1 5</td>
<td>8 9 10</td>
<td>4 5 6</td>
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<td>Physicians and dentists</td>
<td>3</td>
<td>2</td>
<td>11 12</td>
<td>7</td>
</tr>
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<td>Sales: retail</td>
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<td>10 12</td>
<td>20 22</td>
<td>16 19 20</td>
</tr>
<tr>
<td>Sales: non-retail</td>
<td>9 13</td>
<td>11 13</td>
<td>21</td>
<td>17 18 21</td>
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<td>Teachers, except college</td>
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<td>4</td>
<td>15</td>
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<tr>
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<td>23 25 26</td>
<td>22 24 25 26</td>
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<td>Private household workers</td>
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<td>27</td>
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<td>37 39 40</td>
<td>30 31 32</td>
<td>30 31 32</td>
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<td>3</td>
<td>13 17</td>
<td>8 13</td>
</tr>
<tr>
<td>Production supervisors &amp; construction craftsmen</td>
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<td>19 20</td>
<td>38 40</td>
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<tr>
<td>Construction laborers</td>
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<td>33</td>
<td>48</td>
<td>40</td>
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<tr>
<td>Carpenters and precision craftsmen</td>
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<td>18 22 25</td>
<td>39 41 42</td>
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<tr>
<td>Mechanics</td>
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<td>23 24</td>
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<td>Manufacturing, machinists and other laborers</td>
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<td>21 26 28 29 30 34</td>
<td>43 44 45 49 50 51</td>
<td>36 37 41 42</td>
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<tr>
<td>Drivers and transportation</td>
<td>22 24</td>
<td>27 31 32</td>
<td>46 47</td>
<td>38 39</td>
</tr>
<tr>
<td>Farm operators, managers, forestry and fishing</td>
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<td>42</td>
<td>33 36</td>
<td>43 45</td>
</tr>
<tr>
<td>Farm laborers</td>
<td>36 37</td>
<td>43 44</td>
<td>34 35</td>
<td>44</td>
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</tbody>
</table>
Chart 1: Log Gender Wage Differential vs. Year (by occupation)

Administration, Management, and Officials

Other Professional

Engineers and Scientists

Physicians and Dentists

Sales: Retail

Sales: Non-Retail
Teachers, Except College

Secretaries, Stenographers, and Typists

Other Clerical Workers/Administrative Support

Private Household Workers

Protective Service

Food Service
Manufacturing, Machinists, and Other Laborers

Drivers and Transportation

Farm Operators, Managers, Forestry, and Fishing

Farm Laborers
Chart 2: Proportion of Women within an Occupation vs. Year (by occupation)

Administration, Management, and Officials

Other Professional

Engineers and Scientists

Physicians and Dentists

Sales: Retail

Sales: Non-Retail
References


