**University of Maryland Baltimore County**

**Returns Relative to College Major Across Time**

**Alexandra (Ashley) Dolgoff**

**Advising professor: Dr. Lisa Dickson**

**Economics 699**

**Dr. David Mitch**

**Abstract**

Previous estimations regarding returns to college major have consistently demonstrated the presence of horizontal stratification. This paper utilizes two datasets from the National Survey of College Graduates (1993 and 2017) to examine the magnitude of horizontal stratification, estimating the monetary returns to college majors for bachelor degree recipients. This paper also examines how monetary returns may have changed for some majors over-time, given an ever-advancing technological dependent global society. Finally, this paper also estimates the earnings premium among males and females over-time. This paper employs quantile regression with clustered standard errors for estimation. Results indicate that returns for some majors have increased over-time as demand for particular skill sets in the labor market have transformed over the past two and half decades. Additionally, results indicate that the earnings premium among males and females have decreased at both the median and 90th percentile.

1. **Introduction**

Education level is a consequential factor in determining lifetime earnings in an increasingly globalized and competitive labor market. Literature on returns to education have consistently demonstrated that college graduates not only earn more, but are also more likely to be employed, and hold higher ranking jobs (Autor 2014; Hout 2012). However, despite extensive research on the topic, publications often accept homogeneity regarding college majors and college quality when estimating returns to education, and therefore neglect to estimate the impact horizontal stratification has on future earnings. Additionally, research on major selection, and its ensuing impact on lifetime earnings tends to neglect how returns within a major vary based on gender. The field of research that has examined the difference in earnings relative to major selection estimates there may be significant differences. Therefore, with the ever-increasing costs of a college education, it is imperative for future graduates to not only choose a major that satisfies both interests and abilities, but also a major that allows students to see a satisfying return on their time and financial investment.

The goal of this paper is to estimate the magnitude of horizontal stratification, estimating the monetary returns to college majors for bachelor degree recipients. This paper also seeks to answer how monetary returns may have changed for some majors over-time, given an ever-advancing technological dependent global society. Finally, this paper also seeks to understand if the recent promulgation advocating for women to pursue degrees under the science, technology, engineering, and mathematics (STEM) umbrella, has aided in lessening the wage gap between males and females. This paper utilizes data from the National Survey of College Graduates (NSCG) 1993 and 2017. Two datasets are utilized to compare how the magnitude of horizontal stratification may have changed for some majors as the demand for particular skills in the labor force have transformed over the past two and a half decades. The paper will begin with current statistics and information regarding college costs along with a literature review of relevant papers. The paper will continue with the econometric techniques and models used for estimation. The proceeding section will contain empirical results and interpretation. The paper will conclude with potential limitations and thoughts for future research.

1. **Significance: The Cost of a College Education**

According to the National Center for Education Statistics for the 2016 and 2017 academic year, the average annual cost for a four-year public college was $19,488. The average annual cost for private institutions was $41,468, and the average cost for a public two-year institution was $10,091. This equates to ~$80,000 for four-year public institutions, ~$166,000 for private four-year institutions, and over $20,000 for two-year colleges. The average annual cost increased almost 30 percent since the 2006-2007 academic year for public four-year institutions. For private four-year institutions and public two-year institutions, the average cost increased 20 percent and 25 percent respectively (College Costs 2017). Below illustrates the increase in a college education when compared to the median household income during those respective years:



(Berman)

 The steadily increasing cost of a college education is reflected in current student debt statistics. In the United States alone, over 44 million borrowers are indebted 1.5 trillion dollars in student loans.



(College Costs and Median family income).

Furthermore, student debt is the second highest source of consumer debt, following mortgage loan debt (Friedman 2019). While the returns on a four-year degree have significantly increased over time, tuition has increased even more rapidly. From 1993 to 2005 the institution wage premium increased 27 percent, whereas adjusted tuition at public and private four -year universities increased by 43 percent and 63 percent respectively (Trends in College Pricing 2007).

The ensuing estimation can also be of importance to institutions regarding the way in which funding is allocated. Institutions may consider altering funding, allocating more capital to areas of study that are expected to earn better returns on investment. Furthermore, it may incentivize institutions to cut certain majors that have consistently demonstrated poor returns on investment, and are no longer relevant in today’s labor market. According to the Council for Aid to Education, in 2017, alumni accounted for ~26 percent, or $12.15 billion of voluntary support to colleges and universities. Alumni contributions were just slightly lower than foundation donations, which accounted for ~ 30 percent, or $14.01 billion (Council for Advancement and Support of Education 2019). Additionally, while the council found that donations from alumni increased 7.2 percent from 2016, the number of donors was down, therefore those who donated were contributing a larger portion of their income.

Furthermore, some colleges, including Purdue University have begun pilot programs to help combat the student debt crisis. Income Share Agreements (ISA), initially coined by Milton Friedman in the 1950s, permits students pay no tuition upfront, however pay a percentage of their income once they have secured a job (Wharton University of Pennsylvania 2019). Students who chose majors with anticipated lower earnings pay a higher percentage of their income over a longer period of time when compared to students who majored in fields expected to acquire higher salaries. Institutions may also observe greater default rates for students majoring in certain fields. Students would therefore act as investments for institutions, thus further incentivizing schools to allocate funding towards more lucrative fields of study. Next is an examination of the decision making process students take when deciding on their field of study.

1. **The decision Making Process**

Rose and Summervill (2005) reported that the most commonly acknowledged life regret among those living in the United States were choices related to academics. Literature on the psychology behind major choice often refers to students as being “forced” into a major, rather than students making an informed decision (Rose 2005). Beggs, Bantham, and Taylor (2008) found that job characteristics and financial considerations ranked only third and fourth respectively among factors that students consider when declaring a major. Interests and major characteristics were the most influential aspects behind selecting a college major. Additionally, Sowell (1972) found that students who select colleges where their skills are dramatically less than peers, are forced to select less demanding majors that may not be as lucrative (Arcidiacono 2003). Rothstein and Rouse (2007) took a noteworthy approach to major selection, examining how student debt influences field of study.

The university under study in Rothstein and Rouse’s research altered their loan policy to the extent that the loan component of financial aid was substituted with grants. The threshold to receive financial aid was lowered so that students who would not have otherwise received financial aid, would benefit from the program. Rothstein and Rouse utilized a difference-in-difference analysis, and found that student debt influences individuals to select jobs in which they can earn a higher salary. When students did not incur debt, they shifted towards a major in which they would accept lower paying jobs in the service industry.

According to the 2001 Baccalaureate and Beyond Longitudinal Study, between the years of 1999 and 2000, 13 percent of females earned a bachelor’s degree in education, while only 4 percent of males earned a degree in education. In stark contrast, 2 percent of females majored in engineering, while 12 percent of males earned a bachelor’s degree in engineering, despite the insignificant and diminishing gap in mathematical achievement among males and females over the past decades (Zafar 2013). Zafar (2013) examined why such a divergence exists. Zafar found that views regarding academic confidence can only explain an insignificant portion of the gender gap. Rather, he found that a significant percentage of the gender gap is related to the variances in preferences in the workforce. Females are thought to be concerned less with pecuniary outcomes, while future earnings are the main concern for males when selecting a major (Zafar 2013). The substantial difference in major selection may help to explain the wage gap between males and females.

1. **Previous Estimates Regarding Earnings Relative to Major Selection**

Over the past few decades there has been extensive analysis regarding the ever-broadening earnings premium for those with a college education, with some research estimating which majors offer the best return on investment. Arcidiacono (2004) estimated the monetary returns related to major selection and found that natural science and business majors earned the highest return on their investment. Arcidiacono also found that individuals with a high school degree earned more than students who majored in education ($33,616 versus $36,478 annual salary in 1999 dollars). Additionally, education majors, which was the only major to experience a decrease in salary between 1972 and 1974, experienced a $1,311 decline in average earnings.

Kim, Tamborini, and Sakamoto (2015), found similar results for business and STEM majors. Males in their 30s majoring in business were predicted to earn ~63 percent more than high school graduates. However, by their 50s they were only predicted to earn ~49 percent more. STEM majors in their 30s were predicted to earn the greatest return on their investment, earning ~79 percent more than high school graduates. Furthermore, male education majors in their 20s earned ~36 percent less than high school graduates, however they earned about ~20 percent more in their 30s, 40s, and 50s. Female education majors earned more than high school graduates for every age group, ranging from 27 percent more in their 20s, to 39 percent and 42 percent more in their 40s and 50s respectively.

 Hamermesh and Donald (2004), collected data from undergraduates at the University of Texas at Austin, also found that earnings depend on major selection; the highest paying area of study (hard business, i.e. economic and finance) earned approximately three times more than those who selected the lowest paying major, education and humanities. Another noteworthy result was that they found dissimilar earnings for students within the same major based on coursework. A student who took a substantial number of upper-level science or math courses and earns a “B” average, is predicted to earn 10 percent more than their counterpart, even after controlling for SAT math scores. The next section will discuss relevant theories as to why an earnings gap exists among majors.

1. **Theory**

Several theories endeavor to explain why such a gap in earnings among college majors prevails. The human capital theory attributes the gap to variant skills learned during the course of a college education. Those who learn valuable skills relevant to current labor market demands will in turn be able to offer more vendible human capital, and thus have greater lifetime earnings (Daymonti Andrisani 1984). The human capital theory in regards to the gender gap, attributes the difference to be an outgrowth of gender expectations. Because of gender norms regarding child-rearing, females expect to spend less time in the labor force, and therefore will have lower lifetime earnings.

On the other hand the neo-Weberian social closure view explains the difference in earnings by restraints in the supply of labor (Weeden 2002). Colleges and universities have increased admission standards for higher paying fields, thus limiting the labor supply. However, due to the growth of institutions and the increasing conventionality of a college education, there are more varying abilities within institutions. This view emphasizes the differences due to educational gradation. The goal of this paper is to utilize the most recent data available, while combining the most relevant and motivating aspects from the abovementioned papers.

1. **Data**

The analysis utilized 1993 and 2017 data from the National Survey of College Graduates (NSCG), which is a review of college graduates residing in the United States. The questionnaire has been conducted since the 1970s, and is sponsored by the National Science Foundation, Science and Engineering Statistics, as well as the Census Bureau. For 1993 data collection, mail-in surveys were utilized. Telephone and in-person interviews were utilized for non-responders. The sample was conducted in a two-phase random sample. Phase one was a Long Form Sample structure, while phase two was a subset of Long Form construction, which utilized a stratified structure with “probability-proportional-to-size” (National Survey of College Graduates). The 1993 NSCG attained a 78 percent response rate, with 148,932 respondents. Approximately 19,000 of respondents were unqualified because they were either living outside the United States, over the age of 75, or did not earn a minimum of a bachelor’s degree by April 1990.

Data collection for 2017 employed a trimodal collection method, using telephone interviews, as well as online and mail questionnaires. The individual’s preferences were noted in order to increase the likelihood of response for future surveys. Furthermore, a variety of questions that aid in analyzing returns to educations were asked. These unique questions include educational history, job satisfaction, and occupational status. A drawback of the data set is that there is a focus on those with education backgrounds in science and engineering, and an over sample of males.

1. **Analytic Sample NSCG: 93**

The NSCG 1993 dataset included only those between the ages of 25 and 65, with a bachelor’s degree, working full-time, and making less than $150,000. In addition, majors were grouped in the following manner: computer science, math/statistics, agriculture, biology, physical science, economics, nutrition, psychology, political science, philosophy, parks and recreation, public administration, pre-law/legal studies, communications, architecture, criminal justice, sociology, other social sciences, health, education, business, humanities, social services, art, and history. Additionally, the sample includes 108,467 respondents.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Total Sample** | **Male** | **Female** |
| 1992 Average Income | $44,177.18  | $48,855.41  | $36,127.11  |
| Average Age | 41 | 41.7 | 39.8 |
| Observations | 69,892 | 41,701 | 28,141 |
| **Race** |  |  |  |
| Hispanic | 6.8% | 6.4% | 7.2% |
| White | 73.4% | 77.5% | 67.3% |
| Black | 9.7% | 7.1% | 13.5% |
| Asian | 9.1% | 8.1% | 10.6% |
| Native-American | 0.9% | 0.8% | 1.1% |
| Multi-race | 0.0% | 0.1% | 0.0% |
| **Marital Status** |  |  |  |
| Married | 71.0% | 74.0% | 64.9% |
| Widow | 0.5% | 0.5% | 1.7% |
| Separated | 1.5% | 1.2% | 1.9% |
| Divorced | 8.0% | 6.2% | 10.6% |
| Single | 18.8% | 17.2% | 21.1% |
| **Income** |  |  |  |
| Less than $25,000 | 15.7% | 10.6% | 24.3% |
| $25,000 to $50,000 | 53.0% | 49.0% | 60.0% |
| $50,001 to $75,000 | 22.9% | 28.9% | 12.6% |
| $75,000 to $100,000 | 4.6% | 6.4% | 1.5% |
| Over $100,000 | 3.2% | 4.9% | 1.4% |

 |  |  |  |
|  |  |  |  |

**Table 1:** Description of Sample, 1993

1. **Analytic Sample: NSCG:2017**

Similarly,for the 2017 dataset, those between the ages of 25 to 65, with a bachelor’s working full-time, less than 81 hours per week, and made less than 1.9 million were included in the dataset. In addition, majors were grouped in the same manner as the 1993 dataset. Additionally, the sample includes 27,689 respondents.

**Table 2:** Description of Sample, 2017

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Total Sample** | **Male** | **Female** |
| 2016 Average Income | $89,890.47 | $101,182.70 | $72,309.29 |
| Average Age | 42.5 | 43.3 | 41.4 |
| Observations | 27,689 | 16,860 | 10,829 |
| **Race** |  |  |  |
| Asian | 17.97% | 18.80% | 16.90% |
| American Indian | 0.61% | 0.53% | 0.70% |
| Black | 7.70% | 5.96% | 9.90% |
| White | 69.90% | 71.40% | 67.90% |
| Hawaiian | 0.46% | 0.43% | 0.51% |
| Multi-race | 3.43% | 2.90% | 4.10% |
| **Marital Status** |  |  |  |
| Married | 65.20% | 69.60% | 58.48% |
| Marriage-Like | 61.30% | 5.60% | 6.90% |
| Widow | 0.70% | 0.37% | 1.20% |
| Separated | 0.71% | 0.70% | 0.97% |
| Divorced | 5.50% | 4.50% | 8.20% |
| Single | 21.20% | 19.29% | 24.19% |
| **Income** |  |  |  |
| Less than $25,000 | 15.70% | 3.40% | 7.40% |
| $25,000 to $50,000 | 53.00% | 13.40% | 28.70% |
| $50,001 to $75,000 | 22.90% | 22.70% | 28.90% |
| $75,000 to $100,000 | 4.60% | 22.00% | 17.20% |
| Over $100,000 | 3.20% | 35.50% | 16.10% |

|  |  |
| --- | --- |
|  |  |
|  |  |

1. **Average Income by Major**

The graphs below show how average annual income has changed for some majors between 1993 and 2017, broken down by gender. While income has remained stable for some areas of study, average income has increased significantly since the early 1990s for some areas. Female computer science majors experienced an 18 percent change in average salary since 1993. Males majoring in computer science also experienced an increase in salary. The percent change for bachelor’s degree is approximately 32 percent Mathematics was another area of study that experienced an increase. For bachelor’s degrees, males experienced a 9 percent increase, while females experienced a 19 percent increase in earnings since the early 1990s. Economics majors also earned a substantial increase in income. Average annual income for biology, health, sociology, philosophy, art, and communications remained stable, while psychology, humanities, and history majors, experienced a slight decrease in average annual income for some levels of education.

**Table 3:** Changes in Average Annual Income 1992 to 2016, Bachelor’s Degree

**[[1]](#footnote-1)**

**Table 4:** Changes in Average Annual Income 1992 to 2016, Bachelor’s Degree: Males

**Table 5:** Changes in Average Annual Income 1992 to 2016: Bachelor’s Degree, Females

1. **Estimation Strategy**

Quantile regression with clustered standard errors is utilized for estimation. When compared to Ordinary Least Squares, quantile regression does not assume normality or homoskedasticity. Therefore, quantile regression is beneficial under these circumstances, as the distribution of earrings fluctuate by education and by different phases of the professional lifecycle. Furthermore, approximations of quantile regressions are categorized by linear equivariance. A function is deemed as equivariant when the applied transformation to x is the same as applying the conversion to the effect of *f(x)*. Ordinary least squares would therefore result in retransformation bias. Quantile regression on the other hand, can be converted to concrete dollars, as it assumes a “monotone” equivariance property (Kim 2015). Since quantile regression introduction in 1978 by Koenker and Basset, extensions have been developed to achieve consistent standard errors. One of which, clustered standard errors with quantile regression, was developed by Parente and Santos Silva (2016). This estimation technique accounts for when the regression errors may be heteroskedastic and/ or clustered. They describe quantile estimation with clustered data in the following manner:

Data is given as

In which g indexes a set of G clusters with ng elements. When ng is equal to one, heteroscedasticity is present. The following model is estimated:

 is then estimated:

Parente and Santos Silva then demonstrate:

Where

E[

The asymptotic results depend on

Parente and Santos Silva are therefore able to demonstrate consistent estimators of A and B:

(Santos Silva 2015).

Santos Silva has proposed multiple specification tests to assess intra-cluster correlation and/ or heteroscedasticity. To test for intra-cluster correlation Parente and Santos Silva proposed a robust form of the Breusch Pagan (1980). To test for heteroscedasticity, Machado and Santos Silva (2000) improved upon the Glejser (1996) test, when it was found that the test was not asymptotically effective under asymmetric disturbances. Running the Machado-Santos Silva tests for both NSCG: 1993 and NSCG: 2017 indicate the presence of heteroscedasticity and intra-cluster correlation, therefore, estimating quantile regression with robust standard errors is warranted.

1. **Model**

The model to describe the following estimation is developed as:

…

(Katchova 2013).

The dependent variable is the log of salaries for respondents in NSCG: 93 and the log of salaries NSCG: 17. The variables of interest are indicators for college major. Other control variables include: gender, age, age2, marital status, race, mother’s and father’s education, geographical location, citizenship status, and class of worker (e.g. private, government or educational institution).

1. **Empirical Findings NSCG:1993**

The tables below include the results for returns to college majors for both Ordinary Least Squares, (OLS) as well as quintile regression. OLS is included to illustrate how earnings premium fluctuates across the wage distribution.[[2]](#footnote-2) A Chow test was first conducted to assess for the occurrence of a structural break. The Chow statistic was significantly different than zero, therefore it is believed the model is different for males and females.

**Table 6:** 1993 OLS, 50th percentile, and 90th percentile: total sample

|  |  |  |  |
| --- | --- | --- | --- |
|  | (OLS) | (.50) | (.90) |
| VARIABLES | Log income | Log income | Log income |
| Computer Science | 0.212\*\*\* | 0.197\*\*\* | 0.117\*\*\* |
|  | (0.00945) | (0.00787) | (0.0127) |
| Math | 0.172\*\*\* | 0.172\*\*\* | 0.108\*\*\* |
|  | (0.0113) | (0.0109) | (0.0159) |
| Agriculture | -0.119\*\*\* | -0.115\*\*\* | -0.0858\*\* |
|  | (0.0173) | (0.0225) | (0.0380) |
| Biology | 0.0285\*\*\* | 0.000236 | 0.0391\*\*\* |
|  | (0.00945) | (0.00892) | (0.0128) |
| Nutrition | 0.0848\*\* | 0.0500 | 0.124\*\*\* |
|  | (0.0397) | (0.0376) | (0.0273) |
| Physical science | 0.117\*\*\* | 0.103\*\*\* | 0.0725\*\*\* |
|  | (0.00974) | (0.00999) | (0.0151) |
| Economics | 0.143\*\*\* | 0.112\*\*\* | 0.271\*\*\* |
|  | (0.0149) | (0.0175) | (0.0206) |
| Political science | 0.0466\*\*\* | 0.00247 | 0.166\*\*\* |
|  | (0.0126) | (0.0172) | (0.0232) |
| Psychology | -0.0425\*\*\* | -0.0730\*\*\* | 0.0220 |
|  | (0.0103) | (0.0110) | (0.0171) |
| Other social sciences[[3]](#footnote-3) | -0.0509\*\*\* | -0.0778\*\*\* | -0.00914 |
|  | (0.0136) | (0.0161) | (0.0257) |
| Sociology | -0.0655\*\*\* | -0.107\*\*\* | -0.00374 |
|  | (0.0124) | (0.0142) | (0.0225) |
| Engineering | 0.224\*\*\* | 0.225\*\*\* | 0.112\*\*\* |
|  | (0.00661) | (0.00592) | (0.00828) |
| Health | 0.139\*\*\* | 0.104\*\*\* | 0.146\*\*\* |
|  | (0.00877) | (0.00832) | (0.0126) |
| Architecture | 0.0251 | -0.0205 | 0.0468 |
|  | (0.0161) | (0.0148) | (0.0377) |
| Business | 0.0630\*\*\* | 0.0417\*\*\* | 0.126\*\*\* |
|  | (0.00594) | (0.00627) | (0.00978) |
| Philosophy | -0.252\*\*\* | -0.277\*\*\* | -0.107\*\* |
|  | (0.0193) | (0.0256) | (0.0427) |
| Social work | -0.130\*\*\* | -0.181\*\*\* | -0.0994\*\*\* |
|  | (0.0164) | (0.0163) | (0.0239) |
| English | -0.0356\*\*\* | -0.0534\*\*\* | 0.00868 |
|  | (0.0102) | (0.00894) | (0.0211) |
| Humanities | 0.00915 | -0.00822 | 0.0797\*\*\* |
|  | (0.0173) | (0.0197) | (0.0233) |
| History | -0.0524\*\*\* | -0.0457\*\*\* | 0.0290 |
|  | (0.0128) | (0.0130) | (0.0236) |
| Art | -0.120\*\*\* | -0.137\*\*\* | -0.0515\*\*\* |
|  | (0.0105) | (0.0125) | (0.0162) |
| Communications | -0.0187\*\* | -0.0583\*\*\* | 0.0699\*\* |
|  | (0.0110) | (0.0133) | (0.0283) |
| Criminal justice | -0.0693\*\*\* | -0.0960\*\*\* | -0.0345 |
|  | (0.0173) | (0.0181) | (0.0358) |
| Pre-law/legal studies | 0.00455 | -0.0674 | 0.157\*\* |
|  | (0.0349) | (0.0433) | (0.0902) |
| Parks and recreation | -0.113\*\*\* | -0.129\*\*\* | -0.119\*\*\* |
|  | (0.0229) | (0.0216) | (0.0268) |
| Public administration  | 0.212\*\*\* | 0.197\*\*\* | 0.117\*\*\* |
|  | (0.00945) | (0.00787) | (0.0127) |
|  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Other Variables: Gender, Class of worker, Race, Marital status, Citizenship status, Parent’s education, Age, Age2, and region*

*Note: Reference major: Education*

**Table 7:** 1993 Quantile Regression 50th, 90th: by gender

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | (.50 Male) | (.50 Female) | (.90 Male) | (.90 Female) |
| VARIABLES | Log income | Log income | log income | log income |
| Computer Science | 0.119\*\*\* | 0.359\*\*\* | 0.0827\*\*\* | 0.182\*\*\* |
|  | (0.00878) | (0.0132) | (0.0173) | (0.0209) |
| Math | 0.0992\*\*\* | 0.307\*\*\* | 0.0588\*\* | 0.201\*\*\* |
|  | (0.0123) | (0.0216) | (0.0228) | (0.0235) |
| Agriculture | -0.182\*\*\* | -0.0182 | -0.136\*\*\* | -0.00311 |
|  | (0.0220) | (0.0305) | (0.0342) | (0.0360) |
| Biology | -0.0690\*\*\* | 0.113\*\*\* | 0.0242 | 0.0561\*\*\* |
|  | (0.0119) | (0.0153) | (0.0220) | (0.0196) |
| Nutrition | 0.0356 | 0.106\*\*\* | 0.0565 | 0.178\*\*\* |
|  | (0.0533) | (0.0374) | (0.0598) | (0.0316) |
| Physical science | 0.0403\*\*\* | 0.205\*\*\* | 0.0221 | 0.170\*\*\* |
|  | (0.0106) | (0.0231) | (0.0160) | (0.0271) |
| Economics | 0.0444\* | 0.230\*\*\* | 0.225\*\*\* | 0.321\*\*\* |
|  | (0.0233) | (0.0275) | (0.0353) | (0.0399) |
| Political science | -0.0402\*\* | 0.0537\* | 0.116\*\*\* | 0.195\*\*\* |
|  | (0.0173) | (0.0315) | (0.0259) | (0.0322) |
| Psychology | -0.115\*\*\* | -0.00659 | 0.0194 | 0.0286 |
|  | (0.0148) | (0.0167) | (0.0268) | (0.0232) |
| Other social sciences | -0.148\*\*\* | 0.0450\*\* | -0.0456 | 0.0488 |
|  | (0.0214) | (0.0204) | (0.0314) | (0.0344) |
| Sociology | -0.160\*\*\* | -0.0197 | -0.00891 | -0.00376 |
|  | (0.0230) | (0.0197) | (0.0343) | (0.0256) |
| Engineering | 0.155\*\*\* | 0.439\*\*\* | 0.0665\*\*\* | 0.269\*\*\* |
|  | (0.00635) | (0.0137) | (0.0111) | (0.0225) |
| Health | 0.0103 | 0.214\*\*\* | 0.149\*\*\* | 0.158\*\*\* |
|  | (0.0170) | (0.0101) | (0.0518) | (0.0135) |
| Architecture | -0.0936\*\*\* | 0.136\*\*\* | 0.00316 | 0.126\*\* |
|  | (0.0176) | (0.0327) | (0.0564) | (0.0591) |
| Business | -0.0171\*\* | 0.133\*\*\* | 0.118\*\*\* | 0.124\*\*\* |
|  | (0.00724) | (0.0111) | (0.0148) | (0.0145) |
| Philosophy | -0.369\*\*\* | -0.0585\*\* | -0.181\*\*\* | 0.0242 |
|  | (0.0247) | (0.0259) | (0.0530) | (0.0414) |
| Social work | -0.328\*\*\* | -0.0734\*\*\* | -0.229\*\*\* | -0.0746\*\*\* |
|  | (0.0430) | (0.0192) | (0.0703) | (0.0268) |
| English | -0.110\*\*\* | 0.0362\*\*\* | 0.0253 | 0.0332\* |
|  | (0.0186) | (0.0133) | (0.0456) | (0.0188) |
| Humanities | -0.0726\*\*\* | 0.0807\*\*\* | 0.101\* | 0.0906\*\*\* |
|  | (0.0252) | (0.0221) | (0.0542) | (0.0245) |
| History | -0.0972\*\*\* | 0.0298 | 0.0139 | 0.105 |
|  | (0.0205) | (0.0269) | (0.0381) | (0.0797) |
| Art | -0.188\*\*\* | -0.0382\*\* | -0.0835\*\*\* | -0.00628 |
|  | (0.0172) | (0.0176) | (0.0191) | (0.0313) |
| Communications | -0.121\*\*\* | 0.0440\*\* | 0.0218 | 0.135\*\*\* |
|  | (0.0178) | (0.0192) | (0.0328) | (0.0317) |
| Criminal justice | -0.119\*\*\* | -0.0583\* | -0.00700 | -0.0790\* |
|  | (0.0231) | (0.0309) | (0.0285) | (0.0449) |
| Pre-law/legal studies | -0.0688\* | -0.0904 | 0.263\*\*\* | -0.0843\*\*\* |
|  | (0.0362) | (0.0930) | (0.0515) | (0.0325) |
| Parks and recreation | -0.191\*\*\* | -0.0321 | -0.161\*\*\* | -0.0708\* |
|  | (0.0212) | (0.0307) | (0.0469) | (0.0422) |
| Public administration  | 0.119\*\*\* | 0.359\*\*\* | 0.0827\*\*\* | 0.182\*\*\* |
|  | (0.00878) | (0.0132) | (0.0173) | (0.0209) |
|  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Other Variables: Gender, Class of worker, Race, Marital status, Citizenship status, Parent’s education, Age, Age2, and region*

*Note: Reference major: Education*

1. **Empirical Findings NSCG:2017**

The tables below include the results for returns to college majors for both Ordinary Least Squares, (OLS) as well as quintile regression for 2017. OLS is included to illustrate how earnings premium fluctuates across the wage distribution.[[4]](#footnote-4) A Chow test was first conducted to assess for the occurrence of a structural break. The Chow statistic was significantly different than zero, therefore it is believed the model is different for males and females.

**Table 8:** 2017 OLS, 50th percentile, and 90th percentile: total sample

|  |  |  |  |
| --- | --- | --- | --- |
|  | (OLS) | (.50) | (.90) |
| VARIABLES | Log income | Log income | Log income |
|  |  |  |  |
| Computer science | 0.376\*\*\* | 0.423\*\*\* | 0.319\*\*\* |
|  | (0.0232) | (0.0269) | (0.0346) |
| Math | 0.282\*\*\* | 0.306\*\*\* | 0.295\*\*\* |
|  | (0.0287) | (0.0321) | (0.0470) |
| Agriculture | 0.00458 | 0.0196 | 0.0448 |
|  | (0.0306) | (0.0344) | (0.0448) |
| Biology | 0.0811\*\*\* | 0.0781\*\*\* | 0.0644\*\* |
|  | (0.0225) | (0.0267) | (0.0333) |
| Nutrition | 0.135 | 0.137\*\*\* | -0.00576 |
|  | (0.0956) | (0.0451) | (0.141) |
| Physical science | 0.170\*\*\* | 0.179\*\*\* | 0.0740\*\* |
|  | (0.0277) | (0.0305) | (0.0411) |
| Economics | 0.306\*\*\* | 0.312\*\*\* | 0.430\*\*\* |
|  | (0.0273) | (0.0334) | (0.0508) |
| Political science | 0.197\*\*\* | 0.209\*\*\* | 0.228\*\*\* |
|  | (0.0265) | (0.0320) | (0.0441) |
| Psychology | 0.0186 | -0.00746 | 0.0588\*\* |
|  | (0.0239) | (0.0292) | (0.0324) |
| Other social sciences[[5]](#footnote-5) | -0.0219 | -0.00539 | 0.0429 |
|  | (0.0287) | (0.0329) | (0.0408) |
| Sociology | 0.0475 | 0.0457 | 0.0902\*\* |
|  | (0.0299) | (0.0376) | (0.0500) |
| Engineering | 0.408\*\*\* | 0.430\*\*\* | 0.278\*\*\* |
|  | (0.0211) | (0.0253) | (0.0306) |
| Health | 0.214\*\*\* | 0.232\*\*\* | 0.163\*\*\* |
|  | (0.0233) | (0.0262) | (0.0324) |
| Architecture | 0.145\*\*\* | 0.138\*\*\* | 0.184\*\*\* |
|  | (0.0368) | (0.0386) | (0.0547) |
| Business | 0.238\*\*\* | 0.251\*\*\* | 0.233\*\*\* |
|  | (0.0224) | (0.0271) | (0.0314) |
| Philosophy | -0.0977 | -0.0725 | 0.0954 |
|  | (0.0611) | (0.112) | (0.0621) |
| Social work | -0.108\*\* | -0.118\*\* | -0.234\*\*\* |
|  | (0.0457) | (0.0481) | (0.0487) |
| English | -0.0377 | -0.0189 | 0.0250 |
|  | (0.0358) | (0.0437) | (0.0424) |
| Humanities | 0.0599\* | 0.0648 | 0.0965\*\* |
|  | (0.0337) | (0.0421) | (0.0490) |
| History | -0.00953 | -0.00429 | -0.0438 |
|  | (0.0497) | (0.0392) | (0.100) |
| Art | -0.0253 | -0.00639 | 0.0226 |
|  | (0.0329) | (0.0419) | (0.0461) |
| Communications | 0.121\*\*\* | 0.105\*\*\* | 0.123\*\*\* |
|  | (0.0315) | (0.0319) | (0.0387) |
| Criminal justice | 0.0663 | 0.0299 | 0.0895 |
|  | (0.0465) | (0.0472) | (0.0827) |
| Pre-law/legal studies | 0.00549 | 0.0377 | 0.136\*\* |
|  | (0.0543) | (0.0476) | (0.0701) |
| Parks and recreation | -0.0732 | -0.0435 | -0.150 |
|  | (0.0854) | (0.104) | (0.157) |
| Public administration | 0.00724 | 0.0727 | -0.0354 |
|  | (0.0788) | (0.0868) | (0.0652) |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Other Variables: Gender, Class of worker, Race, Marital status, Citizenship status, Parent’s education, Age, Age2, and region*

*Note: Reference major Education*

**Table 9:** 2017 Quantile Regression 50th, 90th: by gender

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | (.50 Male) | (.50 Female) | (.90 Male) | (.90 Female) |
| VARIABLES | Log income | Log income | Log income | Log income |
|  |  |  |  |  |
| Computer science | 0.405\*\*\* | 0.366\*\*\* | 0.326\*\*\* | 0.272\*\*\* |
|  | (0.0382) | (0.0349) | (0.0470) | (0.0554) |
| Math | 0.294\*\*\* | 0.302\*\*\* | 0.280\*\*\* | 0.290\*\*\* |
|  | (0.0432) | (0.0347) | (0.0555) | (0.0888) |
| Agriculture | 0.0254 | 0.000316 | 0.0272 | 0.107 |
|  | (0.0465) | (0.0513) | (0.0557) | (0.0927) |
| Biology | 0.0489 | 0.0927\*\*\* | 0.0448 | 0.129\*\* |
|  | (0.0387) | (0.0269) | (0.0501) | (0.0521) |
| Nutrition | -0.159 | 0.111\*\* | -0.427\*\*\* | 0.00911 |
|  | (0.116) | (0.0505) | (0.0600) | (0.0732) |
| Physical science | 0.141\*\*\* | 0.207\*\*\* | 0.0134 | 0.143\*\* |
|  | (0.0423) | (0.0345) | (0.0605) | (0.0603) |
| Economics | 0.314\*\*\* | 0.263\*\*\* | 0.475\*\*\* | 0.356\*\*\* |
|  | (0.0505) | (0.0612) | (0.0770) | (0.0819) |
| Political science | 0.209\*\*\* | 0.191\*\*\* | 0.214\*\*\* | 0.247\*\*\* |
|  | (0.0474) | (0.0367) | (0.0576) | (0.0621) |
| Psychology | -0.0556 | -0.00652 | 0.0423 | 0.0886\*\* |
|  | (0.0450) | (0.0290) | (0.0651) | (0.0505) |
| Other social sciences[[6]](#footnote-6) | 0.0397 | -0.0531 | 0.0675 | 0.0449 |
|  | (0.0517) | (0.0366) | (0.0648) | (0.0686) |
| Sociology | 0.102\* | -0.0145 | 0.0931 | 0.0768 |
|  | (0.0529) | (0.0389) | (0.141) | (0.0770) |
| Engineering | 0.384\*\*\* | 0.500\*\*\* | 0.244\*\*\* | 0.416\*\*\* |
|  | (0.0370) | (0.0270) | (0.0440) | (0.0526) |
| Health | 0.193\*\*\* | 0.264\*\*\* | 0.157\*\*\* | 0.195\*\*\* |
|  | (0.0492) | (0.0247) | (0.0563) | (0.0486) |
| Architecture | 0.111\*\* | 0.126\*\* | 0.173\*\*\* | 0.167\*\* |
|  | (0.0495) | (0.0720) | (0.0579) | (0.0772) |
| Business | 0.236\*\*\* | 0.229\*\*\* | 0.262\*\*\* | 0.239\*\*\* |
|  | (0.0388) | (0.0314) | (0.0512) | (0.0501) |
| Philosophy | -0.111 | -0.205\*\* | 0.0905 | -0.0725 |
|  | (0.151) | (0.106) | (0.246) | (0.0803) |
| Social work | -0.0179 | -0.127\*\*\* | -0.0513 | -0.240\*\*\* |
|  | (0.0583) | (0.0456) | (0.174) | (0.0781) |
| English | -0.103 | -0.00127 | 0.0110 | 0.0507 |
|  | (0.0741) | (0.0516) | (0.0619) | (0.106) |
| Humanities | 0.0602 | 0.0192 | 0.115 | 0.0993 |
|  | (0.0519) | (0.0659) | (0.0821) | (0.0709) |
| History | -0.0223 | 0.0443 | 0.0935 | -0.0491 |
|  | (0.0655) | (0.0708) | (0.0942) | (0.0971) |
| Art | -0.00272 | -0.00842 | 0.00496 | 0.0763 |
|  | (0.0509) | (0.0559) | (0.0686) | (0.0957) |
| Communications | 0.0364 | 0.184\*\*\* | 0.00963 | 0.333\*\*\* |
|  | (0.0453) | (0.0439) | (0.0648) | (0.0842) |
| Criminal justice | 0.0137 | -0.00551 | 0.0748 | 0.165 |
|  | (0.0831) | (0.0576) | (0.101) | (0.146) |
| Pre-law/legal studies | -0.0482 | 0.0409 | 0.322\*\*\* | 0.151\*\* |
|  | (0.0858) | (0.0532) | (0.112) | (0.0671) |
| Parks and recreation | -0.0778 | -0.156 | -0.0307 | -0.247\*\*\* |
|  | (0.254) | (0.102) | (0.133) | (0.0549) |
| Public administration | 0.321\*\*\* | -0.0523 | 0.0312 | -0.139\*\* |
|  | (0.0943) | (0.175) | (0.0598) | (0.0586) |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Other Variables: Gender, Class of worker, Race, Marital status, Citizenship status, Parent’s education, Age, Age2, and region*

*Note: Reference major: Education*

**Table 10:** Side-by-side comparison of 1993 and 2017 Results

Below is a side-by-side comparison of the results from the 1993 and 2017 dataset for the entire sample.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | (.50, 1993) | (.50, 2017) | (.90, 1993) | (.90, 2017) |
| VARIABLES | Log income | Log income | Log income | Log income |
|  |  |  |  |  |
| Computer science | 0.197\*\*\* | 0.423\*\*\* | 0.117\*\*\* | 0.319\*\*\* |
|  | (0.00787) | (0.0269) | (0.0127) | (0.0346) |
| Math | 0.172\*\*\* | 0.306\*\*\* | 0.108\*\*\* | 0.295\*\*\* |
|  | (0.0109) | (0.0321) | (0.0159) | (0.0470) |
| Agriculture | -0.115\*\*\* | 0.0196 | -0.0858\*\* | 0.0448 |
|  | (0.0225) | (0.0344) | (0.0380) | (0.0448) |
| Biology | 0.000236 | 0.0781\*\*\* | 0.0391\*\*\* | 0.0644\*\* |
|  | (0.00892) | (0.0267) | (0.0128) | (0.0333) |
| Nutrition | 0.0500 | 0.137\*\*\* | 0.124\*\*\* | -0.00576 |
|  | (0.0376) | (0.0451) | (0.0273) | (0.141) |
| Physical science | 0.103\*\*\* | 0.179\*\*\* | 0.0725\*\*\* | 0.0740\*\* |
|  | (0.00999) | (0.0305) | (0.0151) | (0.0411) |
| Economics | 0.112\*\*\* | 0.312\*\*\* | 0.271\*\*\* | 0.430\*\*\* |
|  | (0.0175) | (0.0334) | (0.0206) | (0.0508) |
| Political science | 0.00247 | 0.209\*\*\* | 0.166\*\*\* | 0.228\*\*\* |
|  | (0.0172) | (0.0320) | (0.0232) | (0.0441) |
| Psychology | -0.0730\*\*\* | -0.00746 | 0.0220 | 0.0588\*\* |
|  | (0.0110) | (0.0292) | (0.0171) | (0.0324) |
| Other social sciences[[7]](#footnote-7) | -0.0778\*\*\* | -0.00539 | -0.00914 | 0.0429 |
|  | (0.0161) | (0.0329) | (0.0257) | (0.0408) |
| Sociology | -0.107\*\*\* | 0.0457 | -0.00374 | 0.0902\*\* |
|  | (0.0142) | (0.0376) | (0.0225) | (0.0500) |
| Engineering | 0.225\*\*\* | 0.430\*\*\* | 0.112\*\*\* | 0.278\*\*\* |
|  | (0.00592) | (0.0253) | (0.00828) | (0.0306) |
| Health | 0.104\*\*\* | 0.232\*\*\* | 0.146\*\*\* | 0.163\*\*\* |
|  | (0.00832) | (0.0262) | (0.0126) | (0.0324) |
| Architecture | -0.0205 | 0.138\*\*\* | 0.0468 | 0.184\*\*\* |
|  | (0.0148) | (0.0386) | (0.0377) | (0.0547) |
| Business | 0.0417\*\*\* | 0.251\*\*\* | 0.126\*\*\* | 0.233\*\*\* |
|  | (0.00627) | (0.0271) | (0.00978) | (0.0314) |
| Philosophy | -0.277\*\*\* | -0.0725 | -0.107\*\* | 0.0954 |
|  | (0.0256) | (0.112) | (0.0427) | (0.0621) |
| Social work | -0.181\*\*\* | -0.118\*\* | -0.0994\*\*\* | -0.234\*\*\* |
|  | (0.0163) | (0.0481) | (0.0239) | (0.0487) |
| English | -0.0534\*\*\* | -0.0189 | 0.00868 | 0.0250 |
|  | (0.00894) | (0.0437) | (0.0211) | (0.0424) |
| Humanities | -0.00822 | 0.0648 | 0.0797\*\*\* | 0.0965\*\* |
|  | (0.0197) | (0.0421) | (0.0233) | (0.0490) |
| History | -0.0457\*\*\* | -0.00429 | 0.0290 | -0.0438 |
|  | (0.0130) | (0.0392) | (0.0236) | (0.100) |
| Art | -0.137\*\*\* | -0.00639 | -0.0515\*\*\* | 0.0226 |
|  | (0.0125) | (0.0419) | (0.0162) | (0.0461) |
| Communications | -0.0583\*\*\* | 0.105\*\*\* | 0.0699\*\* | 0.123\*\*\* |
|  | (0.0133) | (0.0319) | (0.0283) | (0.0387) |
| Criminal justice | -0.0960\*\*\* | 0.0299 | -0.0345 | 0.0895 |
|  | (0.0181) | (0.0472) | (0.0358) | (0.0827) |
| Pre-law/legal studies | -0.0674 | 0.0377 | 0.157\*\* | 0.136\*\* |
|  | (0.0433) | (0.0476) | (0.0902) | (0.0701) |
| Parks and recreation | -0.129\*\*\* | -0.0435 | -0.119\*\*\* | -0.150 |
|  | (0.0216) | (0.104) | (0.0268) | (0.157) |
| Public administration | 0.197\*\*\* | 0.0727 | 0.117\*\*\* | -0.0354 |
|  | (0.00787) | (0.0868) | (0.0127) | (0.0652) |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Other Variables: Gender, Class of worker, Race, Marital status, Citizenship status, Parent’s education, Age, Age2, and region*

*Note: Reference major: Education*

1. **Interpretation**

The results above indicate that an earnings premium may exist across some college majors. As other papers have found, majors related to technology, science, and business earn the best return, while education, sociology, philosophy, art, and history, on average are predicted to earn the lowest return.

In 1993, computer science majors earned significantly more relative to education majors. At the median, computer science majors were predicted to earn 21.8 percent more than education majors. In contrast, at the 90th percentile, computer science majors are predicted to earn 12.4 percent more than education majors. Those majoring in mathematics also earned significantly more than education majors, earning 18.7 and 11.4 percent more at the 50th and 90th percentiles respectively. Engineering majors experienced the largest earnings premium at the median, earning 25 percent more. Furthermore, economics majors were predicted to earn the highest return at the 90th percentile, projected to earn 31 percent more than education majors. Those majoring in physical science, public administration, business, and health also earned significantly more than education majors. On the other hand, agriculture, psychology, history, art, sociology, parks and recreation, and social work majors were predicted to earn significantly less than education majors at some levels of income. Parks and recreation majors were estimated to earn 13.7 percent and 12.6 percent less than education majors for the 50th and 90th percentiles respectively. Art majors had one of the lowest returns at the median, predicted to earn 14.7 percent less than those who majored in education. Furthermore, philosophy majors experienced the lowest return, earning 32 percent less at the median, and 11.3 percent less at the 90th percentile. While the signs generally remained the same for 2017 results, the magnitude across majors did change.

Computer science majors experienced a significant increase in earnings since 1993. At the median, computer science majors are predicted to earn 52.6 percent more than education majors. At the 90th percentile they are estimated to earn 37.6 percent more. This equates to a 34 percent and 26.2 percent increase respectively for the 50th and 90th percentiles since 1993. Mathematics was another major to experience a significant increase in earnings since the early 1990s. Those majoring in mathematics were predicted to earn 35.7 percent more at the median, which parallels to a 17 percent increase since 1993. Engineering, economics, health, and business majors were also estimated to earn significantly more than education majors. Engineering majors were estimated to earn 53.7 percent more at the median, a 28.5 percent increase since 1993. Furthermore, economics majors, which were predicted to earn 36.6 percent more at the 50th percentile and 53.7 more at the 90th, experienced an increase of 24.7 percent at the median, and a 22.6 percent increase at the 90th percentile relative to education majors since 1993.

Another component of this paper is to examine the earnings premium across genders. The unequivocal glass ceiling, the figurative barrier for career advancement, attempts to explain why an earnings gap prevails among males and females at higher income levels. In 1993, at the median, females were predicted to earn 13.4 percent less than males. In contrast, in 2017 females were predicted to earn 9 percent less than males. At the 90th percentile, in 1993, females were estimated to earn 15.3 less, while in 2017, females were predicted to earn 11.2 percent less than males. The decreasing gap in earnings at both the median and 90th percentile may be attributed to changes in gender expectations.

In 1993 15.7 percent of females in the sample majored in STEM, whereas in 2017, 25.3 percent of females majored in STEM. Furthermore, the percent of females majoring in commonly regarded female majors, such as education, decreased since the early 1990s. In 1993 20.8 percent of females in the sample majored in education, while in 2017, the percentage decreased to 10.4 percent. Similar trends occurred for other majors popular among females, such as English and humanities. The shift in females majoring in STEM may be an outgrowth of recently developed organizations geared to encourage females to pursue majors in science, technology, engineering, and math. Seven well-regarded organizations, such as the National Math and Science initiative, as well as Women in Engineering Proactive Network were developed to aid in lessening the gap among males and females majoring in STEM (Pittman 2020).

An increase in women holding higher ranking positions within corporations may help to explain the diminishing gap at higher income levels. In 1980, females did not hold any executive positions with Fortune 100 companies. However, by 2011 females accounted for 11 percent of executive positions. Furthermore, between 1997 and 2009 the portion of firms with female CEOs improved more than six-fold (Warner 2014). Choices regarding child-rearing may also explain the decrease at higher level incomes. Average maternal age has been steadily increasing for first-time mothers. In the early 1990s the average age for first-time mothers was 25.6 years, however, in 2016 the average age increased to 30.3 years for college graduates (Mathers 2009) (Miller 2018). Trends may indicate that females are focusing more on career advancement before beginning families.

1. **Conclusion**

Previous literature on the returns to college major have consistently demonstrated that an earnings premium exists among college majors. The above estimation concurs with previous findings. Those majoring in computer science, engineering, business, economics, health, and science are estimated to earn the best return, while those majoring in education, parks and recreation, art, philosophy history, and agriculture are predicted to earn the lowest return. Furthermore, the above results indicate that returns for some majors have increased over-time as demand for particular skills in the labor force have shifted over the past two and half decades. Computer science, engineering, physical science, economics, and business have experienced increases in earnings since 1993. Furthermore, data also indicates that there has been a decrease in the earnings gap among males and females. A shift in the percentage of females pursuing higher paying jobs under the STEM field may help to explain the decreasing gap. Additionally, an increase in the number of females holding higher ranking positions within firms may also help to explain the decrease. While this paper does yield noteworthy results, there are however some notable drawbacks to the research.

The survey data lacks information regarding parent’s socioeconomic status. Instead, mother’s and father’s education were proxied for socioeconomic status. Furthermore, the sample contained significantly more males, and there may have been a bias towards individuals majoring in the sciences. Moreover, some important controls were not consistent among datasets, and therefore were not utilized. Finally, two important additions to the research may be considered. One potential addition may be to evaluate the difference in returns to education relative to a student’s math and verbal Scholastic Aptitude Test (SAT) score within the same field of study. This would illustrate the importance of particular skill sets within certain majors, and how these skill sets subsequently predict relative success. Finally, it may be important to see how returns change due to economic devastation from the COVID-19 global pandemic. Researchers may see subsequent increases in earnings for those in health related fields, as well as a shift towards vocational degrees, as our nation enters uncharted territory.

References

Arcidiacono, P. (2004). Ability sorting and the returns to college major. *Journal of Econometrics*, *121*(1–2).

Autor, D. (2014). Skills, education, and the rise of earnings inequality among the “other 99 percent.” Science, 344(6186), 843–851. https://doi.org/10.1126/science.1251868

Beggs, J., Bathman, J., & Taylor, S. (2008). Distinguishing the Factors Influencing College Students’ Choice of Major. *College Student Journal*, *42*(2), 381–394.

Berman, J. (2018, May 12). Student debt just hit $1.5 trillion. Retrieved May 23, 2020, from https://www.marketwatch.com/story/student-debt-just-hit-15-trillion-2018-05-08

College Costs. (2017). Retrieved September 10, 2019, from https://nces.ed.gov/programs

College Costs and Median family income. (n.d.). Retrieved May 23, 2020, from https://linc.mit.edu/linc2013/presentations/LINC2013Sarma.pdf

Council for Advancement and Support of Education. (2019). Retrieved April 10, 2020, from https://www.case.org/system/files/media/file/2018%20VSE%20Research%20Brief.pdf

Daymonti, T., & Andrisani, P. (1984). Job Preferences, College Major, and the Gender Gap in Earnings. Journal of Human Resources, 19(3), 408–428. https://doi.org/10.2307/145875

Deng, Y., Hillygus, D. S., Reiter, J. P., Si, Y., & Zheng, S. (2013). Handling Attrition in Longitudinal Studies: The Case for Refreshment Samples. Statistical Science, 28(2), 238–256. https://doi.org/10.1214/13-sts414

Friedman, Z. (2019, September 10). Student Loans. Retrieved September 8, 2019, from https://www.forbes.com/sites/zackfriedman/2019/09/10/student-loans-consumers-crisis/#13757b6b224d

Hamermesh, D., & Donald, S. (2004). The Effect of College Curriculum on Earnings: Accounting for Non-Ignorable Non-Response Bias. *National Bureau of Economic Research*.

Hout, M. (2012). Social and Economic Returns to College Education in the United States. Annual Review of Sociology, 38(1), 379–400. https://doi.org/10.1146/annurev.soc.012809.102503

IPUMS Higher Ed. (2019, June 12). Retrieved July 31, 2020, from https://ipums.org/projects/ipums-higher-ed

Katchova. (2013, February 25). *Econometrics - Quantile Regression* [Video file]. Retrieved from https://www.youtube.com/watch?v=P9lMmEkXuBw

Kim, C. H., Tamborini, C., & Sakamoto, A. (2015). Field of Study in College and Lifetime Earnings in the United States. *Sociology of Education*, *88*(4), 320–339. https://doi.org/10.1177/0038040715602132

Matthews, T. (2009, August). Delayed Childbearing: More Women Are Having Their First Child Later in Life. Retrieved August 3, 2020, from https://www.cdc.gov/nchs/data/databriefs/db21.pdf

Miller, Q. (2018, August 4). The Age That Women Have Babies: How a Gap Divides America. Retrieved August 3, 2020, from https://www.nytimes.com/interactive/2018/08/04/upshot/up-birth-age-gap.html

Pittman, O. (2020, July 14). 7 Organizations That Promote Women in STEM - College Raptor. Retrieved August 1, 2020, from https://www.collegeraptor.com/find-colleges/articles/college-majors-minors/7-organizations-working-to-promote-women-in-stem/

Robst, J. (2006). Education and job match: The relatedness of college major and work. *Economics of Education Review*.

Rose, N. J., & Summerville, A. (2005). What We Regret Most... and Why. *Personality and Social Psychology Bulletin*, *31*(9), 1273–1285. https://doi.org/10.1177/0146167205274693

Rothstein, J., & Rouse, C. (2007). Constrained After College: Student Loans and Early Career Occupational Choices. *National Bureau of Economic Research*.

Santos Silva, J. M. C. (2015, September 10). Robust covariance estimation for quantile regression. Retrieved April 20, 2020, from https://www.stata.com/meeting/uk15/abstracts/materials/uk15\_santossilva.pdf

Trends in College Pricing. (2007). Retrieved May 20, 2020, from https://research.collegeboard.org/pdf/trends-college-pricing-2007-full-report.pdf

US Census Bureau. (2015, September 11). National Survey of College Graduates (NSCG). Retrieved June 30, 2020, from https://www.census.gov/programs-surveys/nscg.html#:%7E:text=public%20use%20files-,What%20is%20the%20NSCG%3F,agency%20of%20the%20U.S.%20government.&text=The%20survey%20data%20provides%20important,of%20the%20Nation’s%20college%20graduates.

Weeden, K. A. (2002). Why Do Some Occupations Pay More than Others? Social Closure and Earnings Inequality in the United States. American Journal of Sociology, 108(1), 55–101. https://doi.org/10.1086/344121

Wharton University of Pennsylvania. (2019, July 17). Income Share Agreements: A Solution to the Student Debt Crisis? Retrieved May 20, 2020, from https://publicpolicy.wharton.upenn.edu/live/news/3057-income-share-agreements-a-solution-to-the-student

Zafar, B. (2013). College Major Choice and the Gender Gap. Journal of Human Resources, 48(3), 545–595. https://doi.org/10.3368/jhr.48.3.545

Appendix

1993 additional explanatory variables: (OLS, 50th, 90th) Total Sample

|  |  |  |  |
| --- | --- | --- | --- |
|  | (OLS) | (.50) | (.90) |
| VARIABLES | Log income | Log income | Log income |
| Female | -0.141\*\*\* | -0.126\*\*\* | -0.143\*\*\* |
|  | (0.00397) | (0.00410) | (0.00675) |
| Age | 0.0158\*\*\* | 0.0161\*\*\* | 0.0336\*\*\* |
|  | (0.00184) | (0.00206) | (0.00316) |
| Age2 | -0.000216\*\*\* | -0.000222\*\*\* | -0.000353\*\*\* |
|  | (2.11e-05) | (2.44e-05) | (3.60e-05) |
| Native American | -0.0844\*\*\* | -0.0809\*\*\* | -0.0269 |
|  | (0.0175) | (0.0216) | (0.0181) |
| Hispanic | -0.0361\*\*\* | -0.0199\*\*\* | -0.0269\*\* |
|  | (0.00691) | (0.00624) | (0.0106) |
| Black | -0.103\*\*\* | -0.0982\*\*\* | -0.0953\*\*\* |
|  | (0.00591) | (0.00574) | (0.00820) |
| Asian | -0.0473\*\*\* | -0.0246\*\*\* | -0.0207\* |
|  | (0.00673) | (0.00689) | (0.0109) |
| Other race | -0.0192 | 0.00260 | 0.107 |
|  | (0.0822) | (0.0383) | (0.0710) |
| Educational Institution | -0.141\*\*\* | -0.161\*\*\* | -0.141\*\*\* |
|  | (0.00646) | (0.00599) | (0.00855) |
| Government | 0.0410\*\*\* | 0.0327\*\*\* | 0.191\*\*\* |
|  | (0.00486) | (0.00441) | (0.00635) |
| Widow | 0.00187 | 3.40e-05 | 0.00547 |
|  | (0.0187) | (0.0269) | (0.0287) |
| Separated | -0.0296\*\* | -0.0357\*\*\* | -0.0429\*\* |
|  | (0.0139) | (0.0124) | (0.0192) |
| Divorced | -0.0369\*\*\* | -0.0341\*\*\* | -0.0365\*\*\* |
|  | (0.00628) | (0.00678) | (0.0110) |
| Single | -0.0749\*\*\* | -0.0570\*\*\* | -0.0580\*\*\* |
|  | (0.00461) | (0.00441) | (0.00705) |
| Constant | -0.141\*\*\* | -0.126\*\*\* | -0.143\*\*\* |
|  | 9.990\*\*\* | 10.01\*\*\* | 9.910\*\*\* |
|  | (0.0376) | (0.0395) | (0.0625) |
| Observations |  |  |  |
| R-squared | 62,827 | 62,827 | 62,827 |
|  | 0.262 | 0.260 | 0.221 |

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note omitted groups: Gender: male, Class of worker: private, Race: white, Marital status: married*

1993 additional explanatory variables (Quantile) by gender

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | (.50 Male) | (.50 Female) | (.90 Male) | (.90 Female) |
| VARIABLES | Log income | Log income | Log income | Log income |
|  |  |  |  |  |
| Age | 0.0202\*\*\* | 0.0143\*\*\* | 0.0340\*\*\* | 0.0295\*\*\* |
|  | (0.00278) | (0.00316) | (0.00536) | (0.00421) |
| Age2 | -0.000256\*\*\* | -0.000201\*\*\* | -0.000346\*\*\* | -0.000316\*\*\* |
|  | (3.38e-05) | (3.67e-05) | (6.54e-05) | (4.82e-05) |
| Native American | -0.133\*\*\* | -0.0208 | -0.144\*\*\* | 0.0534 |
|  | (0.0340) | (0.0275) | (0.0468) | (0.0363) |
| Hispanic | -0.0377\*\*\* | 0.0189\*\* | -0.0525\*\*\* | -0.00316 |
|  | (0.00851) | (0.00922) | (0.0146) | (0.0155) |
| Black | -0.128\*\*\* | -0.0657\*\*\* | -0.137\*\*\* | -0.0657\*\*\* |
|  | (0.00805) | (0.00813) | (0.0129) | (0.0111) |
| Asian | -0.0476\*\*\* | 0.0154 | -0.0285\* | -0.0175 |
|  | (0.00942) | (0.0115) | (0.0168) | (0.0157) |
| Other race | 0.0312 | 0.0244 | 0.207\*\*\* | 0.0898\*\*\* |
|  | (0.0664) | (0.0589) | (0.0633) | (0.0297) |
| Educational Institution | -0.198\*\*\* | -0.0963\*\*\* | -0.165\*\*\* | -0.149\*\*\* |
|  | (0.00838) | (0.00975) | (0.0161) | (0.0119) |
| Government | 0.0543\*\*\* | -0.00654 | 0.226\*\*\* | 0.117\*\*\* |
|  | (0.00520) | (0.00842) | (0.00788) | (0.0112) |
| Widow | -0.0119 | 0.0236 | 0.0601 | -0.00530 |
|  | (0.0421) | (0.0306) | (0.113) | (0.0319) |
| Separated | -0.0379\*\* | -0.00553 | -0.0382 | -0.0183 |
|  | (0.0177) | (0.0224) | (0.0449) | (0.0356) |
| Divorced | -0.0553\*\*\* | 0.00608 | -0.0462\*\*\* | -0.0192 |
|  | (0.00910) | (0.00885) | (0.0136) | (0.0126) |
| Single | -0.0781\*\*\* | -0.0163\*\* | -0.0911\*\*\* | -0.0154 |
|  | (0.00579) | (0.00726) | (0.00925) | (0.0102) |
| Constant | 9.958\*\*\* | 9.821\*\*\* | 9.891\*\*\* | 9.890\*\*\* |
|  | (0.0522) | (0.0641) | (0.100) | (0.0853) |
|  |  |  |  |  |
| Observations | 39,735 | 23,092 | 39,735 | 23,092 |
| R-squared | 0.208 | 0.193 | 0.162 | 0.160 |

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note omitted groups: Gender: male, Class of worker: private, Race: white, Marital status: married*

2017 additional explanatory variables: (OLS, 50th, 90th) Total Sample

|  |  |  |  |
| --- | --- | --- | --- |
|  | (OLS) | (.50) | (.90) |
| VARIABLES | Log of income | Log of income | Log of income |
|  |  |  |  |
|  |  |  |  |
| Female | -0.116\*\*\* | -0.0882\*\*\* | -0.106\*\*\* |
|  | (0.00779) | (0.00807) | (0.0118) |
| Age | 0.0421\*\*\* | 0.0408\*\*\* | 0.0481\*\*\* |
|  | (0.00172) | (0.00165) | (0.00259) |
| Age2 | -0.000379\*\*\* | -0.000351\*\*\* | -0.000383\*\*\* |
|  | (1.99e-05) | (1.90e-05) | (3.04e-05) |
| Educational institution | -0.357\*\*\* | -0.333\*\*\* | -0.429\*\*\* |
|  | (0.0115) | (0.0130) | (0.0163) |
| Government | -0.0409\*\*\* | -0.0428\*\*\* | -0.185\*\*\* |
|  | (0.0104) | (0.00918) | (0.0129) |
| Asian | -0.00847 | 0.0156 | 0.0235 |
|  | (0.0115) | (0.0121) | (0.0179) |
| American Indian | -0.0801\*\* | -0.0820 | -0.0756 |
|  | (0.0398) | (0.0545) | (0.0695) |
| Black | -0.110\*\*\* | -0.127\*\*\* | -0.0729\*\*\* |
|  | (0.0131) | (0.0155) | (0.0167) |
| Hawaiian | -0.0725 | -0.0665\* | -0.0959 |
|  | (0.0442) | (0.0356) | (0.0767) |
| Multi-race | -0.0507\*\*\* | -0.0422\*\* | -0.0345 |
|  | (0.0181) | (0.0172) | (0.0230) |
| Marriage-like | -0.0850\*\*\* | -0.0593\*\*\* | -0.0869\*\*\* |
|  | (0.0145) | (0.0136) | (0.0179) |
| Widow | -0.104\*\*\* | -0.103\*\* | -0.116\*\* |
|  | (0.0405) | (0.0463) | (0.0491) |
| Separated | -0.177\*\*\* | -0.119 | -0.101\* |
|  | (0.0379) | (0.114) | (0.0607) |
| Divorced | -0.0905\*\*\* | -0.0690\*\*\* | -0.128\*\*\* |
|  | (0.0146) | (0.0149) | (0.0174) |
| Constant | 9.218\*\*\* | 9.316\*\*\* | 9.503\*\*\* |
|  | (0.0499) | (0.0526) | (0.0759) |
| Observations |  |  |  |
|  R-squared | 26,483 | 26,483 | 26,483 |
|  | 0.290 | 0.287 | 0.262 |
|  |  |  |  |
|  |  |  |  |

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note omitted groups: Gender: male, Class of worker: private, Race: white, marital status: married*

2017 additional explanatory variables (Quantile) by gender

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | (.50 Male) | (.50 Female) | (.90 Male) | (.90 Female) |
| VARIABLES | Log income | Log income | Log income | Log income |
|  |  |  |  |  |
|  |  |  |  |  |
| Age | 0.0401\*\*\* | 0.0397\*\*\* | 0.0476\*\*\* | 0.0463\*\*\* |
|  | (0.00204) | (0.00281) | (0.00336) | (0.00435) |
| Age2 | -0.000337\*\*\* | -0.000354\*\*\* | -0.000369\*\*\* | -0.000375\*\*\* |
|  | (2.40e-05) | (3.28e-05) | (3.79e-05) | (5.16e-05) |
| Educational institution | -0.390\*\*\* | -0.292\*\*\* | -0.480\*\*\* | -0.371\*\*\* |
|  | (0.0211) | (0.0169) | (0.0261) | (0.0206) |
| Government | -0.0754\*\*\* | 0.0213 | -0.229\*\*\* | -0.0912\*\*\* |
|  | (0.0110) | (0.0158) | (0.0157) | (0.0213) |
| Asian | -0.00471 | 0.0449\*\* | 0.0157 | 0.0309 |
|  | (0.0154) | (0.0195) | (0.0251) | (0.0270) |
| American Indian | -0.135\*\*\* | -0.000741 | -0.178\*\*\* | -0.0417 |
|  | (0.0433) | (0.0755) | (0.0609) | (0.0385) |
| Black | -0.149\*\*\* | -0.0821\*\*\* | -0.110\*\*\* | -0.0528\*\* |
|  | (0.0170) | (0.0223) | (0.0300) | (0.0257) |
| Hawaiian | -0.0790\*\* | -0.0376 | -0.115\* | -0.0396 |
|  | (0.0375) | (0.0825) | (0.0671) | (0.0633) |
| Multi-race | -0.0260 | -0.0485\* | -0.0362 | -0.0495 |
|  | (0.0315) | (0.0248) | (0.0299) | (0.0384) |
| Marriage-like | -0.0914\*\*\* | -0.0282 | -0.0956\*\*\* | -0.0327 |
|  | (0.0166) | (0.0193) | (0.0283) | (0.0248) |
| Widow | -0.0620 | -0.110 | -0.104\* | -0.0693 |
|  | (0.109) | (0.0708) | (0.0575) | (0.0525) |
| Separated | -0.0582 | -0.179 | -0.0963 | -0.106\*\* |
|  | (0.0927) | (0.119) | (0.0739) | (0.0497) |
| Divorced | -0.0978\*\*\* | -0.0178 | -0.156\*\*\* | -0.0882\*\*\* |
|  | (0.0220) | (0.0202) | (0.0280) | (0.0292) |
| Single | -0.159\*\*\* | -0.103\*\*\* | -0.151\*\*\* | -0.0803\*\*\* |
|  | (0.0112) | (0.0144) | (0.0177) | (0.0206) |
| Constant | 9.429\*\*\* | 9.155\*\*\* | 9.491\*\*\* | 9.381\*\*\* |
|  | (0.0677) | (0.0833) | (0.111) | (0.111) |
| Observations |  |  |  |  |
|  R-squared | 16,132 | 10,351 | 16,132 | 10,351 |
|  | 0.249 | 0.230 | 0.215 | 0.215 |
|  |  |  |  |  |
|  |  |  |  |  |

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note omitted groups: Class of worker: private, Race: white, marital status: married*

1. All incomes are reported in 2016 dollars [↑](#footnote-ref-1)
2. [↑](#footnote-ref-2)
3. Additional explanatory variables included in appendix [↑](#footnote-ref-3)
4. [↑](#footnote-ref-4)
5. Other social sciences include: anthropology, criminology, ethnic studies, linguistics, and geography [↑](#footnote-ref-5)
6. Other social sciences include: anthropology, criminology, ethnic studies, linguistics, and geography [↑](#footnote-ref-6)
7. Other social sciences include: anthropology, criminology, ethnic studies, linguistics, and geography [↑](#footnote-ref-7)