The Effect of College Major on Starting Salary

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Abstract

Of the factors that affect an individual's salary, college major is one of the most conspicuous, as well as one of the most controllable. It is established that different degrees result in different average salaries, but this study delves further to determine the magnitude of the effect, as well as which other factors play significant roles. Using data regarding starting salary of recent graduates from The College of New Jersey, the effects of control variables, college major, and explanatory variables are studied. The results indicate that college major plays the largest role, and that individual institutions may specialize in a particular degree which does not follow the established rankings and averages. Those with Arts and Communications degrees received the lowest salary, while those with Nursing degrees obtained the highest, on average 20% greater than Arts and Communications graduates. College GPA and internship experience are the two explanatory variables with statistically significant effects, while standardized test scores (SAT/ACT) and adding a minor or additional major had no discernable effect. A one-point increase in GPA increased starting salary by 3% and those who participated in internships earned 4.5% more than those who did not.

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Research Question and Motivation

There are many determinants to salary. However, many are fixed or innate with no way to reasonably vary or affect them. One that does stand out as variable is college major. This single choice can often determine one's future career path for years to come. In fact, many people select their major based on potential earning power. Articles citing the top earning majors are regularly published because of their popularity. But how many of these studies or statistics are truly scientific? How much can future monetary success be affected by major choice?

In this paper, major choice is separated from other variables to determine the actual amount of influence it exerts. Studies can easily cite that chemical engineers make more money than education majors. But is this completely due to the choice of major? Perhaps fewer people have the capability to become chemical engineers, but those that do could make a high salary with any major. By evaluating other explanatory variables, the amount of influence that college major exerts was isolated. This allows the determination of which of those explanatory variables have significant effects themselves, and whether their effects differ depending on major. For example, does a high GPA increase the future earnings of a physicist while a marketing major's future success is much more decoupled from their GPA?

Literature Review

There have been numerous studies and journal articles written that have included some analysis of the link between college major and salary. Many are primarily focused on other determinants of salary but end up including college major in their model. Gerhart (1990) studied the difference between male and female wages. However, he also controlled for 65 different college majors using dummy variables. His conclusion was that a significant part of the wage

gap between men and women was due to their unequal distribution across majors. Male dominated majors like engineering and business earn more money than female dominated majors such as education.

In 2010, Gilbreath ran a study that included both gender and college major variables in order to determine lost income from delays in completing a degree. He compared the 1998 and 2008 salaries of men and women who had completed a variety of different degrees. Results showed that gender did make a fairly significant difference to salary (but not salary growth) with males earning an average of $52,000 while females only earned $46,000 (p. 131). However, the difference between majors was even more pronounced. In 2008, petroleum engineering majors were earning over $80,000 and had seen 4.69% growth over the past decade, while elementary education majors were only earning $34,000 with 3.08% growth (129-130). While these two majors are standouts, there is also a general trend that becomes apparent. Engineering and science majors make the most money, while humanities and education majors make the least. Business, computer science, and certain health sciences end up in the middle.

These results were not a great shock. This hierarchy of majors had already been established numerous times. In 1988, Berger sought to discover if cohort size of the graduating class affected salary outcomes in any way. He not only confirmed that engineering and business majors made more in general, but that they were also less negatively affected by a large cohort. This is in contrast to liberal arts graduates and even some science graduates. They saw their pay fall with larger class sizes. He posited that this difference was due to the complementary nature of the types of jobs for which these liberal arts and science majors would be qualified. Additionally, these two categories of majors saw increased human capital investments with

larger cohorts. These graduates felt the need to continue their education further in order to stand out.

While college major is extremely important to future salary, it is certainly not the only determinant. A 2016 study by John Nunley found that for business positions, internship experience makes a larger difference than major choice. Choice of major can indicate to an employer one's competence or area of expertise to some degree, but proven internship experience is much more reliable. He showed that it was not necessarily experience gained in these internships that created the extra value but was instead the "signaling" to employers of the individual's competence. Obtaining and completing an internship can set someone apart from those who don't, especially now that bachelor's degrees are less distinguishing and more prolific.

Thomas Scott performed two studies (2000 & 2005) comparing two other variables alongside major, academic performance and college quality. His first study found that all three made a difference, but college major and academic performance had a larger effect than college quality. Engineering majors had the highest initial salaries and business majors had slightly lower salaries but also lower debt/salary ratios. He also controlled for demographic information and found that gender was significant (females earning less), while race was not significant. His study in 2005 confirmed his previous findings but sought to examine wage growth instead of simply starting wage. In this case, he found that college quality started to become more significant, especially for the already higher earning majors (business, engineering, and math).

These repeated results beg the question of why students do not overwhelmingly flock to the higher paying majors. Thorson (2010) offers a simple explanation that there is a positive correlation between specificity of major and starting salary. The tradeoff is that this specificity means less career path flexibility. Some students are willing to accept a lower salary

for this ability to switch careers. Arcidiacono (2004) sought to determine whether it was the actual choice of major that resulted in a higher salary or whether one's ability to complete those more difficult degrees was the main reason for the increased earnings. He found that student abilities do have some effect, but that simply choosing a business or science major results in a monetary bonus even after controlling for selection. Kinsler (2015) created a model to study a similar issue. He concluded that one only receives the benefit of these higher paying majors if one works in a related field post-graduation. Because people are uncertain about their career path or future abilities, they do not automatically choose the most lucrative major.

Hypothesis and Methodology

To accurately determine the real effect of major choice on salary, regressions testing all the variables included in the data were run to determine which variables have statistically significant effects. Inflation was controlled using the CPI and New Jersey's unemployment rate was included to control for any differences caused by the job market or business cycle. Other control variables included demographics such as gender and ethnicity, as well as current employment status and current graduate school attendance. The variables of GPA, SAT score, and ACT score were used to test ability effects. Internship experience was also examined in light of Nunley's findings. It was also examined whether the effect of these three variables changed across different majors. Finally, whether a student had acquired any minors or second majors was included in many of the models.

A full list of the variables and predicted effects is below. In general, major choice was expected to make the largest difference on starting salary. From highest to lowest salary: engineering majors, business majors, nursing majors, education majors, and lastly humanities

majors. Compared to most of the results in the literature review, the position of education and humanities majors has been exchanged. This is due to The College of New Jersey's (TCNJ) highly recognized education program. The other variables with the most expected significance are GPA and internship experience.

Data

Data are strictly from TCNJ. This focus on a single institution allowed access to a larger variety of variables. This provided the opportunity to create as accurate a model as possible in order to isolate the effect of major choice. The majority of the pre-graduation data was provided by TCNJ's Center for Institutional Effectiveness. TCNJ's Career Center provided the post-graduation data, which they have obtained from their survey sent out to alumni one year post graduation.

The data used encompass all students who responded to the survey from 2014-2017. Only full-time students, and those who answered all the relevant questions on their survey were included. Quantifiable variables used the log form because relative changes to salary, test scores, and other variables are more relevant than absolute changes. Qualitative variables such as major and minor were transformed into dummy variables. Below are all the variables that were collected and tested as well as the hypothesized effect they will have on salary.

Initially, there were three other variables included in the list, but these were removed. Whether the individual was currently seeking new employment, regardless of current employment status was determined to not be appropriate for the model. This was because it was most likely a response variable to salary instead of an explanatory variable. The variables of job search length and job offers were also removed. They also could not be considered explanatory

or control variables. They were most likely correlated with starting salary, but the variables that drove starting salary would also drive these, therefore they were removed.

Variable name or category	Description	Expected effect
Salary	Self-reported salary one year after graduation (log)	(Dependent variable)
Freshman Cohort	Semester of initial enrollment	Used to track students. Different cohorts will not have predictably different salaries once unemployment has been accounted for
Graduation Major(s)	Degrees received at graduation	Those with double majors will make more money. In general: STEM>Business>Nursing>Education>Humanities>Arts
Graduation Minor(s)	Minors at graduation	Graduating with a minor will have a positive impact on starting salary
Standardized Test Scores	Higher of SAT/ACT. Math/Verbal/Composite. Converted into percentiles and logged.	Expected positive correlation between test scores & salary. Math score will be more powerful than verbal.
GPA	Overall GPA at graduation (log)	Having a higher GPA will positively impact salary
Gender	Control for gender	Expected slightly higher wages for males

Ethnicity	Control for ethnicity	No predicted effect
Internship	Whether the student participated in any internships, and for how many total semesters	Participating in an internship as well as total number of internships will be positively correlated with salary.
Part-time worker	Whether the individual is only working part time	Used as a control. Predicted that those only working part time will have a lower salary.
Graduate School	Whether they are attending or planning to attend grad school	Predicted that those who are attending while working full time will make more than those not attending. Those planning to attend graduate school will make more money.

Results

An initial OLS regression with all the above variables was run. This shed some light regarding which variables would end up being significant but had serious issues with both heteroskedasticity and collinearity. Therefore, a robust regression was run to solve the issue of heteroskedasticity. The results of the regression, heteroskedasticity test, and robust regression can be found in Appendix A.

Moving forward, numerous regressions were run with different variables included and excluded to determine which sets of variables were causing collinearity and among those, which should be removed, and which should be included in the final model. Those that ended up removed were composite test score (ACT/SAT), number of internships, second minor, and individual second major variables. This left math and verbal test scores, and simple binary variables for whether the student had completed an internship, obtained any minors, or obtained

more than one major. The variables that remained still exhibited heteroskedasticity when an OLS regression was run. Therefore, a robust regression was again run. (Results in Appendix B)

As far as majors were concerned, most were significant. The only two graduating major categories that did not make the cut were humanities / social sciences, and health and exercise science majors. That was most likely due to smaller sample sizes and not being significantly different than the omitted major, arts and communications. There are relatively few health and exercise science majors, and humanities majors seem to have similar starting salaries to the arts and communication majors. The other majors behaved slightly differently than predicted. The highest earners were actually nursing majors, earning over 20% more than the baseline of arts and communication majors. Next up were engineers and business professionals (accounting, finance, economics), who made 16% - 17% above the baseline. General business majors earned 8% above the baseline. As predicted, education majors graduating from TCNJ perform higher than expectations by earning 7%, 9%, and 13% above the baseline for education, secondary humanities education, and secondary STEM education majors respectively. Surprisingly, science majors earned only 6% above the baseline.

Some of the notable omissions from the list of significant variables were the variables regarding pre-college test scores, second majors, and minors. Getting higher SAT or ACT scores will help you get into a better college. But once you are there, they no longer seem to differentiate you from your fellow classmates. Additionally, graduation with additional majors or minors had no effect on starting salary. Instead, your performance in college, measured by GPA, is much more important. An increase from a 3.0 to 4.0 GPA resulted in a 3% increase in starting salary. Further, this effect was consistent across majors, interaction terms between GPA and

individual majors were not significant. Finally, internships also proved significant. Participating in at least one earned you an additional 4-5% in starting salary.

Conclusion

The goal of this paper was to isolate the effect college major has on salary. Additional goals were to determine which other factors played significant roles, and how TCNJ might differ from other institutions. The main result is the confirmation that college major does exert the largest influence over starting salary. While TCNJ has some unique results as to how the majors are ranked, it is not unique in the fact that the degree with which you graduate has the largest effect on your starting salary.

For other factors that do affect starting salary, it was surprising that adding additional majors or minors does not appear to help future prospects. Instead, students may benefit more from focusing on higher grades or obtaining internships, rather than tacking on another major or minor. Similarly, higher pre-college test scores mean little once you have made it into a particular institution.

This study has yielded interesting results but there are many further avenues to explore. The focus on a single school allowed for testing of more detailed explanatory variables. Therefore, it would be interesting to run similar regressions with other institutions to see if these results held true for other universities. It would also be interesting to see if other colleges often differed from the typical major hierarchy due to specializations or a particular school's reputation. Additionally, it would be enlightening to study more nuanced dependent variables such as salary growth, instead of simply starting salary. Careers and salaries in different fields certainly grow at different rates as well as having different baselines. It would be a useful study

to see if salary growth was similarly tied to major, with only several other explanatory variables, or if perhaps college major is most important for starting salary but does not as strongly affect salary growth.

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Appendices

Appendix A

OLS regression, all variables:

Source	SS	df	MS		
Model	14.6216879	38	.38478126	Number of obs	= 874
Residual	13.3994993	835	.016047305	F(38, 835)	= 23.98
				Prob > F	= 0.0000
Total	28.0211871	873	.03209758	R-squared	= 0.5218
				Adj R-squared	= 0.5000
				Root MSE	= .12668

l_salary	Coef.	Std. Err.	t	P>|t|
fresh_coh_10	.0273141	.0271411	1.01	0.315
fresh_coh_11	.0520132	.0271077	1.92	0.055
fresh_coh_12	.050462	.0279523	1.81	0.071
l_fresh_age	-.4557119	.5293302	-0.86	0.390
sum_adm	-.0079344	.0240101	-0.33	0.741
l_mat_per	.0764741	.1056269	0.72	0.469
l_sat_verb	.0233527	.0843421	0.28	0.782
l_comp_per	-.0461242	.1189609	-0.39	0.698
gender	-.0250753	.0100132	-2.50	0.012
hispanic	.003191	.0160052	0.20	0.842
asian	-.036518	.0169623	-2.15	0.032
afr_amer	-.0167988	.0266246	-0.63	0.528
other	.036087	.0307456	1.17	0.241
l_fir_term_gpa	-.1321956	.100149	-1.32	0.187
bus_pro_deg	.1499724	.018706	8.02	0.000
bus_gen_deg	.0718594	.0205614	3.49	0.000
hum_ssc_deg	-.0290311	.018434	-1.57	0.116
educ_deg	.0537664	.0233045	2.31	0.021
seced_hum_deg	.0773715	.0249245	3.10	0.002
seced_stem_deg	.1227586	.0327134	3.75	0.000
eng_deg	.1517719	.0219283	6.92	0.000
nurs_deg	.1935865	.0252217	7.68	0.000
hes_pe_deg	.012747	.0325599	0.39	0.696
sci_deg	.0496415	.0207601	2.39	0.017
sec_maj	.1271985	.0751688	1.69	0.091
sec_art_com	-.1855008	.0845555	-2.19	0.029
sec_bus_pro	-.1859043	.0976022	-1.90	0.057
sec_bus_gen	-.0102132	.097397	-0.10	0.917
sec_hum_ss	-.1383519	.0789325	-1.75	0.080
sec_sci	-.2751617	.1058648	-2.60	0.010
minor	-.0060036	.0105782	-0.57	0.570
sec_minor	.019009	.0170813	1.11	0.266
l_gpa	.3955061	.1428602	2.77	0.006
internships	.010275	.005403	1.90	0.058
intern_bin	.0117612	.0147483	0.80	0.425
part_time	-.2318418	.0163896	-14.15	0.000
plan_grad	.0074138	.0100842	0.74	0.462
in_grad	-.0946298	.0150874	-6.27	0.000
_cons	4.876395	.6824888	7.15	0.000

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of l_salary

         chi2(1)      =     9.42
         Prob > chi2  =   0.0021
```

Robust Regression, all variables:

Linear regression

Number of obs	= 874
F(38, 835)	= 42.51
Prob > F	= 0.0000
R-squared	= 0.5218
Root MSE	= .12668

l_salary	Coef.	Robust Std. Err.	t	P>|t|
fresh_coh_10	.0273141	.0322824	0.85	0.398
fresh_coh_11	.0520132	.032436	1.60	0.109
fresh_coh_12	.050462	.0329387	1.53	0.126
l_fresh_age	-.4557119	.5175544	-0.88	0.379
sum_adm	-.0079344	.0200967	-0.39	0.693
l_mat_per	.0764741	.1107087	0.69	0.490
l_sat_verb	.0233527	.0865808	0.27	0.787
l_comp_per	-.0461242	.1278558	-0.36	0.718
gender	-.0250753	.0099434	-2.52	0.012
hispanic	.003191	.0157026	0.20	0.839
asian	-.036518	.0213675	-1.71	0.088
afr_amer	-.0167988	.0243019	-0.69	0.490
other	.036087	.0236581	1.53	0.128
l_fir_term_gpa	-.1321956	.1037526	-1.27	0.203
bus_pro_deg	.1499724	.0176231	8.51	0.000
bus_gen_deg	.0718594	.0205795	3.49	0.001
hum_ssc_deg	-.0290311	.0194367	-1.49	0.136
educ_deg	.0537664	.0247326	2.17	0.030
seced_hum_deg	.0773715	.0217637	3.56	0.000
seced_stem_deg	.1227586	.0233268	5.26	0.000
eng_deg	.1517719	.0227327	6.68	0.000
nurs_deg	.1935865	.0214401	9.03	0.000
hes_pe_deg	.012747	.0365331	0.35	0.727
sci_deg	.0496415	.0245453	2.02	0.043
sec_maj	.1271985	.0587409	2.17	0.031
sec_art_com	-.1855008	.0743181	-2.50	0.013
sec_bus_pro	-.1859043	.1108626	-1.68	0.094
sec_bus_gen	-.0102132	.1030046	-0.10	0.921
sec_hum_ss	-.1383519	.0621158	-2.23	0.026
sec_sci	-.2751617	.0653065	-4.21	0.000
minor	-.0060036	.0108643	-0.55	0.581
sec_minor	.019009	.0186826	1.02	0.309
l_gpa	.3955061	.1534362	2.58	0.010
internships	.010275	.0053478	1.92	0.055
intern_bin	.0117612	.014969	0.79	0.432
part_time	-.2318418	.0154593	-15.00	0.000
plan_grad	.0074138	.0099751	0.74	0.458
in_grad	-.0946298	.0175488	-5.39	0.000
_cons	4.876395	.6710562	7.27	0.000

Appendix B

Final Model (OLS):

l_salary	Coef.	Std. Err.	t	P>|t|
fresh_coh_11	.01875	.0089639	2.09	0.037
gender	-.0226949	.0095363	-2.38	0.018
asian	-.0316825	.0163682	-1.94	0.053
bus_pro_deg	.1615508	.0137244	11.77	0.000
bus_gen_deg	.0849135	.0162044	5.24	0.000
educ_deg	.0664331	.0172182	3.86	0.000
seced_hum_deg	.090027	.0202439	4.45	0.000
seced_stem_deg	.1370754	.028199	4.86	0.000
eng_deg	.1728588	.015968	10.83	0.000
nurs_deg	.2248703	.0193605	11.61	0.000
sci_deg	.057768	.015327	3.77	0.000
l_gpa	.3087086	.1005584	3.07	0.002
internships	.0140663	.0034613	4.06	0.000
part_time	-.2385305	.0156236	-15.27	0.000
in_grad	-.105889	.0130503	-8.11	0.000
_cons	4.407617	.0549877	80.16	0.000

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of l_salary

         chi2(1)      =     8.58
         Prob > chi2  =   0.0034
```

Final Model (robust):

Linear regression

Number of obs	=	920
F(15, 904)	=	91.33
Prob > F	=	0.0000
R-squared	=	0.5030
Root MSE	=	.12759

l_salary	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
fresh_coh_11	.01875	.0091594	2.05	0.041	.0007738	.0367261
gender	-.0226949	.009638	-2.35	0.019	-.0416104	-.0037794
asian	-.0316825	.0202428	-1.57	0.118	-.0714109	.0080459
bus_pro_deg	.1615508	.01322	12.22	0.000	.1356053	.1874963
bus_gen_deg	.0849135	.0159856	5.31	0.000	.0535403	.1162866
educ_deg	.0664331	.018911	3.51	0.000	.0293185	.1035477
seced_hum_deg	.090027	.0168273	5.35	0.000	.0570018	.1230521
seced_stem_deg	.1370754	.0156492	8.76	0.000	.1063625	.1677883
eng_deg	.1728588	.0164148	10.53	0.000	.1406432	.2050744
nurs_deg	.2248703	.0150513	14.94	0.000	.1953309	.2544098
sci_deg	.057768	.018591	3.11	0.002	.0212814	.0942546
l_gpa	.3087086	.1045627	2.95	0.003	.1034947	.5139226
internships	.0140663	.0035718	3.94	0.000	.0070563	.0210763
part_time	-.2385305	.014504	-16.45	0.000	-.266996	-.210065
in_grad	-.105889	.015466	-6.85	0.000	-.1362424	-.0755355
_cons	4.407617	.0582626	75.65	0.000	4.293271	4.521963