

NORTHERN ILLINOIS UNIVERSITY
The Gender Wage Gap over the Life Cycle
A Thesis Submitted to the
University Honors Program
In Partial Fulfillment of the
Requirements of the Baccalaureate Degree
With Upper Division Honors

Department Of

Economics

By

Tam Nguyen

DeKalb, Illinois

05-08-10

University Honors Program

Capstone Approval Page

Capstone Title (print or type)

The Gender Wage Gap over the Life Cycle

Student Name (print or type) Tam Nguyen

Faculty Supervisor (print or type) Virginia Wilcox-Gök x

Faculty Approval Signature *Virginia Wilcox-Gök* x

Department of (print or type) Economics

Date of Approval (print or type) 27 April 2010 ✓

**HONORS THESIS ABSTRACT
THESIS SUBMISSION FORM**

AUTHOR:

THESIS TITLE:

ADVISOR:

ADVISOR'S DEPARTMENT

DISCIPLINE:

YEAR:

PAGE LENGTH:

BIBLIOGRAPHY:

ILLUSTRATED:

PUBLISHED (YES OR NO):

LIST PUBLICATION:

COPIES AVAILABLE (HARD COPY, MICROFILM, DISKETTE):

ABSTRACT (100-200 WORDS):

The primary research focus of my paper is to examine the life-cycle earning differences between men and women to draw some conclusions as to the sources of these differences. My goal is to explore the question of whether the male/female differences in wages converge over the life-cycle. To examine this issue, I use the dataset contains a variety of demographic and employment-related variables (age, marital status, education, hourly wage, number of children, and race) that are factors affecting the gender wage gap. I hypothesize that women's work effort is reduced during childbearing years, leading to an increase in the wage gap. However, this is reversed in later years, leading to a decrease in the wage gap. The study suggests that at younger ages, the female to male wage gaps widens. At older ages, however, wage gap decreases. This research is important because it examines how women are improved by education and how increased work experience affects the wage gap. My research will result in a better understanding of how the labor force treatment of women has changed based upon their experience, age, marital status, education, and other employment-related variables.

The Gender Wage Gap over the Life Cycle

Introduction

Historically, earnings between males and females have generally differed from one another. However, the gender gap in earnings in the United States has changed since the 1990s to the most recent year. According to a report from the *Institute for Women's Policy Research*, the ratio of women's to men's median weekly earnings for full-time workers was 71.9 % in 1990 and 79.9% in 2009 which shows that women's earnings have increased relative to men's earnings.

The primary research focus of my paper is to examine the life-cycle earning differences between men and women to draw some conclusions as to the sources of these differences. My goal is to explore the question of whether the male/female differences in wages converge over the life-cycle. This research is important because it examines how women are improved by education and how increased work experience affects the wage gap. My research will result in a better understanding of how the labor force treatment of women has changed based upon their experience, age, marital status, education, and other employment-related variables.

Literature Review

"Male-Female Differences in Hourly Wages: The role of Human Capital, Working Conditions and Housework" is the title of the article written by Joni Hersch published in July 1991 from Industrial and Labor Relations Review. Hersch wants to estimate wage equations that includes for human capital, working conditions and household responsibilities to see how the different effects variable will influence the earning differences between males and females.

Hersch agreeing with Becker and he explain how housework may affect wages by decreasing the women's availability for the market. Hersch wants to investigate if the earnings equation still reveals structural differences when omitted variable bias is reduced by using these groups of variables: human capital characteristics, individual characteristics, household responsibilities, and working conditions. Hersch started to collect the data using a selectivity bias but could not use it because it was not applicable to large population. Therefore, Hersch had used the data from 1988 May Current Population Survey to do the empirical work.

As a result, Hersch found that the human capital characteristics happened as expected-meaning that women receive higher return in tenure than men-but total experience related to men's wage but not women's wages. Housework and household responsibilities had a negative effect on women's earnings. Hersch continue with the study of the decomposition of the wage gap to find evidence of discrimination from the unexplained potential of the gap after consideration of all the possible causes for the gap. The information from this study is a good way of looking at earning differences between men and women due to difference in experience, and housework, working conditions.

In fall 2000, Journal of Economic Perspective published an article by Francine D.Blau and Laurence M.Kahn titled "Gender Differences in Pay". The authors address the gender differences in qualifications, labor market treatment, and the overall wage structure, which affects the size of gender gap. The increase in gender earnings ratio from early 1970s and 1980s could represent the entry of new cohorts into the labor market. The study is motivated by the explanation of the gender gap is based upon the human capital models of Mincer and Polacheck, (1974), who define that woman's employment opportunities tending to have fewer labor market experiences. Women are more likely to interrupt their working careers. Women also have less

incentive to invest in higher education or on-the-job training; therefore, their human capital investment will be less than that of men.

Labor market discrimination described in the model by Becker's (1957) and other's models are used as well to show different types of discrimination between males and females occupations that can increase the size of the gender pay gap. This study yields information similar to Hersch (1991) about the factors of the gender wage gap in human capital characteristics, but it does not include other variables such as housework or household responsibilities. Some of this analysis about human capital, discrimination, and the gender pay gap is directly related to my research paper, in which I want to see whether the earnings differences between male and female wages converge over the life cycle.

October 2006, Industrial and Labor Relations Review published an article by Francine D. Blau and Lawrence M. Kahn named "The U.S Gender pay gap in 1990s: Slowing convergence". In 2000, Blau and Kahn wrote about the convergence of the gender wage gap during the 1980s and 1990s, and in 2006 they study the slowing convergence in the 1990s compared to 1980s. The authors focus on hypotheses that explain the slower progression of women's labor participation in labor market during 1990s. The commitment to labor market happened as in slower pace, while the rate of increase in women's participation in the labor forces decreased. In 1990s, the discrimination reduces sluggishly and other explanation about the demand and supply side shifts. Following these hypotheses, the skill price increased more quickly during the 1990s as wage inequality increased faster than in the 1980s. Lastly, the women's labor force participation grew more quickly in the 1980s than in the 1990s.

The authors started to decompose the changes in the gender wage pay as suggested by Juhn, Murphy and Pierce (1991). They decompose the changes into different portions due to different changes in women's human capital level, the labor market price of the measured and unmeasured characteristics labor market price, and the changes in the favorableness of demand shifts. Blau and Kahn conclude that the changes in human capital did not have an effect on the slowdown, but the occupational upgrading and deunionization have more positively affected women's wages in the 1980s than in the 1990s. The technique of decomposing the wage gap into different portions due to various changes is useful tool for my data analysis. The studies helped me understand other sources that might cause the slowdown in convergence of the gender wage gap.

In the two articles of Blau and Kahn, the authors study different topics, but use similar methods. For example, Blau and Kahn analyzed the sources that lead to the narrowed gender wage gap and the causes of the slowdown in the convergence of gender wage gap. They often interpreted the effect on wages of various factors in a similar way, such as the labor market experience of women is likely to be less than men or the unexplained wage gap reveals the existing of discrimination.

In addition, Blau and Kaln approached changes of variable over time. Most of their data was collected from the Current Population Survey and the Panel Study of Income Dynamics, so that only the basic variables, such as human capital and level of education are included .In contrast, Hersch (1991) included household responsibilities and working conditions.

The focus of my research is examining life cycle earning differences between men and women to draw some conclusions as to the source of these differences. The goal is to explore the

question of whether the male/female differences in wages converge over the life cycle. From the literature review, there was evidence about the convergence of the gender wage gap that is helpful for my research because it provides me the sources to create a more precise prediction of the outcome, as well as explaining data collection techniques and the regression results. There was also a section about trends in the gender pay gap about the overall patterns that has given me with an idea of what factors could be involved in the influencing and affecting of earnings differences between males and females.

Forming Hypothesis:

There have been many studies examining the causes of the gender wage gap in the United States. The factors being studied include investment in human capital and labor market discrimination. Today, women are still facing a wage gap, although it is evident that the gender wage gap has narrowed. The reasons for the narrowing wage gap come from the improvement of human capital and the reduction of labor market discrimination.

The explanations of this converging wage gap can be illustrated by comparing the earnings of college educated men and women as they age. At the starting point, the earnings of both groups are the same. This wage rate then increases for men more than for women. The reason for the lower rate of increase for women is that it is common for women to take time off from the labor force (either withdraw entirely or reduce hours to part-time status) for a period to raise their children. These interruptions for women in the labor force create a large wage gap between men and women. Men continue to work, which allows them to earn more money and increase their work experience during periods when women are out of the labor force or have reduced their labor supply.

After women's family responsibilities become less important, women often return to the workplace. Returning to their jobs can be difficult after all the years that they were not working because the qualifications for the job may have changed. Nonetheless, contributing to the closing of the wage gap is the return of women and women their attaining advanced degrees educations. This allows them to catch up with men who have already obtained higher levels of education because higher education tends to lead to higher wages. In addition, women are entering fields that were typically male-dominated, such as engineering, mathematics, and economics, which gives them more opportunities to earn higher wages. Furthermore, women who return to the workplace may earn their work experiences later in life, which can also increase their wages.

As a woman become older and has fewer household responsibilities, her age will have an impact on the improvement in her human capital investment due to education attainment and work experience, which are factors that contribute to the closure of the wage gap. Figure 1 demonstrates the age earning profile between female and male.

Hypothesis: At younger ages, the wage ratio of female to male decreases as the wage gaps widens. At older ages, the ratio increases as wage gap decreases.

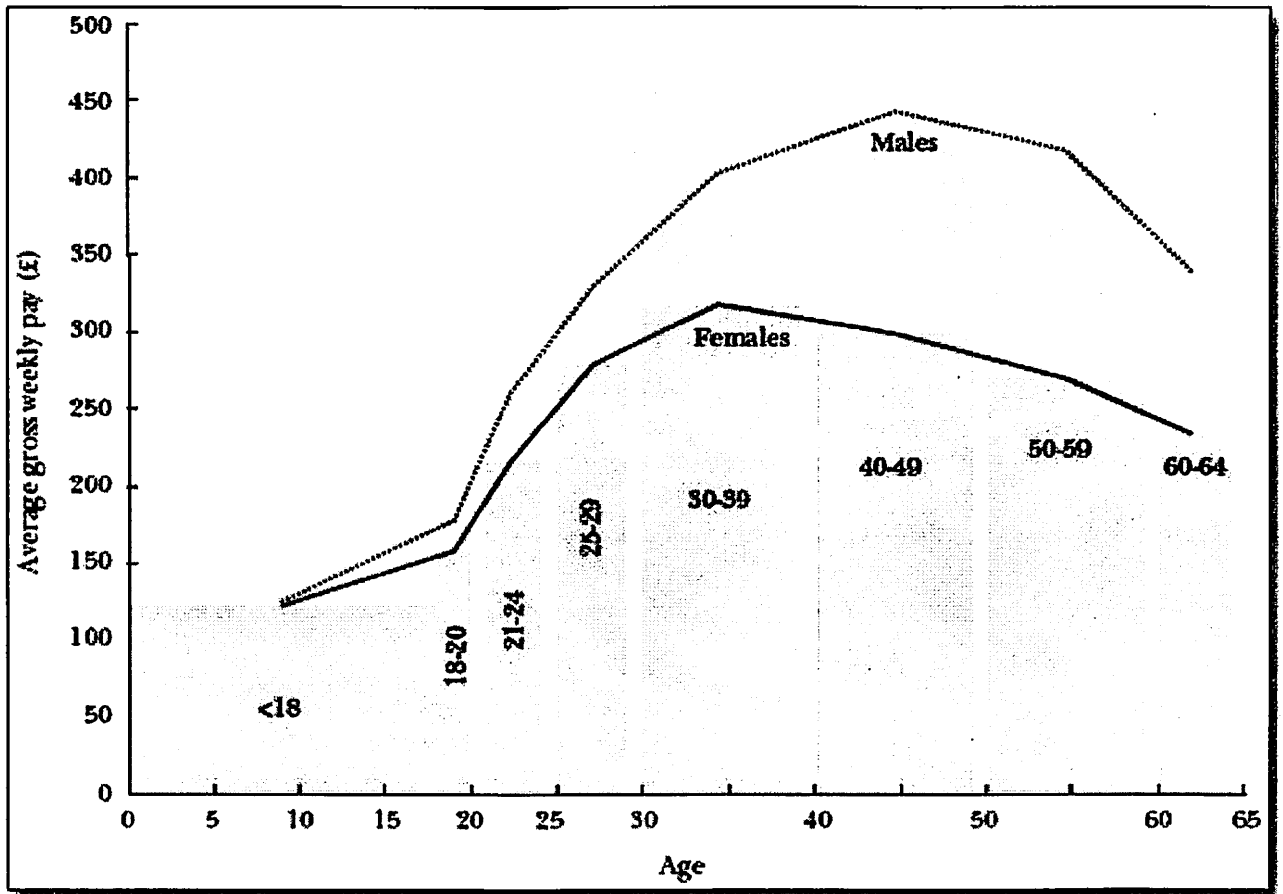


Figure 1: Age earnings profile for men and women

Data and Econometric Model

I will use data from 1994-2009 Current Population Survey for the United States with 87,248 observations of men and women; it includes 39,262 men and 47,986 women. The dataset contains a variety of demographic and employment-related variables: age, marital status, education, hourly wage, number of children, and race. I will use these variables to run a regression because they are factors which can affect the gender wage gap.

Data will be grouped in age groups from 1994 to 2009. For each of the 16 years, I will have nine different age groups: 20-24 years of age, 25-29 years of age, 30-34 years of age, 35-39

years of age, 40-44 years of age, 45-49 years of age, 50-54 years of age, 55-59 years of age, and 60-64 years of age. These categories are used to construct the variables AGEGRP, which has value from 1 to 9. A person is defined as married if they report their status either as married with spouse present or married with spouse not present. A person is determined to be single if their status is widow, divorced, separated, or never married. I create two variables to incorporate marital status in my analysis: MARF represents for percentage of females that are married. MARM is a variable for percentage of males that are married.

There are also others variables such as: AGEGRP is variable for 9 age groups. AGERPSQ is age group square variable because wage can increase as function of age but at a decreasing rate. YEAR is year variable which started from 1994-2009. MALE is a variable for the average percentage of male in the data throughout 16 years. COLLEGEF is variable for percentage of females that have a bachelor degree. COLLEGEF+ is the variable for the percentage of females that have a master degree. COLLEGEM is variable for percentage of males that have a bachelor degree. COLLEGEM+ is a variable for percentage of males that have master degree. CHILF is a variable for the percentage of the number children who are under 18 years old owned by females. CHILM is a variable for percentage of number children who are under 18 years old owned by male.

The education variable is defined as a highest level of school completed, and I selected both males and females that have high school diplomas, bachelors or master's degrees. The number of own children who are less than the age of 18 is another variable in the dataset because it is an important factor that determine the availability of a woman in her work life-cycle. Therefore, a woman who has fewer children who are under 18 years of age will most likely have more time available to work compared with those women have more children. Hourly wage is

determined by the earning hourly pay rate of for both men and women. The last variable is the race of the respondent which I will be controlling for all Caucasian and non-Hispanics.

To be more precise about the gender wage gap, especially from 1994 to 2009 in the United States, I decided to choose groups which represent the highest earning and have reliable information. It is also more specific in eliminating the chance of racial discrimination since there is only one represented group. I will use the variables that I have mentioned above to run a simple regression. The regression will run to determine the different effects that variables have on the earnings ratio. Furthermore, in my empirical analysis, I will estimate the age at which the wage gap starts to converge.

Equation of earnings ratio (*average wage of women/average wage of men*)

$$\begin{aligned} \text{Earnings Ratio} = & \beta_0 + \beta_1(\text{AGEGRP}) + \beta_2(\text{AGERPSQ}) + \beta_3(\text{YEAR}) + \beta_4(\text{MALE}) + \\ & \beta_5(\text{COLLEGEF}) + \beta_6(\text{COLLEGEF}+) + \beta_7(\text{COLLEGEM}) + \beta_8(\text{COLLEGEM}+) + \beta_9(\text{MARF}) + \\ & \beta_{10}(\text{MARM}) + \beta_{11}(\text{CHILF}) + \beta_{12}(\text{CHILM}) + \varepsilon \end{aligned}$$

Empirical Results

The regression presented results are presented in Table 5. The focus of my paper is to see the convergence of the wage gap as women age. Therefore, I will evaluate the marginal effect of the AGEGRP (age group) variable to estimate the effect of age on women's earnings ratio. To do that, I will have to use the coefficient estimates from Table 5.

$$\begin{aligned} \frac{\partial \text{Earnings ratio}}{\partial \text{AGEGRP}} &= \text{coefficient } \beta_1 + 2 * \beta_2 (\text{AGEGRP}) \text{ (the average of AGEGROUP)} \\ &= -0.04953 + 2(0.004386) (5) = -0.00567 \end{aligned}$$

The number (-0.00567) shows the negative relationship between the age group and earnings ratio. In this case, the number shows that on average an increase in age group will decrease the earnings ratio .0567 percent. However, at values of age group other than the average, the effect on the earnings ratio will differ.

When I examine the earnings ratios across the life cycle, I predict that at younger ages, the earnings ratio is decreasing. At older ages, however, I expect to observe that the earnings ratio rises. This U-shaped relationship is the result of the reduction in women's labor supply during the period that a woman may choose to have children. To test this hypothesized relationship, I evaluate the effect of age on earnings ratio at various values of age group by using the coefficient estimates from my regression to predict the female/male earnings ratio.

I use Table 1 to demonstrate the calculation process, in which I take the coefficient of each variable in the regression times its mean value and sum the results of the multiplication which will equal to the predicted ratio.

Table1. The result of predicted ratio in AGE group 1 (20-24 years of age)

	1	
COEF	MEAN	COEFxMEAN
β (0.830656)	1	0.8306562
β_1 (-0.04953)	1	-0.0495277
β_2 (0.004386)	1	0.0043863
β_3 (0.004993)	8.5	0.0424373
β_4 (0.104435)	0.44797	0.0467838
β_5 (0.107327)	0.148497	0.0159377
β_6 (0.392746)	0.029647	0.0116439
β_7 (-0.00245)	0.872928	-0.0021406
β_8 (0.027214)	0.073747	0.002007
β_9 (0.298028)	0.745119	0.2220667
β_{10} (-0.33847)	0.800905	-0.2710825
β_{11} (-0.02956)	0.890351	-0.0263177
β_{12} (0.057797)	0.848895	0.0490636
	Predicted ratio	=0.8759139

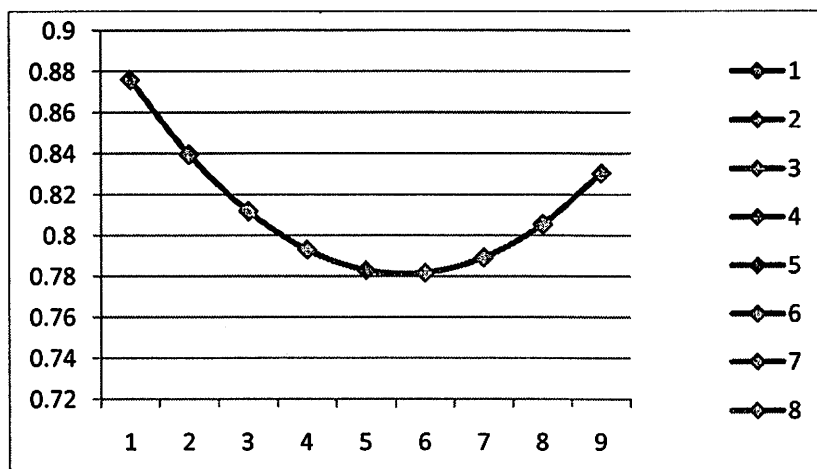
In Table 2 below shows the predicted ratios of female to male earnings for age group 1 through 9. The mean values of the AGEGRP and AGEGRPSQ variables are calculated for age group 1 to age group 9. The data section explained that age group 1 includes all women and men who are 20 to 24 years in age. The number of the age group increases as the ages of women and men in the particular group increase. For instance, age group 9 has all women and men who are 60 to 64 years of age.

Table 2. Result of Predicted Ratio in all AGEGROUP values.

AGEGROUP	Predicted Ratio
1	0.875913889
2	0.839545221
3	0.811949209
4	0.793125854
5	0.783075156
6	0.781797115
7	0.78929173
8	0.805559003
9	0.830598932

My hypothesis is that at younger ages, the wage ratio of female to male decreases as the wage gaps widens. At older ages, the ratio increases as wage gap decreases. The results of my research support my hypothesis by looking at the earnings ratio of women to men from all age groups of working age persons predicted by my regression model in Table 2. We can see that the earnings ratios are decreasing from age group 1 to age group 5 this is illustrated in Graph 2. These groups are the women who are 20 to 44 years of age. The explanation for this decrease in the earnings ratio is that at these ages women are less attached to the labor force because of the demands of having children and family responsibilities.

Graph 2. Illustrates the result of predicted ratio in Table 2.



However, the results show an increase in the earnings ratio from age group 6 to age group 9, which are women from 45 to 64 years of age. This result supports my hypothesis. The explanation for this is that women 45 to 64 years of age are more likely to work longer hours, have more experience, and have higher education, which will enhance their potential to earn higher salaries. In summary, I found that the wage gap is increasing between women and men at younger ages, decreasing at older ages.

Conclusion

The primary focus of my research is to examine the life-cycle earning differences between men and women in hopes of drawing some conclusions about to the source of these differences. My goal was to explore the question regarding whether male/female wage differences converges over a given life-cycle. Several have discussed the convergence of the gender wage gap. These studies were helpful for my research because each provides the sources to create a more precise hypothesis by studying data collection techniques and regression results.

Many researchers have successfully explained and analyzed the causes of the gender wage gap from the 1980s to the 1990s using different ways to look at the contributing factor. I contributed to the literature by looking specifically at the effect the age differences of women has on the wage gap between males and females in a given life-cycle.

My results support my hypothesis. As I reported in my empirical results, the female-male wage gap diverges at younger, but convergences at older ages. Overall, it was interesting to see how women are striving hard to fulfill their families' responsibilities and work hard to improve their earnings in the workplace. Nevertheless, more studies should be done to get better results in terms of accurate data and using advanced analysis techniques to contribute more accurate results to the field.

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Table 5: REGRESSION COEFFICIENT RESULT FOR EARNINGS RATIO.

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	0.830656	0.03017	27.53207	2.54E-56
AGEGRP	-0.04953	0.012173	-4.06872	8.12E-05
AGESP	0.004386	0.001177	3.727503	0.000287
YEAR	0.004993	0.001349	3.702295	0.000314
%MALE	0.104435	0.060596	1.723455	0.087166
%COLLF	0.107327	0.121339	0.884521	0.378036
%COLL+ F	0.392746	0.360343	1.089921	0.277749
%COLLM	-0.00245	0.00217	-1.12997	0.260555
%COLL+ M	0.027214	0.026033	1.045367	0.297778
%MARF	0.298028	0.114897	2.593879	0.01057
%MARM	-0.33847	0.083414	-4.05772	8.47E-05
CHILF	-0.02956	0.05327	-0.55488	0.57992
CHILM	0.057797	0.061269	0.94333	0.347249

SUMMARY OUTPUT	
<i>Regression Statistics</i>	
Multiple R	0.737705
R Square	0.544209
Adjusted R Square	0.502457
Standard Error	0.044247
Observations	144

Table 3. Variable Definitions

Variable Name	Variable Label
AGEGRP	Divided into 9 different age groups
AGEGRPSQ	Square the age groups from 1 to 9
YEAR	From 1994-2009
SEX	1=male; 0=female
EDUCA	Highest level of school completed
MARITL	1=married, spouse present and not present 0= single, widow, divorce, separated, never married
AGE	Age from 20-64
WAGE	Average hourly earnings
CHILD	Number of children < 18 years old
WHITE	2=race is White
NON-HISPANIC	1=race is non-Hispanic

Table 4. Summary statistics on selected variable using 1994-2009 CPS

Variable name	Men	Women
Hourly wage	15.44891 (2.371055)	12.48526 (3.001104)
Percentage of individual has a bachelor degree.	0.872928 (0.24591)	0.148497 (0.044344)
Percentage of individual has a master degree	.073747 (0.24591)	.029647 (0.015016)
Sex	0.44797 (0.111016)	0.55203 (.01102)
Age	37.561 (9.635)	37.3565 (9.845)
Percentage of married	0.800905 (0.191824)	0.745119 (0.145424)
Percentage of number of children under 18 years old	0.848895 (0.445974)	0.890351 (0.51465)

- Means are number above the number in bracket.
- Standard deviations are number in bracket.
- Bold indicates means are statistically different at 5 % level.
- Source : 1994-2009 CPS