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The College Scorecard, College Rankings, and Return on Investment

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ABSTRACT

This paper explores the relationship between the College Scorecard, college ranking systems, and return on investment. Historically, there has been an emphasis, as well as popularity in ranking higher education institutions in terms of quality and job outcomes. This study utilized data from the United States Department of Education's Federal College Scorecard and institutional ranking data from College Factual. A multiple regression analysis was used on the dependent variable of salary after attending, with the independent variables of college rank, graduation rate, and average annual cost. Best subsets regression modeling was used to determine the significance for each of the overall regression models, as well as the significance for each of the independent variables. The study included higher education institutions in the state of Massachusetts, USA. Analysis of the results offer several practical applications, interpretations, as well as recommendations for future research.

Keywords: College Scorecard, College Rankings, Higher Education Return on Investment

INTRODUCTION

Institutions of higher education are increasingly being assessed on their ability to generate a positive return on investment (ROI) for their graduates. Transparency in higher education in terms of economic return is important. Fortunately, there has been momentum within the higher education landscape where "parents, students, college leaders, journalists, policy makers, and researchers are now empowered to more empirically evaluate thousands of U.S. post-secondary institutions in terms of their contributions to student economic success" (Rothwell, 2015a).

A variety of stakeholders use the ROI and similar metrics in the college decision-making process. Yet, with the increased interest and emphasis on rating related metric criteria, a single standardized rating criterion is difficult to obtain. College decision-making should include an analysis of a variety of resources and institutional attributes, which are unique to each student and family. However, it can be overwhelming given the multitude of data that exists within higher education. Of particular importance are the numerous studies that have addressed the growing need to quantify the ROI of colleges and universities. A leading resource is the United States Department of Education's interactive College Scorecard. The Scorecard provides students and families with useful data to make more informed decisions on higher education institutions. The launch of the Scorecard in 2013 illustrated former President Barack Obama's commitment to provide consumers with information about college costs and value in an easy-to-read format (U.S. Department of Education, 2013).

A college education is an important investment that historically has provided substantial economic benefits over a graduate's lifetime. Yet, unemployment and underemployment among recent college graduates has become a concern. Even though recent college graduates often encounter these situations, a few years after graduation as they transition to the labor market, it is becoming more and more difficult to find a good job (Abel, Deitz, & Su, 2014). It is

important to note, that collectively these trends hold true, but on an individual level, students majoring in fields in high demand (such as the "STEM" disciplines of Science, Technology, Engineering, & Math) are doing fairly well (Abel, et. al., 2014).

Many factors can be used to assess the value of a baccalaureate degree at a particular higher education institution. This study specifically explored the College Scorecard and the specific constructs of average annual cost, graduation rate, and salary after attending. In addition to the Scorecard, each institution's respective college rank was also analyzed using college ranking data from College Factual.

The College Scorecard

In 2013, former President Barack Obama as part of his State of the Union address, announced the increased need for transparency in higher education, which precipitated the inception of The College Scorecard (Rothwell, 2015a). Designed as a resource for students and families, the Scorecard is a tool to help navigate the pros and cons of a particular institution. One caveat, is that the Scorecard only accounts for those students who receive some form of federal financial aid. Yet, Rothwell (2015a) still asserts that the Scorecard is a valuable asset to the public and should be continued with annual updates that reflect new data. In addition to basic information such as average annual cost and graduation rate, Turner (2015, para. 6) agrees that "there's also lots of useful new information; you can now see how much students earn 10 years after entering a school (thanks to a joint effort between the departments of Education and the Treasury)." The three constructs used in this study were based on the Scorecard's average annual cost, graduation rate, and salary after attending, respectively.

The Average Annual Cost.

The Scorecard, quantifies the "average annual cost" as the average annual net price (cost) for federal financial aid recipients, after aid from the school, state, and/or federal government. For public higher education institutions, the tuition was calculated using the in-state student rate.

Graduation Rate.

The Scorecard, measures "graduation rate" as those students who graduate within six years upon entering college as a first-year student.

Salary After Attending.

The Scorecard, calculates "salary after attending" as the median earnings of former students who received federal financial aid, at 10 years after entering the college as a first-year student.
Further explanation of these Scorecard constructs were provided by Chingos and Whitehurst (2015), where they pointed out that the Scorecard was only reflective of those students who received federal financial aid. The first construct on the Scorecard is the average annual cost. Net of any federal, state, and institutional grant aid; this cost to students includes tuition, fees, books, supplies, room, and board. The tuition at public institutions use the in-state tuition rate. Therefore, the remaining amount represents the average annual cost, including loans, a student must contribute from their own financial resources. The second construct of graduation rate accounts for the proportion of first-year, full-time students who, upon initial full-time enrollment, graduate within six years. Finally, the construct of salary after attending is the median earned income of students 10 years after initial enrollment.

In terms of average annual cost and graduation rate data for the Scorecard, Chingos and Whitehurst (2015) stated that the data was obtained from a required annual report made to the National Center for Education Statistics (NCES) through the Integrated Postsecondary Education Data System (IPEDS). On the other hand, Scorecard data that pertains to salary after

attending was gathered from different information sources and managed by different U.S. Department of Education offices (Chingos and Whitehurst, 2015).

One of the Scorecard's major weaknesses was that it only reports earnings data on undergraduate students who receive federal financial aid, which approximately applied to half of all students (Rothwell, 2015b). The New England Board of Higher Education (2016) makes it clear that "significant variation exists from student to student and college to college in terms of the sources and amounts of financial aid, which can make predicting and tracking what students pay difficult" (p. 2). Nevertheless, "there is no doubt that the Scorecard is a leap forward from previous government data collections on colleges and universities, which focused on inputs such as number of faculty and student characteristic and the immediate outcomes of retention and graduation rather than longer term outcomes including earnings in the labor market" (Chingos and Whitehurst, 2015, para. 9).

College Ranking Systems

College ranking systems can serve as a simple and quick way to find a college or university that meet certain search criteria (Campus Explorer, 2018). Although college rankings are intended to help prospective students in their search for top colleges, often overlooked are schools that are especially strong in specific majors or programs (Campus Explorer, 2018). There is an inherent popularity of ranking institutions with a convenient ordinal numbering system. Numerous college ranking systems have conveniently ranked institutions, often with their own weighted metrics, underlying assumptions, and other subjectively derived underpinnings. All of this in an attempt to objectively quantify a school's respective rank in comparison to the competition. Campus Explorer (2018) is quick to mention that many of the popular college ranking systems are inherently biased and utilize vague ranking criteria. Such arbitrary measures raise questions to the legitimacy of using a college ranking system.

And, there have been several popular and well established, albeit debatable, rating systems developed and promulgated by organizations such as U.S. News and World Report, the Princeton Review, Forbes College Rankings, and College Factual, to name a few. College rankings often overlook more tangible outcomes, including job placements and the quality of those job placements (Campus Explorer, 2018).

On the other hand, Carey (2007) draws an analogy between reducing institutions to a single number with the reality of the consumer marketplace; where full-time students can only choose to attend one single university. No one can ever fully comprehend the totality of an institution as rich and complicated as a university, yet as long as ranking systems maintain transparency in the underlying data elements and their respective weights, then this can facilitate comprehension and comparison (Carey, 2007).

College Factual

College Factual obtains their data from a variety of public and private sources, including data from IPEDS of the National Center for Education Statistics, which is a branch of the Department of Education (College Factual, n.d.). College Factual's goal in their "2013 best colleges rankings" was to measure educational quality at a specific college, relative to other colleges in the United States (McWilliam, 2013). The College Factual ranking system focuses on four-year undergraduate programs based on 11 different factors; with the factors categorized as either student body caliber, educational resources, degree completion, or post-graduation earnings (McWilliam, 2013). The factors listed by College Factual are further classified by their impact on the rankings, which is either high impact, medium impact, or low impact. McWilliam (2013) summarizes the categories, factors, and impacts as follows:

"Student Body Caliber

1. Average test scores (high impact) – the average of the 25th and 75th percentile math and reading SAT scores as reported by IPEDS is calculated" (para. 2).

"Educational Resources

2. Average faculty compensation (medium impact) – competitive salaries and benefits can attract the best of the best to a college or university.
3. Expenditures per student (medium impact) – this is focused on spending that can directly benefit students, such as instruction, academic support, research and student services.
4. Student to faculty ratio (low impact) – the student to faculty ratio measures how many students each instructional faculty member must support on average (a lower ratio is preferred).
5. Percent full-time teachers (low impact) – this metric includes all instructional employees, including adjuncts, which gives a more complete measure of how many teachers are focused on full-time instruction" (para. 3).

"Degree Completion

6. Freshmen retention rate (high impact) – the higher the number of freshmen returning to the same school for their sophomore year the better.
7. Six year graduation rate (high impact) – this measures the percent of students that started as freshmen and graduated with their four-year degree from a given school within six years after starting (a higher graduation rate is preferred).
8. Expected vs. actual graduation rate (low impact) – this metric accounts for the fact that colleges with highly selective acceptance rates are more likely to have higher graduation rates. Since this may be more reflective of the student and not the institution, a higher than expected graduation rate is indicative that the school is doing a good job at graduating students" (para. 4).

"Post-Graduation Earnings

9. Student loan default rate (high impact) – a large majority of students rely on student loans to earn a degree, with the expectation that their education will provide them with gainful employment opportunities. Therefore, the lower the default rate on student loans the better.
10. Starting salary boost (medium impact) – this measures the college's impact on early career earnings, with a comparison of specific majors from college to college.
11. Mid-career salary boost (medium impact) – this metric is similar to the early career earnings, however, this is focused more on the longer term impact the college might have on mid-career earnings" (para. 5).

Return on Investment

The college experience can be assessed from multiple perspectives, both economic and non-economic. First and foremost, the future earnings of having a college degree, as opposed to a high school diploma, is substantial. Infrequently mentioned, yet important nonetheless, is the inherent value of furthering one's education without factoring in employment and earning power. Education for education's sake provides several tangible and intangible benefits to college graduates and to the larger society as a whole. Hout (2012) surmises that "college graduates find better jobs, earn more money, and suffer less unemployment than high school graduates do; and they also live more stable family lives, enjoy better health, and live longer" (p. 380). Regardless of how you look at it, college is an investment, of both time and money,

and a college education includes returns that extend far beyond the obvious monetary ones (Payscale, 2018).

From an economic perspective, finding a particular educational institution's return on investment (ROI) is challenging. Yet, the financial aspects of evaluating college ROI cannot be ignored (Payscale, 2018). "College is now the second-largest financial expenditure for many families, surpassed only by purchasing a home, so it isn't surprising that taking an in-depth look at the costs and payoffs of a particular college is of paramount importance" (Money, 2015, para. 1). Dickler (2017) agrees that aside from purchasing a home, college is now the second-largest expense an individual will make during their lifetime. Vasel (2014) echoes a similar sentiment that, aside from buying a home, college tuition is the biggest expense most people face, yet while most buyers know the total cost involved in buying a home and can plan accordingly, consumers rarely know the final price tag of a college education. Conversely, and based on the fact that as college tuition prices continually outpace inflation and student loan levels reach record highs, more colleges and universities are offering fixed-rate tuition plans (Vasel, 2014). Regardless of future tuition trends, the fact still remains that college is an investment and maximizing one's return on that investment is imperative. "When you're trying to determine which college you can afford, the most important number is the school's 'net price;' and that is why every college offering federal financial aid programs is required to provide a Net Price Calculator on its website, and why you should understand how to incorporate this handy tool into your college planning research" (Massachusetts Educational Financing Authority, n.d., para. 1). U.S. News and World Report (2017) provides further information on every college and university with respect to their online net price calculators. Even though these net price calculators are helpful, they only account for the investment (cost) and not the short and longer term financial gains (benefits). From this cost-benefit perspective, "many graduates expressed buyer's remorse regarding their education, according to a recent study where 57 percent of students said they regret taking out as many loans as they did, and 36 percent said they would not have gone to college if they fully understood the associated costs" (Dickler, 2016, para. 4). A compounding factor is that student debt is still rising for new graduates, according to a 2014 report released by the Project on Student Debt at The Institute for College Access and Success (TICAS). "At public and nonprofit colleges in 2014, seven in 10 graduating seniors (69%) had student loans, and their average debt was $28,950; up two percent compared to the Class of 2013" (TICAS, 2014, p. 1). Lindsay (2018), in a new report claims the dire student-loan debt crisis in the U.S. has increased the default rate. However, there is evidence that suggests that the type of degree completed may be a more relevant factor related to the default rather than the amount students borrow (Lindsay, 2018). "The reason total debt is not related to the likelihood of default is because while borrowing more may make it difficult to repay one's loans, students who complete degrees also borrow more than students who drop out, and degree completion is a major factor related to default" (Velez, 2018. Para. 8). Velez (2018) found that "students who obtained a bachelor's degree borrow more than their counterparts who obtain an associate's degree or certificate; and those that drop out of college borrow less, on average, than those who attain a bachelor's or associate's degree, but more than those who attain a certificate" (para. 9).

Dunlop (2016) calculated the NPV (net present value) of institutions in Massachusetts using salary after attending compounded over 10 years. This 10-year NPV is an important ROI calculation since a majority of graduates face important financial challenges within the first decade after graduation, such as paying off student loans, purchasing a first home, and starting a family (Dunlop, 2016).

To ensure a positive ROI, Schneider (2016) states that "what a student studies often matters

far more than where they study it" (para. 13). Schneider further emphasizes that "graduates with degrees in technology, math and engineering are at the top of the earnings distribution – and graduates with these degrees from regional campuses probably will earn far more than their peers with liberal arts degrees from the nation's most prestigious campuses (2016, para. 14). These types of claims arguably call into question the legitimacy and usefulness of college ranking systems. Rothwell (2015b) states that no ranking system is perfect and there are many limitations and caveats of any such system. However, Rothwell also asserts that value-added measures may assist in filling information voids and still be useful strategy tools focused on improving higher education quality, as well as identifying institutions that are contributing the most to student economic advancement. The American Institutes for Research developed a tool entitled College Measures in an effort to increase student success by making data more useful and usable (n.d.). "College Measures has a commitment to improving higher education in the United States, and operates under the belief that data is underexposed and underused by students, parents, policymakers, and even by institutions themselves" (n.d., para. 2). "Through its Economic Success Metrics (EMS) Project, College Measures assists state agencies in their efforts to make information about the earnings of graduates from their higher education programs publicly accessible" (Institute for Higher Education Policy, 2016, p. 1).

METHODOLOGY

This study focused on elements from the U.S. Department of Education's College Scorecard and college ranking data provided by College Factual. These open-access data sets provided further insight into several important, and often debatable, measures of college quality and the metric quantification of economic factors at a particular educational institution. Given that there is no agreed-upon single measure, this study investigated various constructs related to an institution's ROI.

Based on the delimitations of the study, the usable sample size was 57 (n = 57). Table 1 summarizes the column descriptions for the dependent and independent variables. Table 2 (Appendix) provides a complete and detailed list of all 57 institutions included in the study. The column descriptions for Table 1 included the following:

Table 1: College Data and Variables (Dependent and Independent) – Summary Table

n = 57	Alphabetical Order	Y	X_1	X_2	X_3
#	**College Name**	**Salary after Attending ($)**	**College Rank**	**Average Annual Cost ($)**	**Graduation Rate**

Constructs

The operational constructs in this study included the dependent and independent variables. The dependent variable, Y, of "salary after attending," was measured by the College Scorecard. The dependent variable was correlated against the independent variables of "college rank," "average annual cost," and "graduation rate;" X_1, X_2, and X_3 respectively. All of the independent variables were derived from the College Scorecard, expect for college rank, which was calculated by College Factual.

The multiple regression equation was stated as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$$

Where:
Y= dependent variable (response variable)
$X_{1,2,3}$ = independent variables (predictor or explanatory variables)

β_0 = intercept (value of Y when all X's = 0)

$\beta_{1,2,3}$= coefficient of each independent variable

Procedures

A multiple regression analysis with all three independent variables was initially conducted. Then stepwise regression via backward elimination was used to determine the best subset regression model. Based on the successive regression models, each of the independent variables *p*-value was tested at a confidence level of 95% (alpha, α = 0.05).

Research Hypothesis.

The hypothesis for the overall regression model was stated as:

Null Hypothesis: H_0: $\beta_1 = \beta_2 = \beta_3 = 0$

Alternative Hypothesis: H_1: At least one β_i is not zero

The hypothesis for the overall regression model was tested, at a confidence level of 95%, by comparing the *Significance F* (*p*-value) to the significance level 0.05 (alpha, α = 0.05).

Delimitations

This study researched four-year undergraduate higher education institutions located in the state of Massachusetts using the College Scorecard, as well as ranking data from College Factual. In order for an institution to be included in the study, the institution must have complete Scorecard information on all three constructs (average annual cost, graduation rate, & salary after attending) and must be ranked in College Factual.

The College Scorecard.

Based on the constructs of average annual cost, graduation rate, and salary after attending, this study was delimited based on the following Scorecard search criteria:

Degree = 4 year (Bachelor's)
Control = Public and Private (non-profit)
Size = Any
Program = Any
Location = Massachusetts
Excluded = For-profit controlled institutions and institutions with incomplete data available

College Factual.

Each institution that had complete Scorecard data was cross-referenced with College Factual ranking data. Any institution not ranked by College Factual was excluded from the study. Since this study only included institutions located in the state of Massachusetts, the Microsoft Excel function "Rank.EQ" was used to properly rank order the 57 institutions included in the study. This critical function returns the rank of a number in a list of numbers with its size relative to other values in the list.

RESULTS

The multiple regression analysis utilized in this study calculated several results. A stepwise regression approach via backward elimination was used to determine the best subset and the significance of this overall regression model. By using best subsets regression, this allowed for an evaluation of all possible regression models for a given set of independent variables. The backward elimination began with all the independent variables in the model and then deleted them one at a time until the best model was identified. This approach allowed for further investigation into the statistical significance and usefulness of each model in describing and predicting the relationship between the dependent and independent variable(s).

The adjusted R^2 statistic and the *Significance F* (*p*-value) were both used to identify the best regression model. Furthermore, the *p*-value for each independent variable was computed for all of the regression model subsets and tested for statistical significance. All of the statistical tests were conducted at 95% confidence levels ($\alpha = 0.05$).

Table 3 overviews the multiple regression analyses and the key metrics that were calculated for each regression model. The dependent variable (Y) was salary after attending and the three independent variables were X_1 as college rank, X_2 as average annual cost, and X_3 as graduation rate. The first regression model included all three independent variables ($X_1, X_2,$ & X_3). The second regression model eliminated the X_3 variable, and therefore, only included two variables (X_1 & X_2). After eliminating the X_2 variable; the third, and final, regression model was found to be the best model and included only the X_1 variable of college rank.

Table 3: Multiple Regression Analysis Summary

Model Number	Model Variables	*Significance F* *p*-value of model	Adjusted R^2	*p*-values of independent variables
First	$X_1, X_2,$ & X_3	9.9857E-08; $p < 0.05$	0.455111	X_1 = 0.011515128; $p < 0.05$ X_2 = 0.677459279; $p > 0.05$ X_3 = 0.86660512; $p > 0.05$
Second	X_1 & X_2	1.7418E-08; $p < 0.05$	0.464914	X_1 = 6.94149E-09; $p < 0.05$ X_2 = 0.674902623; $p > 0.05$
Third	X_1	2.0742E-09; $p < 0.05$	0.472913	X_1 = 2.0742E-09; $p < 0.05$

Based on Table 3, the best explanatory model includes only the independent variable of college rank (X_1) on the dependent variable of salary after attending (Y). This returns the highest adjusted R^2 value and the strongest level of statistical significance in terms of the overall regression model and the individual *p*-value for X_1. The MS Excel Summary Output for this model is depicted in Table 4. The other subset regression models (Table 5 and Table 6) are included in the Appendix.

Table 4: MS Excel Summary Output: College Rank

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.694496
R Square	0.482325
Adjusted R Square	0.472913
Standard Error	11117.64
Observations	57

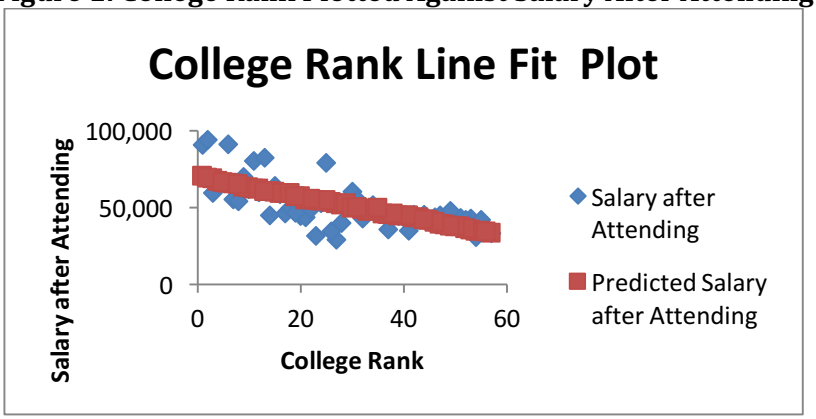
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	6.33E+09	6.33E+09	51.2442201	2.0742E-09
Residual	55	6.8E+09	1.24E+08		
Total	56	1.31E+10			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	69795.43	2984.318	23.3874	2.9613E-30	63814.7195	75776.13
College Rank	-640.738	89.50716	-7.15851	2.0742E-09	-820.113978	-461.361

The "XY" scatterplot which depicts the relationship between the independent variable of college rank (X_1) and the dependent variable of salary after attending (Y) is illustrated in Figure 1. The Appendix includes "XY" scatterplots (Figure 2 and Figure 3) for the other two independent variables of average annual cost and graduation rate, respectively.

Figure 1: College Rank Plotted Against Salary After Attending



Another important analysis determined if there was any explanatory relationship among the independent variables. Generally, a correlation coefficient of +/- 0.70 may indicate multicollinearity. Table 7 summarizes all three independent variables and their corresponding relationships. From the table, it appears that there was a strong negative relationship between the independent variables of graduation rate (X_3) and college rank (X_1). In other words, the value of -0.9386 indicates that higher graduation rates are correlated with a lower college rank (where #1 was the best rank and #57 was the worst rank).

Table 7: Multicollinearity Analysis

	College Rank	*Average Annual Cost*	*Graduation Rate*
College Rank	1		
Average Annual Cost	-0.322855597	1	
Graduation Rate	-0.938622603	0.302394701	1

CONCLUSION

Given the need for greater transparency in higher education and the popularity of quantitatively derived metrics, the results of this study provided further insight into several important variables. Information was gleaned by analyzing the data elements of salary after attending, average annual cost, and graduation rate, which was enumerated by the College Scorecard. Additional insight was collected upon analysis and investigation of College Factual's rank ordering of higher education institutions in the state of Massachusetts, USA.

Multiple regression analysis and stepwise regression provided several model subsets. The best regression model subset was identified by calculating the statistical significance of each regression model's *Significance F* and adjusted R^2 values. In addition, *p*-values were computed in order to determine which independent variables were statistically significant. Finally, multicollinearity analysis was conducted to determine if relationships existed among the independent variables.

In summary, and despite the challenges of a one-size fits all methodology when determining the return on investment (ROI) of a particular higher education institution, this study provided evidence that college ranking systems are useful in determining an institution's ROI. This study provides a framework for conducting similar future analyses. Not only could this study be replicated by using Scorecard data from other states, it could also use data provided by other ranking systems (e.g., the Princeton Review, Forbes College Rankings, etc.). Additionally, future research could expand to include other types of institutions (e.g., two-year colleges, for-profit/proprietary, etc.), as well as specific programs of study. Furthermore, international higher education systems could conduct similar research based on the techniques and metrics offered in this study.

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APPENDIX
TABLES AND FIGURES

Tables

Table 1: College Data and Variables (Dependent and Independent) – Summary Table

n = 57	Alphabetical Order	Y	X_1	X_2	X_3
#	**College**	**Salary after Attending ($)**	**College Rank**	**Average Annual Cost ($)**	**Graduation Rate**

Table 2: College Data and Variables (Dependent and Independent) – Detailed Table

n = 57	Alphabetical Order	Y	X_1	X_2	X_3
#	**College Name**	**Salary after Attending ($)**	**College Rank**	**Average Annual Cost ($)**	**Graduation Rate**
1	American International College	43,200	51	20,943	38%
2	Amherst College	59,700	3	18,848	95%
3	Anna Maria College	42,900	53	29,404	36%
4	Assumption College	53,000	24	27,756	72%
5	Babson College	91,400	6	31,884	89%
6	Bard College at Simon's Rock	29,200	27	31,085	60%
7	Bay Path University	41,000	48	20,377	60%
8	Becker College	42,100	55	27,752	30%
9	Bentley University	80,600	11	32,713	89%
10	Boston College	70,000	9	33,661	92%
#	**College**	**Salary after Attending ($)**	**College Rank**	**Average Annual Cost ($)**	**Graduation Rate**
11	Boston University	62,000	10	34,910	85%
12	Brandeis University	55,300	7	28,370	89%
13	Bridgewater State University	43,800	40	18,745	59%
14	Clark University	44,500	20	24,040	80%
15	College of the Holy Cross	65,200	4	32,040	92%
16	Curry College	44,900	47	29,464	46%
17	Dean College	31,000	54	27,303	44%
18	Eastern Nazarene College	42,200	52	18,677	57%
19	Elms College	44,700	39	21,102	73%
20	Emerson College	43,700	21	39,148	80%
21	Emmanuel College	47,400	36	30,986	64%
22	Endicott College	49,800	33	32,906	72%
23	Fisher College	33,200	57	24,111	35%
24	Fitchburg State University	41,900	43	13,923	55%
25	Framingham State University	45,500	42	17,967	54%
26	Gordon College	39,800	28	27,418	71%
27	Hampshire College	31,800	23	32,117	72%
28	Harvard University	90,900	1	17,882	98%
29	Lasell College	39,900	50	24,150	54%
30	Lesley University	35,900	37	30,616	56%
31	Massachusetts College of Art & Design	34,600	26	22,323	71%
#	**College**	**Salary after Attending ($)**	**College Rank**	**Average Annual Cost ($)**	**Graduation Rate**
32	Massachusetts College of Liberal Arts	34,900	41	16,069	52%

33	Massachusetts Institute of Technology	94,200	2	22,968	92%
34	Massachusetts Maritime Academy	79,300	25	17,224	71%
35	Mount Holyoke College	46,100	17	23,760	83%
36	Nichols College	48,100	49	27,124	46%
37	Northeastern University	64,000	15	28,869	83%
38	Pine Manor College	35,600	56	22,810	32%
39	Regis College	45,300	38	26,083	46%
40	Salem State University	41,000	45	16,884	48%
41	Simmons University	49,000	22	29,461	70%
42	Smith College	44,900	14	27,880	87%
43	Springfield College	43,000	32	27,047	70%
44	Stonehill College	58,700	16	28,388	85%
45	Suffolk University	51,800	34	29,563	56%
46	Tufts University	66,500	5	29,565	93%
47	University of Massachusetts Amherst	49,700	18	18,869	77%
48	University of Massachusetts Boston	47,000	35	11,789	42%
49	University of Massachusetts Lowell	50,800	29	18,005	55%
50	Wellesley College	60,100	12	25,429	92%
51	Wentworth Institute of Technology	60,300	30	35,232	65%
52	Western New England University	54,900	31	28,053	59%
#	**College**	**Salary after Attending ($)**	**College Rank**	**Average Annual Cost ($)**	**Graduation Rate**
53	Westfield State University	43,900	46	16,808	63%
54	Wheaton College	46,700	19	31,172	78%
55	Williams College	54,100	8	23,924	95%
56	Worcester Polytechnic Institute	82,600	13	37,002	85%
57	Worcester State University	45,600	44	17,495	52%

Table 3: Multiple Regression Analysis Summary

Model Number	Model Variables	*Significance F* *p*-value of model	Adjusted R^2	*p*-values of independent variables
First	$X_1, X_2, \& X_3$	9.9857E-08; $p < 0.05$	0.455111	X_1 = 0.011515128; $p < 0.05$ X_2 = 0.677459279; $p > 0.05$ X_3 = 0.86660512; $p > 0.05$
Second	X_1 & X_2	1.7418E-08; $p < 0.05$	0.464914	X_1 = 6.94149E-09; $p < 0.05$ X_2 = 0.674902623; $p > 0.05$
Third	X_1	2.0742E-09; $p < 0.05$	0.472913	X_1 = 2.0742E-09; $p < 0.05$

Table 4: MS Excel Summary Output: College Rank

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.694496
R Square	0.482325
Adjusted R Square	0.472913
Standard Error	11117.64
Observations	57

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	6.33E+09	6.33E+09	51.2442201	2.0742E-09
Residual	55	6.8E+09	1.24E+08		
Total	56	1.31E+10			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	69795.43	2984.318	23.3874	2.9613E-30	63814.7195	75776.13
College Rank	-640.738	89.50716	-7.15851	2.0742E-09	-820.113978	-461.361

Table 5: MS Excel Summary Output: College Rank & Average Annual Cost

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.695718
R Square	0.484024
Adjusted R Square	0.464914
Standard Error	11201.68
Observations	57

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	6.36E+09	3.18E+09	25.32803	1.7418E-08
Residual	54	6.78E+09	1.25E+08		
Total	56	1.31E+10			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	72891.43	7933.261	9.188078	1.25E-12	56986.1958	88796.66
College Rank	-653.711	95.2865	-6.86048	6.94E-09	-844.749293	-462.673
Average Annual Cost	-0.10618	0.251767	-0.42172	0.674903	-0.61093893	0.398588

Table 6: MS Excel Summary Output: College Rank, Avg. Annual Cost & Graduation Rate

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.695918
R Square	0.484301
Adjusted R Square	0.455111
Standard Error	11303.82
Observations	57

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	6.36E+09	2.12E+09	16.59107	9.9857E-08
Residual	53	6.77E+09	1.28E+08		
Total	56	1.31E+10			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	76764.62	24303.36	3.158602	0.002618	28018.2662	125511
College Rank	-695.52	265.705	-2.61764	0.011515	-1228.4566	-162.583
Average Annual Cost	-0.10626	0.254064	-0.41824	0.677459	-0.6158476	0.403327
Graduation Rate	-3941.2	23349.88	-0.16879	0.866605	-50775.14	42892.73

Table 7: Multicollinearity Analysis

	College Rank	*Average Annual Cost*	*Graduation Rate*
College Rank	1		
Average Annual Cost	-0.322855597	1	
Graduation Rate	-0.938622603	0.302394701	1

Figures

Figure 1: College Rank Plotted Against Salary After Attending

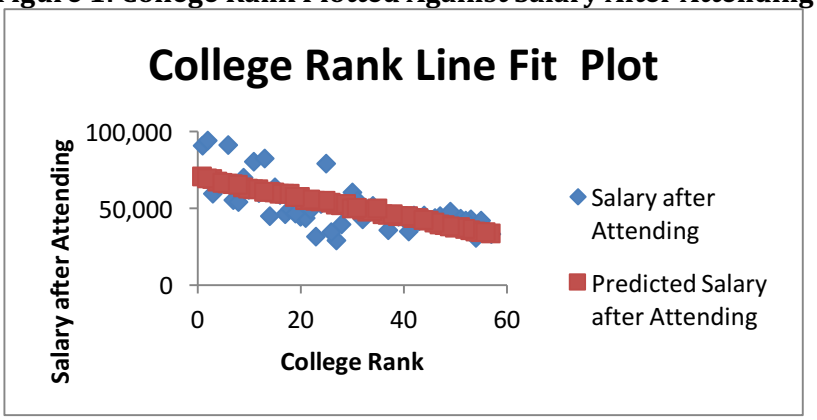

Figure 2: Average Annual Cost Plotted Against Salary After Attending

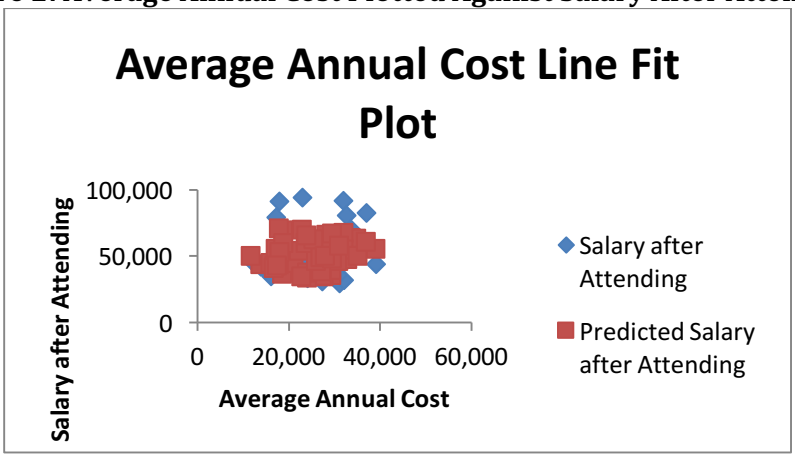

Figure 3: Graduation Rate Plotted Against Salary After Attending