

Salaries of Graduates

Office of Institutional Assessment and Research

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Abstract

This internal report models the salaries of Furman University ten years after graduation to try to account for an apparent lag behind peer institutions. Explanatory variables are parental family incomes, types of major programs offered and concomitant average earnings of those, and geographic location.

Introduction

The motivation for this study comes from an article in the *New York Times* [3] based on research from The Equality of Opportunity Project [2], which links the salaries of college graduates ten years after graduation to the income of their parents. The intent of that research was to understand the economic mobility provided by a college degree. The purpose of this paper is to see how much of that difference we can explain, using three explanatory variables.

Because of the varying missions of colleges and resulting mix of degree disciplines, some variation in salaries can be ascribed to this distribution. For example, an engineering school and a music school would be expected to have different salary profiles because of the earning potentials of related occupations. Another *New York Times* article [4] links to a data set [5] that we can use for this purpose. This requires downloading completions data from IPEDS [6] and creating weighted averages for each institution by multiplying the number of graduates in a field by the median lifetime earnings associated with that major. This is necessarily approximate because of the limited number of majors that data were provided for. In all, 28 different categories like ENGINEERING and PHILOSOPHY AND RELIGIOUS STUDIES were linked to median earnings. The weighted average was calculated for each institution, resulting in a coverage of 92% of graduates across all institutions. The missing degree types were omitted from the weighted average.

Finally, the economic influence of the location where graduates find employment probably has an impact. We do not know where graduates settle, but we make the assumption that a significant fraction stay in the U.S. state where their *alma mater* is located. Median family incomes are taken as a proxy for salary variance, and the data came from The U.S. Census Bureau [7].

In making comparisons to other institutions, we have four levels of association. The broadest useful category includes all institutions that grant four-year degrees, since our focus is on undergraduates. Next is the IPEDS **Art and Sciences** designation, which associates with a liberal arts mission. We further refine that to a list of IPEDS peer institutions that we use for comparing faculty salaries. A list of these appears later in this report. Finally, of course, our institution itself as a category of one.

Analysis

Throughout the report we will use the following variable names.

- *StudentInc* is the average graduate's salary ten years after graduation.
- *ParentInc* is the average parental family income of students.
- *InstEarnings* is the weighted averages of predicted earnings based on the mix of majors offered at an institution.
- *StateInc* is the median family income of the state in which an institution resides.

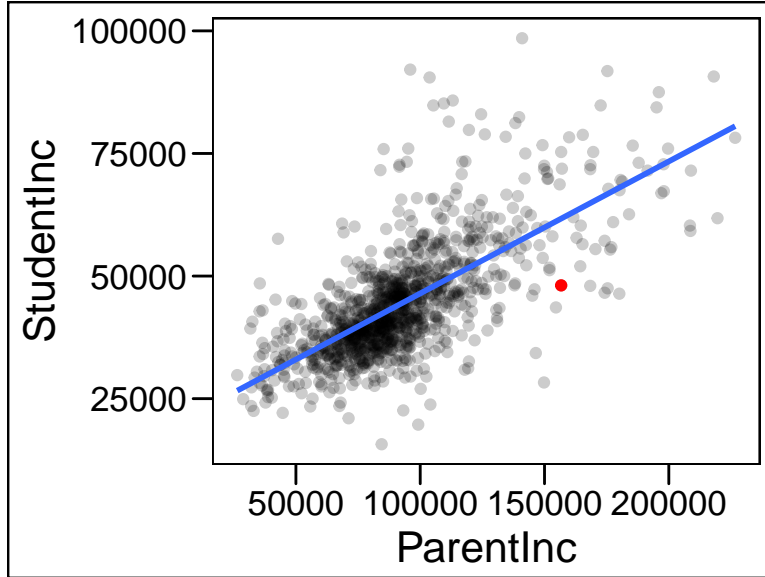


Figure 1: Parent and Student Income

Graduate Income Predicted by Parent Income

The first thing we do is to replicate the graph in the New York Times article, to make sure we have the right data and are using it correctly.

The scatterplot shows all undergraduate institutions with Furman University marked in red and a linear regression trend line added. The linear model ($R^2 = 0.48$) uses standardized coefficients (meaning means are subtracted and the results divided by the standard deviation), so that the intercept is zero and hence omitted.

	Estimate	Std. Error	t value	Pr(> t)
scale(ParentInc)	0.69	0.02	31.43	0.00

Table 1: $StudentInc \sim ParentInc$

This result strongly resembles the original in the New York Times article. The model coefficient tells that that for every standard deviation of parental income, a student benefits by about 0.69 standard deviations of income, ten years after graduation. The scatterplot shows Furman University below the trend line with a residual of \$-13617 dollars of annual salary that we will now try to account for.

The Effect of Institutional Type

Next we include the weighted average of median lifetime earnings using the list of 2006 graduates and their major programs from IPEDS. This results in a single estimate for each institution that we incorporate into the model. Due to the nature of averages we would expect that these estimates would be normally distributed.

The figure shows that the distribution of estimated lifetime earnings based on the discipline studied is mound-shaped, but has fatter tails than a normal distribution. This is because some institutions have a very focused mission, so that they produce a restricted range of majors. Furman University is marked as a red dot for comparison.

The next model considers only the effect of the estimated earnings from institutional degree mixes, to see if this explanatory variable actually explains anything. It turns out to be useful ($R^2 = 0.17$).

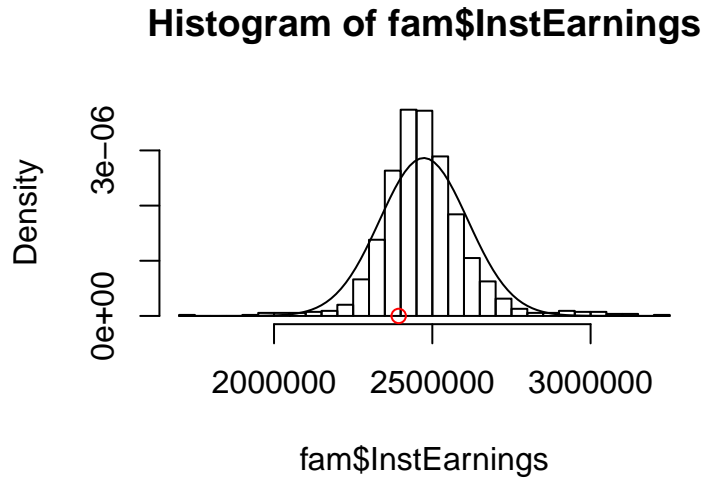
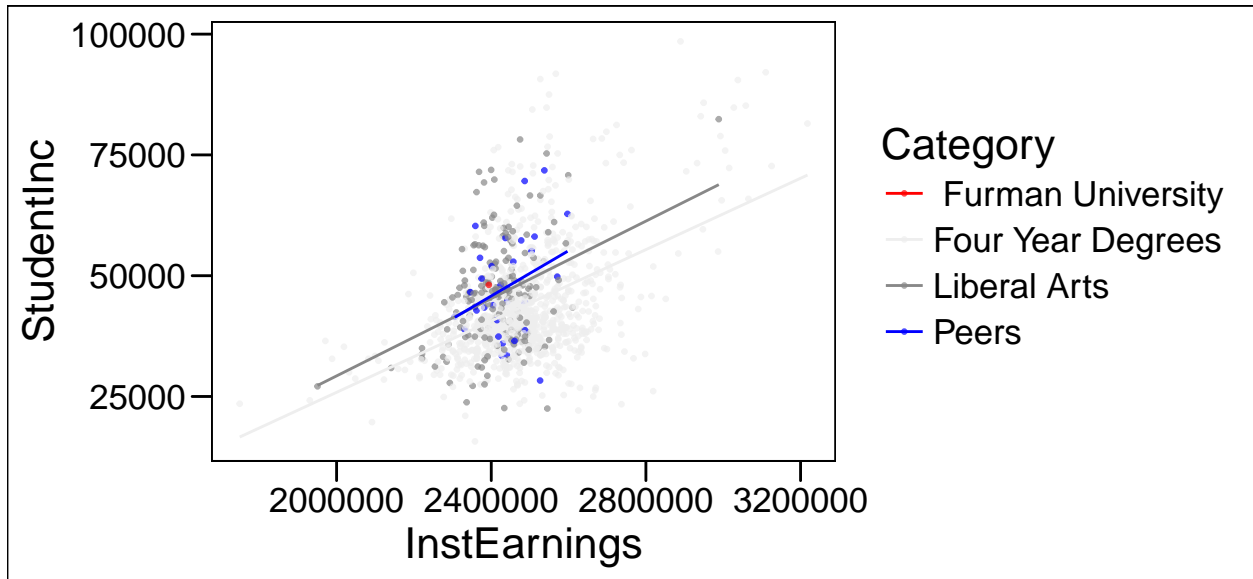


Figure 2: Estimated Earnings by Four-Year College

	Estimate	Std. Error	t value	Pr(> t)
scale(InstEarnings)	0.42	0.03	15.19	0.00

Table 2: $StudentInc \sim InstEarnings$



The correlation of estimated *InstEarnings* by institution with the *ParentInc* variable is very close to zero ($r = -0.0018$), meaning the two variables are independent and will have cumulative effect on explaining the output variable *StudentInc* when combined in the same model.

A Combined Model

In order to move things along, the next model includes all three explanatory variables. Recall that the third one is the median family income of the home state of the institution. Its effect on the outcome depends on

	Name	ParentInc	InstEarnings	StateInc	StudentInc
1	Bucknell University	-4%	6%	12%	49%
2	University Of Richmond	15%	4%	22%	45%
3	Citadel, The Military College Of South Carolina	-32%	8%	0%	31%
4	Davidson College	33%	-1%	-1%	25%
5	Trinity University	-2%	5%	7%	21%
6	Franklin & Marshall College	4%	2%	12%	20%
7	Butler University	-22%	3%	3%	19%
8	Wofford College	-15%	5%	0%	15%
9	Denison University	-5%	-1%	-1%	12%
10	Susquehanna University	-28%	3%	12%	10%
11	Rhodes College	5%	0%	-6%	8%
12	Morehouse College	-48%	7%	-1%	4%
13	Centre College Of Kentucky	-29%	-1%	-17%	3%
14	Birmingham Southern College	-12%	1%	-13%	0%
15	Furman University	0%	0%	0%	0%
16	Elon University	-7%	2%	-1%	-2%
17	University Of The South	11%	-2%	-6%	-3%
18	Millsaps College	-29%	2%	-24%	-7%
19	Stetson University	-37%	4%	-6%	-7%
20	Presbyterian College	-25%	0%	0%	-9%
21	Berry College	-34%	0%	-1%	-10%
22	Rollins College	-23%	-1%	-6%	-11%
23	Wheaton College of Wheaton, IL	-16%	-4%	13%	-14%
24	Samford University	-16%	1%	-13%	-15%
25	Agnes Scott College	-38%	-3%	-1%	-19%
26	Florida Southern College	-46%	4%	-6%	-20%
27	Erskine College	-40%	1%	0%	-22%
28	University Of North Carolina Asheville	-42%	3%	-1%	-24%
29	Palm Beach Atlantic University	-41%	2%	-6%	-25%
30	Clafflin University	-77%	2%	0%	-30%
31	Bennett College	-68%	1%	-1%	-31%
32	Lynn University	-4%	6%	-6%	-41%

Table 3: Peer Statistics as Relative Increase over Furman University

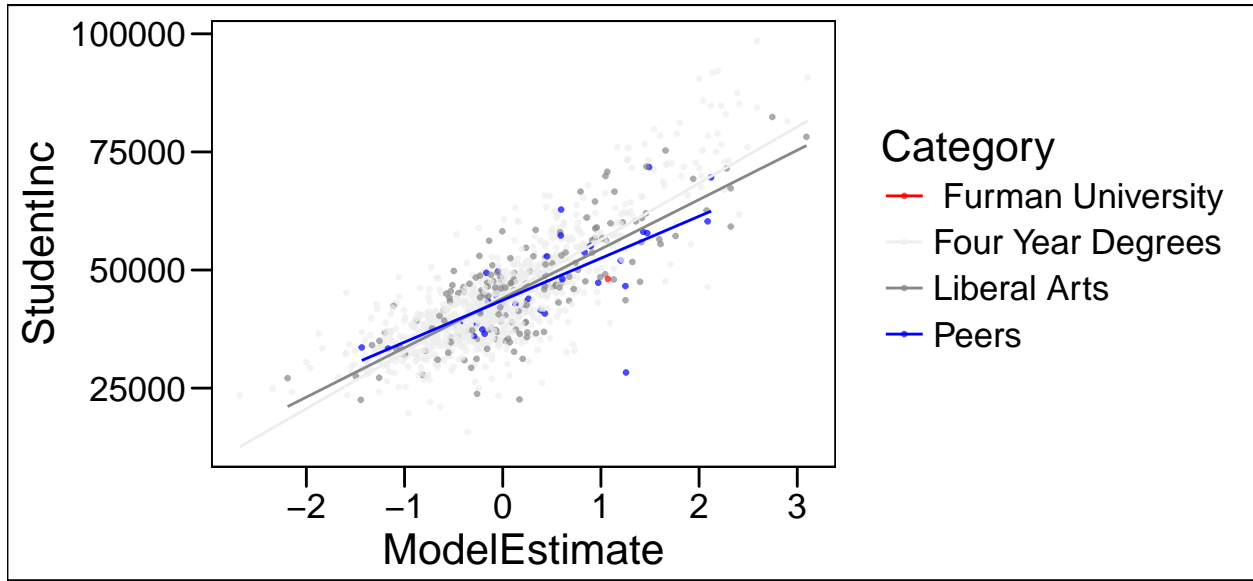
the proportion of graduates who stay in the state after graduation. Relationships between the variables can be seen in the correlation table.

	StudentInc	ParentInc	InstEarnings	StateInc
StudentInc	1.00			
ParentInc	0.69	1.00		
InstEarnings	0.42	-0.00	1.00	
StateInc	0.35	0.29	0.00	1.00

Table 4: Correlations between Variables

	Estimate	Std. Error	t value	Pr(> t)
scale(ParentInc)	0.64	0.02	35.59	0.00
scale(InstEarnings)	0.42	0.02	24.25	0.00
scale(StateInc)	0.16	0.02	8.82	0.00

Table 5: $StudentInc \sim ParentInc + InstEarnings + StateInc$



The addition of the two variables improves the original model considerably ($R^2 = 0.68$). The scatterplot now compares the model's predicted value of *StudentInc* to the actual value. Furman University has a residual of \$-8538, compared to the original \$-13617.

Discussion

Graduate incomes are potentially a lagging indicator of the success of initiatives to smooth the path from college to career. The same *New York Times* article where the median earnings by major are found [4] contains an assertion that liberal arts students are well-prepared for careers, but have difficulty with the transition after graduation. If so, this initial slowdown could put them behind and explain part of the liberal arts gap in incomes visible in the data; in other words, if graduates start at lower incomes than other graduates, it will be hard for them to make up that difference over the course of their career. The article also suggests programs to expand the options of liberal arts graduates by adding particular skills (e.g. data analysis, social media expertise) to their curriculum.

This study is part of a larger effort to understand the transition from college to career, especially for students well-prepared in thinking and communication skills, but for whom no established major-to-career path is available. An extension of the present study is to further eliminate variance by introducing new information, and try to identify comparable institutions that are outperforming in order to understand their practices.

About this Report

This report was produced quickly, and should be considered a work in progress. The intent is that it will be shared with the higher education community as appropriate for discussion and improvement. The first draft was produced at Furman University on 11/17/2017, taking about ten hours of staff time. A public version was released on 12/2/2017.

The data used in this report are all public sources, and this code is released on github with a GNU public license, meaning you can use it freely for your own purposes. It comes with no warranty of usefulness or correctness; you are on your own to ascertain its usefulness to you.

If you feel moved to cite this project in a paper, please use:

Eubanks, D., & Klonis, S. (2017) Graduate Salaries, Github repository <https://github.com/stanislavzza/GraduateSalaries>.

Contact: David Eubanks at david.eubanks@furman.edu.

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