The Factors That Matter to College Graduate Salary: A Statistical Analysis of College Ranking Systems and Performance of Graduates

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Abstract

College rankings purport to measure academic quality, but often lack student outcome measures. This study authenticates the measures used in the popular college ranking systems with baccalaureate graduate success, measured by the mid-career salary graduates. Using principal components analysis three composite factors are found that explain 67.7% of the variance in mid-career salary of graduates. The study also examines differences in mid-career salary between types of universities. Not surprisingly Ivy League and engineering schools lead the salary pack. Interestingly, private research and liberal arts schools are found to provide a significant median mid-career salary advantage for graduates over their private and public school counterparts. Liberal arts schools are also found to provide greater salary mobility than any of the other types of schools.

Keywords: college ranking, college graduate salary, academic quality, graduate success

Introduction

A college education is an asset for those who are able to achieve it. The lingering effects of the economic recession of 2008 have put pressure on state budgets, which have lowered the contributions made to their institutions of higher learning. The reduction in these contributions, along with rising costs at universities has driven these institutions to raise tuition at a rapid rate. These rising costs have caused some in the popular press to question the cost, and even the value of a college education.

It is difficult to measure the outcomes and value of an education. In secondary education a debate is raging regarding the importance of standardized testing. School ratings and the award of school funding can be based on the performance of graduates on these exams. In higher education the students branch out in a wide variety of majors, making it difficult for standardized testing to be employed.

For parents and students, post-graduate salary represents an economic measure of the value of the education. In a time of economic challenge and high unemployment, salary measures take increasing importance with parents and graduates. While the value of a college education far exceeds the simple math of the salary of the graduates, this has become a focal measure.

If the earning power of graduates of an institution of higher learning is an important measure of success, some key questions are raised. What are the drivers these outcomes? What educational environment leads to success in these factors? Do the current college rankings correlate with economic success of graduates? What types of schools affect post-graduate salary? What amount of the effect is explained by the students themselves? These are the key questions that are explored in this study.

Literature Review and Hypotheses

The purpose of higher education

The purpose of higher education has long been debated. Cardinal John Henry Newman, arguing for the value of a liberal education in 1873, proposed that the purpose of a university is to teach universal knowledge where truth is the object of knowledge (Newman, 2001). Universities should create individuals of great intellect who take "a connected view of old and new, past and present, far and near, and which as an insight into the influence of all these one on another" (Newman, 2001). Newman also argued that an education should also serve a practical purpose.

The practicality of higher education often lies in gaining expert knowledge. Alfred North Whitehead (1929) wrote that we should aim at producing "men who posses both culture and expert knowledge in some special direction. Their expert knowledge will give them the ground to start from, and their culture will lead them as deep as philosophy and as high as art". Put more succinctly, "education is the acquisition of the art of the utilization of knowledge" (Whitehead, 1929). Universities produce individuals who have a broad knowledge, who can see and utilize the interconnectedness of various fields of science, and who can frame current events through the lens of history. This grounding in a variety of fields adds value to the specific expert knowledge gained in a student's chosen field of study.

Measuring the Results of Higher Education

In the early 1900's most universities in the United States adopted an elective system, following the lead of Harvard University's president Charles Eliot. This diversification of educational experiences away from a 'classical education' makes it difficult to craft a universal post-graduate examination that compares the learning outcomes between universities.

Some attempts have been made at cross-college assessment. The Collegiate Learning Assessment (CLA) measures critical thinking, analytic reasoning, and communication skills (Benjamin, 2010). The National Survey of Student Engagement (NSSE) seeks to gauge the quality of an undergraduate education by looking at how actively involved students are with their studies, professors and the campus community (Marklein, 2007). The College Senior Survey conducted by UCLA's Higher Education Research Institute is similar to the NSSE and asks questions about activities associated with student success and about post-college plans (UCLA, 2011). The NSSE discourages its system from being used in ranking systems (Marklein, 2007) and none of these systems are widely utilized. Devoid of a common learning attainment measure, ranking systems use a variety of measures to compare institutions.

The Rise of College Rankings

In 2010 there were 4,634 institutions of higher education listed in the Carnegie Classification system with over 20 million students in total enrollment (Carnegie Foundation, 2010). This presents students and parents with a broad selection of schools. To provide structure for the decision on where to attend college, various ranking systems have been created to supply information to parents and students.

1983 saw the publication of the first US News & World Report college rankings. Initially based on a subjective peer evaluation, ranking systems expanded in 1987 to include a variety of more objective data (Monks & Ehrenberg, 1999). The intent of these systems is to measure academic 'quality' and provide comparative information for parents and students.

For intangible purchases, ratings may serve to reduce uncertainty, especially with increasing mobility of students across state lines (Litten, 1986). The ranking systems are used more frequently by a desirable demographic: students who receive A grades in high school, are from high-income families with college-educated parents, and who intend to go on to post-graduate studies (McDonough, Antonio, Walpole, & Perez, 1998).

The ranking systems utilize a combination of input and process measures to rank institutions. Common input measures include items such as SAT scores or high school GPA of incoming freshmen. These input measures attempt to show the quality of students who attend the school, in addition to providing feedback on the selectivity of the institution. Process measures include items such as faculty to student ratio, average class size, annual cost, size of the student body, residential status, and number of full-time faculty. These measures are used to analyze the type of institution and educational experience offered.

Although frequently criticized, ranking reports from U.S. News, Princeton Review, Barron's, Peterson's and others are widely used to guide the choice of which college to attend. Beyond the United States, national college ranking systems have been established in more than 20 countries around the world (Bollag, 2007). Online colleges now also have their own ranking system similar to the US News system (Kolowich, 2009).

Unfortunately, outcome measures are lacking in these rating systems (Gallagher, 2004). Measures such as graduation rate, acceptance rate to graduate schools or post-graduate career placement rate are only sometimes available. The current ranking systems are obviously lacking in depth. The Washington Monthly has proposed an alternative outcome-based ranking system focused on how much colleges benefit the country (Editors of The Washington Monthly, 2011). Seemingly imperfect, this alternative system has been criticized that its categories do not measure what is intended (Goldin, 2006).

Response to the Influence of Ranking Systems

There is evidence that university presidents' job prospects are directly affected by the ranking systems (Bollag, 2007). Some universities have fabricated test scores and acceptance data to improve their ranking (Stecklow, 1995). These actions are in response to the real affect that rankings have on universities.

Moving up one rank in the US News & World Report ranking corresponded to a 0.4% reduction in the acceptance rate, a 0.2% improvement in the yield, and a three point gain in average SAT score and

allowed schools to raise net tuition by 0.3% for private schools the following year (Monks & Ehrenberg, 1999). For public schools, improving in rank from the second to first quartile lowers acceptance rate by over 4% and increases SAT scores by almost 20 points and the percentage of students in the top 10% of their high school class who apply (Meredith, 2004). The effect of ranking changes appears to be more strongly felt in public universities (Meredith, 2004). Ranking systems are powerful forces that shape organizational decision making and identity (Elsbach & Kramer, 1996; Espeland & Sauder, 2007).

Criticisms of Ranking Systems

The validity of the ranking systems' methodologies has been widely criticized. The rankings may not represent the very factor they attempt to measure, academic quality (McGuire, 1995; Schmitz, 1993; Stuart, 1995). Ranking systems do not measure student learning (Clayton, 2001), quality of life on campus or satisfaction with post-graduation job placement (Gallagher, 2004).

The data used in the rankings have been found to have severe and pervasive multicollinearity among the variables used in the ranking function (Webster, 2001). Baughman and Goldman (1999) found that there is a positive correlation between faculty scholarship and institutional ranking. Because the ranking methodology includes research productivity, this finding has been criticized as simply measuring the same thing (Ewell, 1999). This may work against teaching related measures because the more time faculty spend on publication, the less time they spend on teaching (Fairweather, 1996).

The ranking systems do not measure important criteria such as a commitment to general education, writing, speaking, critical thinking, active learning and opportunity to extend that learning beyond the classroom (Boyer, 2003). The rankings also have a penalty for religiously affiliated schools in peer assessment scoring (Baumann, Chu, & Anderton, 2009).

Peer assessment by university presidents and deans are a key factor in the rankings. Research by Bastedo and Bowman has shown that the rankings themselves affect future peer ratings, creating a self-fulfilling feedback loop (Bastedo & Bowman, 2010). This effect is robust across all types and sizes of universities. To counter this effect, universities have begun to expend significant funds in public relations campaigns aimed at each other to improve their peer ratings (USA Today, 2007).

Universities can also move up in the rankings by playing games with their structures and decisions. Ehrenberg (2005, p. 32) has noted that:

"an institution that hired full-time lecturers, at lower salaries, to do more of its undergraduate teaching and devoted the resources that it saved from doing so to increasing the average salaries of its tenure-track faculty would, other factors held constant, go up in the rankings … but would its students be disadvantaged by having a smaller share of their classes taught by tenure and tenure track faculty?"

Other manipulations include a shift towards helping freshmen more than transfer students, concentrating on large alumni donors instead of broader based fundraising, providing less access to disadvantaged students, and increasing research expenditures pushing faculty towards research and away from teaching activities (Ehrenberg, 2005).

Some journalists have reported outright fabrication and misrepresentation of data by colleges to improve their ranking. Egregious infractions include excluding minority students' SAT scores when calculating the school average, including part-time faculty and graduate students in the faculty to student ratio, and fabricating endowment figures, application numbers and graduation rates (Glass, 1997; Stecklow, 1995). The most recent example of this was exposed in February 2012 when the elite liberal arts school, Claremont McKenna College, admitted that it has inflated reported test scores of incoming freshman to boost its ranking (Simon, 2012).

The ranking systems use the data that is available, but many times this data is not what matters in student success. Research has shown that the degree of academic and social fit between the students and the institutions they attend and the extent to which they are involved inside the outside of the classroom determine the effect and outcome of their educational experience (Astin, 1985; Kuh, Schuh, & Whitt, 1991; Pascarella & Terenzini, 1991). As a result of these criticisms some universities have refused to fill out the peer evaluation survey in an attempt to opt out of this system (Arnoldy, 2007).

Salary Based Outcome Measures

With their predominant focus on input and process measures, the current college rankings have room for improvement. Outcome measures are obviously desired but until recently have been either expensive or impossible to gather.

The value of a college education is multi-faceted. A college education provides benefits to the individual, their quality of life and increases understanding of the world around them. College graduates have measurably better quantitative skills, cognitive skills, self-esteem, moral reasoning, educational attainment and ability to relate to the world around them (Pascarella & Terenzini, 1991). Colleges also provide a variety of services to their local communities. Nevertheless, especially in tough economic times, parents and prospective students are interested in their earning potential upon graduation.

Human resources compensation professionals use a variety of resources to benchmark proper salary levels for their employees based on comparable market salaries. Traditional salary surveys have moved toward web-based data gathering utilizing advanced statistical methods backed up by manual quality control processes to obtain large data sets for calculation of average salaries in various industries and regions. One firm, PayScale, has added questions to their survey that include the employee's college attendance and graduation date. Using this data PayScale has produced a return on investment (ROI) analysis based on the average salary of graduates and the total cost of each college (PayScale, 2010a).

In addition to the ROI report, PayScale provides publically accessible data on the starting median salary and mid-career salary of graduates from the majority of universities in the United States (PayScale, 2010b). PayScale's data includes only salaries for individuals with undergraduate degrees that have not gone on for further graduate education. They have also done an exemplary job of publishing their methodology for accepting data in their data set. Their processes include both statistical and manual quality control processes before data is accepted from their salary survey participants.

Research Hypotheses

The criticisms of the college ranking systems have been only partially enumerated here. Nevertheless, the ranking systems have a significant effect on parents, students and the universities that are being ranked. The various data items used in college rankings are an attempt to provide objective measurements of 'academic quality'. Absent outcome measurements, analysis of the construct and measurement validity of the ranking instruments is difficult to achieve. The evaluation of the ranking systems input and process data elements are central to this research and hypotheses.

The key data elements in the measurement of 'academic quality' in most of the college ranking systems include: cost of tuition, % of students receiving financial aid, the average amount of financial aid, total undergraduate enrollment, acceptance rate, average high school GPA, SAT score, average need based loan, % women, % transferred in, % international students, % of students living on campus, # of faculty, % full time faculty, student to faculty ratio, NCAA division, and size of the school's endowment.

Schools can be subdivided into several different categories. Payscale's report suggested several meta categories based on the Carnegie classifications and data from the Integrated Postsecondary Education Data System (IPEDS) (Carnegie Foundation, 2010; National Center for Education Statistics, 2011; PayScale, 2010c). This research will examine if there are differences in 'success' of graduates from these different types of institutions.

Hypothesis One: There is a statistical difference in mid-career salary of graduates between types of higher educational institutions. The types include: Arts, Music & Design; Business; Engineering; Ivy League; Liberal Arts; Private; Private Research; and Public.

The college rankings that are published by US News & World Report, Peterson's, and others suggest that the rankings are based on measurement of 'academic quality'. If the ranking systems have merit, graduates of institutions with higher levels of 'academic quality' should perform accordingly after graduation. One measure of that performance is the salary earned by graduates.

Hypothesis Two: The key data elements used in college ranking systems are correlated with median mid-career salary and a regression model can be created for mid-career salary using these 'quality' measures.

Methods

Population and Sample

There are nearly 2,400 bachelor's degree granting institutions listed in the Carnegie Classification (Carnegie Foundation, 2010). This population of schools includes 1,600 schools which are listed by US News & World Report in their 2011 Best Colleges rankings (US News & World Report, 2011a).

The purpose of this study is to examine the correlation between the characteristics used in the college rankings to the outcome measure, college graduate salary. The 2010 Payscale Salary Report contains data on 999 schools which include over 90% of the enrolled undergraduates in the U.S. (PayScale, 2010d). The 2010 PayScale College ROI report is based on this data and represents a more rigorously scrubbed data. The PayScale College ROI report contains data on 690 schools (PayScale, 2010b). These 690 schools

represent the population sample for this study. All of these schools were also found in the US News & World Report rankings as well as Peterson's College Search online (Peterson's, 2011; US News & World Report, 2011a).

The unit of measurement in this study was institutions, not individuals. Within the sample frame all institutional categories were represented. The expansion from the public and private types into the more granular meta categories were mostly an expansion of the private schools. The only exception is that seven of the twenty three engineering schools were public.

PayScale has done an exemplary job to maintain the quality of their salary data set. Salary data is self-reported by individuals and industry associations in return for regional and profession comparative salary reports. Before inclusion in the PayScale data set every entry is evaluated using a proprietary algorithm that examines the data. All data entries that violate this algorithm are reviewed by PayScale compensation analysts (PayScale, 2010c).

Materials

Data on colleges and salaries of graduates was obtained from the public web sites of PayScale.com, USNews.com and Petersons.com. Microsoft Excel 2010 (Microsoft Inc, Redmond, WA) was utilized to assemble the data used in this analysis. SPSS for Windows (version 17, SPSS Inc, Chicago, IL) was utilized to perform all of the statistical analyses.

Design

The design for hypothesis one was a non-randomized intact between groups analysis of difference of median mid-career salary. The design for hypothesis two used a correlational research model and principal components analysis to evaluate the degree of bivariate association between measures said to represent academic quality and reported median mid-career salary of baccalaureate graduates.

The 2010 PayScale College ROI data contains starting and mid-career salary data from individuals employed full time with a bachelor's degree granted from U.S. based schools (PayScale, 2010c). Median mid-career salary was the dependent variable utilized in this study. Salary combines "base annual salary or hourly wage, bonuses, profit sharing, tips, commissions, overtime, and other forms of cash earnings" (PayScale, 2010d). Mid-career was defined by PayScale (2010d) as full-time employees with at least 10 years of experience in their field who hold a bachelor's degree and no higher degrees. Typical mid-career in this data set is 42 years old with 15 years of experience. The other potential dependent variable, median starting salary, was also statistically analyzed but is subject to greater variation and may not measure the long-term value result of educational factors.

Measures stated to be representative of academic quality in the US News & World Report College Rankings were the independent variables in this analysis. The values of these variables for each institution were obtained from the public web sites of Payscale.com, USNews.com and Petersons.com. The independent variables included: 2009 total cost upon graduation, % of students receiving financial aid, average financial aid amount, undergraduate enrollment, acceptance rate, average high school GPA, SAT 75th percentile, average need-based aid, % women students, % transfer students, % international students, % of students who live on campus, number of faculty, % of full time faculty, student to

faculty ratio, NCAA division, and endowment.

Procedure

Data gathering and sample frame.

The names of the 690 schools for the sample used in this analysis were imported from the 2010 PayScale College ROI Report into Microsoft Excel 2010, (Microsoft Inc, Redmond, WA). The total cost of graduation, % of students receiving financial aid, average aid amount per student, undergraduate enrollment and the median mid-career and starting salary data was entered from PayScale ROI report and stored on a separate Excel tab.

The list of names was copied into separate tabs for the US News & World Report data as well as the Peterson's College Search data. Because the institutional data found on these public sites is presented one at a time, each college was retrieved and its data entered from these sites manually. The data retrieved manually included the remainder of the independent variables described above. A quality control check was performed periodically while entering the data. The data was also scanned for statistical outliers and checks were manually done for anomalous data points.

The VLOOKUP function of Microsoft Excel 2010 was used to create a single data set incorporating each source of data. This function prevented errors as the data was aggregated. This same function was used to assign a numerical category value for each institution. A numeric ID was also assigned for each institution by sorting alphabetically by name.

Statistical Analysis

For hypothesis one, differences in mid-career salary for graduates across eight categories of educational institutions were compared. For this analysis, the Kruskal-Wallis ANOVA based on ordinal rankings was used to determine if there was an overall difference in mid-career salary at an alpha 0.05 level. (Sheskin, 2007, p 981-984; Plitka, & Kelvin, 2012, p 154). The Mann-Whitney U test with Bonferroni correction for post hoc pair-wise comparisons was applied. In this analysis, there were 28 pairwise combinations for comparison of difference. The overall family wise pairwise alpha of 0.05 was therefore divided by 28, for an adjusted alpha to be less than 0.00178 to infer pairwise statistical difference. (Sheskin, 2007, p 998-990; Field 205, p 998-990). If significant multicolinearity is found, a principal components analysis will be created to control for internal correlations within the model.

For hypotheses one, non-parametric tests were selected in lieu of the parametric counterparts of the independent t test and one-way analysis of variance because: (1) The salary numbers reported by educational institutions in the data set was the median mid-career salary for its graduates; (2) The assumption for normal distribution of the reported median mid-career salary for the independent groups was not supported (Shapiro-Wilk $p<.05$) (Field 2005; Plitka, & Kelvin, 2012); and (3) Logarithmic transformation of the data away from salary units to fit normal distributions, a necessary assumption for parametric analysis, would in the authors' opinion distract from clarity of interpretation.

Results for between groups that were statistically different for hypothesis one, effect sizes, expressed as an r correlation, were calculated. Effect size with an $r = .10$ would equal a small effect, an $r = .30$ would equal a medium effect and an $r = .5$ would indicate a large effect. (Field 2005).

For hypothesis two, Spearman rho bivariate correlations among measures thought to represent academic quality and reported median mid-career salary of baccalaureate graduates were analyzed. The reason for selecting the Spearman rho correlation instead of the Pearson r correlation was that the data did not meet bivariate normal assumptions (Plitka, & Kelvin, 2012, p 265-266). The data for this correlation analysis, however, could be ranked, showed linear association, and were free to vary thus meeting assumptions for the Spearman rho analysis (Field, 2005, p 129-130F).

Results

Comparisons by Type of School

A non-parametric Kruskal-Wallis ANOVA based on rank was conducted and indicated a significant difference overall across the eight categories, chi-square (7) =181.254, p<.0017. A Mann-Whitney U post-hoc test for pairwise comparisons was applied with a Bonferroni correction p<0.00178 (.05/28) to control for alpha inflation. A summary of the significance levels and degree of effect size of the post-hoc Mann-Whitney U analysis is given in Table 1. This test showed the following pair-wise differences.

Ivy League (n=8) and engineering (n=23) schools (n=8) had statistically significantly higher mid-career median salaries ($110,500 and $97,000 respectively) than all other types of schools. Ivy League and engineering schools however, did not statistically differ from each other.

Private research schools (n=67) ranked third in mid-career salary with a median salary of ($86,600). Private research schools differed statistically from public, private and business schools but did not differ significantly from liberal arts and art, music and design schools.

Liberal arts schools (n=72) ranked

Table 1

Post-Hoc Mann-Whitney U Pairwise Significance in Mid-Career Salary & Degree of Effect Size

Type of Institution	*Engineering*	*Private Research*	*Liberal Arts*	*Private*	*Public*	*Business*	*Art, Music & Design*
Ivy League	0.007	< 0.001* r = 0.48 Medium Effect	< 0.001* r = 0.40 Medium Effect	< 0.001* r = 0.39 Medium Effect	< 0.001* r = 0.25 Small Effect	< 0.001* r = 0.70 Large Effect	0.001* r = 0.84 Large Effect
Engineering		< 0.001* r = 0.40 Medium Effect	< .001* r = 0.45 Medium Effect	< .001* r = 0.54 Large Effect	< 0.001* r = 0.39 Medium Effect	< 0.001* r = 0.69 Large Effect	.001* r = 0.63 Large Effect
Private Research			.073	< .001* r = 0.52 Large Effect	< 0.001* r = 0.36 Medium Effect	< 0.001* r = 0.40 Medium Effect	0.007
Liberal Arts				< 0.001* r = 0.41 Medium Effect	< 0.001* r = 0.35 Medium Effect	< 0.001* r = 0.40 Medium Effect	0.058
Private					.910	.144	0.771
Public						.115	0.719
Business							0.924

* indicates statistical significant pairwise difference p < 0.00178 with family alpha maintained at 0.05.
Effect Size correlation r reported where r = .1 small effect; r = .3 medium effect; r = .5 large effect

fourth with a median mid-career salary of ($82,700). Liberal arts schools were statistically higher in mid-career salary when compared to private, public and business schools. It did not differ from private research and art music and design schools.

Art, music and design schools (n=7) ranked fifth with a mid-career median salary of $76,300. Given its small sample of institutions, it only differed statistically as a lower salary level when compared to the highest salaries from Ivy League and engineering schools.

Private (n=142), public (n=354), and business schools (n=17) median mid-career salaries ($71,600, $71,000 and $65,400 respectively) were not statistically different from one another other.

This indicates that there are statistically significant differences in mid-career salary between types of schools. Eighteen of the twenty eight pariwise post hoc tests were statistically significant at less than a 0.00178 alpha. There were six significant differences of large effect, 11 significant differences of moderate effect, and only a single difference of small effect. Table two indicates significant pairwise differences and effect size in mid-career salary.

Hypothesis one is supported. The detailed descriptive statistics on mid-career salary by type of school is given in Table 2. A graphical representation of these differences is given in Figure 1.

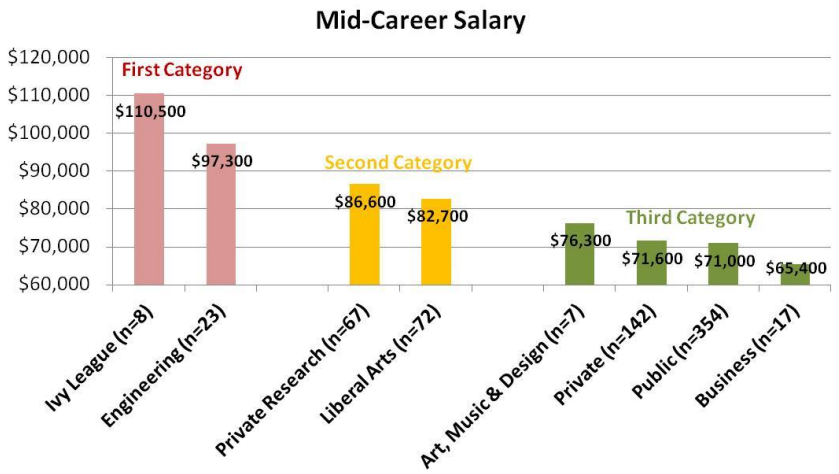

Table 2

Mid-Career and Starting Salary Statistics by Type of Institution

Type of Institution	*Number*	*Median Mid-Career Salary*	*Mid-Career Salary Interquartile Range*	*Median Starting Salary*	*Starting Salary Interquartile Range*
Ivy League	8	110,500	15,750	55,800	5,575
Engineering	23	97,300	19,200	57,100	7,700
Private Research	67	86,600	15,500	46,900	6,000
Liberal Arts	72	82,700	17,275	42,200	4,950
Private	142	71,600	14,950	40,900	6,250
Public	354	71,000	14,450	41,100	5,450
Art, Music & Design	7	76,300	26,200	42,300	8,000
Business	17	65,400	17,550	39,800	7,550

Type of Institution	*Number*	*Mean Mid-Career Salary*	*Mid-Career Salary Standard Deviation*	*Mean Starting Salary*	*Starting Salary Standard Deviation*
Ivy League	8	112,838	8,608	55,463	3,477
Engineering	23	99,504	12,222	57,617	5,912
Private Research	67	87,206	12,659	47,310	5,252
Liberal Arts	72	84,076	13,326	42,910	4,214
Private	142	72,270	11,141	41,395	4,707
Public	354	72,013	10,358	41,502	4,282
Art, Music & Design	7	70,628	16,449	40,286	4,366
Business	17	70,088	15,705	42,300	5,935

Analysis of College Ranking systems

Correlation analysis.

A two-tailed non-parametric Spearman's rho correlation found that all variables used in the college ranking systems were statistically correlated with mid-career salary at the p<=.05 level. All but two (average need based loan and % of international students) were significant at the p<=.01 level. Hypothesis two is supported by the findings.

The following variables were found to be positively correlated with mid-career salary (correlation coefficients given in parentheses):

- Total cost of education (.660)
- SAT 75th percentile (.647)
- Size of the endowment (.624)
- Average financial aid amount (.484)
- Average high school GPA (.475)
- % of international students (.363)
- % students living on campus (.304)
- Number of faculty (.250)
- % of full time faculty (.199)
- Number of students (.107)
- Average need based loan (.211)

The following variables were found to be negatively correlated with mid-career salary:

- % of female students (-.501)
- % of transfer students (-.420)
- Acceptance rate (-.393)
- Student to faculty ratio (-.336)
- % of receiving financial aid (-.192)

The correlation matrix is given in Table 3.

Five of the variables had bivariate correlations that had colinearity of 0.8 or above. Both correlation analyses confirmed prior findings of multicollinearity between college ranking factors. Given the high level of multicollinearity present, a principal components analysis was conducted to control for these correlations.

Table 3 *Non-parametric Spearman's rho Correlation Between Factors*

Spearman's rho		Dollars	2010 Cost	Proportion Receiving Aid	Average Aid Amount	Student Enrollment	Proportion Acceptance	Average HS GPA	SAT 75 Percentile	Average Need Based Loan	Proportion Women	Proportion Transfer	Proportion International	Proportion Live on Campus	Faculty Size	Proportion Full Time Faculty	Student Faculty Ratio	Millions
Dollars	Coefficient	1.000	.660**	-.192**	.484**	.107**	-.393**	.475**	.647**	.211**	-.501**	-.420**	.363**	.304**	.250**	.199**	-.336**	.624**
	Sig. (2-tail)		0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	690	690	690	690	662	662	518	585	655	674	665	258	652	671	662	671	544
2010 Cost	Coefficient	.660**	1.000	0.063	.801**	-.172**	-.396**	.426**	.587**	.269**	-.156**	-.514**	.390**	.490**	0.041	-0.020	-.640**	.618**
	Sig. (2-tail)	0.000	.	0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.287	0.615	0.000	0.000
	N	690	690	690	690	662	662	518	585	655	674	665	258	652	671	662	671	544
Proportion Receiving Aid	Coefficient	-.192**	0.063	1.000	.239**	-.376**	.210**	-0.011	-.134**	.110**	.194**	-0.074	-0.098	.140**	-.365**	-.254**	-.226**	-.096*
	Sig. (2-tail)	0.000	0.100	.	0.000	0.000	0.000	0.798	0.001	0.005	0.000	0.056	0.118	0.000	0.000	0.000	0.000	0.024
	N	690	690	690	690	662	662	518	585	655	674	665	258	652	671	662	671	544
Average Aid Amount	Coefficient	.484**	.801**	.239**	1.000	-.426**	-.384**	.377**	.499**	.194**	-0.031	-.528**	.381**	.643**	-.223**	-0.038	-.747**	.475**
	Sig. (2-tail)	0.000	0.000	0.000	.	0.000	0.000	0.000	0.000	0.000	0.428	0.000	0.000	0.000	0.000	0.324	0.000	0.000
	N	690	690	690	690	662	662	518	585	655	674	665	258	652	671	662	671	544
Student Enrollment	Coefficient	.107**	-.172**	-.376**	-.426**	1.000	0.040	0.021	-0.018	-0.065	-.231**	.322**	-0.022	-.589**	.921**	.174**	.548**	.208**
	Sig. (2-tail)	0.006	0.000	0.000	0.000	.	0.300	0.639	0.658	0.103	0.000	0.000	0.735	0.000	0.000	0.000	0.000	0.000
	N	662	662	662	662	662	659	517	585	633	652	643	249	630	650	641	649	532
Proportion Acceptance	Coefficient	-.393**	-.396**	.210**	-.384**	0.040	1.000	-.282**	-.450**	0.017	.099*	.239**	-.264**	-.323**	-0.072	-.126**	.340**	-.330**
	Sig. (2-tail)	0.000	0.000	0.000	0.000	0.300	.	0.000	0.000	0.670	0.011	0.000	0.000	0.000	0.068	0.001	0.000	0.000
	N	662	662	662	662	659	662	516	584	634	653	644	250	631	651	642	650	534
Average HS GPA	Coefficient	.475**	.426**	-0.011	.377**	0.021	-.282**	1.000	.806**	.210**	-.195**	-.385**	0.111	.365**	.115**	.289**	-.334**	.556**
	Sig. (2-tail)	0.000	0.000	0.798	0.000	0.639	0.000	.	0.000	0.000	0.000	0.000	0.121	0.000	0.009	0.000	0.000	0.000
	N	518	518	518	518	517	516	518	462	499	511	508	198	497	509	505	508	419
SAT 75 Percentile	Coefficient	.647**	.587**	-.134**	.499**	-0.018	-.450**	.806**	1.000	.128**	-.373**	-.558**	.389**	.473**	.100*	.410**	-.504**	.709**
	Sig. (2-tail)	0.000	0.000	0.001	0.000	0.658	0.000	0.000	.	0.002	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.000
	N	585	585	585	585	585	584	462	585	568	578	569	220	560	577	571	574	473
Avg Need Based Loan	Coefficient	.211**	.269**	.110**	.194**	-0.065	0.017	.210**	.128**	1.000	-0.030	-.107**	0.083	.173**	-0.006	-.102**	-.161**	.116**
	Sig. (2-tail)	0.000	0.000	0.005	0.000	0.103	0.670	0.000	0.002	.	0.442	0.007	0.194	0.000	0.889	0.010	0.000	0.008
	N	655	655	655	655	633	634	499	568	655	646	638	244	626	644	635	646	525
Proportion Women	Coefficient	-.501**	-.156**	.194**	-0.031	-.231**	.099*	-.195**	-.373**	-0.030	1.000	.218**	-.262**	-.081*	-.219**	-.349**	-0.018	-.376**
	Sig. (2-tail)	0.000	0.000	0.000	0.428	0.000	0.011	0.000	0.000	0.442	.	0.000	0.000	0.038	0.000	0.000	0.650	0.000
	N	674	674	674	674	652	653	511	578	646	674	664	257	648	667	659	663	543
Proportion Transfer	Coefficient	-.420**	-.514**	-0.074	-.528**	.322**	.239**	-.385**	-.558**	-.107**	.218**	1.000	-.219**	-.694**	.209**	-.294**	.524**	-.501**
	Sig. (2-tail)	0.000	0.000	0.056	0.000	0.000	0.000	0.000	0.000	0.007	0.000	.	0.000	0.000	0.000	0.000	0.000	0.000
	N	665	665	665	665	643	644	508	569	638	664	665	253	639	658	651	654	536
Proportion International	Coefficient	.363**	.390**	-0.098	.381**	-0.022	-.264**	0.111	.369**	0.083	-.262**	-.219**	1.000	.197**	0.067	0.089	-.256**	.366**
	Sig. (2-tail)	0.000	0.000	0.118	0.000	0.735	0.000	0.121	0.000	0.194	0.000	0.000	.	0.002	0.290	0.163	0.000	0.000
	N	258	258	258	258	249	250	198	220	244	257	253	258	248	254	248	252	205
Proportion Live on Campus	Coefficient	.304**	.490**	.140**	.643**	-.589**	-.323**	.365**	.473**	.173**	-.081*	-.694**	.197**	1.000	-.445**	.160**	-.659**	.334**
	Sig. (2-tail)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.000	0.002	.	0.000	0.000	0.000	0.000
	N	652	652	652	652	630	631	497	560	626	648	639	248	652	644	636	643	531
Faculty Size	Coefficient	.250**	0.041	-.365**	-.223**	.921**	-0.072	.115**	.100*	-0.006	-.219**	.209**	0.067	-.445**	1.000	0.048	.323**	.342**
	Sig. (2-tail)	0.000	0.287	0.000	0.000	0.000	0.068	0.009	0.016	0.889	0.000	0.000	0.290	0.000	.	0.219	0.000	0.000
	N	671	671	671	671	650	651	509	577	644	667	658	254	644	671	662	664	543
Proportion Full Time Faculty	Coefficient	.199**	-0.020	-.254**	-0.038	.174**	-.126**	.289**	.410**	-.102**	-.349**	-.294**	0.089	.160**	0.048	1.000	0.037	.393**
	Sig. (2-tail)	0.000	0.615	0.000	0.324	0.000	0.001	0.000	0.000	0.010	0.000	0.000	0.163	0.000	0.219	.	0.343	0.000
	N	662	662	662	662	641	642	505	571	635	659	651	248	636	662	662	655	536
Student Faculty Ratio	Coefficient	-.336**	-.640**	-.226**	-.747**	.548**	.340**	-.334**	-.504**	-.161**	-0.018	.524**	-.256**	-.659**	.323**	0.037	1.000	-.420**
	Sig. (2-tail)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.650	0.000	0.000	0.000	0.000	0.343	.	0.000
	N	671	671	671	671	649	650	508	574	646	663	654	252	643	664	655	671	540
Millions	Coefficient	.624**	.618**	-.096*	.475**	.208**	-.330**	.556**	.709**	.116**	-.376**	-.501**	.366**	.334**	.342**	.393**	-.420**	1.000
	Sig. (2-tail)	0.000	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.
	N	544	544	544	544	532	534	419	473	525	543	536	205	531	543	536	540	544

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Principal Components Analysis

An equamax rotation Kaiser-Meyer-Olkin greater than .50 (KMO=.834) and Bartlett's Test of Sphericity (Chi-sq= 3785.96, df=55, p=.000) support the use of factor analysis. A small number of missing values (5.28%) were replaced by interpolation analysis.

Looking at a scree plot a three-factor solution was indicated. The three factors indicated by the principal components analysis are:

- ***Quality of educational experience and students*** – this factor explains 29.6% of the variance in mid-career salary and is comprised of the following individual factors: proportion of students living on campus (.812), proportion of transfer students (-.749), student/faculty ratio (-.735), average aid amount (.723), 2010 cost (.640), SAT 75th percentile (.513) and average HS GPA (.412).
- ***Endowment and exclusivity*** – this factor explains 21.4% of the variance in mid-career salary and includes endowment (.804) and acceptance rate (-.672).
- ***Gender gap and starting salary*** – this factor explains 16.7% of the variance in mid-career salary and includes proportion of female students (-.881) and starting salary (.725).

This three factor solution explains 67.7% of the variation in mid-career salary of graduates and eliminates the bivariate collinearity problems (variance inflation factor (VIF) = 1 and tolerance = 1 across all factors).

A stepwise regression analysis shows all three components are significantly predictive of mid-career salary of graduates $F(1,680)=652$, $p<.01$ and results in a regression model with an adjusted R squared = .741. Cook distance as a measure of leverage per case is well below 1, and residuals are normally distributed. Table 4 provides the detailed coefficients and t values.

Discussion

This analysis confirms that there are significant differences in post-graduate salaries based on the type of educational institution. It also confirms that objective measurements used in many college ranking systems are correlated with post-graduate salary.

It is not surprising that Ivy League and engineering schools had higher starting and mid-career salaries than the other types of institutions. Private research and liberal arts schools outperformed public, private and business schools in mid-career graduate salary by about one standard deviation, or $13,575 per year. These findings are of a larger magnitude than the small positive effect based on selectivity noted in the

Table 4 - *Principle Components Analysis Coefficients and Statistics*

Factor	*Unstandardized Coefficient (B)*	*Standardized Coefficient (β)*	*Observed t value (t)*	*R-squared (% of variance)*
Quality of Educational Experience & Students	4,718	.343	17.602 p<.001	.416
Exclusivity & Endowment	6,282	.459	23.587 p<.001	.625 Δ.209
Gender Gap & Starting Salary	8,804	.641	32.905 p<.001	.741 Δ.116
Constant	76,118		285.597 p<.001	

research synthesis by Pascarella and Terenzini (1991). Over the course of a career, these differences can be substantial. If we assume that salary progression stops at mid-career, this represents about $500,000 in lifetime earnings difference of graduates from private research and liberal arts schools over their public, private and business competitors. Assuming the linear trend from starting to mid-career salary continues until retirement, this gap widens to approximately $600,000 over their career. This is illustrated by *Figure 2*. Projected Career Earnings by Type of School.

Liberal Arts Salary Mobility

The chart in Figure 2 shows that liberal arts colleges' graduates were the only group to change strata from starting salary to mid-career. Graduates of liberal arts colleges were in the bottom statistical category upon graduation, but had risen by mid-career (average age 42) to be statistically similar to private research school graduates. This is a significant finding that appears to illustrate that traditional liberal arts schools provide significant upward salary mobility for their alumni. This may be partially attributable to large gains in critical thinking and reasoning skills noted by Pascarella and Terenzini (1991) for institutions with a strong and balanced commitment to general education that is commonly found in Liberal Arts schools.

In addition to differences between types of schools, insights into the factors that contribute to career salary success have been uncovered by this analysis. A three factor principal components analysis shows that a three-factor predictor model can explain 67.7% of the variation in mid-career salary. The quality of the educational experience/students, size of endowment/level of exclusivity and gender gap/starting salary are the three factors uncovered in the model.

Taken overall, more costly institutions with larger endowments, attracting international and higher performing students living on campus, being taught in smaller classes, create conditions that are correlated with higher mid-career salaries of graduates. The gender bias in female salaries versus male graduates was also confirmed (Stanley & Jarrell, 1998). To a lesser extent, larger institutions with more financially able students, with less transfer students who employed higher percentages of full time faculty were weakly correlated with higher post-graduate salaries. While all of these factors are included in college rankings, other subjective factors are also included.

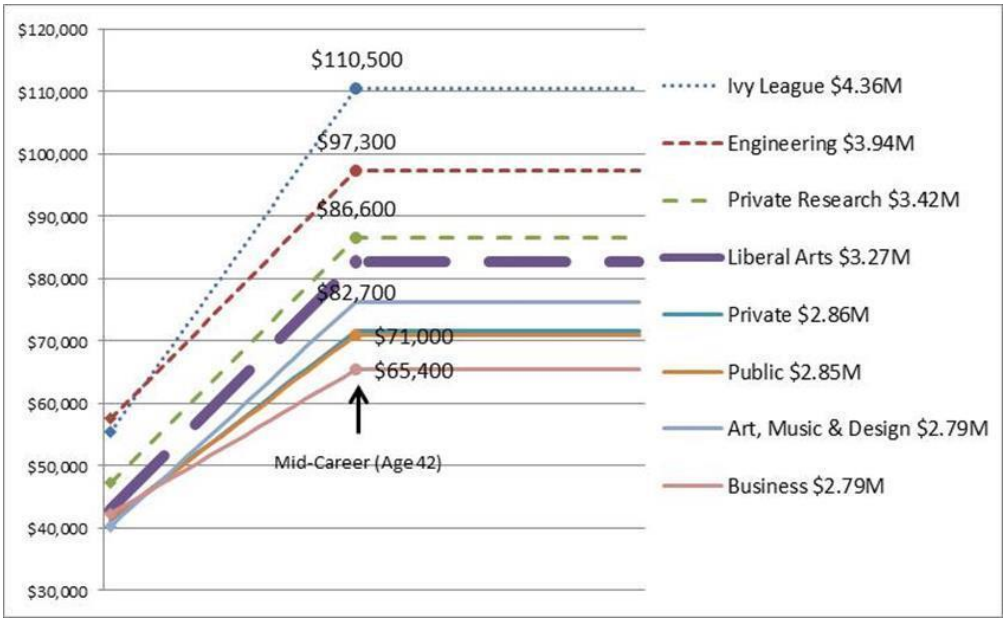

Figure 1 Projected Career Earnings by Type of School

U.S. News & World Report (2011b) has reduced the statistical weight of the subjective peer review element used in the rankings over the last few years. They also utilize the Carnegie classification for schools to determine their categorization. Unfortunately they also create sub-categories based on the size and scope of institutions. Small and mid-sized schools with a lesser number of post-graduate degree offerings are often relegated to regional categories. Placing universities in these categories may create a false impression on those attempting to choose a university that the 'nationally' ranked schools are 'better' than the 'regionally' ranked schools. This analysis indicates that while institution size is weakly correlated with post-graduate salary, factors such as quality of the student body, smaller class sizes, and the cost and financial well-being of the university should be considered as more significant factors.

The authors of the various college ranking systems should refine their rankings based on weights related to the correlation factors found in this analysis. They could also enable customized weights based on what is important to prospective students and their parents using more interactive Web 2.0 tools. Limiting the rankings by categories that are prejudiced by organizational size and scope creates an arbitrarily stratified system for individuals using the rankings as key input to a major life decision for a student.

Limitations and Assumptions

This research was not able to include the peer assessment portion of the US News & World Report because the data is not made available. Further correlation analysis of the peer assessment ratings with mid-career salary would help to validate or invalidate this as a factor in the college rankings process.

Threats to internal validity.

There are several limitations in the intact groups and correlational research models used in this analysis. The instrumentation used by PayScale, US News & World Report and Peterson's College Search may have flaws and provide a threat to internal validity. The threat to the PayScale salary data is lessened due to their robust data analysis processes. The institutional level data may have flaws because much of it is self-reported. This threat is somewhat controlled as studies comparing the rankings data with that provided to the NCAA and U.S. Department of Education are conducted. The increased importance and visibility of the rankings data has made it more likely that willful or accidental reporting errors will be detected.

Threats to external validity.

The 690 schools used in the analysis is a sample of the population of 1,600 schools ranked by US News. This may create a concern for generalization across the entire population of schools. This concern is somewhat mitigated by the large sample size used in this analysis.

There is also a potential concern with interaction of variables over time. Mid-career salary represents one of the outcomes of the college experience by graduates at least ten years or more in the past (mid-career). If the characteristics of the academics and environment have changed between their graduation and the current characteristics reported in the college rankings, the variables being compared may not be of the same basis. This threat is somewhat controlled by the finding that mid-career and starting salaries are highly correlated (Spearman's rho correlation coefficient=.812, $p<.01$).

The institution-level data aggregation of the publically available data does not allow for more detailed analysis. With access to the individual student-level pay data, matching the year of graduation with the characteristics of the institution at that time would improve the analysis. A longitudinal study examining maturation of variables over time may also provide further insight.

Recommendations for Further Research

This research found differences in post-graduate performance measured by salary by types of educational institution. Further analysis of the structural differences of private research and liberal arts schools that cause their graduates to outperform public, private and business schools by mid-career in salary is warranted. Replication of this analysis as more salary information becomes available over time using a longitudinal model may also further clarify or validate this research.

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