AN EMPIRICAL ANALYSIS OF ALTERNATIVE EXPLANATIONS FOR THE FEMALE WAGE GAP

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ABSTRACT

The social sciences have four explanations for the gender wage gap: preference, crowding, power, and socialization. Neoclassical economists explain the wage gap as the result of employers and employees' work-related preferences. Crowding theorists argue the wage gap is caused by women crowding into a small number of occupations. Power theorists contend men use their socioeconomic superiority to maintain a two-tier wage system that discriminates against women. Socialization theorists note women's secondary status in the labor markets is a result of lifelong socialization processes. Previous econometric research has mostly overlooked the power explanation. Crowding researchers have also not examined the crowding hypothesis over the entire post-World War II era, choosing instead to focus on one particular year or a few years; this research decision is made even though women were continually increasing their share of the labor force throughout the postwar era.

The purpose of this study is to address the two mentioned shortcomings. A wage model is constructed with controls for compensating differentials, power, and female

crowding. The model is fitted on male and female workers who were employed in 103 occupations; the 103 occupations were selected because their categorizations have remained consistent between 1950 and 2008. Approximately 30 percent of male workers and 40 percent of female workers are employed in the 103 selected occupations. The robustness of the wage model is tested on ten time-sensitive Census and American Community Survey PUMS.

The study finds supporting evidence for the power and crowding explanations. Male workers earn wage premiums when employed in occupations with high degree of collective bargaining whereas women receive wage penalties. Women also receive no premiums in occupations with apprenticeship requirement until 1990, even though their presence in these occupations has not changed between 1950 and 2008. Also, men and women employed in female-crowded occupations receive wage penalties in every surveyed postwar year, but women are more likely to be employed in female-crowded occupations than their male counterparts.

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the School of Graduate Studies have examined a dissertation titled “An Empirical Analysis of Alternative Explanations for the Female Wage Gap,” presented by Xuan Pham, candidate for the Doctor of Philosophy degree, and certify that in their opinion it is worthy of acceptance.

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To my parents, Phạm Đình Hội and Phạm Thị Hà,

who left their homeland and made sacrifices everyday to give me an education

CHAPTER 1

INTRODUCTION

The gender wage gap phenomenon has a long history in U.S. labor studies. In the early days of the republic, women employed in agriculture and domestic activities earned 28.8% of their male counterparts' wages (Goldin 1990, 63). The development of manufacturing industries pushed women's wages up a considerable extent; the female-to-male manufacturing wage ratio increased to 44% by 1832 and then 50% in northeastern states by 1850 (Goldin 1990, 63). The overall female-to-male wage ratio narrowed again at the turn of the century, increasing from 46% in 1890 to 56% in 1930 (Goldin 1990, 62). The second narrowing of the gender wage gap occurred not as a result of women earning more but rather because men were earning less. Clerical work boomed dramatically in the late 1800s and early 1900s as large corporations replaced small firms. Women's increasing education—more women graduated from high school than men by the early 1900s—but lack of employment opportunity made them a desirable substitute for male clerical workers (Goldin 1990, 106). Female entry into clerical work coincided with the decline of male wages. The average male clerical worker earned 1.6 times his counterpart in the manufacturing sector in 1890, but this wage advantage disappeared by 1930 (Goldin 1990, 107).

World War II was a watershed moment in the history of working women. Married women, who did not typically work in the prewar era, entered the labor force in dramatic numbers. Married women outnumbered single women in the labor force 45.7% to 40.9% for the first time in 1944 (U.S. Bureau of the Census 1975, 133). Married women continued to work after the war, mostly as part-time personal service workers (Kessler-

Harris 1982, 301). Many more single women found employment in the government sector as clerical workers; the federal government increased its payroll from five to twelve million workers between 1947 and 1969 (Nicholson 2004, 269). The female labor force participation rate stood at 36.9% in 1956, surpassing the wartime high of 36.3% in 1944 (U.S. Bureau of the Census 1975, 131-132). Kessler-Harris (1982) summarized the female presence in the postwar labor force as follows: A woman who did not work for wages by the mid 1960s was an anomaly (Kessler-Harris 1982, 302).

The significant presence of women in the labor force prompted the federal government to undertake numerous legal actions in the 1960s to protect female workers. The Equal Pay Act of 1963 prohibits employers from paying men and women different wages when both are employed in equivalent jobs.[1] Title VII of the Civil Rights Act of 1964 makes it illegal for employers to discriminate against women because of their sex. The Equal Employment Opportunity Act of 1972 gives federal courts the power to force employers to implement affirmative action plans when the latter is found guilty of gender discrimination. Title IX of the Education Amendments of 1972 forbids the practice of gender discrimination in educational institutions receiving federal funding. Despite the federal government's push to secure gender-equal protection, women's wages relative to men's did not improve in the first three postwar decades. The female-to-male wage ratio stagnated at 60% between 1950 through 1980 even though women's labor force participation rate grew from 36.9% in 1959 to 43.3% in 1970 and then to 51.5% in 1980 (Goldin 1990, 62; U.S. Bureau of the Census 1975, 131-132; U.S. Bureau of Labor

[1] Equal pay for performing equivalent job is not the same as "equal pay for equal work," which is the mantra of the 1980s comparable worth movement. Bielby and Baron (1986a) found by employers give men and women different job titles even when they were performing equivalent work tasks. The goal of the comparable worth movements was for women to receive equal pay for performing equivalent work tasks regardless of job titles.

Statistics 2010, 8). The gender wage gap began to narrow again after 1980. The female-to-male wage ratio increased from 64.2% in 1980 to 71.9% in 1990 and then 76.9% in 2000 (U.S. Bureau of Labor Statistics 2010, 52). More recently, the female-to-male wage ratio increased to an all time high of 81% in 2005, and it had since decreased slightly to 80.2% in 2009 (U.S. Bureau of Labor Statistics 2010, 52).

Social scientists observing the persistent nature of the gender wage gap have proposed four broad explanations. Neoclassical economists explain the wage gap as the result of individual preference. Demand side neoclassical economists say employers, consumers, and workers have a preference for engaging in market interactions with men rather than women (Becker 1971; Phelps 1972). Supply side neoclassical economists posit female workers have a preference for lower human capital investments, and, thus, cannot reap higher wage compensations (Mincer and Polachek 1974; Polachek 1981; Filer 1989). Heterodox economists and power theorists working in sociology and history disciplines believe the unequal distribution of power in the wage bargaining process between the sexes is the cause of the wage gap. According to this theory, men are the superior sex in American patriarchal society, and their social superiority maintains a two-tier wage system that discriminates against women (Reich, Gordon, and Edwards 1973; Hartmann 1976 and 1981; Matthaei 1982; Fligstein and Fernandez 1988; Kessler-Harris 1990; Kessler-Harris 2007). Socialization theorists argue women's secondary status in the labor markets is a result of lifelong socialization processes. Girls are taught to aspire to do "female work," and women are confined to performing female work despite the low wages because they do not have social ties with men employed in male-dominated occupations (Granovetter 1983; 1985; 1992; 2005; Jacobs 1989; McPherson, Smith-

Lovin, and Cook 2001; England and Folbre 2005). Still, other theorists in the social sciences believe female crowding is the cause of the gender wage gap (Bergmann 1974; England 1984; Johnson and Solon 1986; England et al 1988; Macpherson and Hirsch 1995; England, Reid, and Kilbourne 1996; Lewis 1996; Bellas and Coventry 2001; Solberg 2005). Women are penalized with lower wages because the majority of female workers are crowded into a small number of occupations.[2] The preference, power, socialization, and crowding explanations are the social scientists' understanding of the wage gap.

Previous studies examining the wage gap explanations have demonstrated two shortcomings. First, crowding studies have not examined the change in the wage effect, if any, that may result from changes in the gender composition of occupations. In other words, past research has focused on the wage effect of female occupational crowding at one moment in time and has found workers employed in occupations with a high concentration of women received wage penalties. No study has examined the changes in the wage effect of female occupational crowding *over time*. An examination of how wage changes when there is a change in female occupational crowding is important for two reasons. First, there has been a historic movement of women into the formal labor force since the end of World War II. The female share of the labor force nearly doubled from 29% in 1948 to 47% in 2008 (Bloom 1986, 25; U.S. Bureau of Labor Statistics 2010, 1). Second, women have lowered their concentrations in administrative and service

[2] Bergmann (1974) argued female crowding lowers the marginal productivity of labor (MP_l) of all workers in the occupation. The equilibrium wage is equivalent to the MP_l in the competitive labor market; thus, a lower MP_l yields lower wages. England et al. (1988) rejected Bergmann's marginal productivity of labor interpretation of the connection between female crowding and low wages; they offered an alternative explanation: employers' sexist attitudes cause female crowding and low wages. The debate between Bergmann (1974) and England et al. (1988) is not settled.

occupations since the 1970s and were the majority of workers in professional and management and related occupations in 2009 (51% women to 49% men) (Blau and Kahn 2000; U.S. Bureau of Labor Statistics 2010, 1). Given the changes in the degree of female crowding in the labor force in general and in the administrative, service, management, and professional occupations specifically throughout the postwar era, one may wonder if the relationship between female occupational crowding and wages has remained stable or has changed. Heckman (1991; 2001) noted a socioeconomic relationship like female occupational crowding and wage is state-dependent. Factors that influence this socioeconomic relationship may change over time, which may result in a new socioeconomic relationship. Past research has focused on the relationship between female occupational crowding and wages at one chosen moment in time, but it has not examined the relationship over an extended time period when women have made great advances in the workforce. An investigation about the female occupational crowding and wages connection throughout the postwar era is warranted.

Second, econometric studies have largely ignored the power explanation of the gender wage gap. Power theory argues the gender wage gap is caused by the unequal distribution of power between the sexes in the wage bargaining process. Macpherson and Hirsch (1995) did account for the wage effect of the worker's union membership status, and England, Reid, and Kilbourne (1996) also controlled for the incidence where the worker's wage is set by union collective bargaining. However, Macpherson and Hirsch (1995) and England, Reid, and Kilbourne (1996) did not intend to examine power status difference between the sexes in their studies, so they did not give a more complete treatment of the power explanation. Furthermore, Macpherson and Hirsch (1995) and

England, Reid, and Kilbourne (1996) used a power variable measured at the level of the individual worker. There is reason to believe gender power difference also occurs above the individual level—that is, at the occupational level. Reich, Gordon, and Edwards (1973) and Gordon, Edwards, and Reich (1982) showed men and women are separated into different occupations and men are assigned to occupations with more desirable work tasks and career ladders. Hartmann (1976) also hypothesized that employers' and male workers' patriarchal attitudes ensured that women stay in the less-than-desirable occupations.

The purpose of this dissertation is to address these two shortcomings. A logarithmic wage model that includes elements from three of the four explanations of the gender wage gap, preference, power, and crowding, is presented in this study.[3] The data chosen for this study is the Census and ACS PUMS, which are cross sectional datasets and do not contain information about a worker's youth or adult work-related aspirations or experiences. Consequently, the socialization explanation cannot be examined.

The preference explanation is composed of numerous theories, many of which cannot be empirically examined. One particular preference theory called compensating differentials, which argues the gender wage gap exists because women are willing to trade off lower wages for desirable work conditions, is empirically testable and will be examined in this dissertation. Filer (1989) found men earn a wage premium over women because they work in physically demanding occupations. Jacobs and Steinberg (1990) found both men and women suffer wage penalties when employed in physically demanding jobs, while women suffer additional wage penalties if they work in jobs

[3] Chapter 2 will discuss the superiority of the logarithmic human capital model in predicting wages in the gender wage gap literature.

performing repetitious tasks. The mixed findings in Filer (1989) and Jacobs and Steinberg (1990) necessitate another examination of compensating differentials theory. In particular, this study will look at the wage effects of three compensating differentials variables: 1) degree of mental stress required by the occupation, 2) degree of physical hardship required, and 3) degree of the lack of freedom a worker has in determining his or her work goals and pace of work.

The preference explanation contains four other theories: human capital (Mincer and Polachek 1974), occupational self-selection (Polachek 1981), taste for discrimination (Becker 1971), and statistical discrimination (Phelps 1972). The wage model presents in this study includes three human capital variables: years of schooling, years of potential work experience, and the square of years of potential work experience. Human capital theory has been subjected to valid criticisms, which will be discussed in Chapter 2; however, the criticisms do not dismiss the importance of education and work experience in predicting an individual's wage rate (Johnson and Solon 1986; England et al. 1988; Macpherson and Hirsch 1995; England, Reid, and Kilbourne 1996; Lewis 1996; Stanley and Jarrell 1998; Bellas and Coventry 2001; and Solberg 2005). No examination of occupational self-selection, taste for discrimination, and statistical discrimination will be carried out because the first theory requires knowing an individual's preference for work and home life balance and the latter two theories require information about an individual's subjective valuation for "maleness" versus "femaleness." The Census and ACS PUMS do not contain sufficient information to be able to model an individual's preference structure.

The power explanation of the gender wage gap is also examined by means of five power variables: whether the occupation requires a license or certification for entry, whether the occupation has voluntary licensing or certification, whether the worker can only gain entry into the occupation via an apprenticeship program, percentage of workers who are unionized in the occupation, and percentage of workers who are covered by collective bargaining agreements in the occupation. All five power variables are measured at the occupational level. The first three variables examine occupational barriers to entry. Restricting occupational entry gives workers already employed in these occupations an advantage in the wage bargaining process. The latter two variables measure unions' ability to bargain for higher wages in the occupation. Previous research shows men and women do not work in the same occupations (Reich, Gordon, and Edwards 1973; Hartmann 1976; Gordon, Edwards, and Reich 1982, Bergmann 1986 and 2005). Consequently, if men and women do possess different power status, the difference should be revealed at the occupational level.

Furthermore, the study requires a dataset that contains historical information about common occupations of employment in the United States. The dataset that meets this requirement is the ACS PUMS and its predecessor, the Census PUMS. The Census PUMS contains detailed information about demographic, income, and employment characteristics of one percent of individuals living in the U.S. The Census PUMS was conducted in April every ten years (coinciding with the decennial national population count) between 1850 and 2000. The ACS PUMS replaced the Census PUMS starting in 2001. The ACS PUMS is conducted annually but throughout the year instead of a certain month. The 2001 through 2004 ACS PUMS are too small and not comparable to the

Census PUMS; however, the ACS increased the PUMS sample size beginning in 2005, making it comparable to the Census PUMS. At the time of initiating this study, the 2008 ACS PUMS is the latest sample made available to the public.

The time coverage of this study is limited to the 1950 Census through 2008 ACS PUMS. Historic changes in the female work experience took place between these PUMS. Women nearly doubled their labor force participation rate, doubled their share of the total labor force, and outnumbered men in the professional and management and related occupations during this time period (Bloom 1986, p.25 and U.S. Bureau of Labor Statistics 2010, p.1). In general, women's historic gains in professional and management occupations indicate the gender composition in occupations have changed since the end of World War II. Consequently, the time period between the 1950 Census and 2008 ACS PUMS is ideal for examining the changing relationship, if any exist, between female occupational crowding and wages.

The most significant problem encounters in this study is the lack of occupational code comparability across the PUMS. The U.S. Census Bureau defines occupations and then categorizes them into occupational codes to enhance informational consistency.[4] The bureau tries to keep its list of occupations up to date in order to reflect changes in labor demand, but this task results in occupations being added, deleted, and merged into new or existing codes across time. The lack of occupation code comparability makes it impossible to track changes in gender composition in occupations over time. A solution is proposed to circumvent this problem: narrow the focus of the study only to occupation

[4] For example, two sampled individuals may report different job titles assigned by employers, but their work tasks are similar. The Census Bureau would categorize both individuals as being employed in the same occupation code. This practice allows for greater employment comparability among sampled individuals.

codes in which the occupations listed in the codes have remained stable between the 1950 Census and the 2008 ACS. 103 occupation codes meet this criterion, and they are labeled the "selected occupations" for ease of exposition. Approximately 30% of male workers and 40% of female workers are employed in the selected occupations in each PUMS. Interested readers should refer to Appendix A to examine the complete list of selected occupations.

The findings of this study, while limited to the selected 103 occupations, provide support for the power and crowding explanation but not for the compensating differentials theory. The following dissertation is divided into four chapters. Chapter 2 surveys the specific theories grouped under the four broad explanations of the gender wage gap: preference, power, crowding, and socialization. Chapter 3 explains the methodology of the study. Chapter 4 reports the study's findings. Chapter 5 summarizes the study and proposes future research plan. A website has been created to share data files, SAS® programs, and complete regression results in Microsoft Excel® spreadsheets with the readers. Interested readers may download the files by visiting https://sites.google.com/site/bridgecodes/.

CHAPTER 2

LITERATURE REVIEW

The social science understanding of what causes the gender wage gap can be grouped into four broad explanations: preference, crowding, power, and socialization. The preference explanation is subdivided into two categories, demand- and supply-side theories. Demand-side preference theories include taste for discrimination (Becker 1976) and statistical discrimination (Phelps 1972), while supply-side preference theories include human capital (Mincer and Polachek 1974), occupational self-selection (Polachek 1981), and compensating differentials (Filer 1989). The demand- and supply-side theories share the assumption that the gender wage gap is caused by employers' and employees' work-related preferences. At the opposite end of the spectrum of explanations for the gender wage gap is the crowding explanation. Bergmann (1974) said the wage gap can be explained without making an assumption about individuals' preferences. Women earn less than men because they are crowded in a small number of occupations; the excess supply of labor in the female-crowded occupations causes women's marginal productivity and wages to fall. England et al. (1988) have challenged Bergmann (1974) by noting that female occupational crowding and low female wages are symptoms of gender discrimination and that crowding alone does not cause wage depreciation. The debate between Bergmann (1974) and England et al. (1988) is far from settled. Nevertheless, both sides agree female occupational crowding is a significant predictor of wages. Women earn lower wages when they work in female crowded occupations.

The power explanation of the gender wage gap differs from both the preference and crowding explanations in its belief that work is a social phenomenon fraught with power. Hartmann (1976; 1986) showed patriarchal attitudes keep women stuck in secondary status in the households. Capitalism creates the condition for both sexes to work, thus, endangering men's superior status. Male employers, unionists, and workers made a concerted effort to create a hostile and unfair workplace for women. Reich, Gordon, and Edwards (1973) and Gordon, Edwards, and Reich (1982) showed the labor market is made up of two segments, primary and secondary. Female workers are mostly employed in the secondary segment and the lower levels of the primary segment where work is unfulfilling and wages are low. Male workers are employed at the upper levels of the primary segment where work is a creative, independent endeavor and wages are high. Hence, the power explanation places the difference in gender power in workplaces at the heart of the origin of the gender wage gap.

The socialization explanation of the gender wage gap supports the power explanation that work is a social phenomenon and not merely of preferences. The cumulative disadvantage theory argues that boys and girls are socialized at a young age to perform gender-appropriate tasks (McPherson, Smith-Lovin, and Cook 2001; England and Folbre 2005). When girls grow up to become women, they are confined to working in female-dominated occupations due to their lack of network ties to men. The social control theory criticizes the cumulative disadvantage theory as being too simplistic; youth socialization is not a strong enough force to keep women tied to low-paying female work. Jacobs (1989) showed there are social mechanisms in the workplace that keep women tied to their gender-appropriate positions. Socialization occurs at all stages of life.

The purpose of this literature survey is to examine the theories subsumed under each of the four explanations of the gender wage gap.

Preference

The preference explanation of the gender wage gap includes five theories: tastes for discrimination, statistical discrimination, human capital, occupational self selection, and compensating differentials. The five theories are grounded in the neoclassical economic perspective of the labor market called the Walrasian auctioneer theory.

The Walrasian auctioneer theory makes three assumptions about the workings of the labor market. First, buyers and sellers interacting in the labor market are rational, utility-maximizing individuals. Workers only work if they can maximize their utility given their preferences about work; employers only hire labor power if they can maximize their profits given the competitive conditions in the product markets. Second, employers do not differentiate between the labor power of worker A versus that of worker B unless the workers have different levels of productivity. Third, workers and employers make their decisions independently about how much labor power to sell and buy at different prices and communicate the information to a third party called the Walrasian auctioneer. The auctioneer sums the units of labor demanded and supplied at different prices. The market clears when the quantity of labor demanded equals its quantity supplied; workers sell their labor power at the market-clearing price.[5]

[5] Some readers may argue the third assumption is not a realistic representation of neoclassical theory of labor market and that modern neoclassical theorists understand the complex interactions between workers and employers in the labor market. It is true neoclassical theorists do acknowledge that while reality deviates from the Walrasian auctioneer model, they still hold the model as the ideal labor market. In fact, the Walrasian auctioneer guarantees buyers and sellers of labor power have access to the same information, which ensures market clearing. If buyers and sellers do not share the same information, they may not agree on an equilibrium price and quantity. Furthermore, the parties may withhold information from each other in order to maintain a superior position in the wage bargaining process.

The existence of a gender wage gap is a contradiction to the Walrasian auctioneer theory because workers are paid different wages because of their sex. Preference theories explain this inconsistency from two different perspectives: demand-side and supply-side. The demand-side perspective argues that the gender wage gap is due to employers', consumers', and workers' preferences for market interactions with men rather than women. Taste for discrimination and statistical discrimination are theories that fall under the demand-side perspective. On the other hand, the supply-side perspective believes women's own preferences about work are the cause of the gender wage gap. Women prefer to be employed in situations that pay less than men. Human capital, occupational self selection, and compensating differentials represent the supply-side perspective.

Demand-Side Preference Theories

Neoclassical demand-side preference theories focus on the demand for female labor—or more appropriately, lack of it—as the reason for the gender wage gap. Becker (1971) argued that male and female employers, workers, and customers may have a taste for discrimination, which results from their subjective prejudice for the female sex and/or their ignorance of the economic efficiency of this sex. Becker used the "discrimination coefficient" as a proxy for an individual's taste for discrimination, and he assumed each individual can convert his or her discrimination coefficient into a monetary value.

An employer who has a taste for discrimination against women believes hiring female workers is a cost to him or her. Consequently, the employer would consider the cost of hiring a woman to be $\pi(1 + d_e)$, where π is the wage rate offered to men, and d_e is the employer's monetized discrimination coefficient. If $\pi(1 + d_e)$ is higher than π, the employer would not hire a female worker unless she accepts a wage equal to or less than

πd_e. A discriminating worker who is forced to work with a woman would consider his or her wage to be $\pi(1 - d_w)$, where d_w is the worker's DC; the worker may leave for another job that pays a wage greater than $\pi(1 - d_w)$. A consumer, too, may go elsewhere if s/he deems the cost of buying from a woman to be $p(1 + d_c)$, where p is the price of buying from male workers and d_c is a customer's DC. A non-discriminating employer may still be forced to forgo hiring women because s/he does not want to lose discriminating male workers or discriminating customers. Becker argued the market mechanism would not support an employer with a taste for discrimination in the long run because the employer is paying a wage premium to keep male workers. The discriminating employer would have higher labor costs, making it ever more difficult for him or her to stay competitive against other producers.

Phelps (1972) furthered Becker's analysis by asking why employers want to have a taste for discrimination when this preference leads to higher costs and lower profits. Phelps hypothesized that employers have to make hiring decisions in the face of limited information. Employers can only obtain additional information about the applicant's potential performance at excessive costs, which can hamper their goal of profit-maximization. As a result, employers will use gender as a proxy for unavailable data. Phelps said employers have a priori beliefs about male and female workers, and they will make hiring decisions based on those beliefs. Employers may view female applicants as less qualified than males because of their previous experience with male and female workers; they may also hold the belief that women grow up disadvantaged due to sexual hostility and, thus, are not as well trained as male workers. Employers would only hire female workers if they can get the labor power at a discounted price to offset their risks.

Because employers make their assessments about workers on a "statistical average" basis, Phelps called his explanation the theory of statistical discrimination.

The demand side theories have been criticized by supporters and critics of neoclassical economics alike. Arrow (1998) lamented:

> The trouble with these explanations is that they contradict in a direct way the usual view of employers as simple profit-maximizers. While they do not contradict rational choice theory, they undermine it by introducing an additional variable. First, consider the simple hypothesis of employer discrimination. If employers have one variable other than profits in their maximands, why not others? (Arrow 1998, p. 94-95)

Given Arrow's question, one must wonder what other variables individuals must want to maximize besides profits. Neoclassical economics is grounded on two maximizing variables: profit, on the production side, and utility, on the consumption side. Other variables of maximization must be deduced to profit or utility because economic activities belong to the sphere of production or consumption. Hannan (1982) examined profit and utility maximization and found they are equivalent concepts. He began his analysis by noting that a representative owner of a firm has a minimum reservation managerial wage, which is the amount that must be paid to induce the owner to perform managerial duties. The owner hires managers because s/he has a greater preference for non-pecuniary activities than managerial duties. In order for the owner to maximize his/her utility from engaging in non-pecuniary activities, s/he must maximizes profit to pay hired management.

Prasch (2008) further noted that neoclassical economics treats labor as a commodity, and, thus, the owner's preference for labor power must be treated like preferences for all other goods. In the context of firm's production, the owner must choose between labor and capital inputs, given that his/her non-pecuniary preferences

remain constant. The owner's preference for labor and capital must satisfy three conditions of rationality:

1. Completeness: The owner is able to rank all possible combinations of labor and capital inputs. S/he prefers more labor (capital) to less of the same input.
2. Transitivity: If there are three combinations of labor-capital inputs called x, y, and z and if x has more labor and capital inputs than y and y has more than z, then the owner must prefer x to y, y to z, and x to z.
3. Reflexivity: For every combination of labor-capital input called x, x is as good as itself.

Lee and Keen (2004) showed the range of technology that the owner can choose to include in his/her production function may contain fixed production coefficients. If fixed production coefficients exist, then an increase in labor or capital input alone is necessary but not sufficient for an increase in output (Lee and Keen 2004, 182). An owner has no incentive to prefer more labor if it does not result in greater output (but definitely greater labor cost!). Keynes (1964 [1936]) also showed an owner's decision about how much labor to employ depends on general macroeconomic conditions. An owner may very well prefer labor-capital combination z over x and y if s/he anticipates this level of output sufficiently meets buyers' demand. Consequently, there is insufficient evidence to suggest the owner has rational preferences as presumed in neoclassical theory.

Lee and Keen (2004) also demonstrated the downward sloping demand curve for a given good (such as hired labor) cannot exist if there is no quasi-concave utility curve. The existence of the utility curve, in turn, is dependent on the rationality of preferences, but it has been shown the representative owner does not necessary have rational

preferences. Consequently, the owner does not possess a downward sloping demand curve for hired labor. Without an individual demand curve for labor, there cannot be an aggregated downward sloping market demand curve for labor.

The demand-side preference explanations of the gender wage gap contend the market demand curve for male labor is to the right of the demand curve for female labor, and this is why men receive a greater equilibrium wage rate compared to women. The questionable existences of the representative owner's rational preferences, the owner's demand curve for labor, and market demand curve for labor pose a serious theoretical criticism to the demand-side theories, however. The gender wage gap cannot be adequately explained from a demand-side preference perspective given the shortcomings of neoclassical demand theory.

From an empirical perspective, researchers have also found it impossible to measure employers', workers', and consumers' preferences for men over women. Supporters of demand-side neoclassical theories have resorted to counting the "leftover" portion of the gender wage gap as a proxy for the preference against female workers. The leftover portion of the wage gap is the part that cannot be explained by the workers' skills, labor force experience, degree of attachments to the labor force, or the industries in which they work.[6] Dougherty (2005) said this approach to measuring a preference for discrimination is inappropriate. The leftover portion of the wage gap includes both the effects of discrimination (i.e. an employer pays a female worker less than a male worker on the basis of her gender) and self-selection (i.e. a female worker chooses a lower paying job because it allows her to have a flexible schedule to perform familial duties)

[6] The industries in which individuals are employed are important in the wage determination process. For example, the finance industry pays a higher average wage than agriculture.

(Dougherty 2005, 970). Also, the leftover portion may include the effects of other types of discrimination besides gender—such as discrimination on the basis of ethnicity, sexual orientation, or nationality. Dougherty concluded there is no way to know which part of the leftover portion is due solely to gender discrimination.[7]

Supply-Side Preference Theories

Supply-side preference theories differ from the demand-side theories because they emphasize women's own preferences for work. Supply-side theories attribute women's lack of dedication to the formal workforce as the cause of their lower earnings compared to men. Mincer and Polachek (1974) gave the first presentation of this supply-side perspective via human capital theory.[8] Mincer and Polachek (1974) said all families must allocate time and physical and human capital among three activities: leisure, labor market production, and home production. Leisure and labor market production are shared by all family members. Home production, on the other hand, is the responsibility of wives (Mincer and Polachek 1974). Mincer and Polachek (1974) gave three reasons for women's dominance in home production. First, women are faced with the biological constraint of childbearing, so they must leave the labor force for a considerable amount of time. Second, women invest less in their human capital during their single years

[7] Some examples help to demonstrate Dougherty's criticism. Wood, Corcoran, and Courant (1993) examined the wages of individuals who graduated from the University of Michigan Law School classes of 1972-1975 fifteen years after they left school. The authors found the gender wage gap was 40 percent. The gap still remained at thirteen percent after Wood, Corcoran, and Courant controlled for variables regarding academic performance while in school, work experience after school, personal characteristics, place of work characteristics, and number of hours worked. Likewise, Weinberger (1998) studied 5,952 college graduates who were no more than 30 year old, not enrolled in school full time, and working either full time or involuntarily part time in April 1985. Weinberger reported a gender wage gap of ten to fifteen percent (depending on their race) after she controlled for college majors, grade point average, and college institution attended. Both studies show that while researchers can narrow Dougherty's leftover portion by a significant amount by controlling for more factors, they still do not know how much of what is left unexplained is due to gender discrimination or some other unaccounted factors.

[8] Becker (1975) provided a similar analysis to Mincer and Polachek (1974).

because they expect to spend less time in the labor force after marriage. On the contrary, men probably invest more in their human capital because they expect to spend most of their adult lives in the labor force. Third, even if women invested more in their human capital but take time off to care for young children, their leave of absence from the labor force causes their human capital to depreciate. When women decide to reenter the labor force (presumably after the children are grown), they cannot command a wage rate similar to men. Consequently, women's low level of human capital is the cause of their low wages.

Polachek (1981) furthered Mincer and Polachek (1974) by asking how women can maximize their lifetime earnings given that they know they would spend most of their lives outside the formal labor force. Polachek (1981) proposed women tend to choose occupations that have the lowest penalties for intermittent labor force participation. Polachek (1981) called this penalty the "atrophy rate." Polachek argued occupations with high atrophy rates are riskier investments than low atrophy rate occupations. Occupations with high atrophy-rates usually offer low entry-level wages, leading workers who want higher wages to spend much more time honing their skills. On the other hand, entry-level wages are often higher in low atrophy-rate occupations that do not require extensive skill training. Female workers are better off maximizing their lifetime earnings by entering low atrophy-rate occupations since they have childbearing and child rearing responsibilities. In exchange for higher entry-level wages and lower skill requirements, women in low atrophy-rate occupations have to forgo future promotional opportunities. Consequently, women self-select into low atrophy-rate occupations because this is the most profitable investment for them.

Bowles and Gintis (1975) have criticized human capital and occupational self-selection on three grounds. First, economically relevant skills are not uni-dimensional and cannot be aggregated into a single measure called “human capital” where some individuals have more while others have less of it (Bowles and Gintis 1975, 78-79). Second, the theories eliminate class as a central feature of capitalist production. Mincer and Polachek (1974) and Polachek (1981) assume every worker contributes an identifiable amount of “human capital” to the production process, and s/he receives a factor payment equivalent to his/her contribution. Every worker is, in essence, his/her own capitalist (Bowles and Gintis 1975, 74). In reality, production is a class-conflicted process. In order for raw materials to be transformed into products, individuals with labor power must first be transformed into workers with skills and consciousness compatible with the class-based system; workers must cooperate with capitalists as the latter exploit the former to the fullest to gain a larger profit margin. Consequently, capitalists have an interest to control the education system to ensure trained workers have the desired characteristics needed by the capitalist system. Human capital and occupational self-selection fail to account for this class conflict in the wage structure.

The third criticism Bowles and Gintis (1975) directed against human capital and occupational self-selection theories is their superficial interpretation of the positive correlation between wages and education. Mincer and Polachek (1974) and Polachek (1981) argued workers with higher educational levels are more productive, and, thus, earn higher wages. Bowles and Gintis (1975) argued there are alternative explanations for why investment in education yields higher wages. Capitalists may seek out individuals with high level of educational investment because these individuals have been trained to

accept supervisory authority. Educated workers may have been taught motivational patterns compatible with the class-based power structure and thus are more willing to let capitalists exploit their labor power (Bowles and Gintis 1975, 80). Educated workers also serve as a mean of division in the laboring class. Capitalists can justify the low wages of the majority of workers, who do not have high level of educational investment, by way singling out the "productivity" of the educated workers. Divided workers are less likely to push for a higher share of the production surplus, which leaves more profits for capitalists.

Another theoretical criticism can be directed at human capital and occupational self-selection theories when we examine the neoclassical law of supply, which argues a positive relationship exists between price and quantity of supplied labor. Prasch (2008) showed it is likely that the supply of labor is not represented by an upward sloping curve but rather a backward bending one, as depicted in Figure 2.1. The backward bending supply curve shows that the segment above the subsistence wage level (Ws) is indeed upward sloping. A worker who earns a real wage at the subsistence level can maintain a socially acceptable minimum standard of living. The worker would only sell more labor power if s/he is offered a premium above Ws. The portion of the supply curve above Ws is indeed upward sloping and, thus, conforms to the neoclassical supply curve. However, if the real wage falls below the subsistence wage, the worker will supply additional labor power in order to maintain his/her socially acceptable minimum standard of living. The negative relationship between wage and quantity of labor supplied continues until the real wage falls below the unsustainable level (Wu). The worker cannot supply any more additional labor to maintain the minimum standard of living; s/he also becomes too

physically exhausted and cannot sell additional labor. The supply curve begins to turn inward at Wu. The backward bending market supply curve indicates there is no unique relationship between each rate of marginal productivity of labor (MP_l) and wage. In other words, a worker can be equally productive at different wage rates. Mincer and Polachek (1974) and Polachek (1981) assumed male and female workers earn wages comparable to their marginal productivity of labor. Since men are more productive workers due to their higher human capital investments, men earn higher wages. The backward bending supply curve, however, suggests it is possible that male and female workers can be equally productive but earn different wages.

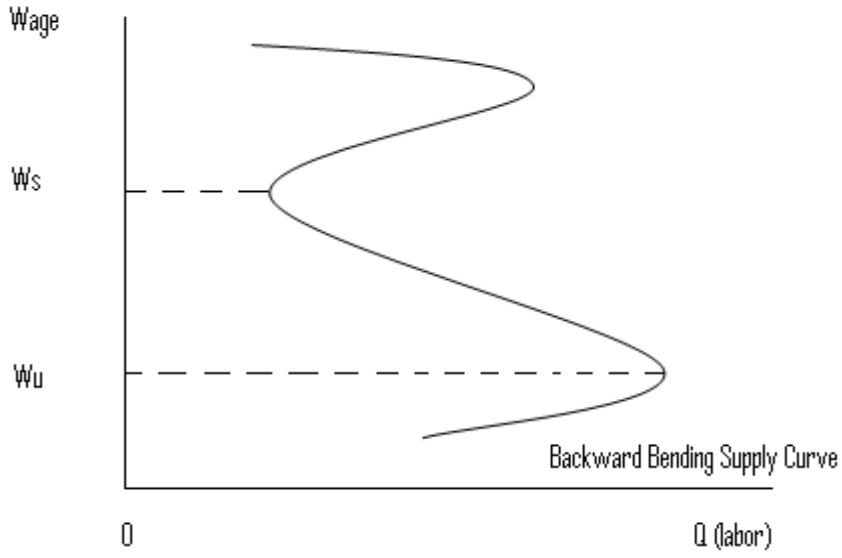

FIGURE 2.1: BACKWARD BENDING SUPPLY CURVE

Source: Adapted from Robert E. Prasch, *How Markets Work: Supply, Demand, and the 'Real World'* (Cheltenham: Edward Elgar, 2008), 88, figure V.2.

The empirical evidence also does not support human capital or occupational self-selection theories. Blau and Ferber (1986) reported women's post-secondary educational

attainments (including their chosen fields of study) and experiences and attachments to the labor force began to mirror men's since the 1970s. Bellas and Conventry (2001) found men and women working in female-dominated sales occupations have more education than comparably paid workers in non-female sales occupations. Bergmann (2005) showed women's educational attainments surpassed men's in early 2000s. Women were more likely to receive some form of higher education than men—63.1% to 56.6%. Women were also more likely to earn bachelor degrees than men—22% to 19%. Women also held as many graduate degrees as men (Bergmann 2005, p.51-52).

England (1984) found no evidence supporting Polachek's occupational self-selection theory. England argued that if women do self-select into feminine occupations due to the low wage penalty for intermittent labor force participation and human capital depreciation, we should expect a negative correlation between female workers' wages and the atrophy rates in male-dominated occupations. England constructed atrophy rates for male-dominated occupations and correlated this variable against female wages in these occupations. She found the variables were not statistically correlated.

In response to the criticisms against human capital and occupational self-selection theories, Filer (1989) proposed a new supply-side explanation for the gender wage gap called compensating differentials.[9] Filer (1989) made the argument that women, even with the same level of human capital as men, may still earn less because they choose to

[9] A reader has pointed out that the theory of compensating differentials is simply a rationalization of the theory of human capital, which has been shown to have theoretical and empirical shortcomings. Compensating differentials is an attempt to "save" human capital theory. This dissertation does not agree with this assessment. Compensating differentials theory is treated as a unique explanation of the gender wage gap in both the neoclassical economics and sociology literature. Moreover, while it is probable that workers with low level of education and work experience are more likely to be employed in occupations that are physically challenging and lacking work freedom, the same generalization cannot be made about individuals working in mentally stressful occupations. Consequently, compensating differentials theory is treated as a separate explanation of the gender wage gap.

take a larger portion of their compensation in the form of non-pecuniary amenities. Women prefer not to work in occupations with dangerous and unfavorable work conditions, so they are willing to trade away some of their wages away to satisfy their preference. Men receive a wage premium because they do not mind working in physically demanding occupations.

England et al. (1988) found workers in female-dominated occupations earn lower wages than those in non-feminized occupations after controlling for differences in human capital, skill demands, and working conditions. Jacobs and Steinberg (1990) analyzed job titles in the New York State Civil Service and found female and male jobs had comparably undesirable working conditions. Furthermore, male and female workers are penalized—not rewarded—for being employed in jobs with unfavorable work conditions. Individuals employed in white male-dominated jobs were heavily penalized for working in environments that have a high risk of injury and involved strenuous physical activity, and individuals working in female-dominated jobs were also heavily penalized for performing repetitious tasks.

The mixed findings about wage effect of undesirable work conditions necessitate another examination of compensating differentials theory. The wage model presents in this dissertation includes measures for occupational physical hardship, mental stress, and lack of freedom to control one's work goals and pace of work. Occupational self-selection theory and demand-side preference theories are not examined because the Census and ACS PUMS do not report an individual's preference for "maleness" versus "femaleness" and work versus home-life balance. [10] Three "human capital" variables,

[10] A possible way around this problem is to include gender as an explanatory variable in the wage regression, but this method requires the error structures of male and female wage models to be the same.

years of schooling, years of potential work experience, and the square of years of potential work experience, are also included in the presented wage model. The human capital variables are included because they have been shown to be important predictors of a worker's wage rate in previous gender wage gap studies (Johnson and Solon 1986; England et al. 1988; Macpherson and Hirsch 1995; England, Reid, and Kilbourne 1996; Lewis 1996; Stanley and Jarrell 1998; Bellas and Coventry 2001; Solberg 2005).[11]

Crowding

The crowding explanation dates back to the nineteenth century when male workers and unionists popularized the belief that female entry into non-feminized occupations would eventually result in wage depreciation for all (Matthaei 1982; Nicholson 2004). Bergmann (1974) gave the first mathematical formalization of the wage effect of female occupational crowding.[12] Bergmann (1974) built her crowding model on three assumptions. First, occupational gender segregation exists regardless of the actual cause of the segregation.[13] Second, workers of the same average skills work in two occupations called "masculine" and "feminine." Third, each worker is paid a wage

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One cannot make this assumption because Macpherson and Hirsch (1995) showed the unexplained factors which affect male wages may not be the same as the unexplained factors affecting female wages. Macpherson and Hirsch (1995) ran separate wage regressions for men and women, and this study follows Macpherson and Hirsch's methodology.

[11] For example, Stanley and Jarrell (1998) conducted a meta-regression analysis of 41 gender wage gap studies and found those studies that omit work experience as an explanatory variable report a mean wage gap of 28 percent higher than studies that do not omit the variable.

[12] Bergmann (1974) credited Edgeworth (1922) for inspiring her formulation of the crowding hypothesis. A reading of Edgeworth (1922) shows Edgeworth's analysis differs markedly from Bergmann's. "The pressure of male trade unions," said Edgeworth, "appears to be largely responsible for that crowding of women into a comparatively few occupations, which is universally recognized as a main factor in the depression of their wages" (Edgeworth 1922, p. 439). Edgeworth gave credit to the role that unequal distribution of power between female workers and male unionists as the cause of crowding. Bergmann did not make an attempt to explain the source of occupational segregation.

[13] In other words, occupational gender segregation is an exogenous variable.

equivalent to his or her marginal productivity. Illustration 1 shows a dual labor market in which women's wage rate is W_f when they are segregated into the feminine occupation. If the masculine occupation is desegregated and women are allowed entry, their presence increases the supply of labor in the masculine occupation causing the occupation's marginal productivity to decline. Furthermore, the supply of labor in the feminine occupation decreases, causing the occupation's marginal productivity to increase. The wage rate increases from W_f to W_e in the feminine occupation and decreases from W_m to W_e in the masculine occupation. When wages in the masculine and feminine occupations are equalized at W_e, female entry into the masculine occupation stops.

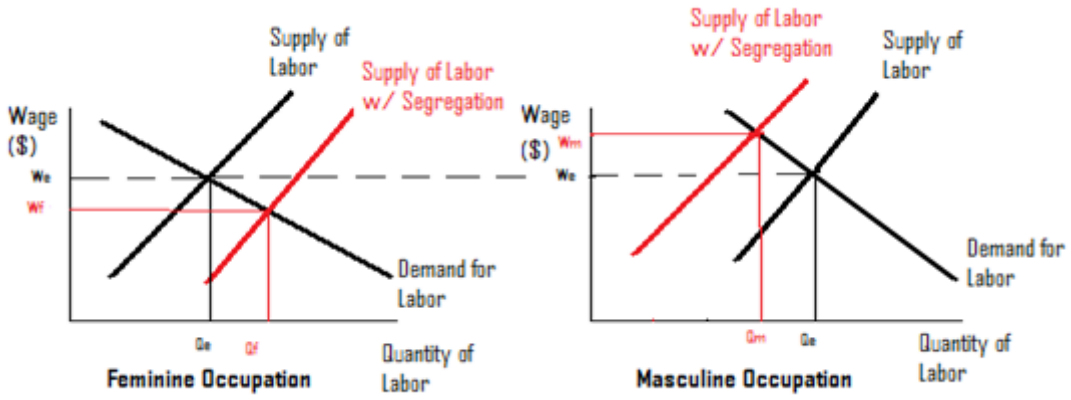

FIGURE 2.2: BERGMANN'S FEMALE OCCUPATIONAL CROWDING MODEL

Source: Adapted from Francine D. Blau and Marianne A. Ferber, *The Economics of Women, Men, and Work* (Englewood Cliffs: Prentice-Hall, 1986), 256, figure 8.1.

Bergmann (1974) has received much theoretical but few empirical critiques. England et al. (1988) admitted female crowding leads to lower wages, but they argued other factors must be at play besides the proportion of women employed in an occupation. England et al. (1988) identified sexism as a possible explanatory factor. Employers may choose to hire only female workers and either offer them low wages at

the time of hiring or imposing low wages once the occupation is sufficiently feminized. Reich, Gordon, and Edwards (1973), Hartmann (1976), Matthaei (1982), Gordon, Edwards, and Reich (1982), and Kessler-Harris (1990) also argued that employers deliberately separate female workers into specific occupations and offer them lower wages than male workers in other occupations.[14]

Empirical findings have been mostly supportive of Bergmann (1974). England (1984) estimated women's wages increased by 1.9% for every 10% increase in the proportion of men who work in their occupations in the 1974 Panel Study of Income Dynamics after she controlled for human capital characteristics. Johnson and Solon (1986) found a negative relationship between the "femaleness" of an occupation and the wage rate paid for individuals in the May 1978 Current Population Survey (CPS), but they argued a significant portion of the gender wage gap is due to men working in higher paying industries.[15] England et al. (1988) reported white and black women in the National Longitudinal Survey (NLS) 1968-1980 panels and white men in the NLS 1966-1981 panels suffered wage penalties when employed in occupations with the majority being female workers even after controlling for differences in human capital, skills demand, and working conditions. Macpherson and Hirsch (1995) found the same negative relationship between occupational femaleness and wage rates of men and women in pooled March CPS samples between 1983 and 1993; however, they found the gender wage gap narrowed by two thirds after controls for a large number of personal

[14] Another theoretical criticism of Bergmann (1974) is her use of the neoclassical supply and demand concepts. Lee and Keen (1998) and Prasch (2008) have shown the theoretical problems of neoclassical laws of supply and demand.

[15] An example is necessary to elaborate on Johnson and Solon's point. Accountants who work in the finance industry earn higher wages than their counterparts in the agricultural industry. If there are more male accountants in finance than in agriculture, male accountants would, on average, earn higher wages than female accountants.

characteristics and occupation and industry characteristics were added. England, Reid, and Kilbourne (1996) controlled for 200 industry-occupation combinations and found white women, black women, and white men in the 1979-1987 National Longitudinal Survey of Youth (NLSY) suffered wage penalties when they work in combinations where women are the majority workers. Lewis (1996) reported the same negative relationship in a pooled sample of full-time, white-collar, federal government employees for the years 1976 and 1992.

Solberg (2005) did obtain findings that do not support Bergmann's hypothesis. Bergmann's hypothesis implies crowding should occur at the occupational level only. Workers in feminized occupation A earn a lower wage rate than workers in non-feminized occupation B because occupation A is crowded with female workers, but male and female workers within occupation A (or within occupation B) should not have different wages if they possess all similar personal characteristics except sex. Solberg tested Bergmann's hypothesis by examining four different cohorts working in seven generalized occupations in the 1979 NLSY: professional and technical occupations in the hard sciences, professional and technical occupations in the social sciences, managers and administrators combined, sales and clerical workers combined, crafts, operatives, and laborers and service workers combined. In the first cohort, Solberg examined the wage gap within each occupation between white male and female workers and found the gender wage gap was statistically significant in three occupations: sales and clerical, crafts, and operatives. In the second cohort, consisting of only full-time, year-round white male and female workers, Solberg found the wage gap was statistically significant in the professional and technical occupations in the hard sciences and crafts. In the third cohort

of only private sector white male and female workers, the wage gap was statistically significant in the professional and technical occupations in four occupations: social sciences, sales and clerical, crafts and operatives. In the fourth cohort of full-time, year-round, private sector white male and female workers, a statistically significant wage gap was found in three occupations: professional and technical occupations in the hard sciences, professional and technical occupations in the social sciences, and crafts. Solberg concluded,

> ...the results indicate that something else is going on besides the crowding of females into the seven occupational categories. Perhaps females have encountered a 'glass ceiling' within each occupation, perhaps there is crowding within the categories, or perhaps there is some other form of overt gender discrimination within each category (Solberg 2005, p. 140).

In this dissertation, the validity of the crowding hypothesis throughout the post-World War II era will be examined. Women have achieved significant progress in the post-World War II labor force. Women's labor force participation increased from 36.3% in 1944—its highest peak during World War II—to 60% in 1999—an all time high—and stood at 59.2% in 2009 (U.S. Bureau of the Census 1975, p.131-132; U.S. Bureau of Labor Statistics 2010, p.8 and 12). Women had a 47% share of the labor force in 2009, whereas they only had 29% in 1948 (Bloom 1986, p.25; U.S. Bureau of Labor Statistics 2010, p.1). Women have also entered occupations that were closed to them in the prewar era. Blau and Kahn (2000) reported a decreasing concentration of women in administrative and service occupations since the 1970s, although the U.S. Bureau of Labor Statistics reported women accounted for 57.2% of workers in service occupations and 63% of workers in sales and office occupations in 2009 (U.S. Bureau of Labor Statistics 2010, 31 and 33). The Bureau of Labor Statistics also reported women made up

51% of all workers in management and professional and related occupations in 2009 (U.S. Bureau of Labor Statistics 2010, p. 1). Given the changes in the degree of female crowding in the labor force in general and in the administrative, service, management, and professional occupations specifically throughout the postwar era, one may wonder if the relationship between female occupational crowding and wages has remained consistent or has changed. Heckman (1991; 2001) noted a socioeconomic relationship like female occupational crowding and wage is state-dependent. Factors that influence this socioeconomic relationship may change over time, which may result in a new socioeconomic relationship. Previous research has focused on the relationship between female occupational crowding and wages at one chosen moment in time, but it has not examined the relationship over an era when women have made great advances in the workforce. An investigation about the female occupational crowding and wages connection is warranted and is a focus of this study.

Power

The power explanation of the gender wage gap is the antithesis of the preference explanation. Power theorists argue women do not prefer to work in low-paying occupations. Rather, women are forced to work for low wages because they lack the power to protect themselves against unfair employment and wage setting practices of male employers and workers. The power explanation is represented by two theories: labor market segmentation and patriarchy. Labor segmentation and patriarchy share a common starting theoretical position: a rejection of the Walrasian auctioneer labor market theory. The power explanation argues that the Walrasian market does not exist, and the real world labor market is characterized by power relationships. Klein (1987)

defined power as the "ability to decide, to control, to influence" (Klein 1987, p. 1343). Woodbury (1987) said power is present in every market interaction because workers and employers differ in their property right attainments. Employers have access to capital, or the plants and equipment, needed to carry out production. Workers own their own labor power. Eichner (1979) and Seccareccia (1991) noted workers are inherently disadvantaged in market interactions because they cannot store their labor power away in hopes of getting a better selling price on another day. Workers lose their skills if they do not work on a continual basis, and they perish without means of subsistence. Moreover, workers age over time and eventually lose the ability to work. On the other hand, employers have the power to withhold their monetary capital, turn off the machines, and lay off workers if they deem production will not garner a desired rate of profit.[16] Veblen (1904) argued it is the employers' unstable demand for labor that injects precariousness in workers' livelihood. No worker is assured of finding a buyer for his or her labor power.

Fligstein and Fernandez (1988) showed employers and workers are inherently unequal at the start of the wage bargaining process. Employers control the flow of capital and use this power to get workers to accept an "appropriate" wage rate, which usually means a rate at which employers can keep costs low enough to realize their desired rate of profit. On the other hand, workers try to get employers to commit to long-term hiring contracts and preferably ones with fixed real wages. Both parties try to exercise their "domination" strategies to achieve their respective goals. Employers' domination strategies include using labor saving technology to limit their dependency on workers,

[16] A desired rate of profit is one that compels the businessman to keep the production process going (Veblen 1904).

deskilling workers by refusing to train workers to understand an entire production process but rather only to perform individual steps in the process, forming agreements with other employers not to compete for the same workers, and lobbying with the government to protect their interests in labor-capital disputes (Marx 1990 [1867]; Wolff and Resnick 1987; Fligstein and Fernandez 1988; and Braverman 1998). Workers also have their domination strategies: requiring employers to sign closed shop contracts, imposing apprenticeship requirements or professional licenses or certifications, and drafting collective bargaining agreements (Fligstein and Fernandez 1988; Nicholson 2004). Eichner (1979) observed that workers may increase their wage bargaining position in the short run, but he doubted the success of these strategies in the long run. Capitalism has a built-in relief mechanism for labor power shortage: There are always younger workers who have come of age and must work, and they are willing to accept less-than-desirable wages to gain entry into the workforce. Employers eventually find their alternative labor supply.

Labor Market Segmentation Theory

Using the power theory of the labor market, Reich, Gordon, and Edwards (1973) and Gordon, Edwards, and Reich (1982) proposed the theory of labor market segmentation as an explanation of the gender wage gap. Reich, Gordon, and Edwards (1973) noted nineteenth century workers were trained to perform similar tasks under similar working environment; this mass production system promoted labor fraternity, and workers unionized to stand against employers' encroachments on their working conditions and wages. Nineteenth century mass production was a double-edged sword, however. The system was prone to overproduction, which caused intense competition and

declining profits for all. Firms responded by buying out their competitors, and this merger movement gave rise to large corporations by the early twentieth century. Large firms were freed from the nuisance of making a quick profit to stay afloat, and they turned their attention to creating an environment favorable to their long term survivability (Fligstein 1993; Roy 1999; Fligstein 2001). One of the first tasks the corporations undertook to secure their survivability was to resolve the problem of radical labor (Reich, Gordon, and Edwards 1973, 360-361).

Corporations turned to the concept of scientific management, popularized at the time by its founder Frederick Winslow Taylor. Scientific management instituted a workplace hierarchy among workers, allowing some to have the freedom to determine their pace of work, tasks, and goals and denying the same privilege to others. Workers were divided into labor cohorts on the basis of their race, gender, age, work experience, work skills, and so forth. Workers in each cohort were placed on similar career paths. Gordon, Edward, and Reich (1982) categorized the cohorts into two broad categories: primary and secondary. The secondary sector is composed of "dead-end," low-paying occupations like those in unskilled service and manufacturing. Women and teenagers are the main workforce of the secondary sector. The primary sector differs from the secondary sector in that employers provide on-the-job training, job ladders, and higher wages to induce workers' loyalty. All workers are not equal in the primary sector, however. The primary sector is divided into two segments: independent primary and subordinate primary. Independent primary sector workers are encouraged to demonstrate creativity and problem-solving skills. Examples of independent primary sector jobs are those in middle- and upper-management and skilled professional occupations. Men are

the core workforce of the independent primary sector. The subordinate primary sector is made up of workers who serve as assistants to the independent primary workers. Subordinate primary workers are expected to perform repetitive work routines and exhibit deferential attitudes toward their superiors. Women are the main workers of the primary subordinate occupations. These women are paid higher wages than women in the secondary sectors but less than men in the independent primary sector.

Labor market segmentation theory has garnered both support and criticism. Bergmann (2005) found significant gender segmentation in 357 occupations in the 2002 Current Population Survey (CPS). Bergmann (2005) began her study by giving three definitions: an occupation having 35% to 55% female workers is "gender-integrated," an occupation having less than 35% female workers is "male," and an occupation having more than 55% female workers is "female." Bergmann (2005) found half of all female workers were concentrated in 71 "female" occupations; these same occupations employed only 7% of all male workers. Half of all male workers were employed in 154 "male" occupations, which employed only 8% of all female workers. Sixty gender-integrated occupations employed 19% of all male workers and an equivalent percentage of all female workers (Bergmann 2005, p.46; see Appendix A.1 in same text for a complete list of occupations and their gender distribution).

Bielby and Baron (1986a; 1986b) also conducted a study measuring the gender concentration of occupations, but they concluded their findings suggest labor market segmentation theory is too simplistic to capture the degree of gender segregation in the workplace. Bielby and Baron (1986a; 1986b) examined 40,000 working men and 11,000 working women employed in 209 Californian firms between 1964 and 1979. The men

and women held 10,000 official job titles and worked in 645 detailed occupations and seven major occupational groups. Bielby and Baron (1986a) defined an occupation as being gender integrated if men account for no less than 20 percent and no more than 80 percent of employment. Bielby and Baron (1986a) found 266 firms out of 290 employed workers in at least one gender-integrated occupation, but only 144 firms employed both men and women in gender-integrated occupations (Bielby and Baron 1986a, 779). There were 3,000 job titles in the gender-integrated occupations, but only 215 job titles were filled by both sexes (Bielby and Baron 1986a, 779). In addition, only five firms accounted for 40 percent of the gender-neutral job titles (Bielby and Baron 1986a, 779). Bielby and Baron (1986a; 1987b) argued their study shows men and women are separated from each other at much smaller levels than labor market segments. The sexes do not share the same job titles even if they are employed in the same occupation, and, in some cases, do not work in the same firm even if they share the same job title.

Patriarchy has emerged as the "other half" of the power explanation for the gender wage gap. Patriarchy notes that labor market segmentation theory fails to address a fundamental question: Why do employers choose to segregate women, but not men, into subordinate primary and secondary sectors? Hartmann (1976; 1981) provided an answer: employers' patriarchal attitudes resulted in their discriminating against female workers. Hartmann (1976; 1981) showed the institution of patriarchy exists prior to the emergence of capitalism, and its roots are traced back to settled agriculture. Men and women equally shared the burden of producing a material subsistence prior to the rise of settled agriculture. Women were gatherers, and men were hunters. Women provided a greater share of the material production in many instances, as hunting was not a

dependable means of obtaining food. Settled agriculture lessened women's contribution to the community's livelihood because their work of gathering food was no longer needed. Instead, women's labor power was now directed at being caretakers of men, children, and elders. Women lost their say over material surplus redistribution, and patriarchy emerged as an institution of importance. Patriarchal attitudes advanced further when men started exchanging women within their own kin groups to men in other groups.[17] Women who were separated from their kin groups were completely dependent on their male providers (such as husbands) for their material livelihood. Capitalism grew out of this history of patriarchy.

The capitalistic mode of production requires both men and women to work outside the home. Hartman (1976; 1981) noted the appearance of working women is a threat to patriarchy in three ways: male employers did not want to subsidize male workers for child rearing and housekeeping, which were provided by stay-at-home women at no extra cost, male workers' superior status within their family partly depends on their ability to provide material livelihood for other family members, and male workers feared women would be the cheaper labor substitute and drive down their wages. Male workers understood it was not possible to bar women from working. Hence, male workers joined forces with male employers to limit women's position in the workforce. Segregating women into "female" occupations and paying them low wages are two outcomes of this deliberate endeavor to marry patriarchy with capitalism.[18]

[17] Veblen (1898; 1899) theorized that women were the first private property—men's private property—in human societies.

[18] Kessler-Harris (1982) and Matthaei (1986) showed nineteenth and even early twentieth century male workers and employers and, in some instances, nonworking women promoted the "pin money myth" as justification for women's lower wages. The "pin money" myth was a widespread social belief that women only worked to finance frivolous wants like clothes and accessories to improve their appearances.

The 1970s and 1980s saw the blossoming of interest in the history of women and work. Research into this area yields much supporting evidence for patriarchy theory. Dublin (1979), Kessler-Harris (1982), Matthaei (1986), and Amott and Matthaei (1996) have written extensively about female workers in early industrial America. According to these authors, prior to the Industrial Revolution, colonial women were restricted to working from inside the home. Women were responsible for childbearing, child rearing, and housekeeping; they sometimes performed home production activities like weaving textiles, sewing clothes, farming, and keeping boarding houses to earn extra income. Women were not official labor force participants until textiles emerged as an early manufacturing industry in the nineteenth century. Francis Cabot Lowell, founding father of the American textile factory system, actively sought out female workers when he built the Boston Manufacturing Company in 1814 (Kessler-Harris 1982, 25). Lowell chose women for two reasons. First, women already possessed weaving skills, which they frequently performed to produce homemade clothing (Kessler-Harris 1982, 24-25). Second, female labor could be paid at a cheaper price since most women were property-less (Heilbroner and Singer 1999, 106-107).[19] Lowell created a publicity campaign to convince families to let their single daughters to go work in his mill. Lowell advertised a job as a "mill girl" would be a temporary venture, lasting two or three years between adolescence and marriage (Heilbroner and Singer 1999, 107). Lowell promised to teach

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Working women did not have to worry about basic material needs like food and shelter because these necessities were provided by their male family members. Male workers, on the other hand, had to take care of their stay-at-home wives, children, and other female relatives (such as the sisters who worked for "pin money").

[19] Heilbroner and Singer (1999) noted early capitalist employers had trouble recruiting male workers because men owned farms. Farming men abhorred the idea of working for wages because it would result in a loss of self independence and self sufficiency. Women did not own their own farms, so they approached wage work with a less hostile attitude (Heilbroner and Singer 1999, 106-107).

the girls proper Protestant work ethics and prepare them for their roles as future housewives in return for their employment. Lowell said wages paid to the girls were only an *extra* incentive—and should not be considered the primary motive—for working. Lowell even offered to send wages directly to the girls' male relatives so as to temper parents' fears that their daughters would engage in frivolous and immoral consumption. The example of the Lowell mill girls demonstrates women's low wages has long historical roots, and men played a critical role in setting the female wage condition.

The patriarchal control of women's work extended beyond the textile industry. Teaching, once praised as women's "true profession," is another occupation deeply influenced by patriarchal attitudes (Hoffman 2003, 2). The end of the Civil War brought a tremendous demand for teachers to go south to educate former slaves and to the west to teach in new frontier towns, but there were not enough teachers to meet the demand. Teaching was a low paying occupation prior to the Civil War, reserved for men enrolled in college who happened to be home on vacation and needed temporary work to earn extra income or older men who could not farm or do manufacturing work. Anti-slavery charities and their benefactors determined a more reliable teaching workforce was needed if they were to achieve their goal of educating former slaves. Catherine Beecher, an education advocate, proposed educated, single women would be able to meet the nation's need for teachers because they had the maternal instincts and patience needed to shape young minds. In an address given in 1846, Beecher said:

> ...soon, in all parts of our country, in each neglected village, or new settlement, the Christian female teacher will quietly take her station, collecting the ignorant children around her, teaching them habits of neatness, order, and thrift; opening the book of knowledge, inspiring the principles of morality, and awakening the hope of immortality (Beecher 2003, 78).

Women responded to Beecher's call to action in dramatic fashion. The number of female teachers tripled between 1840 and 1880, and women were three fourths of all teaching professionals by 1990 (Hoffman 2003, 24-25). Women's dominance in teaching did not reflect in their wages or career advancements, however. Women were assigned to teach lower grade levels, and they were rarely selected for administrative positions like school principals or district superintendents. Education level could not have been a factor for their low wages or lack of advancement opportunities. L.D. Coffman conducted a survey in 1910 and found 50 percent of male teachers had two to five years of education beyond elementary school whereas 50 percent of female teachers had three to five years of post-elementary school education (Carter 2002, 16). Coffman also found female teachers were significantly underpaid compared to male teachers. The median salary for teachers with five years of experience was $534 for men and $504 for women; with six years of experience was $658 and $543; with seven years of experience was $800 and $594; with eight years of experience was $983 and $671; and with nine years of experience was $1,083 and $688 (Carter 2002, 16). Women who had the most teaching experience were also the ones who earned the least as a proportion of the median male wage with comparable experience.

Male school administrators made no apology for the gender wage gap in teaching, and they provided three justifications for the gap. First, men needed to earn a living wage to take care of their families, while women were just earning "pin money." This justification was given in spite of a 1913 survey that showed almost a third of single female teachers did not live with their parents (Carter 2002, 19). Second, men needed the monetary incentive to stay in teaching so schools could train them for administrative

positions. Women, on the other hand, quit their jobs when they got married. Third, women were biologically, mentally, and physically inferior to men and thus did not deserve the same wage rate (Carter 2002, 35).

The example of women's entry into teaching in the late nineteenth and early twentieth century shows patriarchy's grip extends into the professional sector as well. Carter (2002) noted,

> In their zealous promotion of women as teachers, these early school reformers constructed an identity for female instructors: They embodied self-sacrifice, sentimentality, patience, and docility, and, though lacking "natural brilliance," [they] willingly worked for low wages (Carter 2002, 27).

Women in other professional occupations also faced similar patriarchal attitudes. Women were told they were only suited to be nurses because they were natural caretakers, and they did not have the intellectual capacity to be doctors (Reverby 1987). Women were suitable for clerical work because their feminine nature was needed to soften the harsh and calculating office environment (Davies 1982). Patriarchal attitudes set the boundaries for the female existence in the workplace, and women were expected to stay within those boundaries.

The theory of patriarchy has been criticized for its adversarial generalizations about male and female social relationships. Kessler-Harris (1990) argued that patriarchy is not a strong enough force to create the gender wage gap on its own and that altruism also plays an important role. Kessler-Harris (1990) acknowledged that patriarchy was the prevailing structure of social and familial interactions in America before the Industrial Revolution, but she believed patriarchy's effects on capitalism is much more nuanced than what has been suggested by Hartmann (1976; 1981). Kessler-Harris (1990) said

capitalism gave rise to the first labor-capital dispute in the 1870s. Workers supported the concept of "free labor," which says every (male) individual should have access to self-sufficiency because it is the only effective mean to achieving self-representation in the American republic (Kessler-Harris 1990, 37). On the other hand, employers promoted the concept of "freedom to contract," which says every individual has the freedom to enter into a contract to work and such freedom is equivalent to suffrage in the republic (Kessler-Harris 1990, p. 38). Kessler-Harris (1990) said courts consistently supported the "freedom to contract" view, and frustrated workers began to speak of a new idea called the "living wage." Male workers argued that if they had to contract themselves out for work, they wanted to ensure their wives and children were spared from such conditions. The living wage was meant to give men the economic means to achieve this goal. Kessler-Harris (1990) noted that while it was indeed male workers who attempted to keep women out of the workforce and who lobbied with employers for higher wages for themselves, men did not do what they did because they feared losing their authority over women. Instead, male workers wanted to protect their families. Patriarchal attitudes were indeed at work in the 1870s labor-capital dispute, but their manifestations were more complex than suggested by patriarchy theory.

Kessler-Harris (1990) provided another example to show her point that altruism is an important factor in wage determination. Kessler-Harris (1990) explained that men and women living during the Great Depression held the belief that work should be given to deserving individuals regardless of gender. Kessler-Harris (1990) explained,

> In the code of honor of working people, jobs belonged to providers. Though this typically meant married men, the scales of justice encompassed widows, single women, and married women with unemployed or disabled husbands as well. And while ambivalence

> reigned about the rights of single men, males with other means of support were clearly excluded (Kessler-Harris 1990, 71).

Kessler-Harris concluded an attitude about "deserving employment" does not square with patriarchal theory. Employment and wages are matters of livelihood in a capitalist society, and, as a consequence, people also demonstrate altruistic tendencies when determining who should work and how much they should be paid for their efforts.[20]

Few econometric studies have been conducted to examine the power perspective of the gender wage gap because power is a difficult concept to quantify. Macpherson and Hirsch (1995) did attempt to address this quantification problem by adding a union status dummy variable to wage equations in their study about female occupational crowding. Macpherson and Hirsch (1995) found a positive correlation between union status and wages for both male and female workers. England, Reid, and Kilbourne (1996) also controlled for the incidence of a worker's wage being set by union collective bargaining in another study about female crowding. The drawback with Macpherson and Hirsch (1995) and England, Reid, and Kilbourne (1996) is the authors did not intend to examine gender power status difference, so they did not give a more complete treatment of the power explanation. Moreover, Macpherson and Hirsch (1995) and England, Reid, and Kilbourne (1996) used a power variable measured at the level of the individual worker. There is reason to believe gender power difference also occurs above the individual level—that is, at the occupational level. Reich, Gordon, and Edwards (1973) and Gordon, Edwards, and Reich (1982) showed men and women are separated into different occupations and men are assigned to occupations with more desirable work tasks and

[20] Kessler-Harris's criticism of patriarchy theory is rooted in the perception that individuals have a preference between being selfish or altruistic. Hence, one could make the argument that Kessler-Harris's criticism is the preference theories' refutation of patriarchy theory.

career ladders. Hartmann (1976) also showed employers' and male workers' patriarchal attitudes ensured women stay in the less-than-desirable occupations and are paid lower wages. Consequently, a more complete treatment of the possibility of gender power difference at the occupational level and its wage effect is needed.

This study attempts to provide the needed econometric examination of the power explanation of the gender wage gap by examining the occupational wage effects of five variables: 1) a dummy for occupations requiring licensing or certification, 2) a dummy for occupations with voluntary licensing or certification, 3) a dummy for occupations that require completion an apprenticeship program for entry, 4) the percentage of workers who are unionized in the occupation, and 5) the percentage of workers who are covered by collective bargaining agreements in the occupation. The first three variables examine workers' abilities to restrict entry into their occupation and, thus, keep up their bargaining power against employers. The latter two variables measure unions' power in wage bargains in the occupation. Previous research shows men and women do not work in the same occupations (Reich, Gordon, and Edwards 1973; Hartmann 1976; Gordon, Edwards, and Reich 1982, Bergmann 1986 and 2005). Consequently, if men and women do possess different power status, the difference should be revealed at the occupational level. I do not control for union status measured at the individual level because the Census and ACS PUMS do not report this information.

Socialization

The socialization explanation does not refute the importance of women's preferences in selecting to work in "female" occupations for low wages; however, socialization theorists disagree with preference theorists that preferences can be taken as

exogenous variables. Instead, socialization theorists say men's and women's decisions about where to work, what to do, and for how much are influenced by social interactions. The socialization explanation offers two contrasting viewpoints about the relationship between socialization and the gender wage gap. Cumulative disadvantage theory argues individuals' socialization in youth influence their work decisions as adults. On the other hand, social control theory argues childhood socialization is not strong enough to be a lifelong factor in work-related decisions and that gender socialization takes place throughout life.

Cumulative disadvantage and social control theories are grounded in a particular view of the relationship between individuals and society called social embeddedness. Granovetter (1983, 1985, 1992, and 2005) theorized that individuals are embedded in a system of social networks. Individuals interact with other individuals by transmitting and receiving information through networks. England and Folbre (2005) said information includes cultural values and beliefs, social norms, laws, and technical knowledge (England and Folbre 2005, 629). Individuals rely on the information received from social networks to make decisions in everyday life, including occupational decisions. For example, a female student decides to major in elementary education in college because she thinks she would enjoy being a teacher. The woman's perception that she would enjoy teaching is probably influenced by many factors. The student sees that society accepts women as teachers because she observes many teachers are of her gender. The woman's peers and family tell her teaching is an appropriate career for women. The woman discovers a scholarship exists for college students who want to become teachers,

and she wants to take advantage of the opportunity. The list of potential influencing factors is long.

Cumulative Disadvantage Theory

Cumulative disadvantage theory argues socialization begins in childhood and its effects are present through adulthood. McPherson, Smith-Lovin, and Cook (2001) reported that children know gender is a permanent personal characteristic by the time they are enrolled in school (McPherson, Smith-Lovin, and Cook 2001, 422). Boys and girls tend to play with others of their own gender, and girls have smaller play groups than boys (McPherson, Smith-Lovin, and Cook 2001, 422). England and Folbre (2005) said boys and girls are also socialized in school, where teachers reward children for demonstrating gender appropriate characteristics. Childhood socialization persists well into adulthood. McPherson, Smith-Lovin, and Cook (2001) noted men are more likely to have network ties that develop in the workplace whereas women are more likely to form ties with wives of individuals who work with their husbands (McPherson, Smith-Lovin, and Cook 2001, 435). Moreover, job-seeking women are less likely to benefit from their male contacts than female contacts unless women share voluntary organizational memberships with their male contacts (McPherson, Smith-Lovin, and Cook 2001, 434). However, women belong to smaller voluntary organizations than men, and they also do not gain as many ties from their organizational memberships as men do (McPherson, Smith-Lovin, and Cook 2001, 432). Given that men's and women's network ties are quite different from each other, it is not difficult to see why they also work in different occupations, jobs, and firms. Women's lack of male network ties also hampers their

ability to move into male-dominated occupations, where wages have traditionally been higher.

Marini and Fan (1997) found a positive relationship between occupational aspirations and occupational attainments for first-time male and female full-time, labor-force participants. Okamoto and England (1999) further found that the gender composition of occupations that men and women aspired and expected to work in is positively correlated with the gender composition of occupations they are actually employed in fourteen years later even when their present and aspired and expected occupations are different.

Social Control Theory

Social control theory differs from cumulative disadvantage in one way: It does not believe childhood socialization is a strong enough force to keep women tied to low-paying female occupations. Jacobs (1989) acknowledged women face tremendous peer pressure to study "female" disciplines in high school and college, but he said the connection between disciplinary studies and subsequent employment is overstated (Jacobs 1989, 59). Instead, Jacobs (1989) proposed there are a set of social control mechanisms that keep women tied to female occupations. Jacobs (1989) found young women entering the labor force seek out female or gender-neutral jobs. Employers, too, hired a large number of women for female jobs, a moderate number for gender-neutral jobs, and a small number in male jobs. Women are thus given the opportunity to enter gender-neutral and male jobs, but they do not remain in these jobs. Male colleagues view hired women as social misfits, which often leads to verbal or physical harassment directed at the women. In addition, male superiors choose to bypass women for

promotions even when the latter demonstrate the desired level of competency. Female workers employed in gender-neutral and male occupations become frustrated with their work conditions and move to female jobs, where wages are lower but so is the emotional distress.

Jacobs (1989) conducted a study in which he found a positive relationship between the gender compositions of occupations women aspired to and actual attainment after being in the labor force for ten years, but he did not interpret his finding the same way as Marini and Fan (1997). Instead, Jacobs (1989) said the weak correlation between occupational aspiration and attainment is due to a peculiar characteristic in his data: A small number of women in his study remained in the occupations they aspired to at the beginning of their work careers. Jacobs (1989) believed these women and their stable aspirations and attainments masked the true relationship between occupational aspirations and attainments for the majority of individuals in his study. When he excluded the women with stable aspirations and attainments, Jacobs (1989) found no significant relationship between the gender compositions of occupations women aspired to and actually attained.[21] However, Okamoto and England (1999) repeated Jacobs's "exclusion" methodology and found a statistically significant positive relationship between gender compositions of occupations women aspired to and actually attained.

Kmec, McDonald, and Tremble (2010) also found evidence consistent with another aspect of social control theory. In their study of individuals who found their current jobs informally through their social networks and who were not actively

[21] Jacobs' exclusion of women who have stable occupational aspirations and attainments (a smaller portion of sampled individuals than those who change their aspirations and attainments) is a methodological flaw. By excluding women with stable occupational aspirations and attainments, Jacobs eliminated a key characteristic of the original dataset, and, thus, cherry picked his sample observations to ensure a desired regression result.

searching for the jobs at the time (the authors called these individuals informal non-searchers), Kmec, McDonald, and Tremble (2010) found male non-searchers who used to work in female-dominated environments and who moved to jobs in male-dominated environments saw their authority over the work environments and wage rates increased. Female non-searchers did not see an increase in their job authority or wage rates when they moved to male-dominated work environments, however. Kmec, McDonald, and Tremble (2010) concluded social networks exert control over men and women in such a way that they elevate men to positions of higher authority and higher wages while keeping women down.

The socialization perspective of the gender wage gap is not examined in this study. The dataset selected for this study, Census and American Community Survey (ACS) Public Use Microdata Samples (PUMS), are cross sectional data and do not survey career aspirations nor do track individuals' employment decisions throughout their lifetime. Without this information, socialization factors cannot be included in the study's presented wage model.

In conclusion, social scientists have proposed many theories to explain the gender wage gap. Neoclassical economists argue the gap is caused by women's preferences about work, which happen to be different from men's. Crowding theorists hypothesize female occupational crowding is the cause of women's lower wages. Power theorists believe men and women earn different wages because they have different power status in workplaces. Researchers of the gender wage gap phenomenon are best served by being cognizant of the four explanations discussed above and their linkages with each other.

CHAPTER 3

METHODOLOGY

The purpose of this study is to examine the wage effects of compensating differentials, power status, and female occupational crowding on men and women in 103 selected occupations between the 1950 Census and 2008 ACS. Chapter 3 describes the methodology used to investigate the research questions of this study, and it is divided into three sections. The first section presents the wage models constructed to examine the wage effects of compensating differentials, power, and female crowding. The second section lays out the hypotheses about the wage effects of compensating differentials, power, and female crowding. The third section discusses the data and methods used to fit the wage models.

Wage Models

Mincer and Polachek (1974) presented the human capital wage model in their effort to explain the gender wage gap:

$$\ln W_i = \sum \beta_k DEM_{i,k} + \sum \beta_l HC_{i,l} + \varepsilon_i$$

An individual's natural log of the hourly wage rate is a function of his or her personal characteristics (such as gender, race, marital status, number of children, and full-time or part-time work status) and human capital characteristics (such as work experience and education).

Johnson and Solon (1986) extended Mincer and Polachek's model to account for female occupational crowding. Gender crowding is represented by the variable FEM, which is the ratio of female workers to all workers (male and female) in an occupation:

$$\ln W_i = \sum \beta_k DEM_{i,k} + \sum \delta_l HC_{i,l} + \theta FEM_i + \varepsilon_i$$

A negative FEM coefficient indicates a high concentration of women in an occupation is correlated with low wages for workers. Macpherson and Hirsch (1995) estimated Johnson and Solon's wage model separately for male and female workers because they believe it is possible that the error structures of the male and female models are different. Factors left unaccounted in the male and female wage models may not be the same, and if this is the case, the error terms would be different as well.

Filer (1989) included measures for physical hardship to the human capital wage model. Jacobs and Steinberg (1990) constructed a similar compensating differentials model, and they included measures for physical hardship and performing repetitive work tasks. Jacobs and Steinberg (1990) said the control for work repetition is necessary because women are employed in occupations that demand this undesirable work characteristic. Macpherson and Hirsch (1995) also included a large number of controls for physical hardship and repetitive work in their human capital with crowding model. This study includes three compensating differentials controls: physical hardship, mental stress, and lack of freedom to determine one's work tasks and pace of work. The construction of the gender compensating differentials measures will be discussed in the data and methods section below.

Past studies have not examined wage effect of gender power difference except in a very limited way. Macpherson and Hirsch (1995) included a dummy accounting for a worker's union membership status in their wage model. England, Reid, and Kilbourne (1996) controlled for the incidence where a worker's wage is set by union collective bargaining agreements. However, power theorists have argued gender power difference manifests itself above the individual level. Reich, Gordon, and Edwards (1973),

Hartmann (1976), and Gordon, Edwards, and Reich (1982) showed men and women are separated into different occupations and men are assigned to occupations with more desirable work tasks and career ladders. Consequently, the chosen wage model that incorporates the power explanation must do so at the occupational—and not the individual—level. Five power variables will be examined in this study: whether the occupation requires licensing or certification, whether the occupation has voluntary licensing or certification, whether a worker can only enter the occupation via an apprenticeship program, percentage of workers who are unionized in the occupation, and percentage of workers who are covered by collective bargaining agreements in the occupation. The first three variables examine workers' abilities to restrict entry into their occupation and, thus, keep up their bargaining power against employers. The latter two variables measure unions' power in wage bargains in the occupation.

Another focus of this dissertation is to examine the wage effects of female occupational crowding throughout the post-World War II era. This study defines the beginning of the postwar era as April 1949, the time period for which the 1950 Census (the first postwar census) was conducted, and the end of the postwar era as January to December 2007, the time period for which the 2008 American Community Survey was conducted. During this specified time period of analysis, the relationship between female occupational crowding and wages may have undergone state-dependent changes. Consequently, the robustness of the chosen wage model will be tested on six Census PUMS between 1950 and 2000 and four ACS PUMS between 2005 and 2008.

The dependent variable of the chosen wage model is the natural logarithm of annual wage, which is different from the natural logarithm of hourly wage dependent

variable typically used in gender wage gap studies [see discussion about Mincer and Polachek (1974) above]. Annual wage is income earned from working in a twelve months period, but this period does not necessarily coincide with a calendar year. The decennial Census Public Use Microdata Samples (PUMS) asked individuals to report their pretax wages and salaries from the previous calendar year. For example, individuals sampled in the 2000 Census would report their wages and salaries from 1999. The annual American Community Survey (ACS) PUMS asked individuals to report their wages and salaries from the past twelve months. Because the ACS is conducted throughout the year, sampled individuals' reported wages and salaries do not reflect a calendar year. For example, an individual sampled in January 2008 would report his or her wage for January through December 2007 but an individual sampled in February 2008 would report wages for February 2007 through January 2008.

Attempts to construct an hourly wage rate were carried out, but a decision was made against using the hourly wage rate variable after noticing the loss of important sample information in the constructed variable. The hourly wage rate is constructed using the annual wage, the number of hours worked last week reported in intervals of hours, and the number of weeks worked last year reported in intervals of weeks for the 1950 through 1970 Census. The 1980 Census through 2008 ACS do not report the number of hours worked last week in intervals of hours but rather the number of usual hours worked per week, so this variable is used to construct the hourly wage rate for these PUMS. The constructed hourly wage variable shows a large amount of sample information inconsistency. There are high, median, and low annual wage earners at every hourly wage rate; this is due to variation in the reported hours worked last week, the usual hours

worked each week, or the number of weeks worked last year. A two part solution for the problematic hourly wage variable is offered. First, this study will use annual wage as the dependent variable in order to retain the full sample information provided by the Census and ACS. Second, a control for the variation in the number of hours worked in a week and number of weeks worked is specified in the form of a "full-time" and "part-time" work status. A worker is considered part-time status if s/he works at least fifteen hours a week irrespective of the number of weeks worked last year. A worker is considered full-time if s/he works at least 30 hours a week and for at least 40 weeks last year.[22] Individuals who do not meet part-time work status are excluded from the study. It is important to note that controlling for the hours and weeks worked is important because Stanley and Jarrell (1998) found researchers tend to report a larger wage gap when using annual wage rather than hourly wage as the dependent variable. The authors argued such a finding is not surprising because annual wage does not control for the difference in the number of weeks both sexes work in a year. Men are more likely to work more weeks in a year than their female counterparts (Stanley and Jarrell 1998, 963).

The following list specifies the ten wage models that are fitted to the ten PUMS between 1950 and 2008:

Model 1 (Human Capital Model):

$$\ln Wage_{i,t} = \sum \beta_{k,t} PC_{i,k,t} + \sum \beta_{l,t} HC_{i,l,t} + \varepsilon_{i,t}$$

Model 2 (Human Capital + Crowding Model):

$$\ln Wage_{i,t} = \sum \beta_{k,t} PC_{i,k,t} + \sum \delta_{l,t} HC_{i,l,t} + \theta_t FEM_{i,t} + \varepsilon_{i,t}$$

Model 3 (Human Capital + Compensating Differentials Model):

[22] For example, an individual who works more than 30 hours a week but less than 40 weeks last year would be considered a part-time worker.

$$\ln Wage_{i,t} = \sum \beta_{k,t} PC_{i,k,t} + \sum \delta_{l,t} HC_{i,l,t} + \sum \gamma_{m,t} CD_{i,m,t} + \varepsilon_{i,t}$$

Model 4a (Human Capital + Power Dummies):

$$\ln Wage_{i,t} = \sum \beta_{k,t} PC_{i,k,t} + \sum \delta_{l,t} HC_{i,l,t} + \sum \varphi_{n,t} PD_{i,n,t} + \varepsilon_{i,t}$$

Model 4b (Human Capital + All Power Variables):

$$\ln Wage_{i,t} = \sum \beta_{k,t} PC_{i,k,t} + \sum \delta_{l,t} HC_{i,l,t} + \sum \varphi_{n,t} P_{i,n,t} + \varepsilon_{i,t}$$

Model 5 (Human Capital + Crowding + Compensating Differentials):

$$\ln Wage_{i,t} = \sum \beta_{k,t} PC_{i,k,t} + \sum \delta_{l,t} HC_{i,l,t} + \theta_t FEM_{i,t} + \sum \gamma_{m,t} CD_{i,m,t} + \varepsilon_{i,t}$$

Model 6a (Human Capital + Crowding + Power Dummies):

$$\ln Wage_{i,t} = \sum \beta_{k,t} PC_{i,k,t} + \sum \delta_{l,t} HC_{i,l,t} + \theta_t FEM_{i,t} + \sum \varphi_{n,t} PD_{i,n,t} + \varepsilon_{i,t}$$

Model 6b (Human Capital + Crowding + All Power Variables):

$$\ln Wage_{i,t} = \sum \beta_{k,t} PC_{i,k,t} + \sum \delta_{l,t} HC_{i,l,t} + \theta_t FEM_{i,t} + \sum \varphi_{n,t} P_{i,n,t} + \varepsilon_{i,t}$$

Model 7a (Human Capital + Crowding + Compensating Differentials + Power Dummies):

$$\ln Wage_{i,t} = \sum \beta_{k,t} PC_{i,k,t} + \sum \delta_{l,t} HC_{i,l,t} + \theta_t FEM_{i,t} + \sum \gamma_{i,m,t} CD_{i,m,t} + \sum \varphi_{n,t} PD_{i,n,t} + \varepsilon_{i,t}$$

Model 7b (Human Capital + Crowding + Compensating Differentials + All Power Variables):

$$\ln Wage_{i,t} = \sum \beta_{k,t} PC_{i,k,t} + \sum \delta_{l,t} HC_{i,l,t} + \theta_t FEM_{i,t} + \sum \gamma_{i,m,t} CD_{i,m,t} + \sum \varphi_{n,t} P_{i,n,t} + \varepsilon_{i,t}$$

where

t = PUMS year, in which *t* is one of the following years: 1950, 1960, 1970, 1980, 1990, 2000, 2005, 2006, 2007, and 2008

$\ln Wage_i$ = an individual's natural logarithm of wage and salary for a year

PC = personal characteristic variables including:

1) Four dummy variables representing race: Black/Negro (*Black*), American Indian or Alaska Native (*Native*), Chinese, Japanese, other Asian or Pacific Islander (*Asian*), and those of mixed race or whose race is not one of the previously cited category or white (*Other*). White (*White*) is the null dummy variable.

2) Three dummy variables representing family status: *Spouse* represents individuals who are married with spouse present; *Divorced* for individuals who are "separated, divorced, or windowed"; *Under5* is another variable indicating whether the individuals have children under five year old. *Single* is the null dummy variable.

3) A dummy variable to identify part-time worker (*PT*).

4) Twelve dummy variables representing the industry in which the individual is employed: mining (*Mine*), construction (*Cons*), manufacturing(*Manufacturing*), wholesale trade (*Wholesale*), retail trade (*Retail*), transportation and warehousing (*Transportation*), utilities (*Utilities*), information and communications (*Information*), finance, insurance, real estate, rental and leasing (*Finance*), professional, scientific, management, administrative, waste management, educational, health, and social services (*Professional*), arts, entertainment, recreation, accommodation, food, and other (not public administration) services (*Services*), and public administration (*PublicAd*). Agriculture (*Ag*) is the null dummy variable.

HC = human capital variables including years of schooling (*Schooling*), years of potential work experience (*Expr*), squared years of potential work experience ($Expr^2$). The Census and ACS report an individual's education in categories, which requires me to assign numerical values to the categories. Table 3.1 shows the number of years of schooling

assigned to each educational level category. Years of potential work experience is calculated as follows: *Expr* = age of individual – *Schooling* – 5. The number "5" represents the age an individual must reach before being able to attend kindergarten.

TABLE 3.1

ASSIGNED YEARS OF SCHOOLING

Census & ACS Educational Level	Assigned Number of Years of Schooling
Not available or no schooling	0
Nursery school to grade 4	4
Grade 5, 6, 7, or 8	8
Grade 9	9
Grade 10	10
Grade 11	11
Grade 12	12
1 year of college	13
2 years of college	14
3 years of college	15
4 years of college	16
5+ years of college	17

CD = compensating differentials variables including three indices for physical hardship (*Physical*), mental stress (*Mental*), and lack of freedom to control one's work tasks and pace of work (*WrkFreedom*)

PD = power dummy variables including whether the occupation required licensing or certification for entry (*LicenseRe*); whether the occupation has voluntary licensing or

certification (*LicenseVol*); and whether a worker must be admitted into and complete an apprenticeship program to gain entry into the occupation (*Apprentice*)

P = all power variables. These include the three power dummies (*LicenseRe*, *LicenseVol*, and *Apprentice*) plus the percentage of workers who are unionized in the occupation (*UnionPer*) and percentage of workers who are covered by collective bargaining agreements in the occupation (*BargainPer*).

Information about occupational unionization and collective bargaining coverage was not available for samples prior to 1990. After 1990 this information is gathered from the Union Membership and Coverage Database. As a consequence, Models 4b, 6b, and 7b are only fitted for the 1990-2000 Census and the 2005-2008 ACS PUMS. In addition, the ten wage models fit to the 1950 Census PUMS do not contain the variable *Other* due to lack of observations. No woman and only one man employed in selected occupations in the 1950 Census are identified as being of mixed or an unidentified race.

Hypotheses

Three hypotheses about the wage effects of compensating differentials, power status, and female occupational crowding are examined in this study. The first hypothesis is workers employed in the selected occupations that have a high degree of physical hardship (*Physical*) and lack of work freedom (*WrkFreedom*) received wage penalties; this hypothesis is consistent with Jacobs and Steinberg (1990). On the other hand, workers employed in mentally stressful (*Mental*) occupations should receive wage premiums; this hypothesis has not been examined in previous studies, but it is consistent with Filer (1989) who argued workers are paid higher wages for working in undesirable conditions. The second hypothesis is that workers employed in occupations with required

or voluntary license or certification (*LicenseRe* and *LicenseVol*), required apprenticeship (*Apprentice*), and high percentages of union membership (*UnionPer*) and collective bargaining coverage (*BargainPer*) have greater power status and, thus, earned wage premiums. The third hypothesis is that workers employed in female-crowded selected occupations suffer wage penalties; this hypothesis is consistent with Bergmann (1974).

Joint Significance Tests of Compensating Differentials and Power Variables

In order to three hypotheses laid out above, a decision must be made which of the ten wage models is the most appropriate for selected male and female observations in each PUMS. The selection of the preferred wage model is a two step process. First, a determination must be made whether the inclusion of compensating differentials and power variables increase the predictive power of the basic human capital + crowding model (Model 2). Second, the increase in the predictive power of compensating differentials and power variables, if they are statistically significant, must justify the cost of selecting a less simple model over Model 2. Model 2 is chosen as the "base model" of analysis for two reasons: 1) Jarrell and Stanley (2004) showed schooling and work experiences are important wage determinants and 2) Johnson and Solon (1986), England et al. (1988), Macpherson and Hirsch (1995), England, Reid, and Kilbourne (1996), Lewis (1996), and Solberg (2005) showed female occupational crowding is also an important wage determinant.

Two sets of joint significance tests, the first for compensating differentials measures and the second for power variables, are conducted on Models 7a and 7b. Model 7a is the resulting wage model if the compensating differentials and the three power dummies are jointly significant. Model 7b is the resulting wage model if the

compensating differentials and all five power variables are jointly significant. As stated earlier, Model 7b is only fitted for the 1990 Census through 2008 ACS because the information needed to construct the *UnionPer* and *BargainPer* variables are not available until 1983.

Wald Test of Joint Significance of Compensating Differentials Measures

The test of joint significance of compensating differential variables is performed on Models 7a and 7b separately. The hypothesis of each test takes the following form:

$$H_0: \gamma_1 = \gamma_2 = \gamma_3 = 0$$

$$H_1: \gamma_1 = \gamma_2 = \gamma_3 \neq 0$$

where:

γ_1 = estimate of the regression coefficient of wage effect of physical hardship (*Physical*)

γ_2 = estimate of the regression coefficient of wage effect of mental stress (*Mental*)

γ_3 = estimate of the regression coefficient of wage effect of worker's lack of autonomy over work environment (*WrkFreedom*)

The standard joint significance test used in regression analysis is the F-test; however, the F-test is not suitable when the dependent variable, the natural log of annual wage, is censored. The U.S. Bureau of the Census places a ceiling on reported annual wages of high earners. Because the wages reported for high income earners are not their true wages, OLS estimation yield biased estimates of the regression coefficients. The solution for the top coding problem is to utilize a "Tobit model" to fit the data. (A detailed explanation of the Tobit model will be presented in the next section of this chapter.) When estimating nonlinear models like the Tobit, the Wald test is used in place

of the F-test. The calculated Wald statistic measures the distance in standard error between estimated parameters and the hypothesized value (Greene 2008, 299):

$$W = [r(b) - q]'\{Estimated\ Asymptotic\ Variance[r(b) - q]\}^{-1}[r(b) - q]$$

where:

$r(b)$= estimate of $r(\beta)$, which is a column vector of J continuous functions of the elements of parameters β

q = the hypothesized value, which is 0 in a joint significance test

The calculated Wald statistic is compared against the critical value from the chi square distribution. The determination of the chi square critical value depends on the chosen level of significance, which is usually set at 1% or 5%.[23] If the Wald statistic is greater than the critical chi square value, the null hypothesis is rejected.

Wald Test of Joint Significance of Power Variables

Three Wald tests for the joint significance of the power variables are also carried out. The first one tests the joint significance of the three power dummies; the second examines the joint significance of percentages of workers who have union membership (*UnionPer*) and who are covered by collective bargaining agreements (*BargainPer*); and the third examines all five power variables. The first Wald test is performed on Model 7a, and it takes the following form:

$$H_0: \varphi_1 = \varphi_2 = \varphi_3 = 0$$

$$H_1: \varphi_1 = \varphi_2 = \varphi_3 \neq 0$$

where:

[23] The level of significance is the probability of rejecting the null hypothesis when it is in fact true.

φ_1 = estimate of the regression coefficient of wage effect of required license/certification for occupational entry (*LicenseRe*)

φ_2 = estimate of the regression coefficient of wage effect of voluntary license/certification (*LicenseVol*)

φ_3 = estimate of the regression coefficient of wage effect of required apprenticeship for occupational entry (*Apprentice*)

The second Wald test examines the significance of *UnionPer* and *BargainPer*:

$H_0: \varphi_4 = \varphi_5 = 0$

$H_0: \varphi_4 = \varphi_5 \neq 0$

where:

φ_4 = estimate of the regression coefficient of wage effect of percentage of workers who are union members in occupation (*UnionPer*)

φ_5 = estimate of the regression coefficient of wage effect of percentage of workers who are covered by collective bargaining agreements in occupation (*BargainPer*)

The third Wald test examines the significance of all five power variables, *LicenseRe*, *LicenseVol*, *Apprentice, UnionPer,* and *BargainPer*:

$H_0: \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 = 0$

$H_0: \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 \neq 0$

Preferred Wage Models

The Wald tests determine whether the compensating differentials, power dummies, or all five power variables should be included in Model 2 for each PUMS, but they do not show whether the inclusion of these variables yield models that have the best goodness-of-fit. The minimum Akaike Information Criterion (AIC) rule is one that can be

applied to find the preferred model for each PUMS. The AIC is a measure of goodness-of-fit for nonlinear regression models, and it is comparable to the adjusted R^2 fit measure in linear regressions. The calculation of the AIC is as follows (Greene 2008, 143):

$$AIC(K) = ln\left(\frac{e'e}{n}\right) + \frac{2K}{n}$$

where:

$e'e$ = sum of squared residuals

K = number of parameters

n = number of observations

The AIC accounts for two things: the discrepancy between the estimated and real values of the dependent variable and the principle of parsimony, which favors fewer independent variables to more given a measured discrepancy (Wilson and Keating 2009, 246-247). A calculated AIC has no practical meaning by itself, but the comparison of AICs calculated from two or more regressions is useful in determining goodness-of-fit. The minimum AIC rule indicates the model with the lowest AIC has the best goodness-of-fit because it minimizes the measured discrepancy while adhering to the principle of parsimony. Thus, the preferred model chosen for each PUMS in this study is the simplest wage model with the highest predictive power, given the joint significance of the compensating differentials and power variables.

Hypothesis Tests of Compensating Differential, Power, and Crowding Variables

After the preferred wage models are specified, the statistical significance of each compensating differentials, power, and crowding variables is examined.

(1)

$H_0: \gamma_1 \geq 0$

$$H_1: \gamma_1 < 0$$

where:

γ_1 = estimated regression coefficient of wage effect of physical hardship (*Physical*)

(2)

$$H_0: \gamma_2 \leq 0$$

$$H_1: \gamma_2 > 0$$

where:

γ_2 = estimated regression coefficient of wage effect of mental stress (*Mental*)

(3)

$$H_0: \gamma_3 \geq 0$$

$$H_1: \gamma_3 < 0$$

where:

γ_3 = estimated regression coefficient of wage effect of worker's lack of autonomy over work environment (*WrkFreedom*)

(4)

$$H_0: \varphi_1 \leq 0$$

$$H_1: \varphi_1 > 0$$

where:

φ_1 = estimated regression coefficient of wage effect of required license/certification for occupational entry (*LicenseRe*)

(5)

$$H_0: \varphi_2 \leq 0$$

$$H_1: \varphi_2 > 0$$

where:

φ_2 = estimated regression coefficient of wage effect of voluntary license/certification (*LicenseVol*)

(6)

$$H_0: \varphi_3 \leq 0$$

$$H_1: \varphi_3 > 0$$

where:

φ_3 = estimated regression coefficient of wage effect of required apprenticeship for occupational entry (*Apprentice*)

(7)

$$H_0: \varphi_4 \leq 0$$

$$H_1: \varphi_4 > 0$$

where:

φ_4 = estimated regression coefficient of wage effect of percentage of workers who are union members in occupation (*UnionPer*)

(8)

$$H_0: \varphi_5 \leq 0$$

$$H_1: \varphi_5 > 0$$

where:

φ_5 = estimated regression coefficient of wage effect of percentage of workers who are covered by collective bargaining agreements in occupation (*BargainPer*)

(8)

$$H_0: \theta \geq 0$$

$H_1: \theta < 0$

where:

θ = estimate of the regression coefficient of wage effect of female crowding in the occupation (*FEM*)

The null hypothesis is rejected if the calculated t-test statistic (t_{STAT}) is less than the critical t-value at the chosen level of significance in a lower tail hypothesis test; the null hypothesis is rejected if the t-test statistic is greater than the critical t-value in an upper tail hypothesis test. ***(1)***, ***(3)***, and ***(9)*** are lower tail hypothesis tests whereas ***(2)***, ***(4)***, ***(5)***, ***(6)***, ***(7)***, and ***(8)*** are upper tail hypothesis tests.

The t-test statistic (t_k) is calculated as follows:

$$t_k = \frac{\hat{b}_k - \beta_k}{se_{\hat{b}_k}}$$

where

t_k follows a t-distribution with n-k degrees of freedom; n is the number of observations and k is the number of parameters estimated

β_k = populated parameter

$\hat{b}_k$ = coefficient estimate of β_k

$se_{\hat{b}_k}$ = standard error of $\hat{b}_k$

Data and Methods

Four data sources are used in this study: Census and American Community Survey (ACS) Public Use Microdata Samples (PUMS), Occupational Information Network (O*NET), Occupational Outlook Handbooks (OOH), and Union Membership and Coverage Database. The Census and ACS PUMS provide the samples needed to fit

the constructed wage models. O*NET provides occupational work condition information necessary to construct the compensating differentials variables. OOH and UMCD provide power status information of workers employed in an occupation. This section describes the nature of each data source and its contribution to the study.

Census and ACS PUMS

The samples used in this study are six decennial 1% Census PUMS between 1950 and 2000 and four annual ACS PUMS between 2005 and 2008. Each Census year sample contains demographic, work-related, and income information of 1% of the U.S. population during the sampled time period. The 1950 Census PUMS does not contain information about individuals living in Hawaii or Alaska. Each Census PUMS is conducted in April of every census year—1950, 1960, 1970, 1980, 1990, and 2000. Each ACS PUMS is conducted throughout a given calendar year. There are four data comparability problems in the six decennial Census PUMS due to the extended period of time covers by the PUMS. The data comparability problems and solutions to overcome these problems are described below.

Comparability of Age Variable

The PUMS between 1950 and 1970 sampled working individuals 14 years and older. The PUMS after 1980 sampled workers 16 years and older. This study only examines individuals who are at least 16 year old in order to maintain minimum working age comparability across PUMS.

Comparability of Hours Worked Last Week, Usual Hours Worked Last Week, and Weeks Worked Last Year

The hours worked last week, the usual hours worked each week, and the weeks worked last year variables are not measured the same. The hours worked last week variable was reported in intervals for the 1950 through 1970 PUMS whereas the usual hours worked each week was reported as values between 0 and 99 for the 1980 through 2008 PUMS. The problem is resolved by taking the midpoint of each interval for the hours worked last week variable and assigning the midpoints as numerical values for sampled persons in the 1950 through 1970 PUMS. The midpoint values used are 0, 7.5, 22, 32, 37, 40, 44.5, 54, and 60. The three variables measuring amount of time spend working are then used to construct two worker status dummies: part-time and full-time. A part-time worker must work at least 15 hours but less than 30 hours last week or usually each week; however, no number of weeks worked last year requirement is imposed. A full-time worker must work at least 30 hours last week or usually each week for at least 40 weeks last year.

Comparability of Occupational Titles and Codes

The Census and ACS group occupations into "occupational codes." The occupational titles identified in each occupational code change from one PUMS to the next, and the changes are more pronounced in some years than in others. The Census and ACS change the titles in the codes because employer demand for worker skills has changed throughout the postwar era. The Census and ACS add new titles when employers demand new work skills. When employers cease demand for certain work skills, the Census and ACS delete the titles linked to these tasks. The Census and ACS also merge and split titles into new and/or existing codes if they deem the work tasks of certain titles were similar enough to be grouped together. The changing titles in the

occupational codes across the PUMS present a problem for the study. This problem is resolved by identifying occupational codes whose titles have remained consistent between the 1950 and 2008 PUMS. Two rules are created for matching the disparate occupational codes.

The first rule is if the codes contain the same title(s) in all ten PUMS, they are matched together and are given one consistent occupational code based on the 2005 ACS coding structure. The new assigned code is labeled "recode" to differentiate between what code is assigned by the Census and ACS and what code is assigned by this study. Each recode represents one "selected occupation" in this study. The second rule is if there are PUMS years when previously existing title(s) under one code are split into two codes but no additional title(s) are added, this study combines the split codes into one code during the "split years" and the combined code is matched with the codes of the "non-split" years. The matched "split" and "non-split" codes are then assigned a consistent recode. Each recode is a four digit number that is also based on the 2005 ACS coding structure; the fourth digit in each recode is "1," and it signifies a selected occupation that has been split at some point in the PUMS. For example, "lawyers and judges" are assigned code "055" in the 1950 Census and code "105" in the 1960 Census. The occupation titles are split into two codes for the 1970 through 2000 Census: code "30" for judges and code "31" for lawyers in the 1970 Census, code "178" for lawyers and code "179" for judges in the 1980 and 1990 Census, code "210" for lawyers and code "211" for "judges, magistrates, and other judicial workers" in the 2000 Census.[24] The occupational titles are then regrouped in the 2005 through 2008 ACS as code "210."

[24] Judicial workers do not include people in assistant positions like clerks or security personnel. They only include people who have power similar to those of judges.

These disparate occupational codes are matched up and then reassign the recode "2101" to create coding consistency. Recode "2101" is considered one selected occupation. There are eight other selected occupations with the same "split" and "non-split" codes like recode 2101: recode "2051" for "directors, religious activities and education and all other religious workers," recode "2301" for "preschool, kindergarten, elementary, middle school, and secondary school teachers," recode 2441 for "library technicians and clerical library assistants," recode "2811" for news analysts, reporters, correspondents, and editors," recode "4051" for "combined food preparation and serving workers, including fast food and counter attendants, cafeteria, food concession, and coffee shop," recode 5701 for "secretaries, administrative assistants, word processors, and typists," recode 8241 for "job printers, prepress technicians and workers, and printing machine operators," and recode "9351" for "parking lot and service station attendants."

The result of the recoding procedure are reported in ten Occupational Bridge Codes tables entitled "code50" for the 1950 Census, "code60" for the 1960 Census, "code70" for the 1970 Census, "code80" for the 1980 Census, "code90" for the 1990 Census, "code00" for the 2000 Census, "code05" for the 2005 ACS, "code06" for the 2006 ACS, "code07" for the 2007 ACS, and "code08" for the 2008 ACS. The tables "code05," "code06," "code07," and "code08" are exactly the same because the ACS last changed its coding scheme in 2005. Interested readers can access the Occupational bridge Codes tables at https://sites.google.com/site/bridgecodes/.

The occupational title comparability requirement restricts the study's analysis to selected occupations, suggesting there may be a problem of sample selection bias. Heckman (1979) noted selection bias exists when the sampled individuals select

themselves into a researcher's study. Heckman showed parameter estimates are biased when regression models do not control for selection bias. Heckman's solution for selection bias is a two step procedure. In the first step, the researcher constructs a selection model to estimate λ or the probability of a sampled individual being selected into the study. In the second step, λ is incorporated into the wage model to account for selection bias. In other words, the failure to correct for selection bias is equivalent to omitting an important explanatory variable of wage determination.

If sample selection bias does exist in this study, then the bias is an arbitrary occurrence caused by the Census' and ACS's occupational categorization decisions. The Census and ACS do not publish information about the methods used in deciding how occupational titles are grouped together. Furthermore, it would not have been possible to make an educated guess as to why individuals choose to work in selected occupations even if the Census's and ACS's occupational categorization methodology is known. Without being able to determine systematic cause(s) of the selection bias, this possible problem cannot be corrected.

Comparability of Wage Variable

The Census and ACS have a practice of "top coding" the wage variable. Sampled individuals who reported wages above a predetermined ceiling are assigned the ceiling, or "top coded" value. The Census and ACS argued top coding is necessary to maintain the confidentiality of top income earners because there are fewer observations of top earners than observations of median and low income earners (U.S. Bureau of the Census 1992, 3-1). The Census used a national top-coded wage value for the 1950 through 1980 PUMS. The top-coded values for these years in chronological order are $10,000,

$25,000, $50,000, and $75,000. The Census switched to a state-level, top-coding scheme in the 1990 PUMS. Individuals who earned above the national ceiling of $140,000 had their wages and salaries top coded with the *median* value of all above-national-ceiling earners in their states of residence. The Census adopted a similar coding scheme in the 2000 PUMS, which resulted in earners being coded above the national ceiling of $175,000 with the *mean* value of all above-national-ceiling earners in their states of residency. The bureau did not report how it decided on the published national ceilings in the PUMS except for census year 1990. The 1990 PUMS codebook contained the following statement about the national ceiling value:

> Most economic items were topcoded on a national basis. The criteria used was whether the topcode protected either ½ of 1% of total universe or 3% of the cases with the characteristic. In most instances, we used the value that was more favorable to the user (U.S. Bureau of the Census 1992, C-1).

A request was made with the Integrated Public Use Microdata Series (IPUMS) of the Minnesota Population Center, a federally funded research project whose mission is to collect and distribute census data, for assistance on finding the rule the Census used to set national wage ceiling values in other PUMS. Brandon Trampe, an IPUMS researcher who answered the request, was not able to find the rule. Furthermore, Mr. Trampe said he did not know of any individual who has completed research to determine how the Census sets its wage and salary ceiling.[25] Interested readers should refer to Appendix B to view the electronic mail correspondences between this study's author and Mr. Trampe.

[25] Mr. Trampe also performed calculations to show that the variable wage is top-coded by state of residency and not state of employment. This top coding scheme is problematic because there are individuals who do not work and live in the same states. For example, some individuals work in Missouri but live in Kansas and vice versa. The top coding scheme rules out the possibility of controlling for state legislations that may affect the power status of workers in an occupation in a given state. For example, the variables *UnionPer* and *BargainPer* are included to account for the occupation's bargaining power via unionization; however, a union's ability to affect the wage bargaining process is limited by the law of the

The ACS eliminated the national ceiling coding scheme in its PUMS beginning in 2005. The ACS set the ceiling at 99.5 percentile of the reported wages for each individual state. Individuals who earned above the state ceiling were assigned the mean value for all observations above that ceiling. The ACS's top coding scheme results in 50 state-level wage ceilings for each PUMS. This dissertation addresses the incomparability between the Census's national ceiling and the ACS's state ceiling by imposing a national-level top code requirement on the ACS PUMS. The national ceiling in each ACS PUMS is set at the value of the state with the lowest top code. The state of West Virginia reported the lowest state-level top code for four consecutive years between 2005 and 2008, so its top codes were used as national ceilings. The assigned national ceiling values for the ACS in chronological order is $132,000, $143,000, $239,000, and $238,000. The assigned ceiling values ensured all individuals whose wages are top coded by the ACS would be identified in the wage regressions. The drawback of this practice is that it results in a larger proportion of individuals having top-coded wages than in the original PUMS.

The practice of top coding wages is equivalent to censoring true data values. Tobin (1958) observed ordinary least squares estimation of censored data results in biased estimates. Tobin showed the censored data problem can be overcome by utilizing an index regression model (Greene 2008, 869):

$$\ln Wage_i^* = x_i'\beta + \varepsilon_i,$$

$$\ln Wage_i = a \; if \; \ln Wage_i^* \geq a$$

$$\ln Wage_i = \ln Wage_i^* \; if \; \ln Wage_i^* < a$$

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state in which their chapters reside. Right to work legislation illegalizes a union's "closed shop" policy. The National Right to Work Legal Defense Foundation reports 23 states currently have some form of right to work legislation (http://www.nrtw.org/rtws.htm). Since it is not possible to control for state of employment, this dissertation cannot examine the wage effects of right to work legislation and the interaction between a right to work legislation dummy and *UnionPer* or *BargainPer*.

where

$x_i'\beta$ = vector of regressors

a = national ceiling value in each Census or ACS PUMS, which is reported in previous paragraphs.

Greene (2008) showed Tobin's censored regression model (also called the "tobit model") can be estimated using a log-likelihood function:

$$\ln L = \sum_{y_i>0} -\frac{1}{2}\left[\log(2\pi) + ln\sigma^2 + \frac{(y_i - x_i'\beta)^2}{\sigma^2}\right] + \sum_{y_i=0} \ln[1 - \Phi\left(\frac{x_i'\beta}{\sigma}\right)$$

The first part in the above function is the classical regression for the continuous observations, and the second part corresponds to the relevant probabilities for the censored observations (Greene 2008, 874-875). The estimated mean and the variance are as follows (Greene 2008, p. 871):

$$E[lnWage] = a(1 - \Phi) + [\mu + \sigma\lambda]\Phi$$

$$Var[lnWage] = \sigma^2\Phi[(1 - \delta) + (\alpha - \lambda^2)(1 - \Phi)]$$

where $\alpha = \frac{a-\mu}{\sigma}, \phi(\alpha) is\ the\ standard\ normal\ density\ and$

$$\lambda(\alpha) = \frac{-\phi(\alpha)}{\Phi(\alpha)}$$

Occupational Information Network

The Occupational Information Network, or O*NET, is an online database sponsored by the U.S. Department of Labor/Employment and Training Administration and the North Carolina Employment Security Commission. O*NET contains information about physical and mental demands of hundreds of occupations, which closely mirror the occupational codes in the Census and ACS PUMS. This dissertation utilizes the occupational characteristics in the O*NET to construct measures of physical hardship,

mental stress, and lack of work autonomy occupations. The physical hardship index contains 24 characteristics, and the characteristics are listed in Table 3.2 below. O*NET assigns a "grade" for each of the 24 work condition characteristics; each grade is measured on a scale between 0 and 100. The average of the 24 grades is calculated and then assigned as the mean degree of physical hardship (*Physical*) suffered when employed in the selected occupation.

TABLE 3.2

CHARACTERISTICS INCLUDED IN THE PHYSICAL HARDSHIP INDEX

1.	Frequency of being in cramped work space or awkward positions
2.	Frequency of dealing with physically aggressive people
3.	Frequency of being exposed to contaminants
4.	Frequency of being exposed to disease or infections
5.	Frequency of being exposed to hazardous conditions
6.	Frequency of being exposed to hazardous equipment
7.	Frequency of being exposed to high places
8.	Frequency of being exposed to minor burns, cuts, bites, or stings
9.	Frequency of being exposed to radiation
10.	Frequency of being exposed to whole body vibration
11.	Frequency of being exposed to extremely bright or inadequate lighting
12.	Frequency of working indoors in non-controlled environmental conditions
13.	Frequency of working outdoors and being exposed to the weather
14.	Frequency of being exposed to distracting/uncomfortable noise levels
15.	Frequency of spending time bending and twisting one's body
16.	Frequency of spending time climbing ladders, scaffolds, or poles
17.	Frequency of spending time keeping or regaining balance
18.	Frequency of spending time kneeling, crouching, stooping, or crawling
19.	Frequency of spending time sitting
20.	Frequency of spending time standing
21.	Frequency of spending time walking and running
22.	Frequency of working in very hot or cold temperatures
23.	Frequency of having to wear common protective or safety equipment such as safety shoes, glasses, gloves, hearing protection, hard hates, or life jackets
24.	Frequency of having to wear specialized protective or safety equipment such as breathing apparatus, safety harness, full protection suits, or radiation protection.

The mental stress index contains twelve characteristics, and they are listed in Table 3.3 below. The average of the twelve grades is assigned as the mean degree of mental stress (*Mental*) suffered when employed in the selected occupation.

TABLE 3.3

CHARACTERISTICS INCLUDED IN THE MENTAL STRESS INDEX

1.	Seriousness of making a mistake that was not readily correctable
2.	Degree of being in contact with others to perform one's work tasks
3.	Degree of importance of coordinating and/or leading others to accomplish one's work tasks
4.	Frequency of dealing with unpleasant, angry, or discourteous individuals as part of one's job requirements
5.	Frequency of facing conflict situations
6.	Frequency of making decisions that affect other people, financial resources, and/or image and reputation of one's firm of employment
7.	Degree with which one's decisions impact the results of coworkers, clients, and firm of employment
8.	Importance of being exact or accurate
9.	Degree of competitive pressures as part of one's job requirements
10.	Degree of being responsible for work outcomes and results of other workers
11.	Degree of being responsible for the health and safety of others
12.	Degree for worker to meet strict deadlines as part of one's job requirements

The index accounting for the lack of freedom to control one's work tasks and pace of work (*WrkFreedom*) has five measures, which are listed in Table 3.4. The average of these five grades is calculated and then assigned as the "mean degree" of the lack of work freedom (*WrkFreedom*) in the selected occupation.

The decision to use mean grade indices instead of individual work condition measures as controls is because the theory of compensating differentials does not identify specific undesirable work conditions that are associated with pecuniary rewards. For example, the theory states workers who are employed in physically demanding occupations earn wage premiums, but it does not say whether a specific physically

TABLE 3.4

CHARACTERISTICS INCLUDED IN THE LACK OF WORK FREEDOM INDEX

1.	Degree of work automation
2.	Importance of repeating the same physical or mental activities over and over, without stopping
3.	Degree in which one's work tasks are determined by the speed of equipment or machinery
4.	Degree in which one is required to make repetitive motions
5.	Extent to which one's work tasks, priorities, and goals are determined by superiors and not oneself.

demanding work condition is more important than another condition. England et al. (1988), Filer (1989), Jacobs and Steinberg (1990), and Macpherson and Hirsch (1990) have operationalized compensating differentials theory by selecting measures they deem are important wage determinants, but their variable selections differ from each other to a great extent. This approach is problematic if one considers the variation of working conditions within occupations. An occupation may be deemed physically demanding when examined from the lens of one specific work condition measure but is not physically demanding from the perspective of another measure. The mean grade approach gives equal weight to each measure, thus allowing one to gauge the average physical, mental, or work freedom un-desirableness of an occupation. Interested readers can find the *Physical*, *Mental*, and *WrkFreedom* mean grades for each selected occupation at https://sites.google.com/site/bridgecodes/.

Occupational Outlook Handbooks

The Occupational Outlook Handbooks (OOHs) are used to construct three measures of occupational level bargaining power status: *LicenseRe*, *LicenseVol*, and *Apprentice*. The first OOH was published in 1949 as a joint project between the Bureau

of Labor Statistics and the Veterans Administration; the purpose of this publication was to aid returning veterans to prepare for civilian sector employment. The OOHs provide entry level and career advancement information of hundreds of occupations. The OOH editions are matched up with the surveyed time periods in the Census and ACS PUMS. The 1949 OOH was used to construct the power variables in the 1950 PUMS because the reported wages refer to employment done during the 1949 calendar year. The 1959 OOH was paired with the 1960 PUMS, 1968-1969 OOH with the 1970 PUMS,[26] 1978-1979 OOH with the 1980 PUMS, 1988-1989 OOH with the 1990 PUMS, 1989-1999 OOH with the 2000 PUMS, 2004-2005 OOH with the 2005 PUMS, 2006-2007 OOH with the 2006 and 2007 PUMS, and the 2008 OOH with the 2008 PUMS.

Two rules are created for coding the OOH's description of a selected occupation into power dummies. The first rule is if the description clearly states a required license or certification (*LicenseRe*) or required apprenticeship (*Apprentice*) or voluntary license or certification (*LicenseVol*) exists, then occupation is assigned a value of "1" for the given variable of interest; otherwise, the occupation is assigned a value of "0" for the variable. The second rule is called the "rule of precedence" and refers to cases where the OOH edition under consideration does not contain information about a given selected occupation. The rule of precedence is specified below:

1) If the power variable under consideration is coded as 0 in both the preceding and subsequent PUMS, then it is coded as 0 in the current PUMS.
2) If the power variable under consideration is coded as 1 in both the preceding and subsequent PUMS, then it is coded as 1 in the current PUMS.

[26] The Bureau of Labor Statistics moved to a biannual edition of the OOH in this year.

3) If the power variable under consideration is coded as 1 in the preceding PUMS but coded as 0 in the subsequent PUMS, then it is coded as 1 in the current PUMS.
4) If the power variable under consideration is coded as 0 in the preceding PUMS but coded as 1 in the subsequent PUMS, then it is coded as 0 in the current PUMS.
5) If there is no information about the power variable under consideration (missing value) in the preceding PUMS but it is coded as 0 in the subsequent PUMS, then it is coded as 0 in the current PUMS.
6) If there is no information about the power variable under consideration (missing value) in the preceding PUMS, but it is coded as 1 in the subsequent PUMS, then it is coded as 0 in the current PUMS.
7) If the power variable under consideration is coded as 0 in the preceding PUMS, but no information is available in the subsequent PUMS (missing value), then it is coded as 0 in the current PUMS.
8) If the power variable under consideration is coded as 1 in the preceding PUMS but no information is available in the subsequent PUMS (missing value), then it is coded as 1 in the current PUMS.
9) Since there is no preceding PUMS to compare the 1950 Census against, I code all missing values in the 1950 PUMS as 0. Likewise, since there is no subsequent PUMS to compare the 2008 ACS against, I code the missing values in the 2008 PUMS with the information provided by the previous PUMS. There are 42 and nine selected occupations with missing values in the 1950 Census and 2008 ACS,

respectively. Consequently, it is likely that workers' power to impose occupational entry requirements is not well represented in the 1950 Census sample.

Union Membership and Coverage Database

The two other power variables included in the wage models are percentage of workers in occupation who have union membership status (*UnionPer*) and percentage of workers in occupation covered by collective bargaining agreements (*BargainPer*). The information for these two variables is taken from Barry Hirsch and David Macpherson's Union Membership and Coverage Database. Interested readers can access the database at http://unionstats.gsu.edu/. Hirsch and Macpherson reported union membership and collective bargaining agreements information for the year 1983 and forward, and their data are collected from the March supplement of the Current Population Survey (CPS). Consequently, wage effects of *UnionPer* and *BargainPer* are only examined for the period between 1990 Census through 2008 ACS. The 1989 union statistics file provides the union and collective bargaining information needed to examine the wage effects of *UnionPer* and *BargainPer* in the 1990 PUMS; the 1999 union statistics file with the 2000 PUMS, 2005 file with 2005 PUMS, 2006 file with 2006 PUMS, 2007 file with 2007 PUMS, and 2008 file with 2008 PUMS.

Interested readers should access https://sites.google.com/site/bridgecodes/ and navigate to the Occupational Bridge Codes tables to view required licensing or certification (*LicenseReq*), voluntary licensing or certification (*LicenseVol*), required apprenticeship (*Apprentice*), union membership coverage (*UnionPer*), and collective

bargaining agreement coverage (*BargainPer*) information of the 103 selected occupations.

This chapter has outlined the study's hypotheses and explained the data and methods that will be used to examine the hypotheses. The next chapter presents the study's findings.

CHAPTER 4

RESULTS

Chapter 4 is divided into three sections. The first section reports demographic and work-related characteristics of individuals employed in selected occupations in the ten PUMS. The second section discusses the selection of the preferred wage models for each PUMS. The third section compares the findings with the hypotheses made in Chapter 3.

Demographic and Occupational Characteristics of Male and Female Workers in Selected Occupations

Table 4.1 compares the number of men and women who work in the 103 selected occupations to the number of male and female workers in all occupations. It is important to note that Table 4.1 only accounts for the number of men and women who are at least 16 years old, report wages earned for the survey period, have assigned occupational codes, and have either part-time or full-time work status. Table 1 shows approximately 30% of male workers and 40% of female workers are employed in the selected occupations. Hence, even though the 103 selected occupations make up a small proportion of all occupations listed in the PUMS, they include a significant number of workers. A possible explanation for this phenomenon is because the selected occupations make up the traditional, well-established segment of the overall labor market. Also, it seems female workers are more likely than their male counterparts to gravitate towards this traditional segment; thus, this dissertation examines male and female wage experience in a more feminized segment than the overall labor force.

TABLE 4.1

PROPORTIONS OF MALE AND FEMALE WORKERS EMPLOY IN THE SELECTED OCCUPATIONS

PUMS	Total Male	Selected Male	$\frac{\text{Total Male}}{\text{Selected Male}}$	Total Female	Selected Female	$\frac{\text{Total Female}}{\text{Selected Female}}$
1950 Census	78,222	21,459	27.43%	28,299	11,412	40.33%
1960 Census	296,507	83,405	28.13%	121,431	51,003	42.00%
1970 Census	369,173	111,830	30.29%	191,829	86,526	45.11%
1980 Census	469,406	140,867	30.01%	340,126	151,068	44.42%
1990 Census	530,834	160,860	30.30%	446,655	193,721	43.37%
2000 Census	607,177	171,962	28.32%	530,864	208,340	39.25%
2005 ACS	618,598	176,416	28.52%	562,984	229,784	40.82%
2006 ACS	636,261	182,582	28.70%	577,191	234,644	40.65%
2007 ACS	641,330	184,292	28.74%	584,275	237,134	40.59%
2008 ACS	659,626	188,885	28.64%	614,280	251,412	40.93%

Table 4.2 reports the number of selected men and women and their mean values for ten demographic and work-related characteristics in the selected occupations by PUMS year. Men outnumber women in the selected occupations in the 1950, 1960, and 1970 Census, but women begin to outnumber men in the 1980 Census. Women's share of the selected occupations increased with each subsequent PUMS. While women's participation in 103 selected occupations increases over time, their share of the feminized selected occupation increases in the early postwar decades and then declines in recent decades. Women in the 1950 Census work in selected occupations with a mean ratio of female-to-total workers (FEM) of 0.754. Women work in selected occupations with a mean FEM ratio of 0.826 in the 1970 Census. Women move out of the female selected

TABLE 4.2

MEAN VALUES OF SELECTED DEMOGRAPHIC AND OCCUPATIONAL CHARACTERISTICS IN THE SELECTED OCCUPATIONS

Characteristic	**PUMS**					
	1950 Census		1960 Census		1970 Census	
	Male	Female	Male	Female	Male	Female
n =	21,459	11,412	83,405	51,003	111,830	86,526
W	3,161.410 (1,535.651)	2,139.507 (1,015.74)	5,561.183 (2,998.788)	3,288.588 (1,696.963)	8,741.694 (5,497.317)	5,023.520 (2,939.344)
$\frac{W_f}{W_m}$	0.677		0.591		0.575	
Age	40.899 (12.247)	35.372 (12.721)	41.321 (12.782)	39.070 (13.249)	41.014 (13.563)	38.874 (13.993)
Schooling	10.563 (3.362)	11.939 (2.721)	11.363 (3.388)	12.112 (2.486)	12.004 (3.127)	12.521 (2.303)
Exp	25.336 (14.408)	18.433 (13.234)	24.958 (14.039)	21.958 (13.696)	24.009 (14.646)	21.353 (14.404)
FEM	0.113 (0.210)	0.754 (0.247)	0.162 (0.250)	0.825 (0.220)	0.211 (0.262)	0.826 (0.220)
Mental	60.598 (7.266)	59.137 (7.338)	60.501 (7.345)	59.372 (7.772)	60.223 (7.715)	59.038 (7.823)
Physical	35.889 (14.522)	18.796 (8.535)	34.861 (14.672)	18.871 (8.170)	33.690 (14.642)	18.717 (8.240)
WrkFreedom	47.143 (8.602)	51.600 (9.218)	46.963 (8.592)	51.190 (8.948)	46.485 (8.287)	50.453 (8.632)
LicenseRe	0.053 (0.224)	0.163 (0.370)	0.171 (0.376)	0.210 (0.407)	0.173 (0.379)	0.217 (0.413)
LicenseVol	0.122 (0.328)	0.042 (0.200)	0.116 (0.320)	0.023 (0.151)	0.116 (0.320)	0.026 (0.158)
Apprentice	0.203 (0.402)	0.011 (0.102)	0.061 (0.239)	0.008 (0.086)	0.073 (0.260)	0.007 (0.081)
UnionPer	--	--	--	--	--	--
BargainPer	--	--	--	--	--	--

TABLE 4.2: Continued

Characteristic	**PUMS**					
	1980 Census		1990 Census		2000 Census	
	Male	Female	Male	Female	Male	Female
n =	140,867	151,068	160,860	193,721	171,962	208,340
W	16,521.627 (11,682.038)	8,760.920 (6,178.400)	28,628.271 (23,673.216)	16,827.970 (13,134.897)	38,616.698 (33,037.150)	25,883.418 (21,026.754)
$\frac{W_f}{W_m}$	0.530		0.588		0.670	
Age	38.575 (14.038)	36.187 (13.726)	39.413 (13.528)	38.175 (13.146)	40.679 (13.520)	40.146 (13.216)
Schooling	12.877 (3.004)	12.951 (2.328)	13.223 (2.749)	13.251 (2.290)	13.240 (2.785)	13.521 (2.378)
Exp	20.698 (14.701)	18.237 (14.043)	21.190 (13.753)	19.924 (13.348)	22.438 (13.446)	21.625 (13.225)
FEM	0.252 (0.253)	0.791 (0.240)	0.309 (0.262)	0.755 (0.229)	0.321 (0.277)	0.755 (0.217)
Mental	60.622 (8.248)	59.168 (8.289)	60.709 (8.500)	59.636 (8.520)	60.848 (8.552)	60.553 (8.930)
Physical	33.165 (14.476)	19.768 (8.562)	32.253 (14.406)	20.359 (8.570)	32.454 (14.432)	21.244 (8.583)
WrkFreedom	45.820 (8.277)	49.385 (8.496)	45.786 (8.335)	49.037 (8.793)	45.706 (8.202)	47.978 (8.669)
LicenseRe	0.168 (0.374)	0.248 (0.432)	0.176 (0.381)	0.273 (0.446)	0.248 (0.432)	0.336 (0.472)
LicenseVol	0.156 (0.363)	0.056 (0.230)	0.151 (0.358)	0.089 (0.285)	0.200 (0.400)	0.258 (0.437)
Apprentice	0.116 (0.321)	0.011 (0.104)	0.089 (0.284)	0.006 (0.075)	0.076 (0.265)	0.013 (0.115)
UnionPer	--	--	21.041 (18.464)	15.330 (14.565)	17.742 (16.125)	15.212 (14.455)
BargainPer	--	--	23.431 (19.330)	18.016 (16.575)	19.253 (16.742)	17.118 (15.792)

TABLE 4.2: Continued

Characteristic	**PUMS**					
	2005 ACS		2006 ACS		2007 ACS	
	Male	Female	Male	Female	Male	Female
n =	176,416	229,784	182,582	234,644	184,292	237,134
W	44,059.307 (33,774.529)	31,343.414 (24,345.415)	45,191.478 (35,413.331)	32,301.715 (25,370.351)	50,184.078 (47,180.098)	34,303.516 (29,517.035)
$\frac{W_f}{W_m}$	0.711		0.715		0.684	
Age	42.554 (13.919)	42.107 (13.564)	42.414 (14.042)	42.154 (13.740)	42.647 (14.155)	42.317 (13.837)
Schooling	13.584 (2.682)	13.828 (2.335)	13.572 (2.700)	13.838 (2.334)	13.603 (2.686)	13.889 (2.335)
Exp	23.970 (13.800)	23.278 (13.627)	23.842 (13.886)	23.316 (13.785)	24.044 (14.001)	23.428 (13.884)
FEM	0.345 (0.278)	0.757 (0.212)	0.342 (0.279)	0.753 (0.211)	0.346 (0.279)	0.751 (0.209)
Mental	61.169 (8.775)	60.846 (8.996)	61.131 (8.799)	60.884 (9.019)	61.179 (8.803)	60.972 (9.045)
Physical	31.381 (14.401)	21.041 (8.442)	31.533 (14.453)	21.111 (8.419)	31.387 (14.424)	21.152 (8.390)
WrkFreedom	45.373 (8.083)	47.438 (8.615)	45.343 (8.046)	47.439 (8.610)	45.326 (8.020)	47.315 (8.607)
LicenseRe	0.297 (0.457)	0.358 (0.480)	0.297 (0.457)	0.360 (0.480)	0.300 (0.458)	0.365 (0.482)
LicenseVol	0.228 (0.419)	0.113 (0.317)	0.192 (0.394)	0.093 (0.290)	0.193 (0.395)	0.095 (0.294)
Apprentice	0.078 (0.269)	0.002 (0.041)	0.080 (0.271)	0.002 (0.040)	0.081 (0.273)	0.002 (0.041)
UnionPer	16.062 (14.913)	15.669 (14.719)	15.241 (14.181)	14.911 (14.296)	15.422 (14.549)	15.447 (14.496)
BargainPer	17.440 (15.740)	17.559 (15.960)	16.354 (15.224)	16.385 (16.017)	16.725 (15.208)	17.204 (15.799)

TABLE 4.2: Continued

Characteristic	**PUMS**	
	2008 ACS	
	Male	Female
n =	188,885	251,412
W	51,271.203 (47,813.204)	35,681.981 (30,405.595)
$\frac{W_f}{W_m}$	0.696	
Age	42.876 (14.285)	42.598 (13.920)
Schooling	13.603 (2.759)	13.915 (2.396)
Exp	24.273 (14.187)	23.683 (14.024)
FEM	0.349 (0.281)	0.752 (0.208)
Mental	61.147 (8.823)	61.081 (9.013)
Physical	31.230 (14.331)	21.196 (8.289)
WrkFreedom	45.295 (8.038)	47.055 (8.680)
LicenseRe	0.304 (0.460)	0.380 (0.485)
LicenseVol	0.195 (0.396)	0.095 (0.293)
Apprentice	0.080 (0.271)	0.001 (0.037)
UnionPer	16.033 (14.590)	16.498 (14.968)
BargainPer	17.367 (15.462)	18.170 (16.443)

The standard deviation is reported in parentheses.

occupations beginning in the 1980 Census, and they work in occupations with a mean FEM ratio of 0.755 in 2000 Census and 0.752 in the 2008 ACS. The trend of women moving out of the feminized selected occupations coincides with the trend of men experiencing greater occupational feminization over time. Men work in selected occupations with a mean FEM ratio of 0.113 in the 1950 Census, 0.252 in the 1980 Census, 0.321 in the 2000 Census, and 0.349 in the 2008 ACS. Despite these trends, men and women do not work with each other in selected occupations. Table 4.3 reports the nature of gender segregation in selected occupations. k_m is the number of men in each PUMS who worked in selected occupations with a female-to-total workers ratio of less than 0.30. k_f is the number of women who worked in selected occupations with a female-to-total workers ratio of greater than 0.70. Approximately two of three women work in a selected occupation with more than 70% of female workers in any given PUMS. Approximately one of two men work in a selected occupation with less than 30% of female workers in any given PUMS. Women are more likely to work with other women and men with other men in selected occupations.

In addition, men and women do not earn similar annual wages (*W*) in selected occupations (see Table 4.2). Men earn more than women in every PUMS, but women earn more as a proportion of male mean wage-over-time. The female-to-male mean wage ratio $\left(\frac{W_f}{W_m}\right)$ decreases from 0.677 in the 1950 Census to 0.591 in the 1960 Census. The ratio decreases to 0.530 in the 1980 Census, the lowest level in the ten PUMS. The gender mean wage ratio begins to increase again in the 1990 Census, registering at 0.588 in that PUMS and 0.670 in the 2000 Census. The gender wage ratio stands at 0.696 in the 2008 ACS. It is important to note that the decline in the female-to-male mean wage ratios

TABLE 4.3

GENDER SEGREGATION IN THE SELECTED OCCUPATIONS

	Male			Female		
PUMS	k_m	n_m	k_m/n_m	k_f	n_f	k_f/n_f
1950 Census	18,998	21,459	0.885	7,854	11,412	0.688
1960 Census	72,220	83,405	0.866	43,770	51,003	0.858
1970 Census	86,135	111,830	0.770	74,495	86,526	0.861
1980 Census	100,831	140,867	0.716	119,680	151,068	0.792
1990 Census	91,118	160,860	0.566	135,862	193,721	0.701
2000 Census	94,652	171,962	0.550	151,291	208,340	0.726
2005 ACS	82,569	176,416	0.468	168,709	229,784	0.734
2006 ACS	86,084	182,582	0.471	168,978	234,644	0.720
2007 ACS	86,035	184,292	0.467	169,776	237,134	0.716
2008 ACS	87,449	188,885	0.463	181,078	251,412	0.720

k_m is the number of sampled men who worked in selected occupations where FEM < 0.30
k_f is the number of sampled women who worked in selected occupations where FEM > 0.70
n_m is the total number of sampled men.
n_f is the total number of sampled women.

in the 1960 through 1980 Census coincides with the period in which working women enter the feminized selected occupations in large numbers, which results in working women outnumbering working men in the 1980 Census in the selected occupations. Also, the observed wage gap trend in selected occupations is consistent with the trend in all occupations. Table 4.2 reports the gender wage gaps in the selected occupations in every PUMS and Table 4.3 reports the same statistics in all occupations. The observed wage

gaps in the selected and all occupations are similar to those reported in Goldin (1990). She found women earned 60% of male wages between 1950 and 1980, and the wage gap began to narrow after 1980 (Goldin 1990, 62).

TABLE 4.4

MEAN MALE AND FEMALE ANNUAL WAGE IN ALL OCCUPATIONS

PUMS	W_m	W_f	W_f/W_m
1950 Census	3,025.81 (1,675.65)	1,899.341 (1,021.627)	0.628
1960 Census	5,411.435 (3,225.208)	2,936.436 (1,693.877)	0.543
1970 Census	8,772.720 (5,793.016)	4,561.924 (2,922.764)	0.520
1980 Census	17,048.730 (11,724.924)	8,661.470 (6,251.700)	0.508
1990 Census	29,208.433 (23,068.908)	16,913.250 (13,211.904)	0.579
2000 Census	40,062.452 (32,380.189)	25,985.239 (21,465.500)	0.649
2005 ACS	46,633.445 (33,735.921)	31,587.559 (24,986.318)	0.677
2006 ACS	47,686.666 (35,157.115)	32,402.542 (25,925.431)	0.679
2007 ACS	52,294.430 (45,349.602)	34,489.043 (30,208.693)	0.660
2008 ACS	53,355.220 (46,044.029)	35,611.190 (31,008.721)	0.667

The standard deviation is reported in parentheses.

The gender wage gap in selected occupations cannot be explained by a gender difference in educational attainment because women, on average, have more years of schooling (*Schooling*) than men in every PUMS (see Table 4.2). Women have fewer

potential years of work experience (*Expr*) compared to men, but they have narrowed much of this gap over the decades. Women have 18.433 mean years of potential work experience whereas men have 25.336 mean years in the 1950 Census.[27] The gap narrows to 21.625 and 22.438 mean years for women and men, respectively, by the 2000 Census. The narrowing of the gender gap of mean years of potential work experience may be attributed to the changes in demographics over time. Women employed in selected occupations in the early postwar years are much younger than their male counterparts. The female mean age is 35.372 years and the male mean age is 40.899 years in the 1950 Census. The same statistics are 40.146 years for women and 40.679 years for men in the 2000 Census.[28]

Men and women do not share similar work environments (see Table 4.2). Men are employed in the selected occupations with a higher mean degree of physical hardship (*Physical*) and mental stress (*Mental*). Women are employed in selected occupations with a slightly higher mean degree of lack of work freedom (*WrkFreedom*). Men and women also do not work in occupations with similar bargaining power status. Women are more likely to work in selected occupations with licensing or certification entry requirement (*LicenseRe*) whereas men are more likely to work in selected occupations with voluntary licenses and certifications (*LicenseVol*). Men are also more likely to work in selected occupations with apprenticeship requirements for entry (*Apprentice).* Men work in occupations with higher mean rates of union membership (*UnionPer*) and collective

[27] Years of potential work experience = an individual's age – years of schooling – 5.

[28] Regression results of Models 7a and 7b indicate women earn higher wage premiums for their years of schooling compared to their male counterparts in every PUMS except the 1950 Census. On the other hand, men earn higher wage premiums than women for their years of potential work experience in every PUMS. Women's wages are not correlated with schooling and are negatively correlated with potential work experience in the 1950 PUMS. Interested readers should refer to Appendix D to examine these regression coefficients.

bargaining coverage (*BargainPer*) than women, but their occupational union power status has been declining since the 1990 Census. Men have a mean occupational union membership incidence of 21.041% in the 1990 Census, 17.742% in the 2000 Census, and 16.033% in the 2008 ACS. Male workers' mean occupational collective bargaining coverage incidence is 23.431% in the 1990 Census, 19.253% in the 2000 Census, and 17.367% in the 2008 ACS. Women experience no major changes in their mean occupational union membership or collective bargaining coverage percentage over time. Women have a mean union membership incidence of 15.330% and mean collective bargaining coverage incidence of 18.016% in the 1990 Census; the same percentages are 16.498% and 18.170% in the 2008 ACS.

Selection of the Preferred Wage Models

The selection of the preferred wage model for each PUMS is a two step process. First, the joint significance of the compensating differential and power variables of Models 7a and 7b is examined to determine whether the inclusion of these measures increase the predictive power of Model 2. Model 2 is the standard wage model that includes human capital and crowding variables. Second, the Akaike Information Criterion (AIC) of Models 7a and 7b are examined; the wage model with the smaller AIC is chosen as the preferred wage model for the PUMS.

Wald Tests of Joint Significance

Five Wald tests are performed on Models 7a and 7b. Tests of joint significance of three compensating differential variables, Mental, *Physical*, and *WrkFreedom*, and three power dummies, *LicenseRe*, *LicenseVol*, and *Apprentice*, are performed on Model 7a. The same Wald test of the compensating differential variables is also performed on

TABLE 4.5

WALD TESTS PERFORMED ON MODEL 7A

PUMS	$\mathbf{H_0: \gamma_1 = \gamma_2 = \gamma_3 = 0}$		$\mathbf{H_0: \varphi_1 = \varphi_2 = \varphi_3 = 0}$	
	Male	Female	Male	Female
1950 Census	8.31	185.20	174.89	125.19
1960 Census	418.71	959.66	1,512.00	357.07
1970 Census	804.29	981.55	1,281.80	367.91
1980 Census	1,022.10	565.85	1,456.50	440.94
1990 Census	2,345.30	3,606.20	2,310.50	380.11
2000 Census	7,749.90	6,479.70	1,073.40	1,586.70
2005 ACS	8,929.10	9,716.70	1,414.10	509.29
2006 ACS	10,468.00	9,437.70	1,262.80	689.07
2007 ACS	9,608.20	10,801.00	756.30	1,288.70
2008 ACS	13,485.00	12,074.00	1,682.20	1,137.50

The critical chi-square value when α = 0.05 is 7.81 and α = 0.01 is 11.34
$H_0: \gamma_1 = \gamma_2 = \gamma_3 = 0$. This is the null hypothesis of the Wald test of the compensating differential variables.
$H_0: \varphi_1 = \varphi_2 = \varphi_3 = 0$. This is the null hypothesis of the Wald test of the three power dummy variables.

Model 7b, along with a Wald test of the two non-dummy power variables, *UnionPer* and *BargainPer*, and another test of all five power variables. Table 4.5 reports the calculated chi-square test statistics for the restricted Model 7a without the compensating differential variables and the power dummies, respectively. The Wald tests show the compensating differentials and power coefficients are significantly different from zero at the 1% level of significance in the male and female Model 7a in all PUMS with the exception of the 1950 Census. The compensating differential measures are significantly different from

zero at the 5% level of significance but not the 1% level of significance in the male Model 7a in the 1950 Census.

Table 4.6 reports the calculated chi-square test statistics for the restricted Model 7b without the compensating differentials, the non-dummy power, and all five power variables, respectively. The coefficients of the compensating differential and five bargaining power status variables are statistically and significantly different from zero at the 1% level of significance in all PUMS. The non-dummy power variables, *UnionPer* and *BargainPer*, are statistically different from zero at the 1% level of significance for all PUMS with the exception of female workers in the 2007 ACS. The Wald tests on Model 7b indicate it has greater predictive power than Model 7a when fitted to male and female samples from the 1990 Census through 2008 ACS, the lone exception being the female 2007 ACS sample.

Akaike Information Criterion (AIC) and the Preferred Wage Models

Table 4.7 reports the AIC of Models 7a and 7b. AIC values are not available for Model 7b in the 1950 through 1980 Census because the model is not constructed for these PUMS due to the lack of occupational unionization information. However, Model 7a has the smallest AIC value among all the constructed wage models for the 1950 through 1980 Census for both sexes, which suggests Model 7a has the best goodness-of-fit for these PUMS. Interested readers should refer to Appendix C to examine the AIC values of all ten wage models constructed for all male and female PUMS. The reported AIC values for Model 7b in the 1990 Census through 2008 ACS indicate Model 7b has a better goodness-of-fit in all PUMS except for the male 2007 ACS sample.

TABLE 4.6

WALD TESTS PERFORMED ON MODEL 7B

PUMS	$\mathbf{H_0: \gamma_1 = \gamma_2 = \gamma_3 = 0}$		$\mathbf{H_0: \varphi_4 = \varphi_5 = 0}$	
	Male	Female	Male	Female
1990 Census	2,557.10	1,827.90	238.82	506.02
2000 Census	7,383.70	351.36	3,348.90	643.80
2005 ACS	8,704.20	4,935.60	358.31	1,063.20
2006 ACS	9,961.20	5,031.50	885.30	934.30
2007 ACS	5,652.00	9,783.10	717.77	1.20
2008 ACS	12,377.00	6,786.70	513.06	850.27

	$\mathbf{H_0: \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 = 0}$	
	Male	Female
1990 Census	2,544.90	886.28
2000 Census	1,430.10	2,232.70
2005 ACS	1,775.30	1,574.90
2006 ACS	2,154.80	1,622.10
2007 ACS	1,474.80	1,285.60
2008 ACS	2,198.60	1,994.00

The critical chi-square value when α = 0.05 is 7.81 and α = 0.01 is 11.34
$H_0: \gamma_1 = \gamma_2 = \gamma_3 = 0$. This is the null hypothesis of the Wald test of the compensating differential variables.
$H_0: \varphi_4 = \varphi_5 = 0$. This is the null hypothesis of the Wald test of the two power dummy variables.
$H_0 = \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 = 0$. This is the null hypothesis of the Wald test of the five power variables.

TABLE 4.7

AIKAIKE INFORMATION CRITERION VALUES OF MODELS 7A AND 7B

PUMS	Model 7a		Model 7b	
	Male	Female	Male	Female
1950 Census	37,285	18,062	--	--
1960 Census	122,065	80,035	--	--
1970 Census	191,966	158,320	--	--
1980 Census	295,469	318,190	--	--
1990 Census	322,763	399,162	322,530	398,660
2000 Census	341,873	405,694	341,523	405,056
2005 ACS	347,199	467,491	346,845	466,434
2006 ACS	382,857	486,149	381,978	485,220
2007 ACS	390,473	492,415	390,477	491,700
2008 ACS	396,528	504,303	396,018	503,451

Table 4.8 reports the models selected as the preferred ones for men and women in each of the ten PUMS. Model 7a is chosen as the preferred wage model for males and females in the 1950 through 1980 Census. Model 7b is selected as the preferred wage model for both sexes in the 1990 and 2000 Census and 2005, 2006, and 2008 ACS. Each of the chosen models includes compensating differentials and power variables that have been determined to increase the predictive power of Model 2, which is the standard model that includes human capital and crowding variables. Each model also has the smallest AIC among the constructed models.

The 2007 ACS is an exception from the other PUMS. Model 7a is chosen as the preferred wage model over Model 7b for both sexes. The Wald test of the joint

TABLE 4.8

PREFERRED WAGE MODEL BY GENDER AND PUMS

PUMS	Male	Female
1950 Census	Model 7a	Model 7a
1960 Census	Model 7a	Model 7a
1970 Census	Model 7a	Model 7a
1980 Census	Model 7a	Model 7a
1990 Census	Model 7b	Model 7b
2000 Census	Model 7b	Model 7b
2005 ACS	Model 7b	Model 7b
2006 ACS	Model 7b	Model 7b
2007 ACS	Model 7a	Model 7a
2008 ACS	Model 7b	Model 7b

significance of *UnionPer* and *BargainPer* indicates the inclusion of these variables does not increase its predictive power over Model 7a for female workers. Also, Model 7b has a slightly larger AIC than Model 7a for male workers, suggesting the increase in predictive power from the inclusion of *UnionPer* and *BargainPer* does not outweigh the penalty imposed for using more variables. Nevertheless, Model 7b is the best performing model for both sexes in five out of six PUMS between 1990 Census and 2008 ACS. This result indicates that Model 7b would be the preferred model for the pre-1990 PUMS if information about occupational unionization and collective bargaining were available.

Hypothesis Tests: Wage Effects of Compensating Differentials, Power, and Crowding Variables

The preferred wage models are then fitted to their respective time-dependent Census and ACS PUMS to examine hypotheses made in Chapter 3. Interested readers should note the full estimates of the preferred wage model are not reported in the following discussion about the hypothesis tests. Readers should refer to Appendix D to view the complete estimated preferred models; there is also the option of downloading all seven estimated wage models (preferred and non-preferred) for the 1950 through 1980 Census and ten estimated models for the 1990 Census through 2008 ACS by accessing https://sites.google.com/site/bridgecodes/.

Wage Effects of Compensating Differentials Factors

Table 4.9 reports the regression coefficients of the compensating differentials variables. A hypothesis was made in Chapter 3 that both sexes should receive wage penalties when employed in selected occupations that are physically demanding and that lack work freedom because Jacobs and Steinberg (1990) reported these results. Also, workers employed in mentally stressful occupations should also receive wage premiums, which is consistent with Filer (1989). I find that men and women receive wage premiums when employed in selected occupations that are mentally stressful in all PUMS except the 1950 and 1960 Census. Women receive wage penalties in the 1950 and 1960 Census, and men receive no wage benefits in the 1950 but premiums in the 1960. Women also receive larger wage premiums compared to men in six out of eight PUMS between the 1970 Census and 2008 ACS. Table 4.2 reports that men are employed in occupations with a slightly greater mean degree of mental stress compared to their female

TABLE 4.9

WAGE EFFECTS OF COMPENSATING DIFFERENTIALS IN PREFERRED MODELS[29]

PUMS	*Mental*		*Physical*		*WrkFreedom*	
	Male	Female	Male	Female	Male	Female
1950 Census	0.000520 (0.000632)	-0.002202~ (0.001051)	0.000201 (0.000397)	-0.008603* (0.000932)	0.001297* (0.000537)	0.004830* (0.000887)
1960 Census	0.004506* (0.000267)	-0.001114~ (0.000533)	0.001517* (0.000182)	-0.012008* (0.000481)	0.001683* (0.000228)	0.004042* (0.000431)
1970 Census	0.006524* (0.000275)	0.007363* (0.000437)	-0.001839* (0.000187)	-0.010813* (0.000390)	0.000760* (0.000244)	0.001632* (0.000384)
1980 Census	0.005925* (0.000294)	0.006901* (0.000366)	-0.002775* (0.000218)	-0.005325* (0.000308)	0.003182* (0.000263)	0.005909* (0.000320)
1990 Census	0.007098* (0.000268)	0.012523* (0.000338)	-0.006819* (0.000233)	-0.005418* (0.000289)	0.002896* (0.000247)	-0.000441 (0.000283)
2000 Census	0.016825* (0.000248)	0.016881* (0.000301)	-0.007150* (0.000232)	-0.005151* (0.000233)	-0.001709* (0.000223)	-0.002192* (0.000250)
2005 ACS	0.017968* (0.000249)	0.018988* (0.000298)	-0.007131* (0.000230)	-0.008099* (0.000232)	-0.002528* (0.000225)	-0.001168* (0.000254)
2006 ACS	0.019002* (0.000253)	0.018671* (0.000296)	-0.009230* (0.000234)	-0.009743* (0.000227)	-0.004900* (0.000241)	-0.003563* (0.000263)
2007 ACS	0.020203* (0.000252)	0.022582* (0.000255)	-0.007384* (0.000215)	-0.009500* (0.000225)	-0.003486* (0.000233)	-0.001968* (0.000251)
2008 ACS	0.021797* (0.000247)	0.021007* (0.000270)	-0.008419* (0.000232)	-0.008281* (0.000215)	-0.003770* (0.000230)	-0.003680* (0.000242)

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

[29] The coefficients report in this table are taken from the estimated best fitting wage models, which the readers can find in Appendix D. Readers who want to compare the magnitude of the compensating differentials coefficients between the best fitting and non-best fitting models should refer to the dissertation website: https://sites.google.com/site/bridgecodes/.

counterparts in all ten PUMS. If women are receiving larger wage premiums when employed in mentally stressful occupations compared to men in six out of ten PUMS, then occupational mental stress is no longer a contributing factor to the gender wage gap.

On the other hand, women receive wage penalties in all ten PUMS when employed in physically demanding selected occupations whereas men received penalties in the 1970 Census through 2008 ACS. Men receive wage premiums in the 1960 Census, but their wage is not correlated with the degree of physical hardship in selected occupations in the 1950 Census. In the eight PUMS where both sexes receive wage penalties, male workers receive larger penalties in four PUMS. Overall, male workers are employed in selected occupations with a higher mean degree of physical hardship than women, but they are not continuously rewarded for such employment decision. This finding is not consistent with Filer (1989), who argues men should receive wage premiums because they are more likely to choose employment in physically demanding occupations. Occupational physical hardship, thus, does not contribute to the gender wage gap.

Women do receive larger wage premiums compared to men when employed in selected occupations where they lack the freedom to determine their work tasks and pace of work between 1950 and 1980. Women's wages are not correlated with the degree of lack of work freedom in the 1990 Census while men receive wage premiums. Both sexes receive wage penalties between the 2000 Census and 2008 ACS, but women earn smaller penalties compared to men. Table 4.2 reports that women are more likely to work in selected occupations that restrict their freedom to control their work tasks and pace of work compared to men; however, women

are also more likely to receive larger wage premiums prior to 1980 and smaller wage penalties starting in 2000 than men. As a consequence, the lack of occupational work freedom is not a contributing factor to the gender wage gap in the selected occupations.

It is important to note that the change to a negative wage effect pattern from positive wage effect occurs in the 2000 Census, which is the second PUMS for which controls for the percentages of workers in a selected occupation who are union members (*UnionPer*) and who are covered by collective bargaining agreements (*BargainPer*) are used. The change in wage effect pattern resembles a state dependent phenomenon. Heckman (1991; 2001) notes a researcher's observation of a relationship between two variables is dependent on the time period chosen in the study. Socioeconomic factors that influence the relationship under consideration may change through time, and these changes may in turn change the very nature of the correlation between the variables of interest. The correlation between wages and lack of work freedom in the selected occupations is positive between 1950 and 1980 for women and between 1950 and 1990 for men. The correlation turns negative between 2000 and 2008 for both sexes. The coefficient sign change occurs even though the same preferred model (Model 7b) is used between 1990 and 2000. The study switches from Model 7a to Model 7b as the preferred model between 1980 and 1990 due to data availability, but regression results show the correlation between wages and lack of work freedom is statistically negative for female workers in the 1990 Census whereas it has been positive in the 1980 Census. The male coefficient in Model 7a is also positive like it is in Model 7b in the 1990 Census. Model specification does not seem to be the likely explanation. Also, the study is examining the same group of occupations through time so this reduces the variation in the data as well; no new occupations are being introduced that may influence the

relationship between wages and lack of work freedom. Consequently, the change between receiving wage premiums in the pre-1990 samples to wage penalties in the post-1990 samples seem to demonstrate a state dependency phenomenon.

Wage Effects of Gender Power Differences

Table 4.10 reports the estimated coefficients of the five power variables—*LicenseRe*, *LicenseVol*, *Apprentice*, *UnionPer*, and *BargainPer*—in the preferred wage models. Men and women receive wage premiums, with women earning larger premiums, when employed in selected occupations with license or certification requirements between 1950 and 1980. Women continue to receive premiums after 1980, but the premiums begin to decline at a rapid pace until 2006. Women receive a small wage penalty in 2007, but regain their premium in 2008. Male workers experience a gradual increase in their wage premiums until 2000, when they start to receive wage penalties through 2008. Furthermore, both sexes receive wage premiums when employed in occupations that offer voluntary licenses or certifications. Men earn larger premiums in occupations with this characteristic than women in nine out of ten PUMS. Table 4.2 reports that women are more likely to work in selected occupations with required licenses and certifications whereas men are more likely to work in occupations with voluntary licensing and certification. Given the high level of gender segregation in the selected occupations, it is possible that female-dominated occupations have more formalized means of restricting entry while male-dominated occupations have voluntary means of entry restriction. The regression results, thus, do not indicate women are negatively affected by occupational barriers to entry. On the contrary, both sexes benefit from these barriers.

TABLE 4.10

WAGE EFFECTS OF POWER STATUS IN PREFERRED MODELS[30]

PUMS	*LicenseRe*		*LicenseVol*		*Apprentice*	
	Male	Female	Male	Female	Male	Female
1950 Census	0.094765* (0.023429)	0.277853* (0.026128)	0.171832* (0.013556)	0.027878 (0.027761)	0.016634 (0.013657)	0.073627 (0.050802)
1960 Census	0.069010* (0.005734)	0.238550* (0.012766)	0.248221* (0.006769)	0.076416* (0.016746)	0.062122* (0.007839)	0.038527 (0.027847)
1970 Census	0.085127* (0.005963)	0.189459* (0.010309)	0.209682* (0.006469)	0.093679* (0.013969)	0.065082* (0.007405)	0.036987 (0.026297)
1980 Census	0.150675* (0.007341)	0.175631* (0.009114)	0.079590* (0.006308)	0.112512* (0.009386)	0.093284* (0.006677)	0.015832 (0.018362)
1990 Census	0.205894* (0.006784)	0.121930* (0.008983)	0.170763 (0.005557)	0.090598* (0.006163)	0.125364* (0.007178)	0.290312* (0.021856)
2000 Census	-0.054388* (0.004755)	0.048299* (0.007482)	0.127280* (0.004770)	0.144454* (0.004344)	0.056904* (0.007865)	-0.096814* (0.014446)
2005 ACS	-0.073030* (0.004336)	0.067786* (0.007268)	0.147582* (0.004527)	0.118945* (0.005066)	0.108101* (0.007662)	0.480560* (0.035829)
2006 ACS	-0.011814* (0.004572)	0.072997* (0.007345)	0.114401* (0.005256)	0.072203* (0.007516)	0.027059* (0.008376)	0.331034* (0.036661)
2007 ACS	-0.038187* (0.004455)	-0.027918 (0.006191)	0.157436* (0.004936)	0.137300* (0.005476)	0.094542* (0.007366)	0.253849* (0.035253)
2008 ACS	-0.077437* (0.004414)	0.043711* (0.006651)	0.177442* (0.004940)	0.147363* (0.005131)	0.135959* (0.008088)	0.403351* (0.037591)

[30] The coefficients report in this table are taken from the estimated best fitting wage models, which the readers can find in Appendix D. Readers who want to compare the magnitude of the power coefficients between the best fitting and non-best fitting models should refer to the dissertation website: https://sites.google.com/site/bridgecodes/.

TABLE 4.10: Continued

PUMS	*UnionPer*		*BargainPer*	
	Male	Female	Male	Female
1990 Census	-0.010472* (0.001356)	0.000232 (0.002121)	0.011506* (0.001278)	-0.003585 (0.001889)
2000 Census	-0.021726* (0.001698)	0.046825* (0.002092)	0.022293* (0.001601)	-0.052398* (0.002261)
2005 ACS	-0.033731* (0.002450)	0.076058* (0.002876)	0.033475* (0.002301)	-0.085158* (0.003106)
2006 ACS	0.045816* (0.001551)	-0.021100* (0.001767)	-0.041464* (0.001432)	0.018770* (0.001971)
2007 ACS	--	--	--	--
2008 ACS	-0.039942* (0.001948)	0.041787* (0.002068)	0.038612* (0.001817)	-0.049239* (0.002281)

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

Men and women have different experiences in occupations with apprenticeship requirement, however. Male workers receive wage premiums when employed in the selected occupations that have apprenticeship requirement in all PUMS except the 1950 Census. Women's wages are not correlated with occupational apprenticeship requirements between 1950 through 1980 Census. Women receive wage penalties in the 2000 Census. They receive wage premiums in the 1990 Census and 2005 through 2008 ACS, and their premiums are larger than men's in these years. The coefficients of Model 7a in the 1990 and 2000 Census have the same sign as the preferred model (Model 7b) for those years. The switching of coefficient signs do not seem to depend on model

specification, suggesting the relationship between wages and occupational apprenticeship requirement relationship is undergoing a state dependency change. Table 4.2 shows that women are much less likely to work in the selected occupations with apprenticeship requirement compared to their male counterparts and that women have also not increased their participation in these occupations over the years. It is thus possible that occupations with apprenticeship requirements are male-dominated, and women may have been penalized for being the minority until 1990. Women have overcome this impediment in terms of wage return, but they are still largely excluded from these occupations.

A hypothesis was made in Chapter 3 that men and women should receive wage premiums when employed in occupations with high percentages of union membership and collective bargaining coverage. Regression results show men do receive wage premiums when employed in selected occupations with high percentages of union membership in 1990 Census and 20006 ACS, but they receive wage penalties in the 2000 Census, 2005 ACS, and 2008 ACS. This finding suggests the decline of unionization in male-dominated occupations has had a significant negative effect on wages of men employed in these occupations. Women have fared better than their male counterparts. Women receive wage premiums when employed in selected occupations with high unionization rate in 2000, 2005, and 2008. It is interesting to note that the female wage premiums coincide with a steady increase of unionization among female workers. Women's mean occupational unionization rate is slightly larger than men's in 2008. Consequently, it seems there is a reversal of fortune in the unionized selected occupations. Women are gaining ground and reaping benefits from unionism in their "female" occupations while men are being punished in their "male" occupations.

Men and women also do not reap equal benefits when employed in selected occupations with high percentages of workers covered by collective bargaining agreements. Women receive wage penalties in the 2000 Census and 2005 and 2008 ACS, and they receive premiums in one year—2006. Men receive premiums between 1990 and 2005 and also 2008. Men are slightly less likely to work in occupations with collective bargaining coverage compared to women in 2005 and 2008, but they receive wage premiums in these years anyways (while women are penalized).[31] It is possible that men and women are not employed in the same selected occupations, and, thus, the collective bargaining structure in female occupations is different from men's. Men and their unions have had more successful wage negotiations than women and their respective unions in female-dominated occupations. Another possibility is that "female" occupations with collective bargaining have such coverage in the first place because paid wages would have been even lower otherwise. Further studies are needed to explain the structural mechanism that gives rise to the different wage returns due to collective bargaining in the selected occupations.

Wage Effect of Female Occupational Crowding

Table 4.11 reports the estimated FEM coefficients in the preferred and in the "base" model. FEM is the female-to-total workers ratio, and it is the measure of female occupational crowding in selected occupations in this study. The base model includes demographic and human capital variables and FEM. The female FEM coefficients in the preferred model are negative in every PUMS whereas they are negative in six out of ten PUMS in the base model. The female FEM coefficients in the base model are not

[31] Refer to Table 4.2 to compare male and female mean occupational collective bargaining rates.

TABLE 4.11

WAGE EFFECT OF FEMALE OCCUPATIONAL CROWDING IN PREFERRED AND BASE MODELS[32]

	Preferred Model		**Base Model [Human Capital + FEM]**	
PUMS	Male	Female	Male	Female
1950 Census	0.054766~ (0.023783)	-0.095080* (0.023876)	0.043510~ (0.020649)	0.006681 (0.021919)
1960 Census	-0.020991~ (0.008914)	-0.137887* (0.012922)	-0.096376* (0.007882)	-0.003490 (0.011073)
1970 Census	-0.070426* (0.008883)	-0.181917* (0.011987)	-0.086776* (0.007384)	-0.030525* (0.009601)
1980 Census	-0.280043* (0.010804)	-0.052138* (0.010227)	-0.224217* (0.008806)	0.016001~ (0.007665)
1990 Census	-0.472151* (0.010159)	-0.037023* (0.009120)	-0.291206* (0.007962)	0.000716 (0.007145)
2000 Census	-0.309945* (0.009536)	-0.182537* (0.007892)	-0.182526* (0.007328)	-0.072313* (0.006905)
2005 ACS	-0.270866* (0.009349)	-0.183807* (0.008290)	-0.182298* (0.007182)	-0.102427* (0.007064)
2006 ACS	-0.317545* (0.009877)	-0.101184* (0.008370)	-0.197769* (0.007593)	-0.100428* (0.007166)
2007 ACS	-0.298309* (0.009227)	-0.133316* (0.008329)	-0.240080* (0.007601)	-0.127898* (0.007187)
2008 ACS	-0.310163* (0.009628)	-0.070397* (0.007947)	-0.187646* (0.007411)	-0.127369* (0.006795)

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

[32] The coefficients report in this table are taken from the estimated best fitting wage models, which the readers can find in Appendix D. Readers who want to compare the magnitude of female crowding coefficients between the best fitting and non-best fitting models should refer to the dissertation website: https://sites.google.com/site/bridgecodes/.

significant in the 1950, 1960, and 1990 Census, and the coefficient is positive at in the 1980 Census. Even in years when the female FEM coefficients in both models are negative, the coefficients in the preferred model are still more negative in all but one PUMS. The female FEM coefficient in the preferred model is less negative compared to the coefficient in the base model in the 2008 ACS. On the other hand, the male FEM coefficients in the preferred and base models are negative in nine out of ten PUMS. The male FEM is positive at 5% level of significance in the 1950 Census in both the preferred and base models. In the preferred model, male FEM coefficients are more negative than female coefficients in every PUMS beginning in the 1980. Furthermore, male coefficients are also much larger in the 1980 and subsequent samples compared to the pre-1980s samples. The male FEM coefficient is -0.070426 in the 1970 Census and decreases to -0.280043 in the 1980 in the preferred model.

The pattern of larger negative male FEM coefficients in 1980 coincides with a reverse pattern in the female FEM coefficients. FEM coefficients in the preferred model in the 1980 and 1990 Census are much less negative than in other years. It is interesting to note that the 1980 Census marks the first time that working women outnumber working men in the selected occupations. Women also suffer less wage penalties due to female crowding when they first overtake men in the selected occupations. The smaller negative wage effect women receive in the selected occupations does not last long. Women receive larger wage penalties again starting with the 2000 Census, and the magnitude of the penalties is comparable to the coefficients in the pre-1980 sample. For example, the FEM coefficient of the preferred model in the 2000 Census is -0.182537, whereas it is -0.181917 in the 1970 Census.

Three conclusions are made from the examination of FEM coefficients. First, the negative wage effect of female occupational crowding is much more pronounced when there are controls for compensating differentials and power differences. Second, the sign of the FEM coefficients do not change when controls for percentages of occupational union membership and occupational collective bargaining agreements are included.[33] Third, the negative wage effect of female occupational crowding is a state dependent phenomenon. Male workers suffer more in feminized selected occupations after 1980 whereas women suffer less between 1980 and 1990 but revert back to the same level of wage penalty starting in 2000. The large-picture implication of the three conclusions is that both consistently suffer from lower wages when employed in feminized selected occupations in the postwar era. Table 4.3 reports that approximately two out of three female workers are employed in selected occupations with more than 70% women in every PUMS. On the contrary, approximately one out of two male workers is employed in selected occupations with less than 30% men in the 1990 Census and forward.[34] Consequently, women are more likely to receive wage penalties due female occupational crowding in the selected occupations even though they receive smaller penalties compared to men who are employed in feminized selected occupations. Female occupational crowding is a contributing factor to the gender wage gap in the selected occupations.

[33] That is, there is no significant change in the magnitude or sign of FEM coefficient between Models 7a and 7b.

[34] Men are much more concentrated in male-dominated selected occupations prior to the 1990 Census. See Table 4.3 for details.

CHAPTER 5

CONCLUSION AND FUTURE PLAN FOR RESEARCH

Even though the focus of this study is limited to 103 selected occupations, there is reason to believe the findings have implications for occupations not in this selected group. First, determinants of the gender wage gap are state-dependent. Factors that are hypothesized to contribute to the gender wage gap behave differently through the postwar decades, even in the same set of occupations. Second, power is an important, although complex, variable of wage determination. Labor segmentation and patriarchy theories have examined the role gender power differences play in the creation and maintenance of the gender wage gap. More empirical research is needed to understand the differences between men and women's power positions in jobs, occupations, and the general labor force.

Third, the study's findings highlight the importance of considering female workers' quality of employment instead of quantity of employment. The layoffs of male workers in the current recession have given women the opportunity to become the majority of workers for the first time in history in February 2009 (Rampell 2010). Discussions are taking place as to whether women will soon close the gender wage gap if they continue to increase their share of the labor force; this view is short-sighted because it is not taking into consideration the important question of the quality of women's employment; it is only focusing on the quantity of female employment. This dissertation shows women in selected occupations outnumber men in the 1980 Census through 2008 ACS, and, while they temporarily receive smaller wage penalties between the 1980 and 1990 decades, the "benefit" disappears in the 2000s. Women in the selected occupations

fail to close the gender wage gap after they outnumber men because they are concentrated in female-crowded selected occupations, where they are penalized for their work. Women are also penalized when they work in selected occupations that are physically demanding, have high percentages of collective bargaining coverage, and offer voluntary certifications and licenses. Consequently, if we are serious about closing the gender wage gap, then a concerted effort to address factors that contribute to the male wage premiums is needed. Women will only achieve wage parity with men when they have equal wage bargaining status.

In order to properly address the problem of gender power differences, additional research is needed to determine the relative positions of wage bargaining power between men and women in all occupations across all industries, whether they are male-dominated, gender-neutral, or female-dominated ones. It is towards this direction that the author of this dissertation plans to conduct her future research.

APPENDIX A

THE SELECTED OCCUPATIONS

The following list of "selected" occupations is based on the occupational titles presented in the 2005 American Community Survey (ACS). Readers should refer to Chapter 3 and the Occupational Bridge Codes tables for a detailed explanation of how occupational codes are matched in each Census or ACS Public Use Microdata Sample (PUMS) to selected occupations listed in this appendix. Readers can examine the Occupational Bridge Codes as SAS® tables by visiting https://sites.google.com/site/bridgecodes/.

	Selected Occupational Title	**Assigned "Recode"**
1.	Farm, Ranch, and Other Agricultural Managers	20
2.	Purchasing Agents and Buyers, Farm Products	51
3.	Accountants and Auditors	80
4.	Aerospace Engineers	132
5.	Chemical Engineers	135
6.	Civil Engineers	136
7.	Electrical and Electronics Engineers	141
8.	Industrial Engineers, Health and Safety	143
9.	Mechanical Engineers	146
10.	Drafters	154
11.	Agricultural and Food Scientists	160
12.	Biological Scientists	161
13.	Conservation Scientists and Foresters	164
14.	Chemists and Material Scientists	172
15.	Environmental Scientists and Geoscientists	174
16.	Economists	180
17.	Psychologists	182
18.	Social Workers	201
19.	Clergy	204
20.	Postsecondary Teachers	220
21.	Librarians	243
22.	Designers	263
23.	Writers and Authors	285
24.	Photographers	291
25.	Dentists	301
26.	Dieticians and Nutritionists	303

APPENDIX A: Continued

	Selected Occupation Name	Assigned "Recode"
27.	Optometrists	304
28.	Pharmacists	305
29.	Physicians and Surgeons	306
30.	Registered Nurses	313
31.	Veterinarians	325
32.	Licensed Practical and Licensed Vocational Nurses	350
33.	Fire Fighters	374
34.	Security Guards and Gaming Surveillance Officers	392
35.	Bartenders	404
36.	Waiters and Waitresses	411
37.	Janitors and Building Cleaners	422
38.	Maids and Housekeeping Cleaners	423
39.	Grounds Maintenance Workers	425
40.	Motion Picture Projectionists	441
41.	Ushers, Lobby Attendants, and Ticket Takers	442
42.	Cashiers	472
43.	Advertising Sales Agents	480
44.	Securities, Commodities, and Financial Services Sales Agents	482
45.	Models, Demonstrators, and Product Promoters	490
46.	Real Estate Brokers and Sales Agents	492
47.	Door-to-Door Sales Workers, News and Street Vendors, and Related Workers	495
48.	Telephone Operators	502
49.	Bill and Account Collectors	510
50.	Bookkeeping, Accounting, and Auditing Clerks	512
51.	Tellers	516
52.	Couriers and Messengers	551
53.	Dispatchers	552
54.	Postal Service Mail Carriers	555
55.	Shipping, Receiving, and Traffic Clerks	561
56.	Office Machine Operators	590
57.	First-Line Supervisors/Managers/Contractors of Farming, Fishing, and Forestry Workers	600
58.	Logging Workers	613
59.	Boilermakers	621
60.	Brickmasons, Blockmasons, and Stonemasons	622
61.	Carpenters	623
62.	Electricians	635
63.	Glaziers	636
64.	Painters, Construction and Maintenance	642
65.	Paperhangers	643
66.	Pipelayers, Plumbers, Pipefitters, and Steamfitters	644

APPENDIX A: Continued

	Selected Occupational Title	"Assigned Recode"
67.	Plasterers and Stucco Masons	646
68.	Roofers	651
69.	Sheet Metal Workers	652
70.	Structural Iron and Steel Workers	653
71.	Derrick, Rotary Drill, and Service Unit Operators, and Roustabouts, Oil, Gas, and Mining	680
72.	Explosives Workers, Ordnance Handling Experts, and Blasters	683
73.	Millwrights	736
74.	Bakers	780
75.	Machinists	803
76.	Tool and Die Makers	813
77.	Welding, Soldering, and Brazing Workers	814
78.	Bookbinders and Bindery Workers	823
79.	Laundry and Dry-Cleaning Workers	830
80.	Upholsterers	845
81.	Sawing Machine Setters, Operators, and Tenders, Wood	853
82.	Power Plant Operators, Distributors, and Dispatchers	860
83.	Stationary Engineers and Boiler Operators	861
84.	Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders	873
85.	Jewelers and Precious Stone and Metal Workers	875
86.	Painting Workers	881
87.	Photographic Process Workers and Processing Machine Operators	883
88.	Cementing and Gluing Machine Operators and Tenders	885
89.	Etchers and Engravers	891
90.	Bus Drivers	912
91.	Taxi Drivers and Chauffeurs	914
92.	Railroad Brake, Signal, and Switch Operators	923
93.	Subway, Streetcar, and Other Rail Transportation Workers	926
94.	Dredge, Excavating, and Loading Machine Operators	952
95.	Directors, Religious Activities and Education; Religious Workers, All Other	2051
96.	Lawyers, and Judges, Magistrates, and Other Judicial Workers	2101
97.	PreK-12th Grade Teachers (Preschool, Kindergarten, Elementary, Secondary, and Special Education)	2301
98.	Library Assistants, Clerical and Librarian Technicians	2441
99.	Editors, News Analysts, Reporters, and Correspondents	2811 4051

APPENDIX A: Continued

	Selected Occupational Title	"Assigned Recode"
100.	Counter Attendant, Cafeteria, Food Concession, and Coffee Shop; Combined Food Preparation and Serving Workers, Including Fast Food	
101.	Word Processors, Typists, Secretaries, and Administrative Assistants	5701
102.	Printing Machine Operators, Prepress Technicians and Workers, and Job Printers	8241
103.	Service Station and Parking Lot Attendants	9351

APPENDIX B

ELECTRONIC CORRESPONDENCES WITH MR. BRANDON TRAMPE OF THE INTEGRATED PUBLIC USE MICRODATA SERIES (IPUMS) OF THE UNIVERSITY OF MINNESOTA POPULAR CENTER

The electronic correspondences have been edited for ease of reading.

From Xuan Pham to Mr. Brandon Trampe

Monday, September 27, 2010

To Whom It May Concern:

Hello! I am using the 1950 through 2000 Census PUMS and 2005 through 2008 (single year files) ACS PUMS for my dissertation research. I need to know whether the Census/ACS top code the incwage (wage and salary) variable by the state in which the individual lived or by the state in which they worked for beginning in the 1990 PUMS. I've tried to look for the answer on the Census PUMS website and googling but without much success. If you can help, I'd appreciate it very much.

From Mr. Trampe to Pham

Wednesday, September 29, 2010

I'm unaware of any CB documentation that specifically states whether the top code is by state of residence or by state of work. I did find previous research stating that it is by state of residence in the ACS, but they didn't cite a source for that information. Additionally, I couldn't find any similar sources for 1990 or 2000.

However, I think I would likely conclude that it is by state of residence. I determined this as follows...

All persons living in California but working in a different state with top-coded income:

Wage and salary income	Freq.	Percent	Cum.
195516	445	0.13	0.13
999999	348,962	99.87	100.00
Total	349,407	100.00	

Then, the distribution of pwstate for persons with top-coded income:

Place of work: state, 1980 to 2005	Freq.	Percent	Cum.
N/A	349,336	99.98	99.98
Alaska	1	0.00	99.98
Arizona	2	0.00	99.98
Colorado	2	0.00	99.98
Connecticut	1	0.00	99.98
District of Columbia	1	0.00	99.98
Florida	3	0.00	99.98
Hawaii	1	0.00	99.98
Illinois	6	0.00	99.98
Louisiana	2	0.00	99.99
Massachusetts	2	0.00	99.99
Michigan	1	0.00	99.99
Missouri	2	0.00	99.99
Nevada	2	0.00	99.99

Place of work: state, 1980 to 2005	Freq.	Percent	Cum.
New Jersey	2	0.00	99.99
New Mexico	1	0.00	99.99
New York	8	0.00	99.99
Oregon	4	0.00	99.99
Pennsylvania	1	0.00	99.99
Rhode island	1	0.00	99.99
South Carolina	2	0.00	99.99
Texas	4	0.00	99.99
Utah	1	0.00	99.99
Virginia	2	0.00	99.99
Washington	3	0.00	100.00
Wisconsin	2	0.00	100.00
Abroad	14	0.00	100.00
Total	349,407	100.00	

I performed similar tests for 2000 and the 2008 ACS. I assume it would be the same in other ACS years, but you'd want to verify independently….Since the topcodes are consistent across state of residence but vary of state of work, I think it would be fair to conclude that the topcode is based on state of residence. Of course, since we can't find any additional documentation (and I don't have any personal knowledge about this) you'd want to use the results of this analysis at your own risk.

From Pham to Mr. Trampe

Sunday, October 3, 2010

Thank you for replying to my question. I do have another question about the top coding of the INCWAGE variable in the ACS. According to the IPUMS website, it states that the Census set the wage cutoff at the 99.5 percentile of each state. All wage observations above the 99.5% cutoff is assigned the mean of all observations above this cutoff for the state (http://usa.ipums.org/usa-action/codes.do?mnemonic=INCWAGE). On the other hand, the PUMS documentation website states, "within each state, all base dollar amounts are top coded using the mean of cases greater than the national minimum value" (http://www.census.gov/acs/www/Downloads/data_documentation/pums/TopCodedValues/2005PUMS_top_coded_values.pdf). The same explanation is also given for the 2006, 2007, and 2008 ACS PUMS. I tried looking for the referred "national minimum value" on the PUMS documentation website, but I did not have any luck.

Can you help clarify this confusion for me? Is there a reported national minimum value for wage and salary in the 2005 through 2008 ACS PUMS (single year files)?

From Trampe to Pham

Monday, October 4, 2010

I believe the cutoffs are in fact by state. The CB documentation states that the values (except for tax values) are topcoded based on state minimum values in 2003, 2006, 2007, 2008 (I believe). I see the documentation for 2005 and 2004 says that the topcode is based on a national minimum value, but I don't think that is correct.

See, for example, the incwage distribution for Connecticut in 2005. There are many values above 142,000, which is Arizona's topcode value for INCWAGE. This would not make sense if the cutoff was really a national value.

Wage and salary income	Freq.	Percent	Cum.
141000	4	0.05	0.05
142000	2	0.02	0.07
143000	2	0.02	0.10
144000	5	0.06	0.16
145000	14	0.17	0.33
146000	1	0.01	0.35
147000	6	0.07	0.42
148000	3	0.04	0.46
149000	2	0.02	0.48
150000	93	1.15	1.63
151000	3	0.04	1.67
152000	4	0.05	1.72
153000	5	0.06	1.78
154000	1	0.01	1.79
155000	3	0.04	1.83
156000	1	0.01	1.84
157000	1	0.01	1.86
158000	1	0.01	1.87
159000	2	0.02	1.89
160000	35	0.43	2.33
162000	5	0.06	2.39
163000	2	0.02	2.41
165000	9	0.11	2.52
166000	2	0.02	2.55
168000	3	0.04	2.59
169000	1	0.01	2.60
170000	2	0.02	2.62
337000	631	7.81	10.43
999999	7,238	89.57	100.00
Total	8,081	100.00	

From Pham to Mr. Trampe

Tuesday, October 12, 2010

I went through the codebooks for 1950-2000 and did not find any specific documentation about how the wage top code was determined, except for the one pageyou

pointed out to me in the 1990 codebook. I searched for numerous keywords, including "wage," "earnings," "economic," "economic items," "universe," "topcoded," "national mean," and "national median." I didn't find anything pertaining to the methodology used to construct wage top code values in the non-1990 PUMS. I want to reach out and ask whether you have any additional resource/persons I can contact who may know the answer.

From Mr. Trampe to Pham

Wednesday, October 13, 2010

I'm also not really finding much in the codebooks about how the top code was determined. It appears that 1990 was the exception rather than the rule. From what I've been told, researchers seem to have been content with looking at the income distribution in the data to determine where the topcoded 'cutoffs' are In other words, researchers have been satisfied in knowing where the cutoffs are rather than knowing why they have been set there. I have not found anyone here who knows how these levels were determined, unfortunately. This isn't to say that you won't be able to find an answer, but I don't know of anyone here who has had to explore this question as part of their own research.

I'm sorry I can't really give you a good answer on this one. If I knew someone who might be able to help then I would certainly point you that way, but I don't think I know who that person might be.

APPENDIX C

AKAIKE INFORMATION CRITERION (AIC) OF ALL ESTIMATED WAGE MODELS

	1950 Census		**1960 Census**		**1970 Census**		**1980 Census**		**1990 Census**	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Model 1	37,463	18,275	124,045	81,085	194,719	160,076	298,610	320,814	330,821	404,969
Model 2	37,461	18,277	123,898	81,087	194,584	160,067	297,965	320,811	329,492	404,971
Model 3	37,454	18,191	123,692	80,531	193,669	158,939	296,613	318,696	326,526	399,576
Model 4a	37,292	18,238	122,532	80,984	192,839	159,290	297,256	319,756	327,006	402,806
Model 4b	--	--	--	--	--	--	--	--	326,941	400,469
Model 5	37,453	18,180	123,560	80,384	193,236	158,681	296,026	318,625	325,048	399,536
Model 6a	37,287	18,240	122,483	80,980	192,765	159,291	296,484	319,636	325,090	402,728
Model 6b	--	--	--	--	--	--	--	--	325,056	400,470
Model 7a	37,285	18,062	122,065	80,035	191,966	158,320	295,469	318,190	322,763	399,162
Model 7b	--	--	--	--	--	--	--	--	322,530	398,660

APPENDIX C—*Continued*

	2000 Census		2005 ACS		2006 ACS		2007 ACS		2008 ACS	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Model 1	350,907	415,594	357,357	480,034	395,024	499,657	403,186	506,050	411,514	521,523
Model 2	350,287	415,486	356,716	479,826	394,348	499,462	402,187	505,735	410,876	521,173
Model 3	344,160	407,737	350,004	468,691	385,797	487,503	393,746	493,989	400,236	506,341
Model 4a	349,903	412,472	356,241	477,060	393,442	495,408	401,605	501,863	409,899	516,130
Model 4b	349,372	408,874	355,670	471,613	391,945	490,195	400,337	497,273	408,260	510,122
Model 5	342,943	407,270	348,601	467,994	384,108	486,828	391,754	493,163	398,198	505,433
Model 6a	349,470	412,072	355,903	477,002	393,093	495,405	400,994	501,829	409,592	516,094
Model 6b	348,750	408,364	355,335	471,312	391,705	490,194	400,018	497,270	408,021	510,124
Model 7a	341,873	405,694	347,199	467,491	382,857	486,149	390,473	492,415	396,528	504,303
Model 7b	341,523	405,056	346,845	466,434	381,978	485,220	390,477	491,700	396,018	503,451

Model with minimum AIC is highlighted.

APPENDIX D

REGRESSION ESTIMATE OF PREFERRED MODEL BY GENDER AND PUMS

PREFERRED MODELS OF 1950 CENSUS PUMS

	Male [Model 7a]	Female [Model 7a]
Schooling	0.044629*	0.000207
	(0.001630)	(0.011668)
Expr	0.030328*	-0.034362 ~
	(0.001113)	(0.015525)
Expr²	0.000442*	-0.160934*
	(0.000018)	(0.023645)
Spouse	0.242929*	-0.229603
	(0.013541)	(0.211582)
Divorced	0.133797*	-0.100431
	(0.02016)	(0.125679)
Black	-0.348148*	-0.075033*
	(0.016459)	(0.025321)
Native	-0.195265	-0.805678*
	(0.148366)	(0.018329)
Asian	-0.028097	0.081474
	(0.077923)	(0.087370)
Under5	0.017019	0.073295
	(0.010296)	(0.059726)
PT	-0.731878*	0.149032
	(0.018445)	(0.037027)
Mine	0.267389*	0.166831
	(0.037947)	(0.050412)
Cons	0.162210*	0.059063
	(0.023730)	(0.041312)
Man	0.232222*	0.089548
	(0.021080)	(0.057050)
Trans	0.172547*	0.088784 ~
	(0.024846)	(0.042408)
Info	0.245719*	-0.121330*
	(0.058186)	(0.037298)
Util	0.195173*	-0.153336*
	(0.032246)	(0.040469)
WS	0.149770*	0.043282
	(0.033310)	(0.038066)
Re	0.001436	-0.011875
	(0.024055)	(0.037576)
Ser	0.002658	0.191443*
	(0.028267)	(0.039511)
Fi	0.072628~	0.043802
	(0.029119)	(0.002482)

PREFERRED MODELS OF 1950 CENSUS PUMS: Continued

	Male [Model 7a]	Female [Model 7a]
Prof	-0.049788~	0.028076*
	(0.025297)	(0.001301)
Pub	0.207519*	-0.000464*
	(0.024301)	(0.000027)
FEM	0.054766 ~	-0.095080*
	(0.023783)	(0.023876)
Mental	0.000520	-0.002202~
	(0.000632)	(0.001051)
Physical	0.000201	-0.008603*
	(0.000397)	(0.000932)
WrkFreedom	0.001297 ~	0.004830*
	(0.000537)	(0.000887)
LicenseRe	0.094765*	0.277853*
	(0.023429)	(0.026128)
LicenseVol	0.171832*	0.027878
	(0.013556)	(0.027761)
Apprentice	0.016634	0.073627
	(0.013657)	(0.050802)
n =	21,459	11,412

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

PREFERRED MODELS OF 1960 CENSUS PUMS

	Male [Model 7a]	Female [Model 7a]
Schooling	0.061490*	0.063903*
	(0.000771)	(0.001307)
Expr	0.035246*	0.022447*
	(0.00502)	(0.000614)
Expr²	-0.000523*	-0.000313*
	(0.000008)	(0.000012)
Spouse	0.268548*	-0.021292*
	(0.006549)	(0.006034)
Divorced	0.144152*	0.000003
	(0.010371)	(0.007832)*
Black	-0.334475*	-0.110655
	(0.007232)	(0.010360)
Native	-0.201733*	-0.081519
	(0.045462)	(0.084912)
Other	-0.057246	0.002512
	(0.058733)	(0.073558)
Asian	-0.032987	0.067204~
	(0.021372)	(0.030390)
Under5	0.054529*	-0.072376*
	(0.004573)	(0.008795)
PT	-0.760996*	-0.973536*
	(0.008106)	(0.007220)
Mine	0.435378*	0.391182*
	(0.022918)	(0.062005)
Cons	0.366506*	0.282729*
	(0.016799)	(0.052989)
Man	0.441489*	0.377392*
	(0.016461)	(0.049211)
Trans	0.233396*	0.333571*
	(0.017966)	(0.052131)
Info	0.464074*	0.280349*
	(0.026501)	(0.050345)
Util	0.402022*	0.363719*
	(0.020445)	(0.053679)
WS	0.323581*	0.286086*
	(0.020853)	(0.050521)
Re	0.167135*	-0.015443
	(0.017928)	(0.049199)
Ser	0.189926*	0.025449
	(0.018001)	(0.049662)

PREFERRED MODELS OF 1960 CENSUS PUMS: Continued

	Male [Model 7a]	Female [Model 7a]
Fi	0.290221*	0.230852*
	(0.018718)	(0.049329)
Prof	0.203686*	0.164763*
	(0.017128)	(0.049194)
Pub	0.334503*	0.352612*
	(0.017241)	(0.049694)
FEM	-0.020991~	-0.137887*
	(0.008914)	(0.012922)
Mental	0.004506*	-0.001114~
	(0.000267)	(0.000533)
Physical	0.001517*	-0.012008*
	(0.000182)	(0.000481)
WrkFreedom	0.001683*	0.004042*
	(0.000228)	(0.000431)
LicenseRe	0.069010*	0.238550*
	(0.005734)	(0.012766)
LicenseVol	0.248221*	0.076416*
	(0.006769)	(0.016746)
Apprentice	0.062122*	0.038527
	(0.007839)	(0.027847)
n =	83,405	51,003

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

PREFERRED MODELS OF 1970 CENSUS PUMS

	Male [Model 7a]	Female [Model 7a]
Schooling	0.065834*	0.068956*
	(0.000804)	(0.001202)
Expr	0.040875*	0.022196*
	(0.000458)	(0.000506)
Expr²	-0.000640*	-0.000310*
	(0.000008)	(0.000010)
Spouse	0.324687*	0.014102*
	(0.006200)	(0.005682)
Divorced	0.219717*	0.073264*
	(0.009355)	(0.007209)
Black	-0.242637*	-0.051577*
	(0.006394)	(0.008041)
Native	-0.178739*	-0.221522*
	(0.033751)	(0.047951)
Other	-0.114326~	0.009737
	(0.050032)	(0.072768)
Asian	-0.003318	0.057313*
	(0.017466)	(0.021562)
Under5	0.072362*	-0.049429*
	(0.004752)	(0.007599)
PT	-0.703600*	-0.878702*
	(0.007141)	(0.005553)
Mine	0.239210*	0.226069*
	(0.021405)	(0.048803)
Cons	0.289299*	0.221934*
	(0.014092)	(0.036332)
Man	0.273172*	0.250731*
	(0.013640)	(0.032859)
Trans	0.098347*	0.168275*
	(0.015862)	(0.035925)
Info	0.263728*	0.115351*
	(0.023055)	(0.034617)
Util	0.227380*	0.233158*
	(0.017933)	(0.039294)
WS	0.188030*	0.160363*
	(0.017495)	(0.034261)
Re	-0.039633*	-0.122711*
	(0.014663)	(0.032795)
Ser	0.069776*	0.008398
	(0.015266)	(0.033488)

PREFERRED MODELS OF 1970 CENSUS PUMS: Continued

	Male [Model 7a]	Female [Male 7a]
Fi	0.150578*	0.093439*
	(0.015845)	(0.032953)
Prof	0.102085*	0.090765*
	(0.014133)	(0.032663)
Pub	0.209398*	0.258664*
	(0.014579)	(0.033468)
FEM	-0.070426*	-0.181917*
	(0.008883)	(0.011987)
Mental	0.006524*	0.007363*
	(0.000275)	(0.000437)
Physical	-0.001839*	-0.010813*
	(0.000187)	(0.000390)
WrkFreedom	0.000760*	0.001632*
	(0.000244)	(0.000384)
LicenseRe	0.085127*	0.189459*
	(0.005963)	(0.010309)
LicenseVol	0.209682*	0.093679*
	(0.006469)	(0.013969)
Apprentice	0.065082*	0.036987
	(0.007405)	(0.026297)
n =	111,830	86,526

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

PREFERRED MODELS OF 1980 CENSUS PUMS

	Male [Model 7a]	Female [Model 7a]
Schooling	0.072888*	0.074496*
	(0.000870)	(0.001012)
Expr	0.039814*	0.028523*
	(0.000525)	(0.000485)
$Expr^2$	-0.000617*	-0.000412*
	(0.000009)	(0.000009)
Spouse	0.233564*	0.002989
	(0.005993)	(0.005272)
Divorced	0.125504*	0.042819*
	(0.008083)	(0.006402)
Black	-0.192018*	-0.039838*
	(0.006722)	(0.006485)
Native	-0.196404*	-0.133104*
	(0.025048)	(0.026668)
Other	-0.134582*	-0.030527
	(0.032892)	(0.038947)
Asian	-0.015175	0.103757*
	(0.013405)	(0.013430)
Under5	0.026548*	-0.052162*
	(0.005603)	(0.006026)
PT	-1.297468*	-1.266375*
	(0.007363)	(0.004437)
Mine	0.423527*	0.344219*
	(0.021414)	(0.037720)
Cons	0.214897*	0.174314*
	(0.013868)	(0.029244)
Man	0.292103*	0.274999*
	(0.013395)	(0.026286)
Trans	0.298972*	0.273100*
	(0.015062)	(0.029033)
Info	0.392693*	0.309848*
	(0.023679)	(0.029495)
Util	0.315372*	0.290124*
	(0.018540)	(0.033602)
WS	0.210925*	0.186951*
	(0.018417)	(0.027860)
Re	0.027345	-0.038448
	(0.014680)	(0.025969)
Ser	0.006342	0.020363
	(0.014822)	(0.026480)

PREFERRED MODELS OF 1980 CENSUS PUMS: Continued

	Male [Model 7a]	Female [Model 7a]
Fi	0.126530*	0.108026*
	(0.015647)	(0.026276)
Prof	0.102379*	0.130544*
	(0.013744)	(0.025939)
Pub	0.191383*	0.223602*
	(0.015014)	(0.026836)
FEM	-0.280043*	-0.052138*
	(0.010804)	(0.010227)
Mental	0.005925*	0.006901*
	(0.000294)	(0.000366)
Physical	-0.002775*	-0.005325*
	(0.000218)	(0.000308)
WrkFreedom	0.003182*	0.005909*
	(0.000263)	(0.000320)
LicenseRe	0.150675*	0.175631*
	(0.007341)	(0.009114)
LicenseVol	0.079590*	0.112512*
	(0.006308)	(0.009386)
Apprentice	0.093284*	0.015832
	(0.006677)	(0.018362)
n =	140,867	151,068

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

PREFERRED MODELS OF 1990 CENSUS PUMS

	Male [Model 7b]	Female [Model 7b]
Schooling	0.076817*	0.095216*
	(0.000845)	(0.000903)
Expr	0.041736*	0.032449*
	(0.000487)	(0.000438)
$Expr^2$	-0.000623*	-0.000468*
	(0.000009)	(0.000008)
Spouse	0.166296*	-0.021635*
	(0.005233)	(0.004801)
Divorced	0.056831*	0.006554
	(0.006879)	(0.005718)
Black	-0.149935*	-0.034483*
	(0.006284)	(0.005559)
Native	-0.234814*	-0.151202*
	(0.020221)	(0.018594)
Other	-0.029701*	0.058145*
	(0.009365)	(0.010477)
Asian	-0.002575	0.096529*
	(0.009616)	(0.009427)
Under5	0.055718*	0.026073*
	(0.005035)	(0.004880)
PT	-1.388333*	-1.258394*
	(0.006164)	(0.003872)
Mine	0.415244*	0.384333*
	(0.021313)	(0.035165)
Cons	0.267954*	0.263753*
	(0.010191)	(0.021772)
Man	0.334525*	0.210689*
	(0.009842)	(0.018852)
Trans	0.291100*	0.427254*
	(0.012909)	(0.021715)
Info	0.433390*	0.367532*
	(0.020231)	(0.023371)
Util	0.390293*	0.380547*
	(0.015357)	(0.026654)
WS	0.308338*	0.225811*
	(0.014585)	(0.020929)
Re	0.143883*	-0.101280*
	(0.011038)	(0.018589)
Ser	0.105910*	0.057276*
	(0.010884)	(0.019052)

PREFERRED MODELS OF 1990 CENSUS PUMS: Continued

	Male [Model 7b]	Female [Model 7b]
Fi	0.264848*	0.144630*
	(0.011965)	(0.019041)
Prof	0.233969*	0.192650*
	(0.010619)	(0.018583)
Pub	0.256020*	0.237794*
	(0.012145)	(0.019799)
FEM	-0.472151*	-0.037023*
	(0.010159)	(0.009120)
Mental	0.007098*	0.012523*
	(0.000268)	(0.000338)
Physical	-0.006819*	-0.005418*
	(0.000233)	(0.000289)
WrkFreedom	0.002896*	-0.000441
	(0.000247)	(0.000283)
LicenseRe	0.205894*	0.121930*
	(0.006784)	(0.008983)
LicenseVol	0.170763*	0.090598*
	(0.005557)	(0.006163)
Apprentice	0.125364*	0.290312*
	(0.007178)	(0.021856)
UnionPer	-0.010472*	0.000232
	(0.001356)	(0.002121)
BargainPer	0.011506*	-0.003585
	(0.001278)	(0.001889)
n =	160,860	193,721

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

PREFERRED MODELS OF 2000 CENSUS PUMS

	Male [Model 7b]	Female [Model 7b]
Schooling	0.073780*	0.089079*
	(0.000789)	(0.000814)
Expr	0.039046*	0.034224*
	(0.000448)	(0.000395)
$Expr^2$	-0.000575*	-0.000466*
	(0.000008)	(0.000007)
Spouse	0.161238*	-0.005635
	(0.004741)	(0.004296)
Divorced	0.034444*	-0.004686
	(0.006169)	(0.005087)
Black	-0.130798*	-0.026519*
	(0.006813)	(0.004828)
Native	-0.155963*	-0.094356*
	(0.017306)	(0.016152)
Other	-0.048442*	0.050142*
	(0.007412)	(0.007933)
Asian	-0.005401	0.116927*
	(0.008372)	(0.007783)
Under5	0.067409*	0.055842*
	(0.005003)	(0.004589)
PT	-1.347471*	-1.183201*
	(0.005928)	(0.003685)
Mine	0.448795*	0.444869*
	(0.027056)	(0.041590)
Cons	0.300477*	0.371853*
	(0.013173)	(0.024415)
Man	0.415904*	0.434426*
	(0.013104)	(0.022917)
Trans	0.303027*	0.503679*
	(0.015139)	(0.024623)
Info	0.318991*	0.341953*
	(0.016461)	(0.023655)
Util	0.507369*	0.530718*
	(0.018848)	(0.030335)
WS	0.304406*	0.370615*
	(0.017624)	(0.024637)
Re	0.199086*	0.170322*
	(0.014535)	(0.022733)
Ser	0.081324*	0.113955*
	(0.014027)	(0.022658)

PREFERRED MODELS OF 2000 CENSUS PUMS: Continued

	Male [Model 7b]	Female [Model 7b]
Fi	0.395184*	0.317412*
	(0.014903)	(0.022991)
Prof	0.324359*	0.322003*
	(0.013019)	(0.022272)
Pub	0.311189*	0.369924*
	(0.014770)	(0.023287)
FEM	-0.309945*	-0.182537*
	(0.009536)	(0.007892)
Mental	0.016825*	0.016881*
	(0.000248)	(0.000301)
Physical	-0.007150*	-0.005151*
	(0.000232)	(0.000233)
WrkFreedom	-0.0017009*	-0.002192*
	(0.000223)	(0.000250)
LicenseRe	-0.054388*	0.048299*
	(0.004755)	(0.007482)
LicenseVol	0.127280*	0.144454*
	(0.004770)	(0.004344)
Apprentice	0.056904*	-0.096814*
	(0.007865)	(0.014446)
UnionPer	-0.021726*	0.046825*
	(0.001698)	(0.002092)
BargainPer	0.022293*	-0.052398*
	(0.001601)	(0.002261)
n =	171,962	208,340

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

PREFERRED MODELS OF 2005 ACS PUMS

	Male [Model 7b]	Female [Model 7b]
Schooling	0.081638*	0.09880*
	(0.000817)	(0.000835)
Expr	0.041437*	0.037932*
	(0.000448)	(0.000402)
Expr²	-0.000614*	-0.000519*
	(0.000008)	(0.000007)
Spouse	0.155860*	0.019287*
	(0.004758)	(0.004371)
Divorced	0.044655*	0.010373~
	(0.006306)	(0.005181)
Black	-0.140981*	-0.055152*
	(0.006046)	(0.005063)
Native	-0.117495*	-0.076559*
	(0.018378)	(0.017074)
Other	-0.037269*	0.065755*
	(0.007262)	(0.007896)
Asian	0.013289*	0.113914*
	(0.007462)	(0.007088)
Under5	0.094478*	0.100537*
	(0.005072)	(0.004843)
PT	-1.428491*	-1.23574*
	(0.005563)	(0.003631)
Mine	0.457803*	0.392643*
	(0.025594)	(0.043408)
Cons	0.211273*	0.260310*
	(0.012074)	(0.023314)
Man	0.314321*	0.316028*
	(0.011771)	(0.022027)
Trans	0.233121*	0.389296*
	(0.013957)	(0.023526)
Info	0.205984*	0.177677*
	(0.015497)	(0.022948)
Util	0.399430*	0.391207*
	(0.018230)	(0.031253)
WS	0.212777*	0.221264*
	(0.017329)	(0.023863)
Re	0.107774*	-0.007354
	(0.013415)	(0.021686)
Ser	-0.037296*	-0.053608~
	(0.012560)	(0.021652)

PREFERRED MODELS OF 2005 ACS PUMS: Continued

	Male [Model 7b]	Female [Model 7b]
Fin	0.342206*	0.175048*
	(0.013551)	(0.021844)
Prof	0.233678*	0.189818*
	(0.011884)	(0.021288)
Pub	0.297841*	0.245293*
	(0.013699)	(0.022165)
FEM	-0.270866*	-0.183807*
	(0.009349)	(0.008290)
Mental	0.017968*	0.018988*
	(0.000249)	(0.000298)
Physical	-0.007131*	-0.008099*
	(0.000230)	(0.000232)
WrkFreedom	-0.002528*	-0.001168*
	(0.000225)	(0.000254)
LicenseRe	-0.073030*	0.067786*
	(0.004336)	(0.007268)
LicenseVol	0.147582*	0.118945*
	(0.004527)	(0.005066)
Apprentice	0.108101*	0.480560*
	(0.007662)	(0.035829)
UnionPer	-0.033731*	0.076058*
	(0.002450)	(0.002876)
BargainPer	0.033475*	-0.085158*
	(0.002301)	(0.003106)
n =	176,416	229,784

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

PREFERRED MODELS OF 2006 ACS PUMS

	Male [Model 7b]	Female [Model 7b]
Schooling	0.084139*	0.102842*
	(0.000846)	(0.000830)
Expr	0.042807*	0.038428*
	(0.000469)	(0.000405)
$Expr^2$	-0.000640*	-0.000521*
	(0.000008)	(0.000007)
Spouse	0.164832*	0.032243*
	(0.004956)	(0.004383)
Divorced	0.041105*	0.012064~
	(0.006587)	(0.005211)
Black	-0.173189*	-0.069322*
	(0.006228)	(0.005030)
Native	-0.150603*	-0.136909*
	(0.019518)	(0.017088)
Other	-0.027740*	0.043109*
	(0.007260)	(0.007620)
Asian	0.037027*	0.109944*
	(0.007862)	(0.006994)
Under5	0.102423*	0.096979*
	(0.005389)	(0.004906)
PT	-1.472118*	-1.248145*
	(0.005810)	(0.003668)
Mine	0.534798*	0.309637*
	(0.025578)	(0.040952)
Cons	0.217616*	0.246422*
	(0.013020)	(0.022769)
Man	0.318661*	0.305557*
	(0.012741)	(0.021503)
Trans	0.241224*	0.374564*
	(0.014761)	(0.022999)
Info	0.216936*	0.183131*
	(0.016563)	(0.022391)
Util	0.421929*	0.386312*
	(0.019396)	(0.031167)
WS	0.222689*	0.203137*
	(0.018635)	(0.023378)
Re	0.107946*	-0.058052*
	(0.014316)	(0.020973)
Ser	-0.029274~	-0.109885*
	(0.013378)	(0.020945)

PREFERRED MODELS OF 2006 ACS PUMS: Continued

	Male [Model 7b]	Female [Model 7b]
Fin	0.348199*	0.152576*
	(0.014468)	(0.021235)
Prof	0.281543*	0.192688*
	(0.012756)	(0.021235)
Pub	0.187746*	0.225511*
	(0.014461)	(0.021657)
FEM	-0.317545*	-0.101184*
	(0.009877)	(0.008370)
Mental	0.019002*	0.018671*
	(0.000253)	(0.000296)
Physical	-0.009230*	-0.009743*
	(0.000234)	(0.000227)
WrkFreedom	-0.004900*	-0.003563*
	(0.000241)	(0.000263)
LicenseRe	-0.011814*	0.072997*
	(0.004572)	(0.007345)
LicenseVol	0.114401*	0.072203*
	(0.005256)	(0.007516)
Apprentice	0.027059*	0.331034*
	(0.008376)	(0.036661)
UnionPer	0.045816*	-0.021100*
	(0.001551)	(0.001767)
BargainPer	-0.041464*	0.018770*
	(0.001432)	(0.001971)
n =	182,582	234,644

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

PREFERRED MODELS OF 2007 ACS PUMS

	Male [Model 7a]	Female [Model 7a]
Schooling	0.088683*	0.099214*
	(0.000845)	(0.000823)
Expr	0.043241*	0.039441*
	(0.000470)	(0.000407)
Expr²	-0.000643*	-0.000535*
	(0.000008)	(0.000007)
Spouse	0.172464*	0.015909*
	(0.004974)	(0.004386)
Divorced	0.045782*	-0.000012
	(0.006646)	(0.005233)
Black	-0.166995*	-0.057901*
	(0.006217)	(0.005027)
Native	-0.111034*	-0.094995*
	(0.019087)	(0.016967)
Other	0.000481	0.048525*
	(0.007379)	(0.007692)
Asian	0.016819~	0.133269*
	(0.007723)	(0.006861)
Under5	0.095004*	0.105651*
	(0.005374)	(0.004888)
PT	-1.443862*	-1.248338*
	(0.005813)	(0.003666)
Mine	0.529552*	0.402850*
	(0.025006)	(0.040981)
Cons	0.214478*	0.264935*
	(0.012842)	(0.022949)
Man	0.319018*	0.282920*
	(0.012541)	(0.021638)
Trans	0.249020*	0.276231*
	(0.014157)	(0.022724)
Info	0.213025*	0.152364*
	(0.016448)	(0.022555)
Util	0.362692*	0.372491*
	(0.018966)	(0.031443)
WS	0.240856*	0.231390*
	(0.019014)	(0.023691)
Re	0.111723*	-0.057378*
	(0.014193)	(0.021141)
Ser	-0.035458*	-0.095374*
	(0.013164)	(0.021042)

PREFERRED MODELS OF 2007 ACS PUMS: Continued

	Male [Model 7a]	Female [Model 7a]
Fi	0.384857*	0.158105*
	(0.014277)	(0.021387)
Prof	0.281187*	0.181696*
	(0.012542)	(0.020837)
Pub	0.259357*	0.229548*
	(0.014202)	(0.021790)
FEM	-0.298309*	-0.133316*
	(0.009227)	(0.008329)
Mental	0.020203*	0.022582*
	(0.000252)	(0.000255)
Physical	-0.007384*	-0.009500*
	(0.000215)	(0.000225)
WrkFreedom	-0.003486*	-0.001968*
	(0.000233)	(0.000251)
LicenseRe	-0.038187*	-0.027918*
	(0.004455)	(0.006191)
LicenseVol	0.157436*	0.137300*
	(0.004936)	(0.005476)
Apprentice	0.094542*	0.253849*
	(0.007366)	(0.035253)
n =	184,292	237,134

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

PREFERRED MODELS OF 2008 ACS PUMS

	Male [Model 7b]	Female [Model 7b]
Schooling	0.075198*	0.091611*
	(0.000791)	(0.000747)
Expr	0.041985*	0.035365*
	(0.000453)	(0.000374)
Expr²	-0.000616*	-0.000463*
	(0.000008)	(0.000007)
Spouse	0.175103*	0.032220*
	(0.004852)	(0.004075)
Divorced	0.044884*	0.014646*
	(0.006482)	(0.004851)
Black	-0.153501*	-0.061598*
	(0.005972)	(0.004594)
Native	-0.174791*	-0.108796*
	(0.018103)	(0.015501)
Other	-0.045813*	0.077127*
	(0.008137)	(0.008217)
Asian	0.019073*	0.120589*
	(0.007388)	(0.006386)
Under5	0.100097*	0.096211*
	(0.005284)	(0.004507)
PT	-1.404288*	-1.209428*
	(0.005585)	(0.003466)
Mine	0.590576*	0.505643*
	(0.023111)	(0.036810)
Cons	0.290580*	0.320851*
	(0.012699)	(0.022558)
Man	0.388052*	0.351086*
	(0.012450)	(0.021231)
Trans	0.281315*	0.401732*
	(0.014399)	(0.022524)
Info	0.314853*	0.230070*
	(0.016364)	(0.022128)
Util	0.471091*	0.420401*
	(0.018855)	(0.029443)
WS	0.337445*	0.285923*
	(0.019343)	(0.02336)
Re	0.198130*	0.010235
	(0.013986)	(0.020751)
Ser	0.041556*	-0.043068~
	(0.013024)	(0.020661)

PREFERRED MODELS OF 2008 ACS PUMS: Continued

	Male [Model 7b]	Female [Model 7b]
Fi	0.473809*	0.205890*
	(0.014682)	(0.021099)
Prof	0.351040*	0.256132*
	(0.012367)	(0.020460)
Pub	0.353696*	0.280013*
	(0.014240)	(0.021318)
FEM	-0.310163*	-0.070397*
	(0.009628)	(0.007947)
Mental	0.021797*	0.021007*
	(0.000247)	(0.000270)
Physical	-0.008419*	-0.008281*
	(0.000232)	(0.000242)
WrkFreedom	-0.003770*	-0.003680*
	(0.000230)	(0.000242)
LicenseRe	-0.077437*	0.043711*
	(0.004414)	(0.006651)
LicenseVol	0.177442*	0.147363*
	(0.004940)	(0.005131)
Apprentice	0.135959*	0.403351*
	(0.008088)	(0.037591)
UnionPer	-0.039942*	0.041787*
	(0.001948)	(0.002068)
BargainPer	0.038612*	-0.049239*
	(0.001817)	(0.002281)
n =	188,885	251,412

The estimated standard error is reported in parentheses.
* = estimated regression coefficient is statistically different from 0 at 1% level of significance.
~ = estimated regression coefficient is statistically different from 0 at 5% level of significance.

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