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I. Introduction

It is widely known that a wage gap between males and females exists in today's labor market. Yet what causes this gap? Are females simply being discriminated against or do men deserve the extra compensation they are receiving? If men are more deserving, what would lead to this edge in order to gain this extra compensation? Many researchers have sought answers to these questions using varying methods and have gotten mixed results. However, one similarity in almost every approach is a discussion of Gary Becker's theory of human capital.

Becker's theory suggests that an individual be compensated for the work he or she performs, as well as for the use of that individual's human capital. Human capital includes accumulated investments in such activities as education, job training, and migration. Hence, the more an individual has invested in their human capital, the more that individual should be compensated. It is important to analyze whether or not employers are actually compensating individuals in this manner. For example, if an individual has spent years of time and large amounts of money to acquire additional human capital, then that individual should be compensated at a higher rate than an individual who has invested very little in their own human capital. Serious questions of equity, fairness, and discrimination should arise if this is not the case. One former study that deals with these questions, as well as Becker's theory of human capital, is Jennifer Van Dyke's research honors project from the spring of 1999 at Illinois Wesleyan University. Van Dyke explored the determinants of the gender pay gap while trying to control for investments in human capital and came to some interesting yet questionable conclusions. These conclusions sparked my interest in this subject and became the inspiration and basis for this research project.

The purpose of my research is to determine if equally qualified college-educated men receive more compensation than college-educated women do after several years of experience in the labor force. The empirical model will include several variables to account for investments in human capital, which will help to establish if the individuals are equally qualified. The variables include controls for education, mobility, migration and area of residence. I am specifically looking to analyze the effects of human capital investment on income. I will also be paying particular attention to the depreciation of human capital, which may occur as a result of discontinuity in the labor market, and other factors that may limit the development of human capital.

This paper will take a section by section approach to address the research problem. Section II will review the literature most responsible for my interest in this subject, including Jennifer Van Dyke's Research Honors Project, as well as a brief overview of other pertinent research. Section III will lay out the theoretical foundation, with a large emphasis on Gary Becker's human capital model, along

with the several hypotheses that I propose. Section IV explains both the empirical model that was used and the data that was utilized in that model. Section V discusses the results of the model and Section VI draws conclusions from the results, proposes ideas for continued research, and offers several policy implications.

II. Literature Review

As noted, the research done by Jennifer Van Dyke sparked my interest in this subject. Van Dyke's research looks at the pay gap between recent male and female college graduates. The conclusions in her research paper, "Does it Pay to be a Man? A Study of Pay Differentials Between College Graduates." seemed unfounded from what her empirical results showed. For example, she concludes that men's starting salaries are greater than women's starting salaries by an average of $1,803. I believe that this conclusion may be skewed due to variables that Van Dyke did not include in her empirical model. By leaving out important variables to account for differences in human capital investment, Van Dyke may have reached an incorrect conclusion. This section will provide an overview of her research, an analytical analysis of potential problems in Van Dyke's empirical model, and how a newly developed research model hopes to correct for these flaws.

Van Dyke analyzed two types of theories in order to determine why a gender income gap exists.

The first set of theories are supply-side theories of the gender wage gap, which focus on the possibility of differences in tastes, qualifications, education, formal training, or other productivity related characteristics. One major theory is the human capital model developed by Gary Becker. (This model will be explained in great detail in the following section.) Essentially, it argues that an individual should be compensated for human capital characteristics, such as level of education, prior experience, mobility, etc., as well as for the actual time spent working. Following Becker's model, Van Dyke theorized that part of the difference in wages between men and women might be derived from different levels of human capital. Furthermore, Van Dyke discusses another example of a supply-side theory that argues that there are systematic differences in the type of human capital men and women obtain. Women may be more likely to invest in human capital that has a high non-market return, while men may tend to invest in human capital with a high return in wages with little regard to non-market returns.[1] In addition, men are more likely than women to work continuously and to have more tenure while women are more likely to have interruptions in their careers. Each of these factors affects the amount of human capital a person possesses. While Van Dyke attempted to control for human capital by using a sample of recent college graduates with little professional experience, this simple control may or may not have been adequate to account for the numerous differences that may occur in attaining and retaining human capital.

Another major set of theories Van Dyke discusses is demand-side theories. Demand-side theories revolve around discrimination, which can occur in various forms including employer, employee, customer, and statistical discrimination. The theory surrounding employer, employee, and customer discrimination is that an individual (or individuals) has an aversion to employing, working with, or being involved with women in a workplace setting. As a result, women are paid less in order to promote personal preferences (usually the employer's), keep the marginal productivity of employees high (prejudiced men cannot work as efficiently with women co-workers), and keep customer satisfaction high. Similar to employer discrimination, statistical discrimination usually takes place during the hiring process and occurs when employers use group averages to determine compensation and/or hiring.

Van Dyke then presents her general hypothesis that the gap between men and women's starting salaries can be attributed to the supply-side theories that affect what fields men and women choose and to

1. Non-market returns, as discussed further in the following pages, refer to the satisfaction an individual receives from working.

demand-side theories of discrimination. She also hypothesizes that the pay gap will increase over time. No emphasis is placed on whether supply-side or demand-side theories will have a larger effect on individuals' income. Even so, Van Dyke then uses an OLS regression analysis to test her hypotheses. A sample of 152 women and 151 men gathered from the National Longitudinal Survey of Youth is used in the empirical model, which takes the form of:

$$\textbf{income} = \alpha + \beta_1\,\textbf{gender} + \beta_2\,\textbf{major} + \beta_3\,\textbf{hours worked} + \beta_4\,\textbf{tenure}$$

In the equation, the variables are defined as follows: ‘Income’ is the respondents total income from salary and wages from the calendar year; ‘Gender’ is a dummy variable indicating the respondent's gender with males taking on a value of one and females taking on a value of zero; ‘Major’ is the percentage of women studying a particular major; ‘Hours Worked’ is the number of hours the respondent worked during the calendar year; ‘Tenure’ is the number of weeks the respondent has been at the job. The regression was run for 1987, the year the graduates began working and then re-run for the years 1988 to 1995 (excluding 1994 due to lack of data) to determine how the income gap changes over time.

The regression from 1987 showed that women's starting salaries were $1,803 less than the starting salaries of men. To Van Dyke, this suggested gender discrimination in the labor market because her model controlled for variances in human capital. All of Van Dyke's predicted signs on each of her variables held true and proved to be significant. However, the 1987 model only accounted for approximately 39% of the variance in income ($R^2 = .388$) and subsequent models accounted for even less of the variance in income. Although the statistical

numbers seem to be adequate in so far as their explanatory nature, Van Dyke may have jumped to incorrect conclusions by assuming labor market discrimination without sufficiently examining differences in human capital.

The main criticism of the research paper is in the formation of the empirical model. It is argued that the model contains built-in controls for human capital because the sample "consists of college graduates who are about the same age and have very little work experience." Even though these particular individuals have attained the same level of education, the variance in different types of human capital investment and retainment are large and this control (the sampling of only recent college graduates) is too limited in its scope to account for these variances. Take, for example, two individuals with the same level of education and little work experience. John, a student at a major state university known for their accounting program, and Jane, a student at a community college, are both accounting majors. John grew up in a working family and spent his high school years working at his parents' bookkeeping company. He has spent most of his college career studying hard and playing varsity athletics and maintains a GPA of 3.7/4.0. He has worked internships at a small accounting firm as well as at an investment bank. Jane on the other hand, grew up in an upper-middle class family and never had to work much. She held several short part-time jobs in high school working as a waitress and has spent most of her college time hanging out with friends and listening to music. She has also worked as an intern keeping the books at a local restaurant. Her GPA is 3.2/4.0. As the Human Resources director of a major accounting firm, would you hire John or Jane? Both are accounting majors, have the same level of education (college degree), and have relatively little work experience (internships). However, it is very possible that their levels of human capital differ greatly. Hence, it would be impossible to accurately account for differences in human capital without a broader scope to define these numerous areas. This limitation in scope could have greatly effected Van Dyke's results and led her to incorrect conclusions.

Other examples of pertinent research that were not addressed in Van Dyke's research include James Albrecht, et. als., research on career interruptions and subsequent wages and Tobias Bauer’s work on the economic consequences of family/work decisions. Albrecht's article, "Career Interruptions and Subsequent Earnings: A Reexamination Using Swedish Data.", divides time out of work into several components. In addition to findings suggesting depreciation in human capital, the authors find that different types of time out have different effects on wages and that these effects vary by gender. Furthermore, Bauer's article, "The Impact of Family Structure on Time Use and Potential Wage in Switzerland.", looks at the interrelations between family situation, time use, and potential wage with descriptive regression equations. He finds that the economic consequences of family/work decisions can be concentrated in opportunity costs over the whole active lifetime. For example, compared with a single woman, a married woman with two children suffers a total loss of labor market income of about 1.9 million francs, which is approximately equal to $1,166,933. Also, similar studies in other

countries generated similar results. Both of these articles suggest that numerous factors must be analyzed when working with human capital theory. The empirical model utilized in this research attempts to encompass these diverse factors.

III. Theory & Hypotheses

Human capital is defined as the income-producing skills, knowledge, and training acquired by a person. It includes accumulated investments in such activities as education, job training, and migration. The knowledge and skills an individual has, which come from education and training, including the training that experience yields, generate a certain 'stock' of productive capital. This stock of capital can be 'rented out' to employers. However, the value of this amount of productive capital is derived from how much these skills can earn in the labor market. In general, the amount of human capital an individual possesses is what entices prospective employers to hire that individual (Becker, 1993).

Gary Becker argues that an individual's skills and qualifications enhance that worker's productivity and can increase the value of that worker to the employer. Therefore, the wage a worker is paid is not only compensation for the time a person spends working for the firm, but also compensation for the use of an individual's human capital during the time spent working; the human capital is 'rented' to the employer during this time. Hence, increased investments in an individual's human capital will lead to increased compensation in the labor market. Moreover, there are numerous ways to invest in human capital. In fact, a large part of the activities we engage in on a daily basis increase our human capital. These activities range from such simple tasks as reading the newspaper to formal education and on-the-job training.

Formal education is one of the most prominent and most effective ways of investing in human capital. Although there are many factors that can affect the attainment of formal education, it's impact on the individual, and it's usefulness in the labor market, this study will focus mainly on education received at the college or university level. (The third regression presented does not limit the sample to college graduates but includes a variable that accounts for years of educational attainment.) A typical measure of the amount of education received is an individual's grade point average (GPA). It is widely accepted that the higher an individual's GPA, the more that individual has invested in their human capital. However, GPA is not a perfect measure, especially when comparing individuals with differing fields of study. Research has shown that males and females tend to invest in different types of human capital and thus chose different fields of study. For example, women tend to invest in human capital that has high non-market returns, while men tend to invest in human capital with a high return in wages but little increase in satisfaction.[2] In addition, men and women are inclined to make choices that lead them to jobs with substantially different working conditions. These differences are shown in choices of college majors and may somewhat explain why there is a gap in income as a result of their marketability. As an example, men in general may prefer business office work while women may prefer an educational setting (such as a professor, teacher, child's aid, etc.). Depending on the market demand, employers in a business office setting may be compensating more than educational institutions due to a lack of supply. Hence, those

that invested in learning about business fields in college would be compensated more when they graduated than those who invested in educational fields, regardless of gender (Filer, 1985).

Table 1 shows the percentage of men and women in general college majors. It is interesting to note the relatively large percentage of men in business related majors (26%) and the relatively large percentage of women in education related majors (27%). As mentioned in the hypothetical example above, if the labor market currently has a higher demand in business related work, it is rational to assume,

2. By non-market returns, Filer is referring to the satisfaction or utility an individual receives from working. For example, a women may choose to become a nurse because she enjoys helping others even those she will receive less monetary compensation than if she had chosen a different field. Conversely, a man may choose a field such as accounting primary because of the monetary compensation it offers regardless of how much utility he receives from performing his duties.

according to Table 1, that more men will be hired in business related fields than women and therefore men, as a whole, will receive more compensation than women, as a whole, in these particular fields.

Table 1

Percentage of College Majors by Gender

College Major	***Men***	***Women***
Business	26	13
Computer Science	2	2
Education	9	27
Engineering	10	1
Humanities	7	11
Health or Biology	5	14
Science or Math	3	2
Social Sciences	11	11
Professional	13	7
Other	13	12

Source: Jacobsen, The Economics of Gender. 1998, p. 282.

On-the-job training is also very important in attaining and retaining human capital. These experiences keep human capital skills current. This type of investment is quite similar to

formal education, but is linked to consistency in the labor market and past work experience. With changing technology, workers must stay current with their human capital skills. "Receiving formal education or on-the-job training may make you better able to turn on-the-job experience into human capital or may cause you to enter into jobs with more possibility for accruing additional human capital through experience" (Jacobsen, 1998). It is easiest to keep skills current by obtaining on-the-job training and continuously being in the labor force. It has been shown in numerous studies (see Albrecht and Landes) that men are more likely than women to work continuously with fewer interruptions. Due to this fact, men may be more apt and able to take advantage of on-the-job training opportunities. Since women are more likely to have work interruptions and hence expect only intermittent labor force participation, they may opt for jobs requiring less investment in human capital in the form of on-the-job-training (Becker 1993).

In addition to the opportunity costs of leaving the labor force, some researchers argue that there is a depreciation of human capital during absences from the labor market. Not only is additional capital not gained through experience or on-the-job training, skills and knowledge previously gained may be lost. According to Albrecht, "the fact that women are more likely than men to interrupt their work careers for family reasons (childbearing, child rearing, etc.) is understood to be an important factor behind the gender gap in wages." Career interruptions are thought to reduce women's wages relative to men's for at least three reasons. First, wages tend to rise with work experience, and time spent away from work is experience forgone; that is, women tend to earn less than men do because on average they have accumulated less work experience. Second, it is thought that, anticipating future work interruptions, women choose jobs with less potential for training and hence have flatter earnings-experience profiles. In other words, women tend to realize a lower rate of return per unit of realized work experience. Finally, time out of the workforce appears to lead to a loss in subsequent earnings greater than can be explained solely by forgone experience. This can be generalized by the simple fact that when you don't use certain skills, you lose them (Albrecht, 1999).

Related closely to absences from the labor force is an individual's overall work experience. According to human capital theory, increases in work experience can also entail increased human capital investment and can cause rising age-earnings profiles. Hence, as an individual works more, his or her stock of human capital increases. A job in which experience makes one more productive should therefore pay more over time. Alternatively, a job in which one becomes no more productive with experience should have a flat profile. Correspondingly, part-time workers accumulate less human capital simply because fewer hours are worked and, therefore, less work experience is obtained (Ehrenberg & Smith). Work experience has proven to be essential in increasing future earnings. According to Jacobsen, "work experience appears to have the most notable effect [on subsequent income]." Several studies have found that between one-fourth to one-half of the sex difference in earnings between men and women is attributable to differences in work experience histories" (Jacobsen, 1998).

Due to the importance of prior work experience, differences between the experience levels of men and women may attribute greatly to the difference in compensation. Available data indicate that, on average, women in the labor market have less work experience than men. In 1984, for example, among employed workers aged 21 to 64, women averaged 5.2 years less labor market experience than men. These 5.2 years break down as 2.4 fewer years with their current employer and 2.8 fewer years of prior work experience. Although it may seem outdated to some, the culture in our society remains that women are more likely to take time off from participation in the labor force, especially when they begin to have children (Jacobsen, 1998).

As can be seen in Table 2, despite the level of education, women tend to work fewer years than men. When looking specifically at college graduates, men will work an average of 6.9 years more than females. In addition, women also work fewer hours per week than men do. In the professional specialty positions, males work 4.2 hours more per week than females. If an average male executive is compared to an average female executive, the male will work 1,507 hours more than the female during the course of their working careers. If these hours are charged at a rate of $40/ hour, the result is a $60,280 difference in lifetime earnings, or a $1,989 difference per year.

Table 2

Average Worklife and Hours of Work by Gender (1991)

Remaining Expected Years of Paid Work at Age 25	***Male***	***Female***
High School graduates	34.1 (years)	25.4 (years)
Some college	35.4	27.8
College graduates	37.2	30.3
Average Weekly Hours of Paid Work for Those		
Working Full-Time in 1991		
Executive, administrative, managerial positions	47.5 (hours)	43.3 (hours)
Professional specialty positions	46.1	41.9
Technicians and related support positions	43.4	41
Sales positions	47.7	42.3
Precision production, craft, and repair positions	43.5	41.5
Data relate to non-disabled individuals in 1988		
Source: US Bureau of Labor Statistics, Employment and Earnings 39, January 1992: Table 34		

An individual's family structure is also a substantial factor to consider when attempting to explain income differentials. When Tobias Bauer performed research on several varying family structure situations, he found that men always tended to work more hours than women do, whether the individual was single, married, or married with children. Take, for example, a married couple with 2 children in 1997. The male will work an average of 2,250 hours per year while the children are under age 10 yet the female will average only approximately 1000 hours per year. In addition, the divorce of married couples generally affects men and women in different manners. If there are children involved, they will traditionally stay with their mother. This leaves the male free to migrate to other areas to find employment that may potentially offer higher compensation. The male will also have more time and opportunity than his female counterpart to pursue formal education, on-the-job training or other activities to increase his human capital. Although the male will tend to have these cited advantages, a divorce generally impacts the male and female (as well as the children) in a negative manner (Bauer, 1998).

Although it is possible that the gender pay gap may be entirely comprised of differences in investments in human capital, discrimination may also account for a portion of the gap. Numerous types of discrimination exist including employer, employee, customer, and statistical discrimination. The theory surrounding the first three forms takes the position that the employer, the employees, or the customers of a firm have an aversion to working with women. For example, in employer discrimination, employers are willing to trade potential profit in order to pay higher wages to desired employees so they can avoid contact with 'undesired' employees. In employee and customer discrimination, employees [customers] have a 'taste for discrimination'. The employee must consequently be paid more to work with the undesirable group and the customer will seek to purchase [goods or services] from firms that do not employ members of the disliked group. As a general result, women are paid less in order to promote personal preferences (usually the employer's), keep the marginal productivity of employees high (prejudiced men cannot work as efficiently with women co-workers), and keep customer satisfaction high. Statistical discrimination differs somewhat from employer, employee, and customer discrimination, but is most similar to employer discrimination in that it usually occurs during the hiring process. Statistical discrimination occurs when employers use group averages to determine compensation or other conditions of employment. For instance, an employer may have heard that women are 40% more likely to leave the labor force than men. He/she may then conclude that the woman he just interviewed will likely leave the labor force or require reoccurring training (as a result of absences from the labor force) and that the man he/she interviewed will be consistent in his labor market participation. Although this assumption may be completely wrong, this general statistic makes women less attractive to prospective employers. Hence, solely on the basis of these generalizations, a perfectly qualified female may not be hired (Jacobsen, 1998).

Each of the factors discussed in the previous paragraphs, including the number of hours the respondent worked, his/her major field of study, AFQT percentile score (as a proxy for GPA), prior working experience, tenure with the current firm, family structure, and the number of weeks absent from the labor force are factors that could have a considerable impact on the respondent's total compensation. Although they are all

important in their own ways, they often end up being linked to one another. (As an example, an individual's amount of prior working experience may be linked to his/her tenure as well as his/her absences from the labor force.) However, the specific hypotheses I am proposing for the models are summarized as follows:

1. The number of hours a respondent worked has a positive relationship to income. This variable is intuitive in nature. As the number of hours worked increases, so will the respondent's income.
2. The respondent's major field of study, in regards to the amount of human capital investment required to attain a degree in the respective major, is positively related to income. In the research model, five dummy variables, which are comprised of similar group of majors (such as science-related fields, business-related fields, etc.), are utilized to attempt to account for the differences in human capital investment. It is hypothesized that science and business related majors will increase and individual's income while educational, humanities, and art related majors will have a negative impact on income.
3. The respondent's armed forces qualifications test (AFQT) percentile score will have a positive relationship to income. The AFQT is an aptitude test designed to measure innate ability and, to a certain degree, achievement. Due to their similarities, AFQT scores are being utilized in this study as a proxy for GPA since data on respondent's actual GPA could not be obtained. (AFQT will be explained further in the following section.) The higher the respondent's AFQT percentile score was, the higher the respondent's income will be.
4. The amount of prior working experience the respondent has will be positively related to income. As an individual's experience increases, so will his/her income.
5. The hours of tenure the respondent has with the firm will have a positive relationship to income. As the number of weeks of tenure increases, income will increase.
6. Family structure, specifically a divorce or separation, will have a negative impact on income. If the respondent has been divorced or separated, income will decrease. It is also hypothesized that divorce will have a worse (more negative) effect on females than on males.
7. The number of weeks an individual is absent from the labor force will be negatively related to income. The longer the respondent has been absent, the larger the decline in income will be.
8. The fact that the respondent lives in a rural area, as compared to an urban area, will have a negative relationship with income. Although this hypothesis is not specifically discussed in the theory, it is intuitively understood that compensation will generally be lower in a rural area as compared to an urban area in order to compensate for differences in cost of living expenses, etc. This variable should also help to account for the differences in industries (and their differences in compensation) generally represented in rural and urban areas. Hence, if the individual lives in a rural area, his/her income will decrease.
9. It is hypothesized that gender will have a very small impact on income. This is contrary to Van Dyke's results (which showed a relatively large, significant impact) due to the additional control variables in the current research model.

10. Although the first two regressions sample only college graduates, the third model is not limited in this fashion. In this model, it is hypothesized that the number of years of formal education an individual has received will be positively related to income. Thus, as the number of years of education increases, so will the individual's income.

I. Empirical Model & Data

The purpose of this paper is to determine if men receive more compensation than women do after several years of experience in the labor force. The models will specifically look at human capital and attempt to control for differences by utilizing several variables. The models also take family structure and area of residence into account when attempting to analyze compensation. The National Longitudinal Survey of Youth (NLSY) was utilized to obtain all data in the empirical models. The sample consists of a group of individuals in an age range of 35-40; that is, college graduates from the years 1980 to 1985. The data was regressed several times using an ordinary least squares (OLS) multiple regression with annual income from wages and salaries as the dependent variable. The first model did not include the dummy variables to account for differences in the respondent's field of study. It utilized the following as independent variables: gender, number of hours worked, armed forces qualifications test percentile score, total hours of prior experience, tenure at the firm, family structure and a family structure interaction variable, number of weeks absent from the labor force, and area of residence. The model is formulated as:

1. $\mathbf{income = \alpha + \beta_1\ gender + \beta_2\ hours + \beta_3\ afqt + \beta_4\ prior + \beta_5\ tenure + \beta_6\ divorce}$

   $\mathbf{+ \beta_7\ female\_d + \beta_8\ absent + \beta_9\ rural}$

   There were 1,394 samples used to obtain the data for this first model. The second model includes the dummy variables to account for differences in the respondent's field of study. However, by including these variables, the scope of available data was severely restricted and only 221 samples were utilized. The second model is formulated as:

2. $\mathbf{income = \alpha + \beta_1\ gender + \beta_2\ hours + \beta_3\ afqt + \beta_4\ prior + \beta_5\ tenure + \beta_6\ divorce}$

   $\mathbf{+ \beta_7\ female\_d + \beta_8\ absent + \beta_9\ rural + \beta_{10}\ science + \beta_{11}\ bus + \beta_{12}\ human}$

   $\mathbf{+ \beta_{13}\ educ + \beta_{14}\ arts}$

   The third model does not include the dummy variables for major field of study and, unlike the other two models, does not control for the respondents being college graduates. Instead, a variable to account for the number of years of formal education the respondent received is included. The sample size for this third regression is greatly increased to 6,707 respondents. The model is formulated as:

3. **income = $\alpha + \beta_1$ gender + β_2 hours + β_3 afqt + β_4 prior + β_5 tenure + β_6 divorce**

+ β_7 female_d + β_8 absent + β_9 rural + β_{10} school

The regressions were run for 1996, the most current data available from the National Longitudinal Survey of Youth. Please refer to Table 3 for a summary of variable definitions and expected signs of the coefficients.

The income variable is the total compensation (including salary, wages, tips, etc.) that the respondent earned for the year. This variable is quite direct, easy to understand, and an appropriate measure of the total compensation an individual would receive. If time-series data was being utilized, some problems might occur in determining actual compensation because of factors such as inflation and other influences that are time-based. However, since cross-sectional data is being used, no problems are anticipated.

gender is a dummy variable that attempts to measure the differences between males and females as well as possibly capture the effects of discrimination. (Without a further breakdown of the resulting coefficient, the part of the whole that could be contributed to discrimination factors will remain unknown.) A value of zero is assigned to male respondents while a value of one is assigned to female respondents. No particular value or sign on this variable is predicted, but if my hypotheses are correct, the effect of gender on income should be relatively small and insignificant.

The hours variable is predicted to be positive, assuming that the more a person works, the more compensation they will receive. Intuitively, pay can vary greatly on the number of hours a person works and as those hours increase, so will income. The variable afqt is a proxy for the individual's college grade point average and its coefficient is expected to be positive. As mentioned earlier, afqt (Armed Forces Qualifications Test) is an aptitude test used to measure achievement and innate ability. The test was administered to all respondents in the NLSY in 1979. Although it is not a perfect substitute for an individual's GPA, AFQT scores have been utilized in this manner previously with considerable success (see Kumazawa and Seeborg). The variable is included to help control for investments in human capital. It can be reasonably assumed that those who have attained a higher AFQT percentile score have invested more in their own human capital. Therefore, these individuals are deserving of higher incomes.

The prior variable will be measured by the number of total hours of experience an individual has in their field or a highly related field. It is hypothesized that an individual who has had experience in the field has gained human capital from these experiences alone. Due to this increase in human capital, the individual would be deserving of more compensation. This variable is included again to help control for investments in human capital and is expected to have a positive effect on income. The tenure variable is closely related to the prior variable. tenure is the total number of hours the respondent has been affiliated with his or her current employer. The same assumption is made relating experience to income but it is hypothesized to have a greater effect on income. General

experience may increase overall human capital, but specific experience with one firm should greatly increase an individuals human capital and usefulness to that specific firm, thus increasing his/her income. Naturally, tenure is predicted to have a positive effect on income.

The divorce variable is a dummy variable that attempts to control for differences in family structure. If the respondent has been divorced or separated, the variable will be assigned a value of one and if the individual is married or single (and has never been married), the variable will be assigned a value of zero. It is predicted to have a negative impact on income and have a larger impact on females' income than on males' income. female_d, which combines the gender variable and the divorce variable, is an interaction variable created to isolate these joint effects. If the respondent is both female and divorced, the variable will be assigned a value of one and if the respondent does not meet both of these characteristics, the variable will be assigned a value of zero. It is predicted that female_d will have a negative affect on income because, traditionally, men are more mobile and hence able to increase their human capital after a divorce. Women tend to be less mobile, sometimes due to the rearing of children, and thus less apt to increase their human capital. These circumstances combined with the prediction that divorce has a negative effect all around will hypothetically produce an inverse effect on income that is more pronounced than the effect of the divorce variable alone.

Table 3

Variable Definitions and their predicted signs

Variable	***Type***	***Definition***	***Expected Sign***
income	Dependent	Total compensation from wages and salary	
gender	Independent	Dummy Variable indicating gender of respondent; 0=male, 1=female	Negative
hours	Independent	Number of hours worked	Positive
afqt percentile score	Independent	Armed Forces Qualifications Test:	Positive
prior respondent's	Independent	Number of hours of prior experience in field or related field	Positive

tenure	Independent Positive	Number of hours respondent has been affiliated with current employer
divorce	Independent Negative	Dummy variable to indicate if respondent has been divorced or separated; 0=not divorced, 1=divorced
female_d males	Independent Negative	Dummy variable to isolate effects of divorce on and females; 0=male & divorced or not divorced, and female & not divorced, 1=female & divorced
absent	Independent Negative	Weeks of absence from labor force since respondent initially entering the labor market
rural	Independent	Dummy variable for place of residence. Negative 0=urban area, 1=rural area
science field	Independent Positive	Dummy variable to indicate if respondents major of study in college was science related; 0=other major 1=science related major
bus major field	Independent Positive	Dummy variable to indicate if respondents of study in college was business related; 0=other major,

1=business related major

human field Independent Negative Dummy variable to indicate if respondents major of study in college was humanities related; 0=other major, 1=humanities related major

educ major field Independent Negative Dummy variable to indicate if respondents of study in college was educationally related; 0=other major, 1=educationally related major

arts major field Independent Negative Dummy variable to indicate if respondents of study in college was arts related; 0=other major, 1=arts related major

school Independent Positive Number of years of formal education received

The variable absent will be measured simply by the number of weeks the respondent has been absent from the labor force. This variable is predicted to be negative because as theory shows, prolonged absences from the labor force not only cause the individual to forgo the particular income missed during that time, but also decreases an individual's overall human capital. These combined effects will, in turn, have a negative effect on income. rural is a dummy variable for the area of residence of the respondent. If the respondent resides in an urban area, the variable will be assigned a value of zero while rural residents will be assigned a value of one. This variable is predicted to have a negative impact on income since incomes in rural areas are generally lower than those in urban areas (to account for differences in costs of living). The variable is included to help control for regional differences across the sample.

The purpose of including the five dummy variables dealing with an individual's college major is to help control for human capital investments. These variables attempt this

control by assuming that different types of majors in college require different amounts of human capital investments. The five variables utilized in this study are science, bus, human, educ, and arts. The science variable encompasses science related majors such majors as architecture, biological sciences, and engineering, as well as others. The bus variable includes such business related majors as accounting, management, and computer science. The human variable is a dummy variable that includes majors in the broad area labeled as humanities. This area includes foreign languages, communications, and public affairs as major fields of study. educ includes educationally related majors such as teaching, special education, etc. The arts variable incorporates majors in fine arts, applied arts, and theology, as well as others. There are no specific hypotheses made as to which groups of majors require larger investments in human capital. However, hypotheses are made as to which majors will ultimately have the highest market returns. Given the current market economy, it is hypothesized that science related majors and business related majors have the highest market return and thus will have a positive impact on income. Furthermore, it is predicted that humanities, education, and art related majors will return less than average payoffs over a lifetime and therefore will have an inverse effect on income.

The final variable, school, is utilized only in the last regression. The first two models control for education by limiting the sample to college graduates. This restriction was included in order to make direct comparisons to Van Dyke's research model. However, since the majority of respondents in the National Longitudinal Survey of Youth are not college graduates, the last model includes individuals that have attained less than a college education as well as college graduates. The school variable reports the number of years of formal education the respondent has attained. For example, if the respondent graduated 6th grade, the school variable would be assigned a value of 6 while an individual who dropped out of high school after his or her sophomore year would be assigned a value of 10. It is hypothesized that as the number of years of education increase, so will the individual's resulting income.

I. Results

The first regression accounted for approximately 22 percent of the variance in income. Eight of the nine independent variables attained the hypothesized sign on the coefficient and seven of the nine variables were significant, five of which being significant to the .001 level. The regression is represented by the following equation:

1. **income** = - 5,237.06 - 9,645.14 **gender** + 7.99 **hours** + 254.84 **afqt** + 0.80 **prior** + 6.168 **tenure**

   + 239.75 **divorce** - 3,330.835 **female_d** - 210.63 **absent** - 10,723.44 **rural**

   The second regression, which included the dummy variables to account for differences in the respondent’s field of study, accounted for approximately 25 percent of the variance in income. Twelve of the fourteen independent variables attained the hypothesized sign on the coefficient but only six of the fourteen

variables were significant, and only one variable was significant to the .001 level. (It is interesting to note that the significant decrease in sample size may play a large role in the significance of all variables in the second regression.) The regression is represented by the following equation:

2. **income** = 3,819.74 – 5,035.28 **gender** + 6.38 **hours** + 118.27 **afqt** + 0.74 **prior** + 3.06 **tenure**

   + 228.02 **divorce** – 1,211.69 **female_d** – 432.50 **absent** – 5,733.31 **rural**

   - 1,895.00 **science** + 106.91 **bus** – 4,355.35 **human** – 6,900.64 **educ** – 7,020.77 **arts**

   The third regression, which did not utilize the major variables and did not sample only college graduates but rather included the school variable to account for years of education, performed the best of the three regressions. This model accounted for approximately 37 percent of the variance in income and nine of the ten independent variables attained the hypothesized sign on the coefficient. All of the independent variables were significant and all but one was significant to the .001 level. The regression is represented by the following equation:

3. **income** = - 28,019.38 – 7,538.98 **gender** + 6.13 **hours** + 127.40 **afqt** + 0.36 **prior** + 11.52 **tenure**

   + 1,490.06 **divorce** – 4,212.60 **female_d** – 31.01 **absent** – 3,907.78 **rural**

   + 2,325.88 **school**

Table 5 presents a summary of regression results.

The following table of descriptive statistics provides a summary of averages for all of the independent variables utilized in each of the three models. It is interesting to note the large differences between men and women in the majority of variables. For example, men on average earn approximately $20,000 more than women. However, this difference is offset by many of the other variables. Men tend to work approximately 600 hours more per year than women, have a higher AFQT percentile score, have more experience and tenure, and are absent from the labor force approximately seven weeks less than women. It is also interesting to note that men tend to be concentrated in science and business related majors, which generally have high market returns, while almost 61% of women are concentrated in humanities, education, and arts related majors, which tend to have lower market returns. The average number of years of formal education attained is approximately the same for both males and females.

Table 4

Descriptive Statistics

Variable	***Average for Women***	***Average for Men***	***Overall Average***
Income	$30,453.60	$50,495.82	$40,087.84
Percentage of Respondents who are Female	*n/a*	*n/a*	52.06%
Hours Worked	1753.60	2385.23	2057.99
Armed Forces Qualifications Test	66.16	72.79	69.32
Hours of Prior Experience (1979-1996)	20,496.40	23,298.37	21,841.21
Weeks of Tenure with Current Employer	280.06	284.53	282.30
Percentage of Individuals Divorced	10.37%	8.10%	9.28%
Weeks Absent from Labor Force	8.50	1.27	5.04
Percentage of Individuals in Rural Area	13.48%	13.00%	13.25%
Percentage of Individuals with a Science Major	14.97%	29.36%	21.09%
Percentage of Individuals with a Business Major	22.45%	26.61%	24.22%
Percentage of Individuals with a Humanities Major	29.25%	18.35%	24.61%
Percentage of Individuals with an Education Major	27.21%	13.76%	21.48%
Percentage of Individuals with an Arts Major	4.08%	8.25%	5.86%
Numbers of Years of Formal Education Attained	12.88	13.08	12.98

Source: National Longitudinal Survey of Youth, 1996

A. *Model #1*

The first model was run in order to provide a comparison to Van Dyke's research model. Van Dyke's model includes the variable major, which attempts to capture effects of the crowding effect (the percentage of females in male-dominated fields). This first model, however, does not include a control variable for an individual's college major. The model was regressed in this fashion due to complications surrounding the use of an individual's college major as a control for human capital investment. (These limitations will be discussed further when the second model is explained.) Even though the control for major field of study is removed, the first regression stills provides a suitable basis for comparison. The model is broken down and discussed according to each independent variable.

Gender- This coefficient is large, negative, and highly significant, which contradicts its predicted value. According to the model, women on average earn $9,645 less than men. When looking solely at this variable, the model tends to support Van Dyke's results that there is a wage penalty associated with being a female that is not related to differences in human capital. However, it is interesting to note that as more human capital variables are added to the equation, the coefficient on gender becomes smaller. For example, refer to Table 4. Regression #1 incorporates the fewest number of human capital variables, regression #3 the next fewest, and regression #2 includes the largest number of human capital variables. As can be seen, the coefficient on gender decreases from -9,645.142 in model #1 to -7,538.975 in model #3 and finally to -5,035.276 in model #2. This suggests that if still more human capital controls were added to the equation, the coefficient on gender could be reduced even further.

Hours- This variable achieved precisely its hypothesized effect. The coefficient is positive and significant to the .001 level. The model predicts that for each additional hour worked, income will increase by approximately eight dollars. This variable was one of the best performing and provided the most consistent results across the three regressions.

AFQT- The use of the Armed Forces Qualifications Test percentile score produced excellent results. As hypothesized, the coefficient on afqt is large, positive, and very significant. The regression predicts that each increase in percentile score on the test will result in approximately a $254 increase in income. This can be compared to increases in an individual's grade point average leading to an increase in income, as theory would suggest.

Prior- This variable is relatively simple and resulted in the hypothesized, intuitively correct results. The coefficient of .795 shows that for each additional hour of prior experience the respondent has, income will increase by approximately $0.80. This is understandable since experience in a particular field leads to a greater knowledge of the field and thus makes the employee more valuable. The result of a large, positive, highly significant coefficient coincides directly with the theory presented linking prior experience to income.

Tenure- Since this variable is closely related to the prior experience variable, the regression produces similar results. Theory suggest that the more tenure a person has with a specific firm, the more compensation that individual should receive. The model supports this theory with a positive, large, and significant coefficient on the tenure variable. According to the regression, with each hour increase in tenure with the respondent's current firm, the individual received an approximately $6.17 increase in income. This result also supports the theory and hypothesis that tenure with a specific firm has a larger impact on income than general experience alone.

Divorce- The resulting coefficient on this variable proved to contradict existing theory that divorce has a negative impact on both male and female income. The coefficient of 239.752 suggests that individuals who get a divorce increase their income by approximately $240. Although the sign of the coefficient disclaims prior theory as well as the predictions of the author, the variable was not significant. This result implies that a divorce will have no significant impact on an individual's income and moreover contradicts the surrounding theory as well as the author's hypothesis.

Female_D- Similarly to the divorce variable, the coefficient on this interaction variable was predicted to be large, negative, and significant. Although the results are not significant, the coefficient of -3,330.835 is interesting due to the large difference between it and the positive coefficient of the divorce variable. According to this model, being a female divorcee has no significant impact on income but the results, had they been significant, do support the theory that divorce has an overall worse effect on female's income than on men's income.

Absent- The coefficient on this variable is large and negative indicating that any absence from the labor force will result in a decline in income. This result is relevant because it supports the hypothesis and the theory that the longer an individual is absent from the labor force, the larger the loss of human capital will be, which results in a negative impact on the individual's income. According to the regression, each week of absence from the labor force results in a $210 decline in income. The coefficient is also significant which supports the theory that absences from the labor force play a large role in determining an individual's income

Rural- The results of the final variable in this regression support the hypothesis that individuals residing in rural areas receive less income than those residing in urban areas. The coefficient is negative, significant, and surprisingly large. The model proposes that individuals living in rural areas earn an income that is approximately $10,723 less than those individuals living in urban areas who possess identical characteristics. Although this effect was predicted, the extent of the difference is much larger than anticipated.

B. *Model #2*

The results of the second regression, in regards to the variables that were utilized in each model, are quite similar to the results of the first regression. All of the coefficients on the nine independent variables already mentioned from model #1 had the same sign as those in the first regression. The coefficient that had the most dramatic change in size was on the gender variable. The coefficient decreased by over 4000 to -5,035.276. This result, which is also significant, proposes a lesser wage penalty associated with being a female when more controls for differences in human capital investment are included. Equally noteworthy in its decrease in size is the coefficient on the rural variable. It decreased from -10,723.44 to -

5,733.31, which shows that less of the difference in income is linked to area of residence. The coefficient on the tenure variable decreased by 50% but lost its significance. The coefficient on afqt decreased to 118.27 and became less significant than in the first model. The coefficient on female_d decreased as well but was still not significant. The coefficients on hours, prior, and divorce, changed only slightly while the negative impact resulting from absences in the labor force increased by over $200 per week of absence to -$432.50. In general, all of these variables decreased except for absent and all variables remained significant besides tenure, which lost its significance. As could be inferred, these results confirm/contradict the previously mentioned hypotheses and theories in the same fashion as they did in the first regression.

The difference between the first and second models is the dummy variables included to control for major field of study, which all proved to be insignificant. This strongly contradicts the theory and hypothesis that choice of college major impacts income. However due to the large difference in sample size, it is difficult to directly compare the two models since some of the changes in coefficients could be a result of sample selection biases. It is noteworthy though that all five of the dummy variables achieved their predicted sign except for science. According to the model, the result of majoring in a science related field is a wage penalty of $1,895. bus, human, educ and arts, all performed as expected achieving results of 106.91, -4,355.35, -6,900.64, and -7,020.77 respectively. As noted above, none of these variables proved to be significant. This may be due to the limited number of samples available. When these five dummy variables were added to the model, the sample size decreased by approximately 85% from 1,394 to 221. It could be postulated that it is impossible to obtain reliable results when a sample is limited to this degree, which would begin to explain the insignificance of these dummy variables as well as the low level of explanation (adjusted R^2 = .251) provided by the entire regression. It is theorized that had these dummy variables not restricted the model to such an extreme degree, an individual's choice of major field of study would have a significant impact on the resulting income. Although this is not the case in the current model, finding a measure to more accurately and effectively account for differences in college major would likely improve the overall results of the model and give more credence to the other human capital variables included in the regression.

C. *Model #3*

Model #3 returned the best results of the three regressions. The model explained the largest amount of variance in income, approximately 37%, and eight of the ten variables were significant to the .001 level. The nine variables that were utilized in each model retained the same signs on the coefficients and, in general, achieved the hypothesized results. The gender variable increased in size slightly to -7,538.98, which is mid-way between what the first and second regressions predicted. Contrary to the research hypothesis, this result is highly significant and proposes a wage penalty of -$7,538.98 associated with being a female. The coefficient on the rural variable decreased again -

5,733.31 to -3,907.78, which indicates that even less of the difference in income is linked to area of residence. It is interesting to note the decline in the size of this coefficient when the sample is not made up entirely of college graduates. This implies that there are more opportunities for non-college graduates to earn a higher income in rural areas as compared to urban areas, which is intuitively and theoretically correct. The coefficient on the tenure variable increased to 11.52 and regained its significance to the .001 level. This result shows that tenure with one specific firm is much more important to non college graduates than to college graduates. Conversely, the result of the coefficient on prior, 0.36, suggests that prior experience in general has less of an impact on income when the sample in not controlled to contain only college graduates. The coefficient on afqt increased to 127.39 and regained the same level of significance that it had attained in the first regression. The divorce variable increased greatly to 1,490.06 and became significant to the .10 level. This model is the only model in which the coefficient on the divorce variable was significant. This result is contrary to the theory that divorce has a negative impact on all individuals involved. The coefficient on female_d decreased significantly to -4,212.59 and, similar to divorce, became highly significant, which is the only instance in which the interaction term was significant. It is interesting that a divorce has such a large, negative, and significant impact on females with varying levels of education as compared to the insignificant impact it has on female college graduates. The coefficient on hours changed only slightly, regaining it's significance from the first regression, while the negative impact resulting from absences in the labor force decreased to -31.00 and lost it's significance. This suggests that a continuous presence in the labor force is not as important when the general population is sampled instead of sampling only college graduates.

As cited previously, the difference between this model and the first two models is that this regression does not limit the sample strictly to college graduates. Instead, the model introduces a control variable, school, to account for the number of years of formal education the respondent received. The model was run in this fashion to ascertain if there was a large difference in the education men and women were receiving. The coefficient on school proved to be exactly as hypothesized, large and highly significant. According to the regression, with each additional year of education an individual receives, income will increase by $2,325.88. Although the result of the school variable and the other variables in this regression are quite interesting, they do little to explain the differences in pay between men and women. Since men and women tend to receive the same level of education, according to the descriptive statistics presented in Table 4 the differences presented in this model are less significant than if a significant difference in educational attainment was discovered.

Table 5

Regression Results

Variable & Expected Sign	***Regression #1***	***Regression #2***	***Regression #3***
Gender (-)	-9,645.142***	-5,035.276*	-7,538.975***

Hours (+)	7.994***	6.382**	6.125***
AFQT (+)	254.842***	118.272*	127.390***
Prior (+)	.795***	.738***	.356***
Tenure (+)	6.168*	3.056	11.516***
Divorce (-)	239.752	228.021	1,490.060*
Female_D (-)	-3,330.835	-1211.688	-4,212.591***
Absent (-)	-210.632*	-432.503*	-31.009
Rural (-)	-10,723.44***	-5,733.310*	-3,907.784***
Science (+)	*n/a*	-1,894.996	*n/a*
Bus (+)	*n/a*	106.910	*n/a*
Human (-)	*n/a*	-4,355.349	*n/a*
Educ (-)	*n/a*	-6,900.644	*n/a*
Arts (-)	*n/a*	-7,020.773	*n/a*
School (+)	*n/a*	*n/a*	2,325.877***
Adjusted R^2	.222	.251	.371
Sample Size	1,394	221	6,707
* Significant to the .10 level			
** Significant to the .01 level			
*** Significant to the .001 level			

Source: National Longitudinal Survey of Youth, 1996.

I. Conclusions & Policy Implications

In general, the models were successful in predicting income and support the majority of the hypotheses and theory presented earlier. Human capital variables play a large role in determining an individual's compensation and differences between male and female compensation can largely be attributed to differences in the amount of human capital those particular individuals possess. Although differences in human capital account for the majority of the gender pay gap, a gap in income still remains. This unexplained portion can likely be attributed to yet more omitted human capital variables, or possibly other external factors. As previously stated, the more human capital variables added to the basic model, the smaller the gender gap in income became. These additional omitted variables could include background characteristics such as access to reading materials (whether or not the individual possessed a library card or his/her family subscribed to newspapers or educational magazines), or such social characteristics as the environment in which the individual grew up. Had these types of variables been included in the model, results may have improved with the gender gap decreasing accordingly. This knowledge

may lead one to believe that if future models account for all differences in human capital, the gender pay gap will decrease to an insignificant size.

As noted, problems occurred when attempting to control for individual's major field of study in college. The limited number of samples available restricted the sample size severely, which had an overall negative impact on the entire regression. It is still hypothesized that an individual's college major has a significant effect on income. However, this research was not able to capture that effect. Future research should incorporate a control for college major that will allow a larger sample size to be tested. Other future research should also look into adding more controls for human capital investment, such as those noted above, in order to ascertain if the gender pay gap does indeed continue to decrease as hypothesized by the results of this study.

The results of this research lend several possibilities for policy implications. One possible implication might be to increase the amount of education on this subject to help individuals understand how the choices they make in investing in their personal human capital may effect their future. Also, incentives to increase the amount and alter the mix of human capital in general that women possess may be useful in increasing their earnings and hence decrease the gender pay gap. By doing so, women may choose forms or disciplines of education with higher future payoff rates. This mainly involves their entering nontraditional majors that develop skills in high demand in the labor market. In addition, creating incentives to decrease absences from the labor market in an effort to decrease the resulting declines in human capital may also be a necessary task. This issue is more difficult than the previously mentioned issues. Women have less incentive to invest in human capital if they are planning to exit from the labor force, and many women feel it is important to exit from the labor force if they are responsible for childraising. Convincing women not to exit the labor force without changing the traditional balance of family responsibility requires incentives, monetary and nonmonetary, to make it possible for them to balance career and family responsibilities. Alternatively, the balance of responsibility for child care in particular, but other nonmarket work as well, must be changed if women are to be able to work a larger percentage of their lives in market work. If this can be done, then women will have the incentive to invest in more specific human capital and enter on-the-job training programs in greater numbers.

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