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Determining Future Success of College Students

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I. Introduction

The years that students spend in college are perhaps the most influential years on the rest of their lives. College students face many different decisions day in and day out that may determine how successful they will be in the future. They will choose majors, decide whether or not they will play a sport, what clubs to join, whether they should join a fraternity or sorority, what classes to take, and how much time to spend studying. It is unclear what aspects of college will benefit a person the most down the road. Are some majors better than others? Is earning a high GPA important? These are some of the many questions that college students have. This paper will determine how the choice of major, GPA, and natural ability affect income.

Some students will graduate from school, get interesting jobs, and make a lot of money soon after graduation, while others will struggle to move ahead in the working world. Every student deserves the best chance to be successful after graduation. Some majors have been proven to lead to higher incomes than others. Perhaps, students can increase their chances of being successful simply by choosing these majors. It is also possible that some majors are simply riskier, lead to less pleasurable occupations, or require particular skills or natural abilities that only a few people have (Scholz, 1996). Therefore, although these majors pay higher, they may not necessarily be a better choice for most people. Another possibility is that certain majors attract the brightest students, which could account for the disparity in pay across majors. This can be controlled for by comparing the aptitudes of students in various majors by using standardized test scores. It is obvious some disciplines lead to better pay, but it is important to understand why. If we understand why some majors pay better, then students will be able to choose their majors more wisely.

The interaction between ability and major is also important to consider. Mathematics might be a high-paying major for those with strong math skills, but for a person who struggles in math it will most likely be a poor choice. It is important to find a major that fits your own strengths and interests. There is no major that is the best choice for everyone, but for each individual there may be a major that is ideal. Each person must consider their own interests and abilities in choosing a major instead of going for the one that pays the most.

Another extremely important aspect of a student's college experience is GPA. Many employers use a student's GPA in order to judge job applicants. It is often easier to get a good job with better grades during college (Rumberger, 1997). However, employers also desire traits such as leadership which cannot be measured quantitatively. Students often have to decide how much time to spend studying versus doing other activities such as sports or clubs. Studying how important GPA is in determining a graduate's income will enable students to better understand how to manage their time effectively during college. Also, it can help students to decide between taking an easy class to boostGPA and taking a more challenging class to gain more knowledge. Hopefully, the benefits from taking more challenging classes will be greater in the long run.

This paper will study the effect of a student's college GPA, major, and standardized test scores in order to see what is most influential on future income. The answer will help students make crucial decisions that will greatly affect the rest of their lives and give them the best opportunity to succeed.

II. Literature Review

Over the course of the past several decades, there have been many studies that have estimated how ability, grades, and major affect income. However, very few papers have studied all of these characteristics together in a single model. Also, the interaction between ability and choice of major has not been studied specifically. All aspects of a student's college experience are linked, so the connection between ability, GPA, and major should be examined so that the results can be useful for everyone. This paper will build on previous research that has examined the post-graduation income of college students in order to determine what is most important.

Several papers have focused on the importance of college major in determining income. Peter Arcidiacono (2004) studies the reasons for ability sorting across majors and the different returns to various college majors on income. Ability sorting across majors is when some majors attract students of a higher ability, on average, than other majors. In order to test whether ability sorting accounts for the disparity in wages across fields of study, Arcidiacono uses a dynamic model between college choice and major choice. He finds, "Virtually all ability sorting is because of preference for particular majors in college" (2004, p.369). This is an interesting finding, because it shows that students choose their major based primarily on what subject they are interested in rather than what career will pay the most. Perhaps, if students are given more information about the differences in pay across majors, they will choose differently. After controlling for ability, Arcidiacono finds that "large earnings premiums exist for certain majors" (p.371). This is a very important finding because it shows that the difference in pay across majors is not entirely due to varying ability levels. Clearly, there are other aspects of majors that lead to different salaries.

Dan Scholz (1996) presents theory relating to risk-aversion to explain why certain majors pay higher than others. He argues that some majors are riskier than other majors because they have greater variance in pay. There are some people who are very risk-averse while others are risk-neutral or even seek risk. People who take on risk must be paid higher average earnings to compensate for the risk they are taking.

The cobweb model is used to explain why more technical fields are riskier. Since technical fields require specific knowledge and skills, the labor supply in these fields is fixed. Thus, changes in the demand for this field will cause much greater changes in income for the workers. Also, shifts in demand seem to be much more pronounced in technical fields, so fields such as engineering are very risky compared to more general fields. Scholz (1996) finds that there is a strong relationship between the average income of various majors and their risk level.

A couple of papers have found that some majors pay higher wages due to the types of skills they teach. "There are two different types of training that can occur: *general training* and *specific training*." (Thorson, 2005, pg. 6) Thorson argues specific training is valuable to a far smaller number of firms than general training, but employees with a more specific education should be paid higher because they are more difficult to substitute for as long as there is not an excess supply of qualified workers. For example, a computer programmer is harder to substitute for than a writer. A computer scientist can most likely write an article more productively than a journalist can write computer programs. This leads to higher pay for the computer scientist with specific training. However, general training gives much more labor market mobility and greater freedom in career choice. Thorson finds that majors that give more specific skills lead to higher pay, which supports the theory. Thomas and Liang (2005) also find that specific job skills lead to higher pay and help a person advance further in the workplace. They find that more specific jobs also lead to higher percent wage growth for the first four years after graduation. General training leads to lower pay, but these workers are rewarded with greater mobility and can perhaps develop more specific skills once they enter a desired career.

Extensive research has also been completed studying the impact of GPA on future income. Chia and Miller (2008) use data from the University of Melbourne in Australia in order to study the effect of college performance. They find that "the main determinant of graduates' starting salaries is the weighted average mark (equivalent to GPA) they achieve at university" (pg.18). Since the labor market in Australia is comparable to that in the U.S., this suggests that employers use college performance as a key factor in determining who to hire. College graduates typically have little or no full-time work experience and are therefore judged by what they achieve in school. This means that employers use GPA in order to screen job applicants. Thus, applicants who have better grades in college will have the highest salaries because employers expect them to have higher potential in the workplace. Chia and Miller find that test scores and college major are significant, but not as important as college performance in determining income after graduation.

David Wise (1975) studies whether the skills that lead to success in school also lead to higher productivity. This paper greatly emphasizes the human capital theory. Those with the greatest set of skills will be the most productive, advance in the workplace, and make the most money. Wise finds that college performance is related to future income, but non-academic characteristics are also important. Skills such as leadership and interpersonal skills are not measured by GPA, but are a vital element of human capital. The study finds that college performance can increase income, but the results are not nearly as strong as the results from Chia and Miller (2008). This suggests that human capital theory also supports the notion that better grades will lead to higher income, but grades are not a perfect measure of human capital.

There is support for the human capital theory in Thomas (2000) and Smart (1988) as well. Both studies find that college performance leads to higher earnings after graduation.

Thomas studies the effects immediately after graduation, which lends support to the longer term results of Chia and Miller (2008). Smart includes variables, such as playing a sport and joining a Greek organization, which measure aspects of a student's college experience other than grades and choice of major. The results support Wise (1975) by finding that both GPA and other college experiences affect income. Smart and Wise both study earnings more than ten years after graduation, so the results support the theory that human capital is reflected in GPA and significantly affects income. Although there are non-academic skills that are vital to performance in the workplace, grades appear to be a fair measure of a person's human capital, and human capital theory suggests that grades will have a positive effect on income.

Barry Gerhart (1988) uses data from a specific firm in order to study the effect of college performance as well as college major in determining salary differences between genders. Gerhart finds that "college major explains most of the difference in salaries between men and women" (pg. 14). This result is interesting, because it suggests that personal preferences account for a large portion of the different earnings across majors. Based on the theory of compensating wage differentials, careers that are more enjoyable will pay less than those which may be more stressful or demanding (Becker, 1993). Some people may prefer a more demanding job with higher pay, while others may prefer a more pleasurable or rewarding job with lower pay. Personal preferences and occupational differences could explain a large amount of the differences in pay across careers and majors.

Boissiere, Knight, and Sabot (1985) study the impact of reasoning skills on income. They use data from Kenya and Tanzania and find that "cognitive skills are the most important form of human capital" (pg. 1020) Cognitive skills are essentially the ability to learn and acquire knowledge. This means that people who have greater natural ability will be able to gain more human capital and eventually be much more productive. This suggests that it is very important to have some measure of natural ability or thinking skills when studying factors affecting income. The study finds that math ability, in particular, leads to higher levels of income. Although the SAT has been shown to be affected by human capital acquired through education, it is the best available measure for natural ability. Therefore, test scores will be considered very important in this paper, along with college major and GPA.

As a whole, the previous research strongly supports that grades, natural ability, and choice of major greatly affect post-graduate earnings for college students. These factors will be further tested in this paper.

III. Theoretical Framework

The theory in this paper builds on of the previous literature with a focus on human capital concepts. Statistics have shown that there are large differences in wages across majors. What are the theoretical reasons that cause these differences to occur? The differences in ability across majors, the differences in risk, and compensating wage differentials all help to explain the effect of major on income.

It is possible that there are differences in ability between certain majors. Perhaps some majors attract stronger students or are simply more difficult to gain entrance into. Higher ability or skills should lead to increased production and higher incomes. Also, higher ability will enable a person to acquire human capital more quickly once they enter a certain profession (Boissiere, 1985). Therefore, the worker's production will be further increased, which will lead to even higher incomes. This process that will enable the brightest workers to earn significantly more than those with lower abilities. Therefore, majors that have higher ability levels amongst their students will likely appear to pay better.

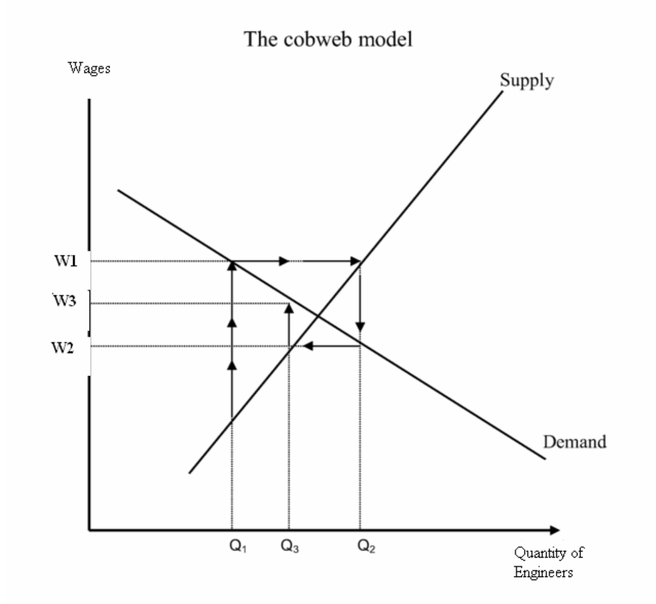
It is also very important to consider the interaction between specific skills and occupation. Ability may have a stronger impact on income for some majors than for others. Certainly, having math skills should be more important for a mathematician than a writer or artist. Therefore, it is useful to compare the relationship between math ability and income in math related fields and non-related fields. The same can be done for verbal skills. There are likely both general and specific benefits for having certain skills. The general benefits of math skills, for example, will affect everyone regardless of their field. The more specific benefits of the skills will apply only to those who enter math-related fields. By interacting ability and major, it is possible to better measure both the general and specific effects of ability on income.

A students GPA should positively affect income as well. Therefore, if some majors tend to have students with higher GPA's this could account for some of the disparity in income. This is supported by the screening theory as well as the human capital theory. The screening theory argues that employers decide who to hire largely based on college GPA. This is because students typically have very limited work experience when they graduate, so grades are the best measure of an applicant's potential productivity (Chia and Miller, 2008). Therefore, students with better grades will be offered better jobs coming out of college and make more money. Based on human capital theory, I argue that GPA is a measure of a student's acquired skills and knowledge. Students with better grades will have acquired more knowledge and human capital, so they will perform better in the workplace. This increased performance will allow them to move ahead quickly and earn more money. Based on these theories, students with higher GPA's should earn higher salaries immediately after graduation and also see greater salary increases during their careers.

There are several other theories that explain why certain majors are higher paying. Some argue that certain majors pay better because they are riskier (Scholz, 1996). This is because those who are willing to take on more risk must be paid a premium to compensate. Also, it is possible that certain majors, such as medical or engineering fields, attract better students because they are more challenging and harder to gain acceptance into. Therefore, these majors will have higher average salaries due to the fact that students have higher abilities.

Also, certain majors, such as engineering or computer science, give more specific training and this makes these graduates more desirable (Thorson, 2005). This is based on the Cobb-Web Theory, which shows that the supply of labor for specific jobs reacts very slowly in comparison to the labor demand in these markets. For example, the supply of engineers is based on the number of engineering students in college and current engineers. Therefore, the number of engineers is essentially set for the next four years. If there is a sudden increase in demand for engineers, there will be a shortage of engineers, so they will receive much higher salaries. This will cause many more people to become engineering majors, but it will take years for this to affect the supply of labor in the market thereby lowering engineering wages. By that time, the demand for engineers may decrease, which would cause salaries to decrease dramatically from when the students started college. The job-specific markets can change rapidly, which leads to higher pay for individuals with those skills, but as a return for risk taking. This is illustrated by Figure 1, which shows how the supply of engineers can lead to large fluctuations in the wage level. Although the wage level may be lower at times for specific fields, the average wages must be higher to compensate for the risk.

Figure 1:



In addition, compensating wage differentials may explain a large portion of the disparity in wages across majors. Some majors may lead to more pleasurable or less demanding occupations than other majors. Some workers favor jobs that are more enjoyable and are willing to accept less salary. Other people prefer a job that is more demanding, provided that they are paid more. Therefore, the theory of compensating wage differentials suggests that more demanding or stressful occupations will have higher incomes than occupations which are more enjoyable or have better benefits (Becker, 1993). An example is a teacher that accepts a lower salary, because they enjoy working with children and do not have to work during the summer. Therefore, some majors may lead to higher incomes, because they lead to more demanding or stressful occupations.

My research hypothesis is that higher natural ability as measured by test scores, higher GPA, and certain college majors will all lead to significantly higher post-graduate income. Test scores and GPA are proxies for an individual's human capital and should be directly related to income after graduation. However, even after controlling for test scores and GPA, income could differ across disciplines because of differences in risk or due to compensating wage differentials.

IV. Data and Empirical Model

The data comes from the National Longitudinal Study of Youth (NLSY_97), which started in 1997. This gives variables such as college major, college GPA, SAT scores, and income. It also gives controls for race, gender, age, work experience, and highest grade completed. The NLSY_97 surveyed about 9000 youth, aged 13 to 17 in 1997, released annually from 1997 through 2006. The survey covers a large range of details, including education and income variables.

The data for income, age, work experience, highest SAT scores, and highest grade completed comes from the 2006 survey, which contains the most recent data available. The GPA variable uses data collected from all the survey years and averaged in order to measure the cumulative college GPA of each student. The GPA variable was only computed for students who were graded on a 4.0 scale. The variable is only for college classes and takes into consideration every class they took. If a student attended more than one college, the GPA combines the classes from all the schools they attended. Most of the respondents were around 26 years old in 2006, so they had graduated four or five years earlier, on average.

The study only includes individuals who completed their baccalaureate, but did not go on to graduate school. This means that the results may not be applicable for those who intend go beyond an undergraduate degree. This was necessary because most of the individuals that went on to graduate school were only working part-time or their current occupations did not accurately reflect their future occupations. Only full-time workers were included in the study, so that outliers do not affect the results.

In order to measure the effect of college major, dummy variables were created for each of the 20 most common college major choices in the data set. For example, if a student is an engineering major then a **1** is entered as the value for engineering for the student. If the student is not an engineering major, then a **0** is entered. The most recent response for choice of major was used to create the college major variable. If a student last reported a major in 2004 then the major reported in that year was used. Dummy variables were also created for race and gender. Age is the person's age at the time of the 2006 survey. Work experience is the number of years of full-time work the person had completed by 2006. Table 1 summarizes the important variables in the data and shows average income, GPA, and test scores for each major.

Table 1 shows that the average income, GPA, and test scores vary across majors. The major with the lowest average income is home economics, which is about $3,300 below the overall average. Computer science majors earn the most and have an average income more than $6,400 above the overall average. This appears to be a very large difference. The highest average GPA belongs to math and the lowest belongs to home economics. No major has an average GPA that differs from the overall average by more than .19. This suggests that the GPA's are fairly similar across majors. The average SAT scores range from 363 to 629 so there are clearly different ability levels across majors. This shows that it is very important to include SAT scores in the empirical model. The data shows that ability varies more between majors than GPA, which suggests that grades are somewhat normalized within disciplines. Hence, some majors may be more competitive or challenging than others.

Table 1:
Comparison of Average Income, Average GPA, and Average SAT Scores for Each Major

Major	Average Income	Average GPA	Average Math	Average Verbal	Sample Size
Architecture	$24,673	3.099	533.33	518.52	30
Biology	$25,892	3.171	567.55	554.79	113
Business	$33,669	3.054	537.62	520.03	459
Communications	$29,712	3.057	529.08	535.20	133
Computer Science	$35,973	3.015	571.51	537.79	152
Criminology	$30,652	2.992	448.68	477.63	96
Economics	$31,905	3.133	629.41	588.24	32
Education	$27,488	3.101	493.50	500.00	218
Engineering	$35,639	3.179	595.83	553.13	152
English	$26,911	3.222	562.96	609.26	62
Art	$27,166	3.183	564.10	576.92	127
History	$29,337	3.232	552.78	616.67	47
Home Economics	$26,431	2.898	363.81	380.47	33
Math	$28,832	3.274	622.73	559.09	33
Nursing	$30,946	3.140	531.75	522.22	129
Health	$31,331	3.106	535.96	530.70	121
Physics	$27,637	3.077	571.88	550.00	40
Political Science	$28,553	3.160	573.68	580.77	63
Psychology	$27,304	3.200	554.08	579.59	141
Sociology	$27,996	2.967	486.59	508.54	62
Total	$29,531	3.086	541.32	539.98	3479

Table 1 gives some other very interesting statistics. Psychology is above average when it comes to GPA, SAT math, and SAT verbal scores but shows a total income of more than $2,300 below average. This suggests that the major may be causing the lower incomes.

Business on the other hand, has below average GPA, math, and verbal statistics, but its average income is the third highest. Perhaps, choosing business as a major leads to higher incomes. Comparing math to engineering gives similar results. Math majors have better grades and test scores than engineering majors, but they have far lower incomes. The regression will test whether these high paying majors are truly better investments or if there are other causes for the disparity in income. It is important to note that these results do not take into account those who went on to graduate school. Majors such as math, psychology, and biology may be good choices for those who intend to further their education.

The empirical model will use an ordinary least squares regression to test the research hypothesis. The model will be in the form of a linear regression:

Income = a + ß1(GPA) + ß2(Major) + ß3(SAT Math) + ß4(SAT Verbal) + ß5(Work Exp) + ß6(Race) + ß7(Female) + ß8(Age) + u

Using a linear regression will make it possible to estimate exactly how much each variable affects income. For example, the coefficient for each major will predict exactly how much annual income will be gained or lost simply by choosing that major in comparison to the omitted major, Art. The coefficient for GPA will predict how much additional income is created from a one point increase in GPA and the coefficient for SAT math and verbal will estimate the increase in annual income from a one point improvement in the respective test score. Linear models have been used in several previous papers done on the subject and have been quite successful. (Gerhart 1988; Rumberger 1993; Scholz 1996)

Variables and their expected signs:

Income (Dependent): Income will be measured as the total income each respondent earned through their own wages and salary during 2006. It includes all respondents that worked at least

1,500 hours during that year, so it is composed of full time workers. Typically, the natural log of income is used in measuring earnings. However, in this data set there are no respondents that reported earnings of over $150,000, so there is not an extremely long tail on the upper income side of the distribution. The regressions run with income had a higher r-squared than the regressions run with the log of income. Therefore, income was used as the dependent variable.

College major (+/-): Some majors should lead to higher pay, such as engineering and computer science, while other majors should be associated with lower salaries. A series of dummy variables was created, one for each major studied. For each respondent, a 1 denotes the student reported that major, a 0 denotes they did not study under that major. The variable Other represents those who were not in any of the specific majors mentioned. Art was chosen to be the excluded major from the regression.

College GPA (+): A higher GPA should lead to higher starting salaries and better workplace performance, which will lead to even higher salaries. This variable was cumulative and measured on a 4 point scale.

SAT Math (+): A higher SAT Math score indicates stronger math abilities, which should lead to increased productivity and higher income. The scores range from 200-800, with 800 being the highest possible score.

SAT Verbal (+) : Better verbal skills should also lead to better work performance, but results from the literature show that verbal skills are not as important as math skills. The scores range from 200 to 800.

Gender (+/-): Men are expected to make more money than women. Some reasons are differences in work experience, hours worked, and possible gender discrimination. A 1 denotes a female in the data and a 0 denotes a male.

Race (+/-): Earnings may also be affected by race, because of differences in experience and possible discrimination. This is also a series of dummy variables. The groups included are Black, Native American, Asian, and Hispanic. Non-Hispanic white are the excluded group. A 1 is used to describe the person of that race, whereas a 0 means they are not the respective race.

Age (+) : Income should increase with age as a person gains knowledge and experience as well as the opportunity to advance in the workplace, but human capital theory suggests that it will increase at a decreasing rate. However, since this paper uses employees who are very close in age, the effect should be nearly linear. This variable is measured in years at the time of the survey.

Work Experience (+): Experience allows a person to develop additional skills, which should increase productivity and income. This is measured in years of work experience.

A separate regression will be run to test the interaction between math and verbal ability and being in a related major. This regression will test whether math ability is has a stronger impact on earnings for those in math-related majors and if verbal ability has added importance for those in verbal-related majors. The empirical model will use an ordinary least squares regression to test the research hypotheses. The model will be in the form of a linear regression:

Income = a + ß1(SAT Math) + ß2(Math Int) + ß3(Math Major) + ß4(SAT Verbal) + ß5(Verbal Int) + ß6(Verbal Major) + ß7(Work Exp) + ß8(Race)+ ß9(Female)+ ß10(Age) +u

This regression will use interaction variables that were not in the previous regression. The SAT math variable will still be the actual SAT mathematics component score. The math interaction variable will be a person's SAT math score if they are in a math-related field, but a 0 will be entered if they are not in a math field. Due to the high correlation between major and the interaction variables, the majors will be grouped into math majors, verbal majors, and other majors. The math majors are engineering, physics, mathematics, economics, and business. The verbal majors are English, history, and sociology. The other majors will be the omitted group.

This will also be a linear regression, so the results will determine exactly how much each variable affects income. For someone in a math related field, the expected effect on income from an additional point on the SAT math will be the sum of the coefficients for the SAT math and the math interaction variables. For a person not in a math related field, the expected effect on income from an additional point on the SAT math will be represented by the coefficient for that variable. The interaction variable will only affect those in fields related to that subject. The same holds true for SAT verbal and verbal interaction variables. The coefficients for math major and verbal major will represent the predicted effect on income simply by choosing a major in a field related to the respective skill.

Variables and Their Expected Signs:

Income (Dependent): Same as in the previous model.

SAT Math (+): The actual SAT mathematics component score. A higher SAT Math score indicates stronger math abilities, which should lead to increased productivity and higher income. The scores range from 200-800, with 800 being the highest possible score.

Math Int (+): This variable represents the interaction between ability and choice of field. If a person is in a math-related field; Business, Computer Science, Economics, Engineering, Mathematics, and Physics; their SAT Math score is entered. If a person is not in a related field, a 0 is entered. Math ability should have additional benefits for those in related fields.

Math Major (+/-): Math-related fields may lead to significantly higher or lower incomes. A 1 is entered for those in math-related fields, and a 0 is entered for those in other majors.

SAT Verbal (+) : The actual SAT verbal component score. Better verbal skills should also lead to better work performance, but results from the literature show that verbal skills are not as important as math skills. The scores range from 200 to 800.

Verbal Int (+): Since verbal skills should be more important in related fields, there should a positive interaction between verbal ability and major. For those in verbal-related fields; English, History, Sociology; the SAT verbal score is entered. For those in other fields, a 0 is entered.

Verbal Major (+/-): It is possible that choosing a verbal related field will have either a negative or positive effect on income. A 1 is entered for those in verbal-related fields and a 0 for those in other majors.

The control variables will be computed in the same method as the previous regression and have the same expected signs.

V. Results

The results of the first regression were very significant. As a whole, the empirical model is significant at the .001 level and has an adjusted R-squared of .374. The regression had many significant variables with the expected signs. Many of the majors were highly significant as were several of the control variables. This implies that there are several aspects of college that significantly affect income.

Table 2: Regression Results

	Regression 1	
Variable	Coefficient	T-Statistic
Architecture	2035.3	.475
Biology	263.4	.101
Business	7673.2	3.453***
Communications	5868.5	2.239**
Computer Science	8815.7	3.158***
Criminology	6449.3	1.704*
Economics	2107.9	.601
Education	1447.1	.559
Engineering	10635.5	3.853***
English	1408.1	.463
History	588.6	.176
Home Economics	2412.9	.412
Math	4546.8	1.102
Nursing	6736.7	2.020**
Health	4653.1	1.489
Physics	4759.3	1.240
Political Science	6012.3	2.052**
Psychology	15.2	.006
Sociology	3730.6	1.105
Other	3471.9	1.517

*Indicates Significance at the .10 level
**Indicates Significance at the .05 level
***Indicates Significance at the .01 level

Table 2 (Continued)

	Regression 1	
Variable	Coefficient	T-Statistic
GPA	3982.4	3.598***
SAT Math	10.780	1.899*
SAT Verbal	3.050	.523
Female	18.337	.020
Black	103.85	.086
Native American	1550.2	.225
Asian	1267.8	.601
Hispanic	1375.9	.877
Work Experience	4630.4	14.669***
Age	1557.5	3.898***
Adj. R-squared	.374	
F-Statistic	21.424	
N	967	

*Indicates Significance at the .10 level
**Indicates Significance at the .05 level
***Indicates Significance at the .01 level

College Major Variables: The results of the regression found that seven of the majors significantly impact income when compared to choosing Art. Business, Communications, Computer Science, Criminology, Engineering, Nursing, and Political Science majors all had significant positive effects on post-graduate income, with Business, Computer Science, and Engineering being the most significant. The other thirteen college majors were not found to have a statistically significant impact on income. This supports the idea the choice of major is important in determining how much money a student will make after graduation.

The coefficients for each major can be interpreted as the amount of annual income that is gained or lost by choosing that major compared to choosing Art as a major. For example, the coefficient for engineering is more than 10,500 in the regression, so that means that being an engineering major will increase one's predicted income by about $10,500 every year compared to the omitted group. That is a lot of extra money to earn every year after college. Interpreting the other coefficients finds that business majors make approximately $7,600 more, nursing majors make about $6,700 more, and computer science majors make over $8,700 more every year by choosing the respective major . If these wage gaps across majors stay the same over time, during the next 20 years an engineering major will make an extra $210,000 simply because they chose engineering. Although in present value terms the amount is smaller and the affect of major on income will vary for each person, these results suggest that the choice of major could be extremely important for an individual in terms of lifetime earnings.

On the other hand, majors such as art lead to lower incomes than other majors. Art majors have the lowest expected earnings followed by psychology majors, biology majors, and history majors. This implies that when a student chooses a major such as art or psychology, either they are unaware of the lower expected income associated with the field or they are willing to sacrifice that amount of income in order to still work in the field. Therefore, the difference in wages across majors is likely due to either compensating wage differentials or a lack of information given to college students.

Since, the data comes from students who recently graduated college, it is not guaranteed that the each major will have the same impact on income later in a person's career. It is possible that a major such as psychology will pay less initially, but will lead to greater opportunities to move ahead or find better jobs further down the road. In addition, there are different proportions of people from each major that go to graduate school. These results only apply to those who do not go to graduate school and there may be some selection bias if the top students from some majors tend to go to graduate school. For example, many biology majors go to medical school and may have high incomes as doctors, but they are not included in the regression.

GPA Variable: The results show that college GPA is a very significant determinant of income. The GPA coefficient is significant at the .01 level. Also, the coefficient is about 3980 in the model, which means that a one point increase in GPA leads to around $3,980 more in salary every year. Clearly, working hard in school pays. An "A" student makes approximately $4,000 more than a "B" student and $8,000 more than a "C" student every year. These results come from workers who recently graduated, so this most strongly supports the human capital theory. Employers use grades as a tool to judge applicants, so students with higher GPA's are likely to get better jobs. Also, it implies that those who did well in school and studied hard perform better in the workplace. Therefore, GPA appears to be a fair measure of human capital after graduation.

SAT Variables: The results for the math and verbal variables are very interesting. The SAT math variable is significant in the regression, but the SAT verbal variable is insignificant. This supports the previous research. It implies that math ability is much more important than verbal or linguistic skills in most occupations. The results also suggest that math ability is more directly linked to acquiring human capital than verbal ability. The coefficient for the SAT math variable is above 10 in the regression. This means that a student that scores a 700 on the SAT math will make over $2,000 more each year on average than someone that scores a 500. It is possible that this difference will grow, because those with higher abilities will be able to gain human capital at a faster rate throughout their careers. Therefore, they will become even more productive than those with less natural ability and the wage difference will grow. This could be tested by studying data consisting of older workers than the one used in this paper.

Control Variables: In the regression, age and work experience variables were very significant. The race variables as well as gender were found to be insignificant in both regressions. It is promising that the race and gender variables were insignificant, because it implies that there is not significant discrimination and also there are similar opportunities for everyone. In many studies, these variables have been found to be significant. Perhaps, since this uses very recent data, the opportunities for women and minorities has increased in recent years while discrimination has decreased. Also, more young women have chosen to work full-time and have more work experience which will help improve their incomes.

The age and work experience variables were both highly significant and positively affected income. Work experience was the most significant variable with a t-statistic of 14.669. The coefficient implies that income increases by more than $4,600 with every additional year of work experience. Also, age increases income by an additional $1,500 every year. These variables both have a very significant impact on earnings shortly after graduation, but will most likely have a diminishing effect in the long-run.

The results of the regression involving the interaction variables were also very interesting. The regression had an adjusted r-squared of .310. The math interaction variable was significant and positive, while the verbal interaction was negative and insignificant.

Table 3: Regressions with the Interaction Variables

	Regression 2	
Variable	Coefficient	T-Statistic
SAT Math	9.001	2.043**
Math Interaction	6.469	4.281***
Math Major	-617.5	-.581
SAT Verbal	1.267	.229
Verbal Interaction	-14.244	-1.356
Verbal Major	7652.8	1.309
GPA	2404.7	3.006***
Work Experience	4050.3	16.395***
Age	1196.3	3.799***
Female	-1398.1	-1.864*
Black	-169.9	-.179
Native American	1283.1	.190
Asian	4126.0	2.238**
Hispanic	1604.8	1.326
Adj. R-squared	.310	
F-Statistic	47.5	
N	1449	

*Indicates Significance at the .10 level
**Indicates Significance at the .05 level
***Indicates Significance at the .01 level

Math Variables: The SAT math coefficient was around 9 in the regression and was significant. The math interaction variable was highly significant and its coefficient was more than 6. The SAT math coefficient is slightly less than it was in the previous model, but very similar. It is most likely smaller because some of its effect is captured by the interaction variable. Since the interaction variable had a positive coefficient, we can infer that math ability gives higher returns for students in math related majors. A student in a math major with a 750 on the SAT math will make about $4,600 more per year than another student in the same major who scored a 450. Students who are strong in math will see additional benefits if they chose a related field. The dummy variable for math major was insignificant in the regression, which implies that students in math fields do not necessarily earn significantly more or less than those in other fields. These results all agree with the expected signs.

Verbal Variables: The SAT verbal, verbal interaction, and verbal major variables were all insignificant in the regression. This agrees with the previous regression and the previous literature. Verbal ability does not appear to be as important in the workplace as math ability. Either math ability is a better measure of human capital or it enables a person to develop human capital more quickly. The results show the verbal ability does not significantly affect income, even for those in verbal-related fields. Also, those who choose majors related to verbal ability do not earn significantly more or less than those who choose other majors.

Other Variables: The results are very similar to the regression run with the prior model for most of the variables. GPA, work experience, and age are all highly significant and positively affect income. This supports the previous results, the coefficients were similar to before, and these appear to be very important determinants of income. The variables for race, with the exception of Asians, were still insignificant. The Asian and Female variables became significant in the regression that included the interaction variables, which is very interesting.

The variable for Asian became very significant and positive after the interaction variables were added. It is possible that this is due to the higher proportion of Asians in math-related fields such as mathematics, computer science, and engineering. The math major variable was insignificant and negative, but the Asian variable became significant and positive. Perhaps, there is an advantage to choosing a math field which was captured by the Asian variable because they are very prominent in math fields. Also, the female coefficient became negative, which could be due to the fact that fewer women enter math related fields than men. Although the variable was insignificant, it is possible there are advantages for choosing math majors, particularly for those strong in mathematics. Also, females are more likely to choose verbal fields, which may be lower paying. This may explain why the coefficient for females was most negative in the regressions that included the verbal interaction variables. Results from previous literature have shown that women earn less money than men, which could be due to the fields they enter.

Table 4 summarizes the rank of each major based on the regressions run. The first column is the rank of majors based only on the true average post-graduate income of students in the respective disciplines. This does not include any controls. The second column gives the rank of each major after controlling for students' GPAs. The third column ranks each field after controlling for GPA, SAT math, and SAT verbal scores. The fourth column gives the final results from the complete regression on the effect of major on income. The majors are ranked after GPA, SAT math, SAT verbal, work experience, gender, race, and age are all controlled for.

Table 4: Ranks of Major by Income after Controlling for Certain Variables

Major	Rank of Average Income (No Controls)	GPA Controlled For	GPA, SAT Math, SAT Verbal Controlled For	Everything Controlled For
Computer Science	1	1	1	2
Engineering	2	2	5	1
Business	3	3	3	3
Economics	4	5	20	14
Health	5	4	7	9
Nursing	6	7	9	4
Criminology	7	6	2	5
Communications	8	8	6	7
History	9	9	12	18
Math	10	12	8	10
Political Science	11	11	10	6
Sociology	12	10	16	11
Physics	13	13	11	8
Education	14	15	13	16
Psychology	15	16	15	20
Art	16	17	14	21
English	17	19	17	17
Other	18	18	18	12
Home Economics	19	14	4	13
Biology	20	20	19	19
Architecture	21	21	21	15

Some of the majors have about the same rank in each column, while others vary greatly. For example, business is ranked third no matter what was controlled for. On the other hand, economics is the fourth highest paying major without any controls, but after controlling for GPA, SAT math, and SAT verbal its rank dropped to 20^{th}. This stresses the importance of control variables. Economics appears to be very high paying if one looks simply at post-graduate earnings, but it is likely that the high incomes are due to higher ability levels rather than the major being a better choice. The rankings did not change much after controlling for GPA, which is due to the fact that GPA's do not vary much across majors. Test scores on the other hand vary greatly, so controlling for ability changed some of the rankings tremendously. Table 4 is very useful for someone looking to compare specific majors to see how they may affect income. Computer science was the highest paying major without any controls, but engineering was ranked first after controlling for all of the variables.

VI. Conclusion

The results of this paper show that grades, math ability, and choice of major are all very important. Students should work hard in school, learn math, and consider income when choosing a major. Since having a higher GPA leads to higher levels of income immediately after graduation, students may benefit financially from taking easier classes in order to get better grades. This is because employers often use GPA as part of the screening process for employees. However, taking more challenging classes may help a student develop more human capital which would increase productivity. Thus, in the long run there may be benefits to taking more challenging courses. Ideally, a student will take challenging classes and get good grades, so they will benefit as much as possible from their education. Working hard in school will very likely lead to higher pay after graduation.

The results showed that math ability is more important in increasing earnings than verbal ability. This means that students should consider spending more time developing their math and problem solving skills. By improving math ability, a student can make significantly more money. The results also suggest that math courses should be more strongly emphasized in school. By increasing the math and problem solving skills of our society, it is possible we will become more productive. Math and science leads to most new technology, which is vital in enabling our economy to continue to grow.

This paper has found that some majors pay better than others even after controlling for ability. The results also showed the wage differentials between the various majors. This information is very useful for college students. Many college students choose their major without knowing the affect each major has on income. This paper will enable students to make more informed decisions when deciding what they want to study. The results suggest that if a student has no preference for occupation, they should choose the highest paying major, engineering. If a student has personal preferences for certain majors or occupations, then they must decide how much income they are willing to sacrifice in order to enter their preferred field. Also, since the earnings from each major vary greatly, a student must consider the risk involved with each major as well as whether or not they believe they will be successful in a field. A student will not necessarily earn more in highest paying field based on these regressions.

It is important that there is a significant interaction between math ability and major. This suggests that the highest paying major may depend on an individual's abilities. Someone who struggles with math, for example, most likely should not choose math as a major even if it pays higher on average. One student may make the most money as an engineer, while another may make the most by choosing political science. A student can compare the amount of earnings they will forgo to the wage differential and risk for each major in order to make the optimal decision. Students must keep in mind both the salary associated with each major as well as the demands of the occupations associated with it. Hopefully, students will choose the right major based on these results.

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