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The Gender Salary Gap and Race: A Case of College-educated Individuals

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Honors Project

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According to a Gallup poll conducted in 2014, "Nearly four in 10 Americans say equal pay is the top issue facing working women in the United States today, a sentiment shared by roughly the same proportions of men, women, and working women" (Jones 2014). As a working woman, it is possible that you have experienced the effects of the gender pay gap in your lifetime, or at least heard that men are paid more than women. But what does that mean, exactly? Do men simply study more and thus make more? Do women naturally select occupations that pay less? Do they have more responsibilities inside the home? Or does race play a role? While there is great disagreement as to the actual cause of the gender pay gap, researchers have found time and time again that this gap, although it has improved over time, continues to exist today.

Further, many studies have found earnings vary among different racial or ethnic groups, with Whites earning substantially more than any other group with the exception of Asians. Day and Newburger (2002) report that based on estimates of work-life earnings for these groups, the racial pay gap actually widens over the lifetime. Before, the argument made was that minority groups such as Blacks and Hispanics simply did not possess as much human capital as higher earning Whites. However, research finds that in fact, college attendance rates among minorities have increased (Lopez and Fry 2013, U.S. Department of Education 2016). Despite these increased rates in college attendance, the earnings gap continues to exist.

As a country with an increasing rate of women in the workforce (Stalsburg 2016), research findings on the pay gap should concern us more. Through my honors project, I will explore the persistence of observed gender salary disparity despite substantial gains in educational attainment over time by women and how race impacts their earnings.

In the following section, I will review the interdisciplinary literature pertaining to the gender salary disparity, specifically the roles of race and college education. Using data from the National Survey of College Graduates of 2010 (NSCG) and the college-educated as the unit of observation, this paper will examine racial earnings differentials after controlling for geographical location, marital status, number of children, educational attainment, and experience. From these results, we will not only gain a deeper understanding of the how the aforementioned factors work together to affect the gender pay gap, but in acquiring that knowledge, we will also be better equipped to negotiate our earnings as women in the workplace.

Research Question

Despite the fact that today, women constitute the majority of higher education graduates, (U.S. Department of Education 2016) they still earn considerably less than their male counterparts. Using controls for region, demographics, and human capital development, how does race help to explain this pay gap? In other words, how does race affect salary for college educated women?

Literature Review

An extensive literature confirms the pay gap observed between men and women (Blau and Kahn 1999, Solberg 1999, Alkadry and Tower 2006, Erosa et al. 2016, Angelov et al. 2016, Kim 2015, Janssen et al. 2016). Using a projection method and assumptions regarding the evolution of educational attainment, Michael Shannon and Michael Kidd (2003) first estimate the future distribution of skills and use those estimates to predict the size of the future gender wage gap in the U.S. They find that although improvement of women's skills—especially that of educational attainment—will result in a continued decrease of the pay gap, the projections suggest that pay

convergence will not only take place at a slow rate, but also that a substantial pay gap will continue to exist in in the United States even in 2040 (Shannon and Kidd 2002).

One factor that may affect the difference in pay across groups of people may be educational attainment. Many studies find "a college degree is key to economic opportunity, conferring substantially higher earnings on those with credentials than those without" (Carnevale et al. 2011). Joanne Lindley and Stephen Machin (2016) find a significant rise in the postgraduate wage premium over time, which reflects an increased relative demand due to the superior skills sets of these individuals and their occupational status. Carnevale et al. (2011) note that the U.S. Census Bureau, in a 2002 study, estimated that in 1999, the average lifetime earnings of an individual with a Bachelor's degree was $2.7 million, a total 75 percent larger than that of a high school graduate. According to their report, today's numbers show similar results: since 1999, the college education premium is 84 percent. In other words, the value of a college education in terms of future income continues to rise. Further, Tamborini et al. (2015) confirm in their study on education and lifetime earnings in the United States, the positive effect of higher education on income. Additionally, Baum et al. (2013) from the College Board Advocacy and Policy Center explain the benefits of post-secondary education on income. According to their report, median earnings of individuals possessing a bachelor's degree who worked full time in 2011 were $56,500, a total $21,100 greater than the median earnings of those who only graduated from high school. Moreover, individuals with attended college for some time, but did not obtain a degree, still earned 14% more high school graduates working full time and year-round. Thus, such results suggest that in analyzing earnings disparities, it might be useful to examine the effects of educational attainment.

When race is added to the question of whether or not educational attainment will improve economic opportunities, the literature suggests whites and Asians are more likely to earn more with more education. Desegregation efforts in the 1970s and 1980s may have led to greater educational gains for black children (Pew Research Center), but does that mean that these children now the same opportunities as white children? Using U.S. Census and Current Population Survey data, Milner finds that while the racial differentials on occupation and education were reduced by 1970, the proportion of the occupational gap that was explained by educational attainment actually increased. This finding suggests efforts to reduce job discrimination played a bigger role in explaining the gap than efforts to desegregate schools to help increase educational attainment levels among black children (Milner 1973). More recently, in a Pew Research Center report, researchers found the high school graduation gap between blacks and whites has significantly decreased, with the percentage of whites in of U.S. population age 25 and older with a high school diploma at 93 and that of blacks at 88. Asians had a high school diploma attainment of 89% and Hispanics 67%. Similarly, they found whites are more likely to have a college degree at 36% of U.S. population age 25 and older (holding at least a bachelor's degree) than blacks at 23%, although this gap was much wider. Hispanics are even less likely to have at least a bachelor's degree at a mere 15% of the U.S. population age 25 and older, while Asians are the most likely at 53% (Pew Research Center 2016). Thus, while whites are the most likely to graduate high school, Asians are the most likely to graduate college. In terms of economic opportunities, the Pew Research Center finds that the median adjusted household income in 2014 dollars was highest for Asians at $77,900, followed by whites at $71,300, and blacks and Hispanics at a low $43,300; a gap which has actually widened over time (2016). These findings suggest that while the racial gaps in terms of educational attainment have

decreased over time, the racial earnings gap continues to exist, suggesting other factors may be playing a role.

Much of the literature also supports the idea that human capital development has positive effects on earnings (Willis 1986, Weiss 1995, Blundell et al. 1999, Gabriel and Schmitz 2015). As explained by Danice Lynn Langdon and Roger Klomegah (2013), "human capital differences are the time and investment that an individual puts into education and work force." In the 1960s and 1970s, different economists including Schultz (1961), Becker (1964) and Mincer (1974) expanded on this idea of "human capital" to include "education, training, work, experience, and even expenditure on health care" as means for increasing the productivity of workers, which is in effect, an investment in human capital (Olson 2012). In other words, human capital theory relies on the idea that the resources we, or others spend to help refine our knowledge and skillset is an investment in the capital we provide as individuals to our employer. Investment in human capital development then, helps increase our earnings.

Further, many researchers argue that human capital development signals explanations of earnings. Andrew Weiss (1995) explores this idea in his research and finds that while human capital development is important in explaining earnings, it also serves as an important signal to employers. As he describes it, "better educated workers are not a random sample of workers: they have lower propensities to quit or to be absent, are less likely to smoke, drink or use illicit drugs, and are generally healthier (Weiss 1995). In other words, the fact that workers obtain an education signals to employers they are already better prepared for the workplace. These are then the individuals a firm wants to employ as by hiring them, firms may experience lower turnover and higher productivity as opposed to hiring non-educated individuals. Thus, human capital development serves as a signal of personality and character traits that may prove beneficial to a

firm. Further, given that many economists argue that one of the ways in which wages are determined is through the productivity of workers (Case and Fair 2004), then investment in human capital can thus serve to help explain wages (Olson 2012), or more generally, earnings.

Weiss' finding that human capital development signals explanations of earnings supports the statistical discrimination model, as proposed by economists Edmund S. Phelps (1972) and Kenneth Arrow (1973). As defined by England and Lewin, statistical discrimination occurs "when decisions are made on the basis of race or sex group averages on indicators of productivity" (1989). Rather than employers simply having a personal prejudice or distaste for a particular group, the idea here is that discrimination takes place because employers face limited information about job applicants. As such, it is simple to use observable characteristics that act as "indicators" to infer or signal an individual's relevant skills and productivity level. Such indicators may include gender, race, and quantity of education. The employer, a profit-maximizer, will thus "…discriminate against blacks or women if he believes them to be less qualified, reliable, long-term, etc. on average than whites and men, respectively, and if the cost of gaining information about the individual applicants is excessive," for example (1972). Phelps explains that the employer's belief that an individual from group A is preferable to one from group B, for example, may stem from previous statistical exposure to the two groups, where most of the time, individuals from group A are hired over those from group B or are hired in more favorable terms. Alternatively, the employer's belief may stem from sociological beliefs about particular groups, one example being the belief that blacks and women simply grow up more disadvantaged because of racial hostility and/or prejudice they experience in society (Phelps 1972). Supposing that the group average for blacks is in fact lower than that of whites in terms of productivity, Arrow argues that because the cause of such a statistic is unobservable, [1]

"then the experience of employers over time will cause them to use the observable characteristic, race, as a surrogate for the unobservable characteristics which in fact cause the productivity differences" (1998). Thus, similar to Phelps, Arrow believes that experience with particular groups helps shape employers' opinions and beliefs about those groups, and leads them to make decisions based on that experience. Nonetheless, the result is that individuals from non-preferred groups undergo discrimination. Further, discrimination in this way can be self-reinforcing in that when individuals of the non-preferred group realize that they are not preferred and are discriminated against, they will not want to participate in the market and/or will not choose to invest in human capital because they believe it will not make a difference in terms of being hired (Arrow 1998). As such, it is possible that the once observed characteristics by employers of the non-preferred group become reality rather remain a mere observation.

Another important aspect in terms of explaining the pay gap then, is racial discrimination. One very popular sociological theory of discrimination is known as the social identity theory. Fathered by Tajfel and Turner, this theory recognizes that humans long for a sense of belonging, defining our social identity as our sense of who we are based on the social group(s) of which we are members (1979). The theory posits that members of a group are "motivated to protect their self-esteem and achieve a positive and distinct social identity" (Al Ramiah et al. 2010). This desire to protect one's group identity may lead to discrimination as we are filled with pride for our group and consequently, we may attempt to minimize any group to which we do not belong or, alternatively, we may give preferential treatment to those with whom we share group membership. This desire results in an "us versus them" mentality, where we seek to raise the status of our group and minimize that of other groups (Al Ramiah et al. 2010). In terms of employer discrimination then, this theory might manifest if, for example, a male employer feels

strongly about his social identity as a man and as such, chooses to hire a male employee over a female or a black individual simply because they share a group identity (both the employer and the employee are male). The result is discrimination toward the out group—in this case, the black and female individuals. Using data from the MultiCity Study of Urban Inequality and the Multi-City Telephone Employer Survey, Julie A. Kmec (2002) studies this effect. She finds the data support the idea of race-based devaluation. In fact, employers pay whites and minorities in mostly black or Latino jobs smaller wages and provide them with fewer benefits than their peers in mostly white jobs, net of controls. Further, she finds that employers hire based on race and/or gender traits they share with applicants (Kmec 2002). In other words, white employers hire more white employees because they share the same race, and male employers hire more male employees because they share the same gender—a finding that supports the social identity theory on discrimination. In other words, employers have certain preferences for groups that affect the way in which they hire and that may result in negative effects in terms of earnings if that worker is in the non-preferred group.

Kmec's findings may also be explained in part by Gary Becker's Taste Discrimination Model, an economic theory that depicts discrimination as a personal prejudice—or taste—against associating with a particular group of individuals. Having a "taste for discrimination" implies that the discriminator is willing to pay a price to discriminate against a particular group (England and Lewin 1989). According to the model, there are three sources of discrimination: the employer, the employee (coworker), and the customer, however, for the purposes of this paper, we will focus on the employer. In maximizing his utility, an employer may choose to forgo profits in order to avoid associating himself with groups for which he has distaste. I will provide an example to better explain the theory. Suppose an employer prefers to associate himself with

neither women nor minorities and instead has a preference, or taste, for hiring white men. Suppose further, for the purposes of explaining the model, these women and minorities are just as productive as white men. Given the employer's preference for hiring white men and the choice between the three groups, he will act as if the non-preferred groups (in this case women and minorities) are less productive than the preferred group (white men), despite equal productivity between the three groups. Thus, the employer's devaluation of the productivity of the non-preferred groups is strictly subjective and is therefore a demonstration of personal prejudice (Ehrenberg and Smith 2012).

In order to affect earnings, these preferences or tastes for particular groups must influence employers' actions in hiring. In order to affect earnings on a larger scale then, these preferences or tastes for particular groups must apply on a large scale—for the purposes of my paper, this means many firms must have distastes for minorities and women and thus discrimination takes place. Ultimately, the result is that the employer pays for his distaste of the non-preferred group, a cost that is denoted by the negative discrimination coefficient "d," which measures the strength of his distaste. The cost to him of employing an individual from a non-preferred group is thus $w_{np} + d$, where w is wage and the subscript "np" stands for the non-preferred group and "d" is a negative number. Further, the discriminating employer ends up hiring the individual from the non-preferred group at a lower wage than that of the preferred group, despite having equal productivity, effectively discriminating against the non-preferred individual. (Borjas 2016). This result is depicted in the equation $w_{np} = w_p - d > w_p$, where the subscript "p" stands for the preferred group. Keeping in mind that the discrimination coefficient is negative, given this example then, the outcome is that wage of the preferred white male is higher than those of the non-preferred minorities and women. As England and Lewin explain, an employer with a

distaste for women, for example, is "unwilling to hire [women] unless they offer themselves at a wage far enough below the wage paid white [males] to completely offset the disutility she or he experiences by employing [women]" (1989). Consequently, the wage gap widens with the discriminatory preferences of employers between the preferred group and the non-preferred group(s). [2]

To gain a better understanding of why discrimination occurs, we can also examine other socio-psychological views on discrimination. It is important to note that discrimination from a sociological standpoint deviates a little from the economics definition. As defined by Correll et al., discrimination is "behaviour directed towards category members that is consequential for their outcomes and that is directed towards them not because of any particular deservingness or reciprocity, but simply because they happen to be members" (2010). Another commonly cited theory of discrimination in the sociological world is aversive racism. The idea here is that rather than professing their racism and/or prejudices openly, individuals do so in a quiet manner, typically by choosing to not interact with those individuals towards which they feel prejudiced. Often times, these individuals actually profess egalitarian values in front of others, despite inner prejudice toward particular groups (Al Ramiah et al. 2010). As Al Ramiah et al. explain, "people generally will not discriminate in situations in which right and wrong is clearly defined; discrimination would be obvious to others and to oneself, and aversive racists do not want to appear or be discriminatory" (2010). The end result, nonetheless, is discrimination. In terms of employer discrimination, this theory would suggest that while employers may seem to uphold egalitarian values on the outside—a good example might be a company that state it is an "equal opportunity employer"—the reality is that he does feel prejudiced against some groups, but because he is racist averse, will tend to be more discreet about it. Perhaps he will choose not to

hire an individual from a group he feels prejudiced towards, but rather than stating that it is a matter of race, for example, will say that he does not possess the skills and/or experience required for the job—a reason that tends to be more accepted as it is not typically associated with discrimination.

Ultimately then, economics tells us that while those who are discriminated against suffer lower earnings than their marginal productivity of labor, employers also suffer the consequence their discrimination by paying a discrimination coefficient, thus lowering their profits. This theory then suggests firms that do not discriminate will fare better in terms of profitability. Sociology, on the other hand, works with economic theories of discrimination to help us to understand why employers might discriminate against their employees, thus providing a better understanding of how earnings might be affected by gender and race.

Theory

Based on the literature review and the various theories of discrimination, race should play a role in the gender pay gap. The logic here is that employers discriminate whether intentionally or unintentionally by basing decisions involving their employees on tastes and/or personal prejudices towards particular groups, lack of information, or their strong connection to their own group identity. For the purposes of this project, discrimination will be defined as a minority group of individuals being treated in a less favorable manner—based on an observable characteristic—than the majority group, despite both groups having equal levels of productivity. Employers may have a particular taste for a certain group, or distaste based on preconceived notions about that group. Because there is no absolute way to measure productivity, in many cases he or she may rely on "indicators" to infer about an applicant's relevant skills and work ethic. He or she may prefer a particular group because he or she shares a social identity with that

group and feels a strong connection with that individual, thus choosing to hire him or her over an individual with whom he or she does not share a social identity. Regardless of the reasoning and intention or lack of intention, the result is discrimination against some group. Generally speaking, the literature suggests there are three groups who "win" in terms of highest earnings. Those three groups are males, whites, and Asians. These findings imply that women are absolutely at a disadvantage because of their gender, as are most minorities, including blacks and Hispanics. While educational attainment and investment in human capital development may help to narrow this gender and racial earnings disparity, the literature suggests the disparity continues to exist.

Hypotheses

Given this theory and the previous literature, one would expect to see a few different results. First, one would expect the effects of the variables encompassing human capital are positive. In other words, the greater the levels of degree attainment, work experience (years since highest attained degree), and firm specific skills (current job tenure), the larger the salary of the individual, as the literature states. Further, despite increasing levels of investment in human capital development, one would expect that women continue to earn less than men. Additionally, one would expect that race plays an important role in the determining of salaries. As the literature tells us, whites and Asians tend to earn more than other minorities despite increasing levels of educational attainment among those minorities, suggesting discrimination may be occurring in the workplace. Thus, one would expect that regardless of gender, whites and Asians will earn more, while blacks and Hispanics will earn less.

H1: An increase in human capital development should result in a larger salary.

H2: Women should have lower salaries than their male colleagues.

H3: Asians should have similar comparable salaries to their white colleagues.

H4: Blacks and Hispanics should have lower salaries than their white and Asian colleagues.

Method for Research

The National Survey of College Graduates (NSCG) is a biennial survey sponsored by the National Science Foundation that provides data on different characteristics of college graduates under the age of 76 living in the United States. The 2010 NSCG sampled approximately 135,000 random individuals who had obtained at least an associate's degree at the time of taking the survey. For the purposes of this study, I will include only full-time individuals who have all the data for the analysis. The sample size then becomes 55,421.[3] Using this data, I will estimate a series of OLS regressions on individual and job-related characteristics to determine the role of race in the persistence of the gender pay gap. Table 1 contains the means and standard deviations of the variables.

In addition to controlling for gender, where male is the omitted variable, the final dataset used for this analysis includes controls for different factors that affect salaries including geographical location (where New England is the omitted variable), social demographics, human capital development, and occupation. Human capital development is controlled for through variables representing the individual education and employment circumstances of those surveyed. Variables representing the highest degree obtained by an individual (i.e. master's, PhD, or professional degree) capture the educational effect, where a bachelor's degree is the omitted category. In terms of employment, variables include years since attainment of highest

degree and tenure with current employer. The occupation controls include fifteen different occupational categories, where a kindergarten through 12th grade teaching job is the omitted category. The notes under part I of the Appendix provide a detailed description of each occupation category used in this analysis.

Using this data, I will use the traditional semi-log functional form for salary regression to determine their effects on women's salaries by race. First, I will run an initial regression with only geographical location (region) as a control. I will then run a second regression controlling for social demographics (marital status and number of children).[4] The third regression will control for human capital (degree attainment, work experience, and firm specific skills—current job tenure) while the fourth regression will control for occupation. Additionally, I will run a final regression to check for possible interactive effects with gender. The full regression equation is written as: $\ln(Sal) = \beta_1 + \beta_2 female + \beta_k \sum_{i=1}^{k} race_k + \beta_j \sum_{i=1}^{j} demographics_j + \beta_l \sum_{i=1}^{l} humancapital_l + \beta_m \sum_{i=m}^{m} region_m + \beta_n \sum_{i=n}^{n} occupation_n + u_i$, with interactions between some of these variables and gender in a final model. Ultimately, by setting up the regressions in this manner, we will be able to see how each set of controls helps to further explain discrepancies in earnings by gender and race.

One of the assumptions of the Classical Linear Regression Model (CLRM) known as "homoskedasticity" is that the variance of the error terms is constant for each observation (Woolridge 2012). Because the error variance measures model uncertainty, this assumption implies that the model uncertainty is same for all observations. When this assumption fails, then the model is likely to have a heteroskedasticity problem. To ensure that the error terms are constant for each observation, I will test for heteroskedasticity in my models using the Breusch-Pagan and White tests. From these tests, I will be able to conclude whether a heteroskedasticity

problem is present and will proceed to correct it. One of the commonly used methods to correct for heteroskedasticity is through the use of robust standard errors. This correction involves producing consistent estimators of the standard errors (Woolridge 2012). The idea here is to create constant variance across observations and thus arrive at homoskedasticity in order to appropriately conduct t and F tests.

Finally, in conducting research, it is always important to recognize limitations. For the purposes of my honors project, it is important to recognize that, as Olson (2013) explains, human capital theory, although useful in understanding the gender pay gap, does not provide measures that are "totally a matter of free choice unaffected by social norms." In other words, there are other factors beyond economics that may influence earnings; there may be social factors involved of which we are unaware. While this study will look at some important factors that play a role in earnings such as occupation, region, human capital development and social demographics such as marital status and number of children, it is not all encompassing.

Results

This study finds that controlling for region explains about 7.1 percent of the variation in salary for the college-educated. Table 2 reports the log-linear salary regressions. Column 2 provides the basic regression with controls for the regions of New England, Atlantic, Central, Mountain, and Pacific, where New England is the omitted variable. Given this these controls, females earn an average salary of 38.2 percent less than males, supporting my second hypothesis that women should earn less than males. Additionally, blacks earn an average salary of 7.0 percent and Hispanics 12.2 percent less than whites, supporting my fourth hypothesis that blacks and Hispanics earn less than their white counterparts. In terms of Asians, controlling for region, the

result is that Asians earn an average salary 4.6 percent larger than whites, supporting my third hypothesis that Asians and whites have similar salaries, although 4.6% is larger than I imagined.

Further, controlling for the social demographics of marital status and number of kids only adds about 1.5 percent explanatory power to the estimation of these college educated individuals' salaries, while the addition of human capital development controls almost doubles its explanatory power at 15.9 percent. As can be seen in the second column of Table 2, adding marital status and number of kids reduces the female coefficient by only two percentage points. These controls do cut the black coefficient by about 3 percentage points to 4.6, but does very little to the coefficients on Asian and Hispanic. As can be seen in the third column of Table 2, when adding human capital development controls, the coefficient on female is reduced to 35.4 percent while the coefficient on Asian increases by about one percent at 5.5 and the coefficient on Hispanic decreases to 7 percent. These results suggest that investment in human capital development may be a worthwhile endeavor, especially for Hispanics, whose average salary rises by about five percent when accounting for human capital development. Similarly, when controlling only for only marital status, number of kids, and region, the result is an increase in the average salary for blacks by about 3 percent. Adding controls for human capital development to the model reduces the coefficient on black decreases to a mere 0.8 percent, although the coefficient is not statistically significant, suggesting white and black salaries are not different once human capital is included in the model. Further, these results suggest that Hispanic and black minorities can gain from obtaining higher levels of education. They reflect the results Cheeseman Day and Newburger, who found that both black and Hispanic work-life earnings increase with higher educational attainment although at a higher rate for blacks than for Hispanics using data from the U.S. Census (2002). Because the coefficients on race are

statistically significant with the exception of the coefficient on black in the third model, these results suggest that human capital definitely affects the earning potentials of individuals by race.

Controlling for occupation adds even greater explanatory power to the estimation of salaries for these college-educated individuals at 27.4 percent. Most of the coefficients on the occupational categories are statistically significant, suggesting that occupation plays a major role in the earnings of individuals by race and gender. Further, in conducting a restricted F-test to determine if occupation jointly matters to the model, the result is that occupation should be included, as it adds to the model. Of all the occupations, the only category not statistically significant is that of social occupations.[5] Some of the best paid individuals are those in engineering, management and business, and the hard sciences with average earnings greater than those of k-12 teachers by 57.8, 50.6, and 42.8 percent, respectively.

Finally, the interactions model as can be seen in column 5 of Table 2, tests for gender differences on any variables interacted with female**.** Incorporating these interactions with all controls explains about 28.08 percent of the salary discrepancy between men and women. Given the literature review and theory which tells us that men earn more than women, one should expect that the coefficient on the salary of men be positive. The results support this information. On average, when all other variables equal zero, the predicted value of natural log of salary for white men is a positive 10.272. In dollar terms, this means that on average, all other variables set equal to zero, white men earn a salary of about $25,058.13.[6] This result further supports the literature and media reporting white men are the top earners. As suggested by the literature, Asian men earn comparable salaries to white men, with an average only 2.3 percent lower than white men. Hispanic men follow with an average salary 7.3 percent lower than that of white men with black men following closely behind at 8.7 percent.

Conversely, one would expect that the coefficients on the earnings of women be negative. As expected, Asian women earn an average salary 26.5 percent lower than white men—a differential comparable to that of white women. Interestingly, white women fall *behind* Hispanic women—although only slightly—earning a lower average salary of 33.3 percent compared to the Hispanic woman's 32.3 percent when compared to white men. More importantly, the data show that black women earn an average salary that is 22.4 percent lower than white males, making them the top female earners, even greater than Asian and white women (when compared to white men). This finding therefore suggests that black women have the most to gain from further educational attainment, a result supporting the findings of others that educated black women are surpassing educated white women in terms of earnings ("It's the Strong Academic Performance" 2001).

In interacting with gender, we see some interesting results for some of the variables. In terms of kids, men can have up to four children before return begins to decline, as can be seen in Figure 1. In contrast, women face a declining return to children after the first one. In other words, men gain in terms of salary by having more children (up to four) while women lose by having even just one. Regarding degree attainment, we can see in Figures 2, 3, and 4 that although men earn more, women can narrow the gap by pursuing a Master's degree, and even further by pursing a PhD or a professional degree such as a JD (law) and a MD (medicine). In interacting gender with current job tenure, we see that the returns to men are rising with another year of tenure until reaching their peak at 41 years of tenure, where returns begin to decline. Similarly, women face increasing returns with each additional year of tenure, however, their peak is at 26 years. These results are illustrated in Figure 5.

To ensure that the error terms were constant for each observation, I tested for heteroskedasticity. The results for the two tests I used, the Breusch-Pagan and the White tests, can be seen Table 4. Using both of these tests, I was able to reject the null and conclude that I had a heteroskedasticity problem. In order to correct for it, I used robust standard errors, which are commonly used to correct for heteroskedasticity (Woolridge 2012).

Conclusion

This paper examines some of the different factors that affect salary differentials by race and gender. By estimating a series of OLS regressions through levels of controls, we are able to see how different controls including geographic location, social demographics, human capital development and occupation work together to explain these differences in pay. On their own, marital status and number of kids (social demographic controls) do very little to explain discrepancies in pay by race and gender. Men are paid more than women across all races and white men are the top earners. As expected, Asians are near the top in terms of salary for both genders with Hispanics falling behind. The inclusion of human capital development controls almost doubles the explanatory power of the model. This finding suggests that my hypothesis that an increase in human capital development should result in a higher salary is correct, thus making it a worthwhile investment for all individuals—regardless of gender or race. After controlling for occupation—which adds significant explanatory power to the model—and interacting race, I find that white women make an average wage 33.3 percent lower than white men, while that same differential is only 22.4 percent for black women. This finding suggests that black women have the most to gain from investing in their human capital development. As such, black women should definitely pursue higher levels of educational attainment as well as

experience in the workplace. In this way, they can continue to work towards narrowing the gap between men and women as well as across races.

Given more time and unlimited resources, I would definitely analyze a few different aspects in ascertaining exactly what factors affect these salary differentials. In terms of the impact on women, I would like to see if there are any important interactions between gender and working in a particular occupation. News articles often cite women choosing to work in occupations that pay less as one of the reasons for the gender pay gap. It would thus be interesting to test whether this statement true, especially in regards to college-educated individuals like me. Further, I would like to investigate how fringe benefits—benefits that supplement an individual's salary such as a company car, health insurance, and/or vacation pay—impact the gender and racial pay gap. According to a study conducted by Solberg and Laughlin that includes a comprehensive measure of compensation for men and women, the inclusion of fringe benefits leads to a reduction in the gap from 12.6 to 3.6 percent (1995). It would be interesting to see how this additional compensation would factor in for college-educated individuals in explaining the differences in salaries across gender and race. Finally, I would also perform a Oaxaca decomposition, which decomposes outcome variables into explained and unexplained variation (Oaxaca 1973). In the case of salary, examples of explained variation could include level of educational attainment and current job tenure, unexplained variation may include discrimination. In this way, one could more accurately determine the nature of the gender and racial salary differentials. As working women, the hope is that this research and any further research conducted on gender and racial salary differentials serve to better inform us on our opportunities or lack thereof as we walk into the workforce and fight for what is not only fair, but also just—equality.

Appendix

I. Information on Categories of Occupations:

- **Scientists (Hard Science):** Computer Science, Mathematics, Biology, Physical Science
- **Engineers:** All Engineers.
- **Doctors and Lawyers:** MDs, Attorneys, Judges.
- **All Other Health Occupations:** Nurses, Pharmacists, Dieticians, Health Technicians, All other Health Occupations.
- **Social Scientists:** Economists, Political Scientists, Psychologists, Sociologists, Anthropologists.
- **Social Services:** All other social scientists, Social Workers, Counselors.
- **K-12 Teachers:** All teachers in K-12 system.
- **University Professors:** All individual teaching at the university level.
- **Management and Business Professionals:** Top and Mid-Managers in public, private, nonprofit industries, Accountants and Auditors, Personnel and Training Specialists, Sales in insurance, securities, commodities, retail.
- **Creative/History:** Artists, Editors, Entertainers, Public Relations, Historians, Librarians, Archivists, and Curators.
- **Technical:** Technicians in all industries, Architects, Actuaries, Drafting Technicians, Surveyors, Computer Programmers.

Table 1: Descriptive Statistics

	Full Sample		Male		Female	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Ln(salary)	11.00136	0.759799	11.16623	0.6718709	10.78035	0.8128795
1 if black=1	0.0953096	0.293645	0.0742146	0.2621239	0.123586	0.3291156
Female =1	0.4272732	0.494687	1	0	1	0
1 if black=1 x female=1	0.052805	0.223646	0.0742146	0.2621239	0.123586	0.3291156
1 if Hispanic =1	0.1045962	0.306035	0.0965295	0.2953207	0.1154091	0.3195217
1 if Hispanic=1 x female=1	0.0493112	0.216519	0.0965295	0.2953207	0.1154091	0.3195217
1 if Asian=1	0.1670136	0.372991	0.1752639	0.3801987	0.1559548	0.3628201
1 if Asian=1 x female=1	0.0666353	0.249392	0.1752639	0.3801987	0.1559548	0.3628201
Number of kids	0.7996597	1.074184	0.8577976	1.113118	0.7217303	1.014477
Number of kids^2	1.793306	3.673288	1.974809	3.902852	1.550015	3.325502
Female=1 x total number of kids	0.308376	0.753123	0.8577976	1.113118	0.7217303	1.014477
Female=1 x total number of kids^2	0.6622798	2.305	1.974809	3.902852	1.550015	3.325502
Highest Degree is MA	0.3433319	0.474825	0.3163285	0.4650501	0.379528	0.4852798
Highest degree=MA=1 x female=1	0.1621622	0.368603	0.3163285	0.4650501	0.379528	0.4852798
Highest Degree is PhD	0.0663275	0.248856	0.0715595	0.2577612	0.0593145	0.2362174
Highest degree=PhD=1 x female=1	0.0253435	0.157168	0.0715595	0.2577612	0.0593145	0.2362174
Highest Degree is Professional	0.0599012	0.237306	0.0601176	0.2377083	0.0596111	0.2367699
Highest degree=Professional =1 x female=1	0.0254702	0.15755	0.0601176	0.2377083	0.0596111	0.2367699
Years since Highest Degree	16.91628	11.14717	18.08367	11.2805	15.35148	10.76944
Years since Highest Degree^2	410.4176	451.0708	454.2647	467.601	351.6438	420.816
Current Job Tenure	8.304375	7.993929	8.804981	8.3752	7.633352	7.399569
Current Job Tenure^2	132.8644	248.3572	147.6694	267.5627	113.0194	218.4367
Female=1 x current job tenure	3.261527	6.136226	8.804981	8.3752	7.633352	7.399569
Female=1 x current job tenure^2	48.29015	153.3379	147.6694	267.5627	113.0194	218.4367
Region						
2	0.335566	0.472192	0.32265	0.4674975	0.3528789	0.4778756

3	0.3430242	0.474724	0.3529932	0.4779082	0.3296615	0.4701002
4	0.0639018	0.24458	0.0677982	0.2514033	0.058679	0.2350279
5	0.1950725	0.39626	0.1943865	0.3957339	0.195992	0.3969708
Married	0.7519053	0.431911	0.7998925	0.4000869	0.6875821	0.463489
Scientist	0.1732409	0.378459	0.1985903	0.3989451	0.139262	0.346227
Engineer	0.2248873	0.417512	0.2407232	0.4275293	0.2036606	0.402728
Doctor	0.0201481	0.140508	0.0205765	0.141964	0.0195738	0.1385333
Health Job	0.0659112	0.248129	0.0218724	0.1462693	0.1249417	0.3306599
Technical Job	0.153835	0.360794	0.1451419	0.3522494	0.1654874	0.3716278
Social Job	0.0299415	0.170428	0.0152665	0.1226127	0.0496123	0.2171473
University Professor	0.0562083	0.230326	0.0490549	0.2159862	0.0657967	0.2479317
Management/Business	0.2634999	0.440535	0.2887667	0.4531964	0.2296318	0.420605
Creative Job	0.0139208	0.117164	0.0093558	0.0962736	0.0200398	0.1401394
Secretary	0.0291088	0.168113	0.0128643	0.1126907	0.0508834	0.2197642
Service	0.0257055	0.158257	0.0234212	0.1512395	0.0287675	0.167156
Social Scientist	0.0239677	0.15295	0.0170049	0.1292913	0.0333009	0.1794248
Manual Labor	0.023316	0.150907	0.0294582	0.1690898	0.0150828	0.1218851
Law	0.0277511	0.16426	0.0270561	0.1622494	0.0286828	0.166917

Table 2: Regressions

	(1) Basic Regression	(2) Married and Kids	(3) Married, Kids, & Human Capital	(4) Married, Kids, Human Capital, and Occupation	(5) Interactions
Female	-0.382***	-0.363***	-0.354***	-0.236***	-0.333***
	(0.007)	(0.007)	(0.006)	(0.006)	(0.016)
Black	-0.070***	-0.041***	-0.008	0.015	-0.087***
	(0.011)	(0.011)	(0.011)	(0.010)	(0.013)
Asian	0.046***	0.040***	0.055***	0.011	-0.023**
	(0.009)	(0.009)	(0.008)	(0.008)	(0.009)
Hispanic	-0.122***	-0.116***	-0.070***	-0.037***	-0.071***
	(0.011)	(0.011)	(0.010)	(0.010)	(0.012)
Married		0.145***	0.085***	0.062***	0.065***
		(0.008)	(0.008)	(0.007)	(0.007)
Total Number of Kids		0.085***	0.045***	0.036***	0.090***
		(0.007)	(0.006)	(0.006)	(0.007)
Total Number of Kids^2		-0.014***	-0.009***	-0.007***	-0.013***
		(0.002)	(0.002)	(0.002)	(0.002)
Highest Degree is MA			0.174***	0.195***	0.155***
			(0.007)	(0.006)	(0.007)
Highest Degree is PhD			0.320***	0.461***	0.397***
			(0.012)	(0.012)	(0.013)
Highest Degree is Professional			0.451***	0.362***	0.318***
			(0.013)	(0.022)	(0.023)
Years since Highest Degree			0.040***	0.035***	0.035***
			(0.001)	(0.001)	(0.001)
Years since Highest Degree^2			-0.001***	-0.001***	-0.001***
			(0.000)	(0.000)	(0.000)
Current Job Tenure			0.022***	0.025***	0.017***
			(0.001)	(0.001)	(0.001)
Current Job Tenure^2			-0.000***	-0.000***	-0.000***
			(0.000)	(0.000)	(0.000)
Control for Region	Yes	Yes	Yes	Yes	Yes
Control for Occupation	No	No	No	Yes	Yes
1 if black=1 x female=1					0.195***
					(0.019)
1 if Hispanic=1 X female=1					0.081***
					(0.019)
1 if Asian=1 X female=1					0.091***
					(0.016)
Female=1 x total number of kids					-0.120***
					(0.013)
Female=1 x total number of kids^2					0.010*

					(0.004)
Highest degree=MA=1 x female=1					0.092***
					(0.013)
Highest degree=PhD=1 x female=1					0.162***
					(0.022)
Highest degree=Professional=1 x female=1					0.110***
					(0.025)
Female=1 x current job tenure					0.017***
					(0.002)
Female=1 x current job tenure^2					-0.000***
					(0.000)
Constant	11.216***	11.053***	10.553***	10.226***	10.272***
	(0.013)	(0.014)	(0.016)	(0.018)	(0.019)
r2	0.071	0.085	0.159	0.274	0.281
N	55241.000	55241.000	55241.000	55241.000	55241.000

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Data Source: National Survey of College Graduates, 2010

Numbers in parentheses are robust standard errors.

All models control for region while models (4) and (5) control for occupation.

Chi^2 was 3675.80.

Table 3: Differentials by Race and Gender

	White Female	Black Female	Hispanic Female	Asian Female
White Male	-0.333	-0.224	-0.323	-0.265
White Female	N/A	0.108	0.010	0.068
Black Male	0.246	-0.139	-0.236	-0.178
Black Female	-0.108	N/A	-0.098	-0.040
Hispanic Male	-0.262	-0.154	-0.252	-0.194
Hispanic Female	-0.010	0.098	N/A	0.058
Asian Male	-0.310	-0.202	-0.300	-0.242
Asian Female	-0.068	0.040	-0.058	N/A

Note: Using the coefficients, I estimated the differentials by race and gender, holding all other variables constant.

Table 4: Testing for Heteroskedasticity

Test	*Chi-Square Statistic*	*P-value*
Breusch-Pagan	3647.17	0.000
White	2879.90	0.000

Figure 1

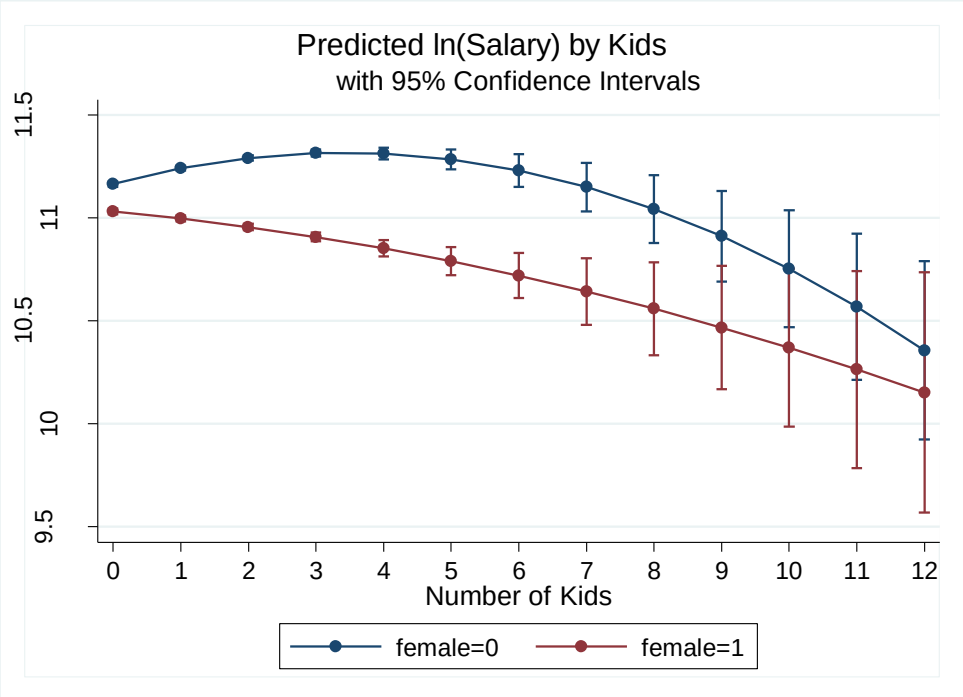


Figure 2

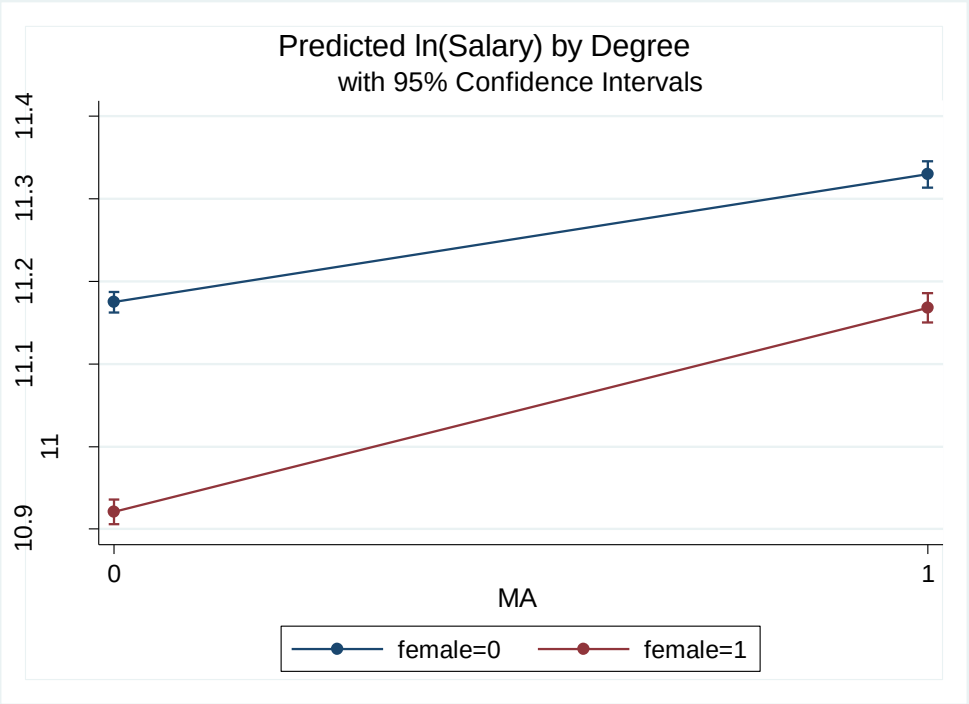


Figure 3

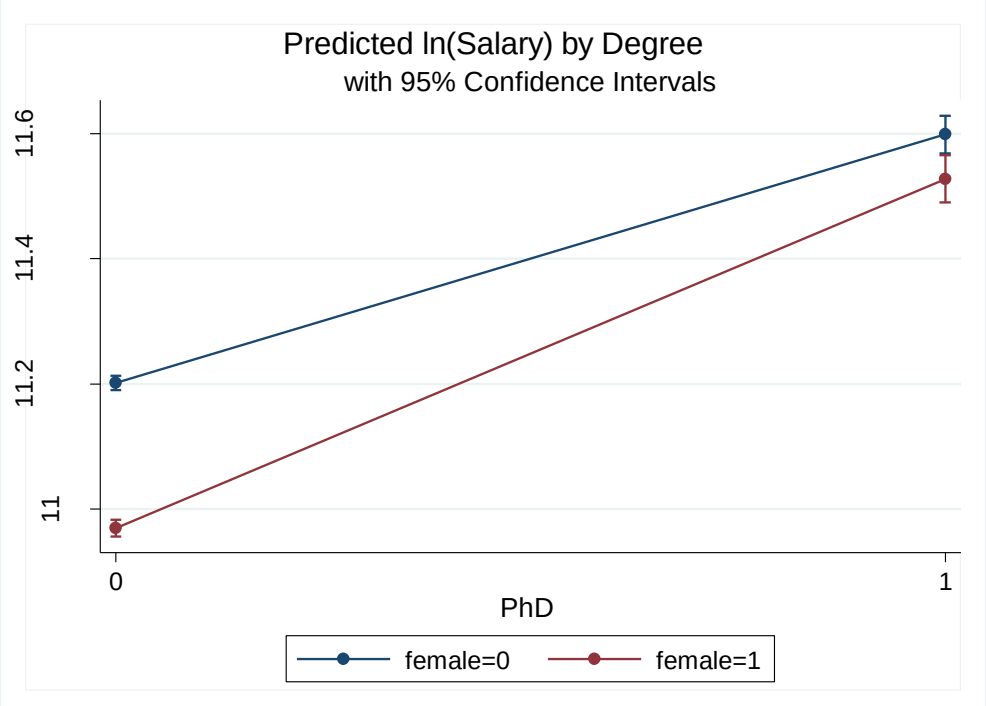


Figure 4

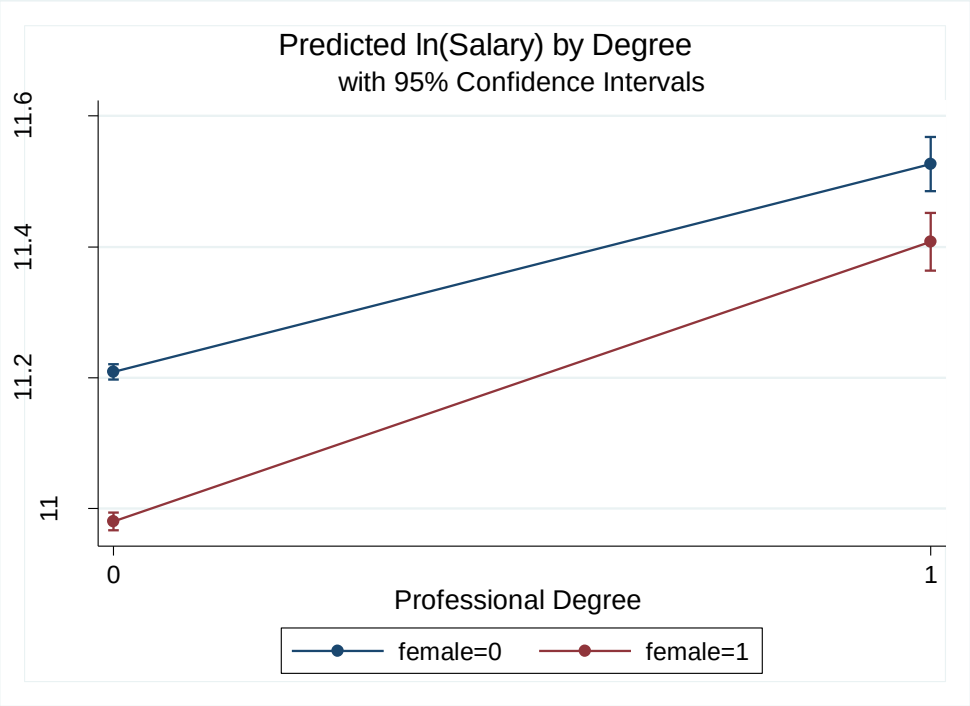
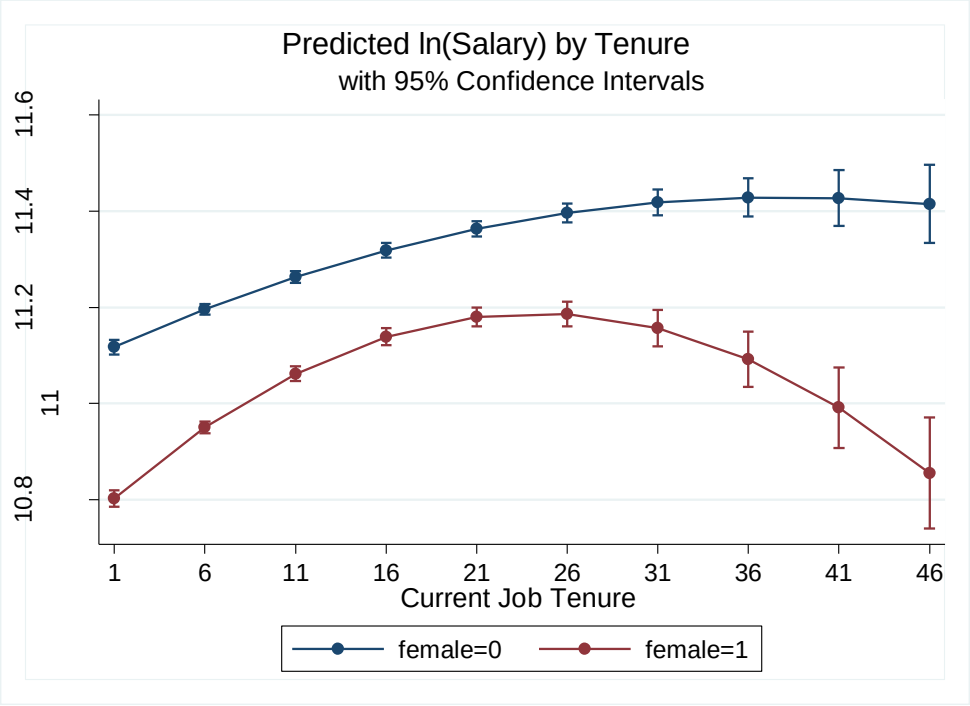


Figure 5



Endnotes

[1] Arrow suggests some of the causes of this difference in productivity may include quality of education or cultural differences; however, the cause itself is unobservable.

[2] Here μ is normally distributed with a mean equal to zero.

[3] Once all individuals not relevant to this analysis are removed, those with an associate's degree disappear well.

[4] Squared terms for time-related variables (years since highest degree and current job tenure) are included to capture the nonlinear relationship of experience to salary.

[5] Details of the occupational coefficients are available from the author on request.

[6] This salary (in dollar terms) is found by taking the antilog of the coefficient on the constant. In this case, I took the antilog of this coefficient to obtain a rough estimate in dollar terms to make it easier for the reader to understand the result.

References

2001. “It's the Strong Academic Performance of African-American Women That Accounts for the Closing of the Income Gap between College-Educated Blacks and Whites.” *The Journal of Blacks in Higher Education*, no. 32, pp. 33–34 (accessed April 30, 2017).

Acemoglu, Daron and David Autor. “Lectures in Labor Economics.” *Chapter 1*, London School of Economics and Political Science (accessed December 11, 2016) at: http://econ.lse.ac.uk/staff/spischke/ec533.

Alkadry, Mohamad G., and Leslie E. Tower. 2006. "Unequal Pay: The Role of Gender." *Public Administration Review* 66, no. 6: 888-898. *EconLit*, EBSCOhost (accessed December 7, 2016).

Al Ramiah, Ananthi, Miles Hewstone, John F. Dovidio, and Louis A. Penner. 2010. “The Social Psychology of Discrimination: Theory, Measurement and Consequences.” *Making Equality Count: Irish and International Approaches to Measuring Discrimination* (pp. 84-112). Dublin: Liffey Press.

Angelov, Nikolay, Per Johansson, and Erica Lindahl. 2016. "Parenthood and the Gender Gap in Pay." *Journal of Labor Economics* 34, no. 3: 545-579. *EconLit*, EBSCOhost (accessed December 7, 2016).

Arrow, Kenneth. 1973. “The Theory of Discrimination.” *Discrimination in Labor Markets*, Princeton University Press, 3-33.

Arrow, Kenneth. 1998. “What Has Economics to Say about Racial Discrimination?” *Journal of Economic Perspectives*, 12, no. 2: 91-100 (accessed April 18, 2017).

Baum, Sandy, Jennifer Ma, and Kathleen Payea. 2013. "Education Pays 2010: The Benefits of Higher Education for Individuals and Society." *Trends*, College Board (Accessed

December 9, 2016). https://trends.collegeboard.org/sites/default/files/education-pays-2010-full-report.pdf.

Blau, Francine D., and Lawrence M. Kahn. 1999. "Analyzing the Gender Pay Gap." *Quarterly Review of Economics and Finance* 39, 625-646. *EconLit*, EBSCOhost (accessed December 7, 2016).

Becker, Gary. 1964. *Human Capital: A theoretical and Empirical analysis, with Special Reference to Education*. New York: National Bureau of Economic Research.

Blundell, Richard, Lorraine Dearden, Costas Meghir, and Barbara Sianesi. 1999. "Human Capital Investment: The Returns from Education and Training to the Individual, the Firm and the Economy." *Fiscal Studies* 20, no. 1: 1-23 (accessed December 11, 2016).

Borjas, George J. 2016. *Labor Economics* (Seventh Edition). New York City: McGraw-Hill Education.

Carnevale, Anthony P., Stephen J. Rose, and Ban Cheah. 2011. "The College Payoff: Education, Occupations, Lifetime Earnings." The Georgetown University Center on Educaiton and the Workplace. (Accessed December 8, 2016).

Case, K. E., & Fair, R. C. 2004. *Principles of Economics* (7th Edition). Upper Saddle River: Pearson-Prentice Hall.

Correll, Joshua, Charles M. Judd, Bernadette Park, and Bernd Wittenbrink. 2010. "Measuring prejudice, stereotypes and discrimination." *The Sage Handbook of Prejudice, Stereotyping, and Discrimination*. Thousand Oaks, CA: Sage.

Cheeseman Day, Jessica and Eric C. Newburger. 2002. "The Big Payoff: Educational Attainment and Synthetic Estimates of Work-Life Earnings." *Current Population Reports*, United States Census Bureau (accessed December 11, 2016).

Ehrenberg, Ronald G. and Robert S. Smith. 2012. *Modern Labor Economics: Theory and Public Policy* (11th Edition). Boston: Pearson-Prentice Hall.

England, Paula and Peter Lewin. 1989. "Economic and Sociological Views of Discrimination in Labor Markets: Persistence or Demise?" *Sociological Spectrum* 9, 239-257.

Erosa, Andres, Luisa Fuster, and Diego Restuccia. 2016. "A Quantitative Theory of the Gender Gap in Wages." *European Economic Review* 85, 165-187. *EconLit*, EBSCOhost (accessed December 7, 2016).

Gabriel, Paul E., and Susanne Schmitz. 2015. "An Examination of ex-post Returns to a College Education for Prime-age U.S. Workers." *Southern Business & Economic Journal* 38, no. 1: 51-60. *Business Source Complete*, EBSCOhost (accessed December 11, 2016).

Glassdoor. 2016. "Global Gender Pay Gap Survey." *Glassdoor*, Press Content. (accessed November 23, 2016).

Janssen, Simon, Simone Tuor Sartore, and Uschi Backes-Gellner. "Discriminatory Social Attitudes and Varying Gender Pay Gaps within Firms." *ILR Review* 69.1 (2016): 253-79. *Econlit*. Web. 7 Dec. 2016.

Jones, Jeffrey. 2014. "Americans Say Equal Pay Top Issue for Working Women." *Poll*, Gallup (accessed April 1, 2016).

Kim, Marlene. 2015. "Pay Secrecy and the Gender Wage Gap in the United States." *Industrial Relations* 54, no. 4: 648-667. *EconLit*, EBSCO*host* (accessed October 17, 2016).

Kmec, Julie A. 2002. "Race in the Workplace and Labor Market Inequality." *Dissertation Awards*, W.E. Upjohn Institute for Employment Research (accessed December 10, 2016).

Langdon, Danice Lynn, and Roger Klomegah. "Gender Wage Gap and its Associated Factors: An Examination of Traditional Gender Ideology, Education, and

Occupation." *International Review of Modern Sociology* 39, no. 2 (September 2013): 173-203. *SocINDEX* with Full Text, EBSCOhost (accessed December 9, 2016).

Lindley, Joanne, and Stephen Machin. 2016. "The Rising Postgraduate Wage Premium." *Economica* 83, no. 330: 281-306. *EconLit*, EBSCOhost (accessed December 8, 2016).

Lopez, Mark Hugo and Richard Fry. 2013. "Among recent high school grads, Hispanic college enrollment rate surpasses that of whites." *FactTank*, Pew Research Center (accessed December 11, 2016).

Manning, Alan, and Farzad Saidi. 2010. "Understanding the Gender Pay Gap: What's Competition Got to do with it?" *Industrial and Labor Relations Review* 63, no. 4: 681-98.

Milner, Murray. 1973. Race, Education, and Jobs: Trends, 1960-1970. *Sociology of Education, 46*(3), 280-298.

Mincer, J. 1974. *Schooling, Experience and Earnings*. New York: National Bureau of Economic Research.

National Science Foundation. 2010. National Survey of College Graduates of 2010 (accessed November 19, 2016).

Oaxaca, Ronald. 1973. "Male-Female Wage Differentials in Urban Labor Markets." *International Economic Review*, vol. 14, no. 3, pp. 693–709.

Olson, Josephine. 2013. "Human Capital Models and the Gender Pay Gap." *Sex Roles* 68, no. 3-4: 186-197. *SocINDEX with Full Text*, EBSCOhost (accessed December 9, 2016).

Pew Research Center. 2016. "On Views of Race and Inequality, Blacks and Whites Are Worlds Apart." *Pew Research Center* (accessed April 19, 2017).

Phelps, Edmund S. 1972. “The Statistical Theory of Racism and Sexism.” *The American Economic Review*, vol. 62, no. 4: 659–661 (accessed April 18, 2017).

Schultz, T. W. 1961. “Investment in Human Capital.” *American Economic Review*, 51, 1–17.

Shannon, Michael, and Michael P. Kidd. 2003. "Projecting the U.S. Gender Wage Gap 2000-40." *Atlantic Economic Journal 31*, no. 4: 316-329. *EconLit*, EBSCOhost (accessed December 7, 2016).

Solberg, Eric J. and Teresa Laughlin. 1995. “The Gender Pay Gap, Fringe Benefits, and Occupational Crowding.” *Industrial and Labor Relations Review*, vol. 48, no. 4, pp. 692–708.

Solberg, Eric J. 1999. "Using Occupational Preference in Estimating Market Wage Discrimination: The Case of the Gender Pay Gap: Decomposition of a Reduced-Form Wage Equation." *American Journal of Economics and Sociology* 58, no. 1: 85-113. EconLit, EBSCOhost (accessed December 7, 2016).

Stalsburg, Brittany. 2016. “Women are Working More than Ever—Inside the Home and Out.” *The Blog*, The Huffington Post (accessed April 6, 2016).

Tajfel, H. and Turner, J.C. (1979). “An Integrative Theory of Intergroup Conflict.” *The Social Psychology of Intergroup Relations* (pp. 33-47). Monterey, CA: Brooks Cole.

Tamborini, Christopher, ChangHwan Kim, and Arthur Sakamoto. 2015. "Education and Lifetime Earnings in the United States." *Demography* 52, no. 4: 1383-1407. *SocINDEX with Full Text*, EBSCOhost (accessed December 8, 2016).

U.S. Department of Education. 2016. *Digest of Education Statistics, 2014. Postsecondary Education*, National Center for Education Statistics (NCES) (accessed December 11, 2016).

U.S. Department of Education. 2016. "Undergraduate Retention and Graduation Rates." *The Condition of Education*, NCES (accessed December 11, 2016).

Weiss, Andrew. 1995. "Human Capital vs. Signaling Explanations of Wages." *Journal of Economics Perspectives* 9, no. 4: 133-154 (accessed December 11, 2016).

Willis, Robert J. 1986. "Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Functions." *Handbook of Labor Economics* 1: 525-602 (accessed December 11, 2016).