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Returns To Education: Is There A Wage Premium Associated With Graduates of Private Colleges?



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Submitted to The Department of Economics

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Table of Contents

Chapter 1: A literature Review……1
I. Introduction……2
II. Literature Review……3

Chapter 2: Theoretical Analysis……14
I. Introduction……14
II. Human Capital……14
III. Wage-Schooling Locus……19
IV. Schooling as a signal……21

Chapter 3: Empirical Analysis……23
I. Introduction……23
II. Regression Analysis……28
III. Potential Problems……33

Chapter 4: Conclusion……35

List of Tables/Figures

Figure 2.1……16

Figure 2.2……17

Figure 2.3……20

Figure 4.1……34

Table 4.1……29

Abstract

College tuitions have been on a steady increase since about 1980. Tuition at private colleges especially has been increasing at an alarming pace. When students graduate high school, they can choose to enter the work force right away, attend a two-year school, or attend a four-year private or public university. If a student chooses to go to a private four-year college, they will pay a much higher price compared to four-year public universities. This can be seen as a human capital investment. We expect to gain more human capital for attending a private college. This paper aims to discover if there is a correlation between a private college education, and future earnings of undergraduate students. College characteristics will also be examined to see of what characteristics might lead to the higher earnings of undergraduates. It is important for people to know that the extra money they spend on a private four-year college education, results in more human capital and/or higher wages.

Chapter I: A Literature Review

I. Introduction

We face many tough decisions throughout our lifetime. One of the biggest decisions that we make is choosing where we want to go to college when we graduate from high school. There are three basic choices that we have to choose from. We can choose to go to a two-year college, a four year state university, or a four year private university. The basic differences between a state and a private college are that private colleges tend to be more selective, therefore less students attend private schools, the teacher/pupil ratio at private colleges is lower, private colleges offer the basic major programs such as Economics, English, chemistry, biology, mathematics, while state schools tend to offer these and professional majors such as architecture, engineering, and finance. A large factor that partly determines where a student chooses to go is tuition costs. Private colleges cost a lot

more in terms of tuition than public (state) universities. In 2006-2007, the average cost of attending a private, four-year college was $30,367. The average cost of attending a four-year public institution in that same time period was $12,796 (Kelly,2006). This is a difference of $17,571 per year. With this large gap in costs between private and state schools, we do expect that the quality of education at private colleges is much above that at state universities. We should, therefore expect graduates of private colleges to earn higher wages than graduates of public universities. The aim of this study is to see if there is a wage premium associated with college graduates of four year private colleges compared to graduates of four-year public universities. To do this, a wage regression is used. The wage model takes into account labor market variables, demographic variables along with college and individual characteristics. For example, it is important to take gender and race into consideration with this topic, but previous literature has left both of these out of their research. The main goal of this paper is to find if there is a correlation between the types of college you attend, private or public, controlling for choice of major, GPA, labor market variables, and individual characteristics, and wages.

Although previous literature has touched upon these same subjects, there has not been a lot of recent study on this topic. This paper serves as an update, to these papers. Also, included in this paper will be new variables that were omitted in other papers. For example, computer science is now a big major on a lot of campuses; as well as Economics. It is important to include these variables in the regression as well.

There has been a lot of research conducted on the quantity of higher education, and its effects on future earnings of college graduates. However, not a lot of research has been done on the quality of higher education and the effects that has on future earnings. Some of the research conducted has looked at certain elite private colleges, and compared the future earnings to graduates of less elite public universities. Also, some research has left out women, or left out other important variables that are very important. It is very important to include women in this study because women have become so much more prevalent in colleges, and in the work force. Another point regarding the literature is that a lot of the information is outdated, because there has not been a lot of recent research done on this topic. One last point is that there have not been a lot of papers published on the topic of comparing public and private four-year universities to one another. There are many papers that have found the returns to state universities education, or private universities only. This paper, aims to compare and contrast both private colleges and public universities to each other.

II. A Literature Review

Rumberger and Thomas's, 1993, study aimed to answer three questions: What are the effects of college major, quality and performance on the earnings of recent college graduates? How do these effects differ between men and women, whites and non-whites? And lastly what are the effects of different measures of college quality on the earnings of college graduates with the same college major?

(Rumberger and Thomas, 1993). The three qualitative characteristics that they used were college major, college quality, and college performance. Important contributions of this study are that the authors chose to use women in their study, while previous literature does not include women. Also they chose to use college major as a variable in their study, which had not been included in previous research.

There were three different categories of variables that they used. There were individual level variables. A few examples of these are dummy variables such as FEMALE, HISPANIC, and BLACK. Rumberger and Thomas, 1993, also looked at college major. The majors they examined were engineering, business, health, education, social sciences, mathematics, and science. They also used GPA as a measurement of college performance. The second category of variables they used was a selection of school level variables. One example is a dummy variable for private schools, labeled PRIVATE. Rumberger, and Thomas used a selectivity variable using the Astin Index (Rumberger and Thomas, 1993). This means that they used the average SAT scores of incoming freshman as a proxy for college selectivity. The Astin Method only includes the SAT scores, however, there are many other characteristics that need to be taken into account, like GPA, and ACT scores. The Astin index seems very narrow and could possibly create some bias in the results. It is difficult to obtain information on individual's characteristics, and this may be why they used the Astin Index. They also included some labor market variables such as years of labor market experience, the time between the survey and college

graduation, hours of work per week, and whether the person employed felt that their degree was not required in the job that they were currently in.

Rumberger and Thomas, 1993, took labor market variables and individual level variables into consideration, which is an important part of any wage analysis in order to avoid bias. The authors used the ordinary least squares method (OLS) for their empirical analysis, which made these results very straightforward to interpret

Results were largely consistent with the hypotheses. Their results showed that all three qualitative measures, college major, college quality, and college performance, significantly, and positively affected the starting salaries of most college graduates (Rumberger and Thomas, 1993). They also found that Engineering and health majors received starting salaries about one third higher than graduates in the humanities. Furthermore, they found that business and science/math majors earned about twenty percent higher wages (Rumberger and Thomas, 1993). My study provides an update in order to examine whether that gap has shrunk. As for the differences between males and females, they found that women in business majors earn 22% higher wages than woman graduates in humanities, but men were only 11% higher (Rumberger and Thomas, 1993). They do not discuss or hypothesize why this difference occurred between males and females.

The most relevant component of their study to my analysis is the college quality measures. They found that males who attend a private school do have an advantage in earnings over male graduates of public universities. They found that females do not. Rumberger and Thomas, 1993, do not address why they did not find

a premium for women who attend a private school. They also found that males and females receive earnings advantages for attending a more selective school, which is about a 3% premium for every 100-point increase in college selectivity and a 4% premium for women measured by the Astin Index (Rumberger and Thomas,1993).

Lastly, the college GPA had a significant impact on future earnings only for women. Rumberger and Thomas, 1993 found that a one-point increase in college GPA raised starting salaries for women by 5 percent. But they found that GPA was not a significant variable for men. Again, they do not hypothesize or discuss why this difference occurred between the males and females.

Fox, 1993, argues that there has not been a lot of literature dedicated to issues relating to college quality. Fox, 1993, investigates the impact of college quality on future earnings. Because tuition in private colleges was increasing faster than the consumer price index in the years of 1981 to 1987, the main focus of Fox's, 1993, research was to examine if the increase in college tuition was leading to higher wages, especially for graduates of elite private colleges (Fox, 1993).

First, Fox divided the colleges into certain categories. In order to divide the colleges into different categories, Fox uses the Profiles of American Colleges, published by Barrons (Fox, 1993). Barron's breaks down colleges into six categories: Most competitive, High competitive, Very competitive, Competitive, Less Competitive, and Non Competitive. In order to be in the most competitive category, you had to be in the top 10-20% of your class, your high school GPA had to be from an A to a B+, your average SAT score was between a 625 and 800 and less than a

third of the people who applied got in (Fox, 1993). This method is very accurate because it takes into account more than one type of variable, unlike the Astin Index. In the most competitive category, almost all of the colleges are private institutions. With the exception of the service academies, and the University of Michigan, all the other schools are private (Fox, 1993).

Next, Fox, 1993, created the variable MOSTHIGH, which consisted of the private colleges in the most competitive, or highly competitive categories. He compared the wages of the graduates of the MOSTHIGH category to the public school graduates in the other four categories (Fox, 1993). This methodology seems inappropriate because he is taking the most prestigious private colleges, and comparing them to the lower, less prestigious public universities. A more appropriate method would be to have compared the public universities in the MOSTHIGH, with the private colleges in the MOSTHIGH category

Fox, 1993, also used the ordinary least squares regression method, and found that when all of the variables were taken into account, that there was an earnings premium of about 13% associated with graduates of the most, or high competitive private colleges compared to the graduates of public universities in the other four categories (Fox, 1993).

Estelle et al, 1989, also argue there is not a lot of literature on the effects of quality of higher education on future earnings. They suggest this is due in part to the fact that it is very difficult to obtain information on student and institutional characteristics. The main goal of Estelle's, et al, 1989, research was to see if it does

matter which college you attend, and if it does matter, which college characteristics or other aspects lead to a higher wage premium (Estelle, Aslam, Conaty, To, 1989).

Estelle, et al, 1989 decided to include four vectors (categories) of variables in their model. They choose student characteristics, which is labeled X1 in their regression and these are characteristics such as family background, and ability. The X2 vector, are a set of institutional characteristics such as college expenditures, and student body composition. They include a set of higher educational variables labeled X3. And lastly, they include X4, which is a set of labor, market variables (Estelle, Aslam, Conaty, To, 1989). This method is similar to Rumberger and Thomas, 1993. The X1 and X4 categories are included in the regression because they have to control for certain labor market conditions, and certain demographics.

A contribution of Estelle et al, 1989 was the inclusion of expenditure per student. This allows the authors to investigate if a college spends more, whether it lead to higher wages. Estelle, et al, 1989 investigates differences in returns to private versus public universities. Estelle's, et al, 1989, is one of the few studies that have focused specifically on university type. They created a dummy variable for private colleges, labeled PRIVATE. Estelle, et al, 1989, also used a selectivity variable, in which they used the average SAT scores of incoming freshman (Estelle, Aslam, Conaty, 1989), which is a somewhat limited measure. Another variable that Estelle, et al, 1989 includes is PRIVEAST. This variable denotes private schools in the east. It does not say in their paper how they geographically broke these down.

This method will not identify the wage premium for all private colleges compared to all public universities everywhere. This narrows the group down only to eastern schools, and may create bias because a lot of the private schools in the east happen to be Ivy League schools.

The vector X3 includes college major, and GPA. The majors that Estelle, et al , 1989 examined were Engineering, Education, Business, Humanities, Social Science, Math plus Natural Science. The vocational category was omitted. So all of the coefficients for these majors will be compared to the vocational majors. One potential issue is the combination of Math and natural sciences, which may decrease accuracy of interpretation for the results on this variable.

Estelle's, et al, 1989 student background variables controlled for race, religion, parental income, number of siblings, father's education, and father's occupational status(Estelle, Aslam, Conaty, 1989). A contribution of Estelle, et al, 1989, is that they controlled for number of siblings. If you have a lot of siblings, you are more likely to attend a state school because it is less expensive. It is unclear why some variables were excluded, for example, they use father's education and father's occupational status but he does not include anything about the mother's education or occupation.

Estelle, et al, 1989, found that the college variables, which are, private east school, expenditure per student and other variables accounted for one to two percent of the variance in earnings (Estelle, Aslam, Conaty, To, 1989). A relatively small value associated with these variables. For the college characteristics category,

they found that the private east variable was most important. They found that when controlling for all characteristics and variables that a private east school yielded about 10% higher wages than public universities (Estelle, Aslam, Conaty, To, 1989). This may be due to this variable proxying for Ivy League schools, where the education is outstanding. An interesting point here is that the regression results showed a negative sign on the variable PRIVATE (Estelle, Aslam, Conaty, To, 1989). This indicates that if you attend a private school not in the Northeast, you actually make less money on average, compared to a graduate of a state university. These results are contrary to those found by Rumberger and Thomas, 1993.

Estelle, et al, 1989, did find that other aspects of higher educational experience like choice of major, number of math credits taken, and GPA explain about three to five percent of the variance in future earnings (Estelle, Aslam, Conaty, To, 1989).

Estelle, et al, 1989, also found that students in the humanities earn about ten percent less than other majors. Natural and social sciences students earn three to eight percent more. Then, within the vocational, Business and Engineering students earn ten and thirty percent more respectively. The Education major, they found had much lower returns. Education students earned about fifteen percent less than other majors on average (Estelle, Aslam, Conaty, To, 1989). One important additional major to investigate, especially after the tech boom of the 1990s, is computer science because it may have a very high wage premium. Estelle's, et al, 1989, conclusion was that if you want to receive higher wages, you should attend a

private institution in the east. But they also suggest that you can send your child to their local state school, and if they major in Engineering, they have the potential to earn equally high wages. They finally conclude that it is not where you attend, but what you do while you are in school (Estelle, Aslam, Conaty, To, 1989).

Murray, 2001 investigates how certain college characteristics affected the wage you could earn. Murray, 2001 directly compares returns to private and public universities.

The variables that Murray, 2001 used for college quality were the teacher/pupil ratio, the instructional expenditure per student, research expenditure per student, average teacher salary, and selectivity measured by SAT scores. A contribution of Murray, 2001 is the inclusion of average teacher salary in the regression. By including this in the regression, Murray, 2001 will be able to examine the relationship between teacher salary and wages of students. We expect that the more a teacher is paid, the more the students earn because higher paid teachers should mean better quality teaching. The personal characteristics were race, gender, and the education level of the parents of the graduates, inclusion of both the mother and father's educational attainment, an improvement to Estelle's, et al, 1989.

Murray's, 2001 research is consistent with the other findings previously presented. He found that attendance at a private institution leads to .149 percent higher wages than those who attend a public school (Murray, 2001). Murray, 2001 also found that a one-unit decrease in the teacher/pupil ratio increases starting hourly wages by .092%. This is consistent with the human capital model because if

there is a lower teacher to pupil ratio, students may learn more, and increase their human capital. An increase in human capital is associated with higher wages. Lower teacher/pupil ratios are associated with private institutions. Murray, 2001 also found that males receive a starting hourly wage .092% higher than females (Murray,2001). Furthermore, Murray, 2001, found that life science majors earned a starting hourly wage of .126% higher than other majors (Murray, 2001). This is consistent with previous research done by Estelle, et al, 1989 and Rumberger and Thomas, 1989, but is a significantly smaller estimate.

Murray, 2001 found that a ten percent increase in average teacher salary is associated with an increase in starting hourly wage by 2.46% (Murray, 2001). This likely means that higher paid teachers are of higher quality.

Rumberger and Thomas, 1989, find that both males and females earn a wage premium for attending a more selective school. Furthermore, the authors found that males have a wage premium for attending a private institution, while females do not (Rumberger and Thomas, 1989). Fox, 1993, divided colleges into six different categories, while looking specifically at the most prestigious private schools. He found that when all of the variables were taken into consideration, that graduates of the most or highly competitive colleges earned a wage premium of about 13 %(Fox, 1993). Estelle, et al, 1989, found that if a person attended a private school in the east, they earned a wage premium over all other graduates. However, Estelle, et al, 1989, found that outside of the Northeast, graduates of private institutions earned less than other graduates (Estelle, Aslam, Conaty, 1989). Murray's, 2001,

contributions are that he found a ten percent increase in average teacher salary is associated with an increase in starting hourly wage of 2.46%(Murray, 2001). My contribution to the previous research serves as an update to the research. Also, it will serve as a combination of all of these papers. I take variables that each research used, and include them in my regression. Also, I include some new majors such as computer science, and economics.

Chapter II: Theoretical Analysis

I. Introduction

This paper aims to identify if there is a wage premium associated with graduates of private colleges. The theory chapter explains the theories that relate to this topic. The human capital model is the most important theory that relates to education, but the signaling theory is also important. The hypothesis that private school graduates should earn higher wages than public school graduates is drawn from the human capital model.

II. Human Capital:

Human capital is defined as the unique set of abilities and acquired skills that workers bring into the labor market (Borjas, 2013). The Becker model of human capital states that human capital is directly useful in the production process. Furthermore, he argues that human capital increases a worker's productivity in all tasks, although more in some tasks than others (Regan, Oaxaca & Burghardt, 2003). By increasing a person's productivity, this should increase their wage. Employers are willing to pay a more productive worker higher wages, because then the employer does not have to pay for training the employee. Also, because an individual is more productive, this increases a firm's profits. An investment in higher education can be seen as a training cost (Borjas, 2013). Therefore, when a

person invests in a college education, they are paying for training that will prepare them for a job.

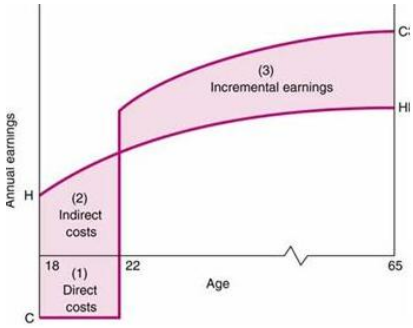
Because all people differ on the amount of human capital they obtain, there are three important sources of human capital differences. One difference in human capital accumulation can result from differences in innate ability. For example, when some people are born, they are naturally good at mathematics, while some people excel at other subjects. The second source of differences in human capital accumulation is schooling. Some one who has earned a college degree has accumulated more human capital than a person who only graduated from high school. The result is a compensating wage differential. This means that people who are more highly educated are paid more than someone who is less educated because they have invested in human capital. Human capital increases an individual's productivity, which increases a firm's profits, which increases an individual's wage. In order to get people to invest in human capital, i.e. college, firms pay college graduates higher wages. If a high school graduate was paid the same amount of money that a college graduate was paid, no one would go to college (Borjas, 2013). Figure 2.1 below, shows that the more education a person receives, the higher their median weekly earnings. Also, as the amount of education increases, the unemployment rate decreases. We can conclude from figure 1 that increased human capital is associated with increased wages.

Figure 2.1: Educational Attainment and Median Weekly Earnings

Unemployment Rate (2011)	Education Attained	Median Weekly Earnings (2011 dollars)
2.50%	Doctorate Degree	$1,551
2.40%	Professional Degree	$1,665
3.60%	Masters Degree	$1,263
4.90%	Bachelor's Degree	$1,053
6.80%	Associates Degree	$768
8.70%	Some College (no degree)	$719
9.40%	High school Diploma	$638
14.10%	Less than HS Diploma	$451
7.60%	All Workers	$797

However, even though a college graduate earns more money than a high school graduate, there are some costs that they have to incur if they choose to go to college. The differences in cost between a college education and entering the labor market immediately is shown in figure 2.2.

Figure 2.2: Potential Earnings Streams Faced by a High School Graduate



The above graph shows that a person who chooses to attend college has to incur some costs that a high school graduate who enters the labor market right away does not. These costs could be tuition, room and board, books, and other miscellaneous

college costs. This is shown on the above graph where the line labeled c is below the x-axis for the years 18-22 and the opportunity costs of college is represented by area 2, the foregone wages. A person who chooses to invest in human capital and attend college foregoes entering the labor market, and the wages associated with a job. After a person graduates from college, they are expected to earn higher wages than the high school graduate. A college graduate earns higher wages because they have gained more human capital and therefore have shown employers that they can be more productive at work than a high school graduate. This is why workers invest in a college education. While the number of years a person is educated is important, the type of education is also important. If attending a private four-year college allows workers to gain more human capital, than attending a four-year public/state university, then this model predicts that, private school graduates earn higher wages than public school graduates.

The third source of differences in human capital is on the job training. On the job training and schooling is where most humans obtain their human capital. There are two types of on the job training programs and they are general training, and specific training (Borjas, 2013). General training is the type of training that, once acquired, enhances productivity equally in all firms. These could be skills such as typing, the ability to drive a car, and learning how to use a calculator. Specific training is the type of training that enhances productivity only in the firm where it is acquired. Some examples of specific training are learning how to drive a tank in the army (Borjas, 2013). Once a person leaves the army, the ability to drive a tank does

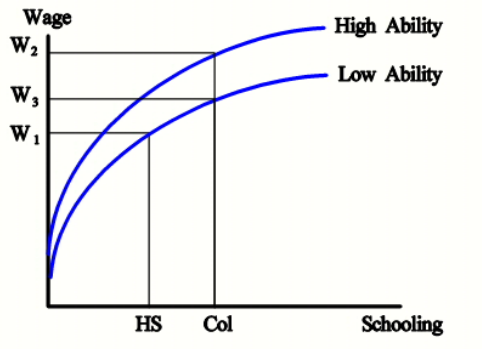
not help the person in any other job. While on the job training is very important, this chapter will mainly focus on education.

As stated before, human capital is defined as the unique set of abilities and acquired skills that workers bring into the labor market (Borjas, 2013). People acquire a lot of their skills through schooling. Learning is the way people gain human capital through schooling. At each level of schooling, we are increasing our human capital. For example, in elementary school, we learn basic skills such as the alphabet, basic writing skills, basic math skills such as addition, multiplication, and subtraction. When we enter high school and college, we learn more advanced things such as algebra, geometry, calculus, and advanced writing skills. After graduating college, we continue to increase our human capital through experience and on the job training. The skills learned in college are valued more than the skill learned in high school. This is seen in figure 2.1, where college graduates are paid a significant greater amount of money than a high school graduate. Not only does the number of years of education increase our human capital, but also, the quality of the schooling is very important. In an article done by business week, they compared the median earnings of college graduates of Yale University, to Kent State University. Yale is one of the top colleges in the world, and the quality of education that a person receives from Yale is unparalleled. Kent State University is an average State University, where the quality of education is marginal. The median earnings of a graduate of Yale in the middle of their career were $326,000 dollars. While the mid career median salary of a Kent State graduate was $124,000(Gopal, 2008). This shows that

not only does the number of years of education matter, but also quality of that education. The hypothesis is that the quality of education at a private school is better than that offered at a public school, and therefore, this model predicts that private college graduates should be paid more than public school graduates.

III. Wage Schooling Locus: The wage-schooling locus gives us the salary that employers are willing to pay a particular worker for every level of schooling. Figure 2.3 is an example of a wage- schooling locus.

Figure 2.3: Wage-Schooling Locus



There are three important properties of the wage-schooling locus:

1) It is upward sloping: This is because workers who have more education should earn more. This goes back to the compensating wage differentials. In order to attract a more educated worker, an employer has to pay that worker more money for incurring costs.
2) The slope of the wage-schooling locus tells us by how much a worker's earnings would increase if he were to obtain one more year of schooling
3) Concave: The law of diminishing marginal returns applies here. As you gain more and more education, eventually you are gaining less incremental knowledge; therefore your wages do not increase by as much.

By looking at figure 2.3, the line representing a college student is higher than the line representing the high school student. This means that employers are willing to pay higher wages to college students. This happens because college students have obtained more human capital, and therefore are more skilled than a high school graduate. If the private education does provide more human capital, then the line for private college graduates will be higher than public college graduates because private school graduates have accumulated more human capital, and they should be compensated for it. A higher line for a private school means a higher marginal return to each year of schooling. The result is that graduating

from a private college will lead to a higher rate of return to education than graduating from a public or state college.

IV. Schooling as a Signal:

While the human capital model suggests that education increases a worker's productivity, therefore increasing their wages, the signaling model suggests that levels of educational attainment signal a worker's qualifications to potential employers. This means that education does not increase earnings because of increased productivity, but because it shows the employer that the worker is cut out for the work (Borjas, 2013). For example, a person who has a college diploma has signaled to a potential employer that they can do a better job than a person with a high school diploma. If a private school education signals to an employer that they are more cut out for the job than a public school graduate, employers would increase the earnings of private school grads relative to public grads. In order to test the hypotheses, regression analysis is used. The fourth chapter discusses the regression model, and the results of the regression.

Chapter IV: Empirical Analysis

I. Introduction

The following chapter focuses on the empirical test of the question. The research question is whether there is a positive correlation between a private school education, and wages. The empirical model used is an ordinary least squares regression. The data analyzed is from the years 1997-2010. The data was obtained from the National Longitudinal Survey of Youth. A longitudinal study is where the

same people are observed over different periods of time. In this case, the people surveyed were observed from 1997-2010. All of the people surveyed were born between 1980 and 1984. This means that at the time of the first survey, they were between the ages of 12 and 18. At the time of the last interview they were between 24 and 30. There were 8984 people interviewed in 1997. At the thirteenth interview in 2010, about 84 percent of those people were interviewed again, resulting in a total of 7561 people surveyed in 2010. The gender dispersion is even; about 51 percent of people surveyed were male. Furthermore, 4665 people surveyed as non-black or non-Hispanic, about 51.9 percent of total people surveyed. 2335, 26 percent, people surveyed were black, 1901(21.2%) people were Hispanic or Latino, and about 83 people, 0.9% of people surveyed as mixed race.

The regression will look like the following:

Log wage = a + b1gradp + +b2Female +b3Black +b4Asian +b5Amerind+ b6Northeast +b7Northcentral +b8South +b9Union +b10Occupation +b11Urban +b12Married + + b13 GPA + +b14children + b15fulltime +b16masters+b17 Hispanic + b18state +b19weeksworked +b20business +b21Major +b22associates +b23vocational +b24Professional +b25doctoral +b26nodegree +b27grads + E

The variable labeled gradp is a created variable denoting whether the person surveyed received a bachelor's degree from a private four-year college in 2008. First, a dummy variable for a private school was created. Then, a dummy variable for a bachelor's degree was created. Then, those two variables were multiplied together; creating a variable that denotes that a person received a bachelor's degree from a private college in 2008. The same variable was created for a state college, and that variable is labeled grads. The coefficients of these two variables are compared to one another, and the hypothesis is that the coefficient on the gradp variable is higher than the coefficient on the grads variable because a graduate of a private college has obtained more human capital than a graduate of a state college, increasing the wage of the private college graduate.

The occupation variable takes into account all of the occupations that people surveyed responded with. These include the teaching profession, to military, lawyers, and many other fields. Occupation is accounted for in the regression because the type of occupation a person has should affect their wage. For example, a finance person earns higher wages than a worker in personal services.

The union status variable is also a dummy variable, where a 1 is given if a person is part of a union, and 0 is given if otherwise. People were asked if a union covered the job that they had in 2009. Unions had a lot of power when they first began to form in 1950's. Since, they have less and less power because of many different reasons. The conclusion is that the coefficient for union is expected to be a

small, positive number because unions fight for higher wages for their members, and still have power today.

The geography variable contains four different parts. The people surveyed were asked where they lived at the time of the survey in 2009. They were given four different choices labeled northeast, north central, south, and west. Northeast denotes the states of Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. The North Central denotes the states of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, North Dakota, South Dakota, and Wisconsin. The south includes the states of Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, and West Virginia. Finally the west includes the states of Alaska, Arizona, Colorado, California, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. The west is omitted from the regression; therefore the coefficients on northeast, northcentral, and south are in comparison to the west.

The race variables are included in the regression in order to account for discrimination in the work force. The races included in the regression are Black, American Indian, Hispanic, and Asian. All minority wages are expected to be lower compared to whites because of discrimination.

The female variable is included in the regression for the same reason that race is, because there is discrimination in the work force against women. This is a

dummy variable as well. Women are offered lower wages then men because they are women. Therefore, the expected coefficient is a negative number.

The married variable is a dummy variable for people who are married at the time of the survey. Being married can lead to higher wages because it makes a person seem more professional, and could lead to higher wages. Furthermore, a positive coefficient is expected on this variable.

The number of children that a person or couple has should affect their wage. The people surveyed were asked how many biological children lived in their household at the time of the survey in 2009. They were given choices from one to anything over ten children living in the house. A person with one child would have to work fewer hours to maintain the same standard of living that a person with three or four children would have to work. The expected result is a small, positive coefficient because a person with more children might work more and earn higher wages because they have more costs than a person with only one child.

The people were asked what their GPA was in college in the year 2008. The choices were given in one-point intervals. For the GPA variable, the expected coefficient is positive because a person with a higher GPA has shown an employer that they have more human capital than a person with a lower GPA. According to the human capital model, more human capital should increase the wage.

Whether the student was a full time or part time student is included in the regression. The variable labeled full time is a dummy variable denoting that a student was a full time student in 2008. This variable is expected to be insignificant

because if a student graduates from college, they have shown the employer that they have a certain level of human capital, regardless of whether they were a full time or part time student.

All of the degree variables are dummy variables, denoting what degree a person earned in 2008. The omitted degree is a master's degree; therefore all of the coefficients are in comparison to a master's degree. The expected result is for the coefficient on the bachelor variable to be negative because a person with a bachelor's degree is expected to accumulate less human capital. A person with less human capital, according to the human capital model, should be paid less money.

The weeks worked variable is a variable that measures the amount of weeks a person has worked since age 20. This variable is expected to have a large, positive coefficient because as a person works more, they tend to gain higher wages because of on the job training increases their human capital.

The major variables are also dummy variables, where the omitted variable is engineering, and therefore all of the coefficients are compared to engineering. Almost all of these variables are expected to have a negative coefficient, because based on previous research; engineering majors make the most money.

The urban variable is a dummy variable denoting if a person lived in a urban area in 2010. A lot of the jobs are concentrated in urban areas; therefore, the expected coefficient on the urban variable is a positive number.

Lastly, the dependent variable is the logarithm of the wage. This gives the interpretations of the coefficients in percents. The wage data is from the year 2009.

Using the wage data from 2009 allows us to interpret how graduating from a private college in 2008 affects the wage one year after graduating from college. Assuming most people graduate in May, it does not make sense to use the wages from 2008 because people who go to college either do not work, or are working in work-study, so that would create bias in the results.

II. Regression Analysis

The results of the regression are as follows:

Table 4.1: Regression Results

Linear regression				Number of obs		5221
				F(42, 5173)		= .
				Prob > F		= .
				R-squared		0.185
				Root MSE		0.90162
		Robust				
logwge	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
nomajor	-0.117385	0.1658137	-0.71	0.479	-0.44245	0.20768
agriculture	-0.1391984	0.2844876	-0.49	0.625	-0.6969144	0.418518
anthropology	-0.188362	0.1123312	-1.68	0.094	-0.4085785	0.031855
architecture	0.5113698	0.3149931	1.62	0.105	-0.1061499	1.128889
areastudies	0.3364236	0.0397544	8.46	0	0.2584883	0.414359
biosci	0.0240903	0.1714761	0.14	0.888	-0.3120753	0.360256
business	-0.0027867	0.1028976	-0.03	0.978	-0.2045095	0.198936
communicationss	-0.3261196	0.1505463	-2.17	0.03	-0.621254	-0.03099
compsci	0.2091269	0.1152733	1.81	0.07	-0.0168575	0.435111
crimonology	(dropped)					
economics	0.1073324	0.3743496	0.29	0.774	-0.626551	0.841216
education	0.0131667	0.0705932	0.19	0.852	-0.1252257	0.151559
english	-0.6207933	0.5348736	-1.16	0.246	-1.669372	0.427785
ethnicstudies	0.6823859	0.0732271	9.32	0	0.5388299	0.825942
arts	-0.296025	0.1220792	-2.42	0.015	-0.5353519	-0.0567
foreignlanguage	0.2091853	0.2551868	0.82	0.412	-0.2910887	0.709459
history	-0.3727338	0.1758602	-2.12	0.034	-0.717494	-0.02797
mathematics	0.2039907	0.2309682	0.88	0.377	-0.2488046	0.656786
nursing	0.1996889	0.0822356	2.43	0.015	0.0384724	0.360906
philosophy	0.1629178	0.331545	0.49	0.623	-0.4870506	0.812886
physicalscience	0.0669135	0.2144977	0.31	0.755	-0.3535926	0.48742
polisci	-0.1984704	0.1672092	-1.19	0.235	-0.5262711	0.12933
predental	-0.5797391	0.2513529	-2.31	0.021	-1.072497	-0.08698
premed	0.2484578	0.0787031	3.16	0.002	0.0941665	0.402749
prevet	0.1893924	0.1582388	1.2	0.231	-0.1208226	0.499607
pyschology	-0.0785642	0.1270298	-0.62	0.536	-0.3275963	0.170468
prelaw	0.3439419	0.0989507	3.48	0.001	0.1499568	0.537927
female	-0.2712273	0.0258029	-10.51	0	-0.3218119	-0.22064
asian	0.3946828	0.0813582	4.85	0	0.2351864	0.554179
amerind	-0.0095764	0.0893569	-0.11	0.915	-0.1847536	0.165601
black	-0.241676	0.0381456	-6.34	0	-0.3164574	-0.16689
hispanic	-0.0557586	0.0314092	-1.78	0.076	-0.1173339	0.005817
union	0.3790685	0.0320435	11.83	0	0.3162497	0.441887
northeast	0.0893741	0.0425296	2.1	0.036	0.005998	0.17275
northcentral	-0.0779508	0.0382063	-2.04	0.041	-0.1528513	-0.00305
south	0.0079726	0.0346436	0.23	0.818	-0.0599434	0.075889
married	0.2716477	0.0271454	10.01	0	0.2184313	0.324864
urban	(dropped)					
bachelors	-0.9292957	0.4304599	-2.16	0.031	-1.773179	-0.08541
associates	0.1705509	0.1273945	1.34	0.181	-0.0791961	0.420298
vocational	0.2155836	0.186493	1.16	0.248	-0.1500216	0.581189
doctoral	(dropped)					
professional	0.42134	0.0959628	4.39	0	0.2332123	0.609468
nodegree	(dropped)					
gradp	1.143027	0.4470786	2.56	0.011	0.2665639	2.01949
grads	1.131485	0.4343599	2.6	0.009	0.2799557	1.983014
fulltime	-0.1141869	0.0621713	-1.84	0.066	-0.236069	0.007695
GPA	0.0000285	0.0000332	0.86	0.391	-0.0000366	9.36E-05
#Child	-0.0453808	0.0049479	-9.17	0	-0.0550807	-0.03568
Occupation	-0.00004	5.68E-06	-7.05	0	-0.0000512	-2.9E-05
Weeks	Worked	0.0001148	17.24	0	0.0017547	0.002205
_cons	9.543547	0.0648706	147.12	0	9.416373	9.670721

The inference drawn from comparing the coefficients on the grads variable and the gradp variable is that a graduate of a private college with a bachelors degree is expected to earn about one percent higher in wages in 2010 compared to a person who graduated with a bachelor's degree from a public institution. This is consistent with the hypothesis, and this indicates that a graduate of a private university has gained more human capital than a graduate of a state university. It is important to note that both of these variables are significant at the five percent confidence level.

The coefficient on the black variable indicates that if you are black, you are expected to earn about 24 percent less in wages. The t value of -6.3 indicates that this variable is significant, which confirms the hypothesis that blacks are discriminated against. The American Indian variable has a t value of -.11 which indicates that this variable is insignificant. The Asian variable has a t value of 4.85, which means that it is significant at the five percent confidence level. The coefficient is .39, which means that if you are Asian, you are expected to earn 39 percent higher wages than a white person regardless of the levels of the other independent variables. This number seems too high, and may be as a result of the small sample size of Asians in the survey. While this number is largely positive, we can conclude that Asians are not discriminated against. Lastly, the Hispanic variable is also insignificant. The problems with the significance of these variables will be addressed later in this chapter.

The number of children is also insignificant at the five percent confidence level. The married variable, however, is significant at the five percent level and the

coefficient indicates that if you are married, you are expected to earn 27 percent higher in wages than a person who is divorced. This number seems unreasonably high and could be as a result of low sample size, which can skew the data.

The northeast variable is significant as indicated by the t value of 2.1. The coefficient on it is .089, which indicates that if you are a person living in the northeast, you are expeced to earn about nine percent higher wages than if you lived in the west. The south variable is significant and the coefficient indicates that if you live in the south, you are expected to earn .8 percent higher wages than if you lived in the west. The northcentral variable is statistically insignificant. The urban variable is dropped.

Whether a student was a full time or part time student is not significant. This is consistent with my hypothesis because as long as a student graduates, they have accumulated the same amount of human capital, regardless of whether they were a full time or part time student.

The GPA variable is significant at the five percent level and the coefficient means that for every one-point increase in your GPA, your wage is expected to increase by .003 percent. This is consistent with the human capital model because a higher GPA means more human capital is accumulated, which should increase the wage.

The female variable is insignificant, which is inconsistent with my hypothesis. This will be addressed later in the chapter.

The major conclusions that can be drawn from the major variables are that almost all of the major variables are significant. This means that the choice of a major has a big impact on determining a person's wage. One variable that changed from previous research was the education variable. According to previous research, the education major was associated with lower earnings on average. According to this regression, if you major in education, you can expect to earn about one percent higher wages than a person who majors in engineering. One of the additions of this paper is the use of the computer science major. Computer science is a relatively new course and the coefficient indicates that computer science majors have an earnings premium of about twenty percent over engineering majors. This could be as a result of the tech boom of the 1990, where jobs in the computer science related field have become very popular. Both of these majors are significant.

As for the degree variables, most all of the degrees are significant, indicating that the type of degree a person has is an important factor in determining a person's wage. The omitted degree was the master's degree. Although the degree variables are mostly significant, they are not consistent with the human capital model. The coefficients on the vocational, nodegree, and associates are all positive, which indicates that people with these degrees are expected to earn higher wages than a person with a master's degree. This is not consistent with my hypothesis. This may indicate that a master's degree is not as important, and does not signal to employers that a person with a master's degree has obtained more human capital than a person with lower level degrees.

The weeks worked variable is highly significant and the coefficient indicates that for every 50 week increase that you work, you can expect to earn .02 percent higher in wages. This is consistent with the human capital theory because the more a person works, the more human capital they can obtain through on the job training and experience, which would increase their wage.

The R-squared is .18 which means that eighteen percent of the variance of the log of the wage from its mean is explained by the independent variables. This number is low for many reasons. One reason is omitted variable bias. Omitted variable bias occurs when variables are left out of a regression, and therefore the results are skewed. In a wage regression, it is very difficult to capture all of the variables that affect the wage, and therefore omitted variable bias has led to the R squared being very low in this regression.

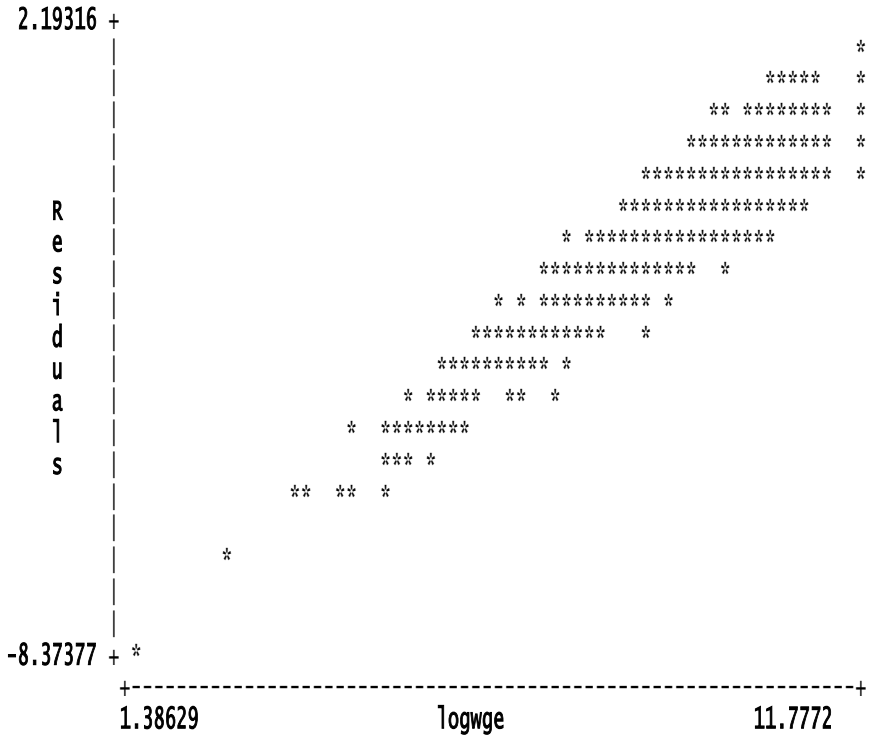
III. Potential Problems

Omitted variable bias is a potential problem with all wage regression analysis. Omitted variable bias is when an independent variable that could affect the dependent variable is omitted from the regression. Omitted variable bias usually occurs because the lack of availability of certain information. It is very difficult to capture all of the factors that affect a person's wage. This could lead to some problems in the regression. One problem that omitted variable bias leads to is a low R squared. The R squared value indicates the predictive power of a model. Since

there are so many factors that determine a person's wage, leaving out variables can lead to a lower R-squared value. By leaving out certain variables such as ability, if a person had an internship or a person's networking ability, can create biased results.

Multicollinearity was tested for and it is not present. However, looking at figure 4.1, heteroskedasticity is present.

Figure 4.1: Residuals and logwage



Heteroskedasticity is when the variance of the independent variables is not constant. This affects the statistical significance of the variables. The regression shown in figure 4.1 is corrected for heteroskedasticity. Heteroskedasticity could explain why some variables such as number of children, black, Hispanic, female, and some of the majors are statistically insignificant even though the hypothesis predicts that they should be significant.

The results of the regression are in Table 4.1 and the last chapter of this paper will sum up the results, and discuss policy implications.

Conclusion:

The aim of this paper is to find if there is a wage premium associated with graduates of private four- year colleges. In order to find the correlation, an ordinary least squares regression was used with the log of the wage as the dependent variable, and a dummy variable labeled gradp as the primary independent variable of interest. There were also a number of other independent control variables used. The results of the regression are consistent with my hypothesis that private school graduates have the potential to earn higher wages than public school graduates. The coefficient on the private variable indicates that a graduate of a private college can expect to earn one percent more in wages than a graduate of a public college. This indicates that a graduate of a private college has obtained more human capital than a person who graduated from a public university.

One implication of these results is to suggest to the government to help students attend private colleges. The government could give money to students who cannot afford to attend private colleges. I also suggest that students choose carefully what they major in. While college type is important, it also seems that the choice of major is important. A degree in Economics for example is expected to have higher earnings than engineering majors.

Another important conclusion is that geography does seem to have a significant effect on a person's wage. A person living in the northeast is expected to earn higher wages than a person living in the west. Furthermore, a person living in an urban area is also expected to earn more than a person living in a rural area. The government could give subsidies to people who want to live in the northeast but cannot afford it. Furthermore, the government could also incentivize students to attend schools in the northeast in hopes that they would stay there after they graduate college.

Works Cited

Borjas, G.J. (2013). *Labor Economics*(6th edition). New York, McGraw Hill.

Estelle, J., Alsalam, N., Conaty, J., & Duc, L. T. (1989). College quality and future earnings:where should you send your child to college?. *The American Economic Review*, *79*, 247-252.

Fox, M. (1993). Is it a good investment to attend an elite private college?. *Economics of Education Review*, *12*(2), 137-151.

Gopal, P. (2008, August 07). Which college grads earn the most? *Bloomberg Business Week*,

Kelly, R. (2006, October 27). *Average college costs breaks $30,000*.

Murray, R. J. (2001). *How college characteristics affect starting hourly wages of college graduates: private vs. public institutions* . Unpublished manuscript, Union College Economics

Regan, T. L., Oaxaca, R. L., & Burghardt, G. (2003). *A human capital model of the effects of abilities and family background on optimal schooling levels.* Unpublished manuscript, University of Arizona Department of Economics.

Rumberger, R. W., & Thomas, S. L. (1993). The economic returns to college major, quality and performance: a multilevel analysis of recent graduates . *Economics of Education Review*, *12*(1), 1-19.