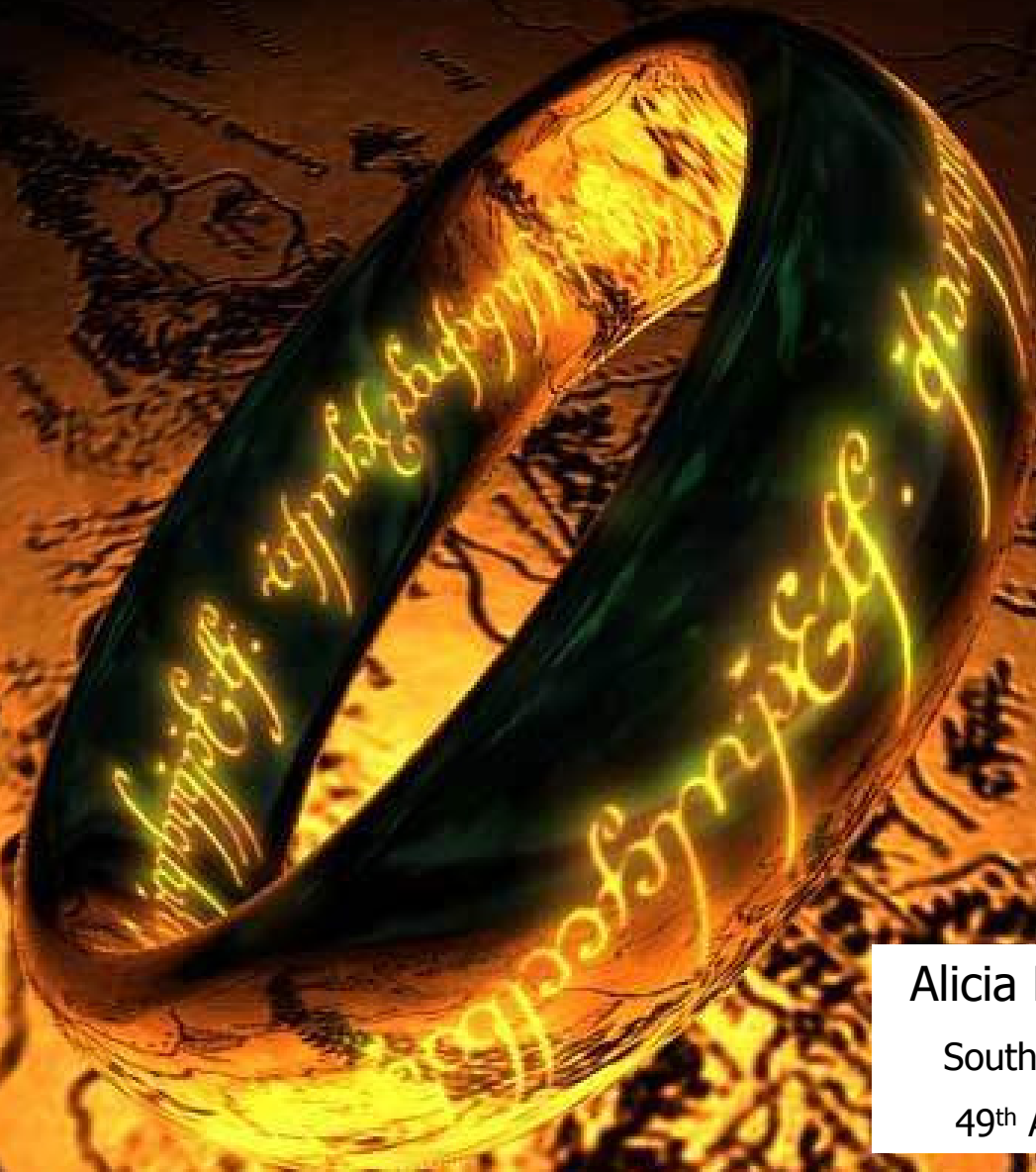


One Ranking to Rule Them All



Alicia Betsinger, Ph.D.

Southwestern University

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Background

- AIR Research Grant
- Data on Liberal Arts colleges, as identified in the 2008 edition (published in 2007) of U.S. News & World Report's *America's Best Colleges*
- Exploring Graduation Rate Performance only
- 6-year graduation rates for the Fall 2000 cohort

Research Questions

- 1) Is it possible to replicate the predicted graduation rates as published by U.S. News & World Report (USN) for Liberal Arts Colleges?
- 2) Are there more powerful, and explanatory, models of predicted graduation rates, that incorporate additional variables from the literature - those not included in USN's model?

Research Questions

3. What are the differences between actual and predicted graduation rates among various liberal arts colleges using different models?
4. What variables help explain why one college's actual graduation rate is much higher, or lower, than predicted?

Disclaimer

- Not an expert on USN methodology and rankings
- IR Director who has had to deal with the questions raised by administrators concerning these ranking systems
 - Want answers... “Why did we go down in the rankings?” “Why is our predicted graduation rate higher than our actual?” “What is causing the discrepancy?”

USN Liberal Arts Colleges

	Count	%
Associates Colleges	1	.38%
Baccalaureate Colleges--General	52	20%
Baccalaureate Colleges--Liberal Arts	188	72%
Baccalaureate/Associates Colleges	3	1%
Masters Colleges and Universities I	7	3%
Masters Colleges and Universities II	7	3%
Other specialized institutions	3	1%
TOTAL	261	100%

*Note: One missing classification: Total is 262

Discrepancies Between USN & IPEDS Actual Graduation Rates

	Count	%
+/- 5% points	24	9%
+/- 1-4% points	73	28%
Zero difference	160	62%
TOTAL	257	100%

USN Predicted Graduation Rates Methodology

The predicted graduation rate is calculated by using a regression to fit a school's 6-year graduation rate to its standardized test scores, expenditures per student, proportion of the entering class in the top 25% of their high school class, proportion of the undergraduate student body that receive Pell grants, and whether the school is public or private.

Standardized test scores are converted to the sum of the SAT 1 verbal and mathematics sections. The mean score of the entering class is used in the calculations. If the mean score is not available, then the midpoint of the 25th and 75th percentiles is used. The standardized test that the most students submit is used, with ACT scores being transformed into the SAT 1 scores. Schools are asked to verify the average score, the 25th percentile score, the 75th percentile score, and the percentage of the appropriate entering class that submitted each particular exam.

USN Predicted Graduation Rates Methodology

The average expenditures per student are taken from two years. The years are selected to be within the first four years of the students entering. The years are also chosen so as to have had consistent IPEDS reporting.

The high school class standing figure is taken for the cohort when it entered. This value is taken as a whole number. At least one-third of the entering freshmen must submit high school class standing for it to be used.

The proportion of the undergraduate student body that receive Pell grants is used. This value is taken as a value between 0 and 1. In future years, if we are able to find this value for the cohort, we will use that.

USN Predicted Graduation Rates Methodology

The predicted graduation rate is done in two categories, the National Universities and the Liberal Arts Colleges. A separate regression is performed on each category of schools.

Because values of the variables change from year to year, the particular formula used is likewise changed. The formula for the Liberal Arts Colleges for the 2008 edition (published in 2007):

$$\begin{aligned} & -2.208 - (18.372 / \text{square root of expenditures per} \\ & \text{student}) + (.057 * \text{standardized test score}) + (-3.30 * 10^{-9}) * (\text{standardized test scores}^3) \\ & + (.285 * \text{proportion of} \\ & \text{students in top 25\% of high school class}) + (-9.617 \text{ if the} \\ & \text{school is public}) + (-33.498 * \text{proportion of student body} \\ & \text{receiving Pell grants}) \end{aligned}$$

The R-squared value for this model is .809.

Replication of USN Rates

- Predicted Graduation Rates methodology (one-pager)
- PowerPoint presentations by Bob Morse from NEAIR 2008 and AIR 2008
- Excel tables from USN

USN Replication Results

	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	0.944	0.282	3.35	0.001
Expenditures	1	-3.522	2.681	-1.31	0.191
SAT cubed	1	-0.009	0.008	-1.03	0.304
SAT z-score	1	0.154	0.033	4.71	<.0001
Percent Pell	1	-0.226	0.069	-3.27	0.001
Public	1	-0.119	0.036	-3.27	0.001
Top 25%	1	0.001	0.000	2.27	0.025

F Value=79.9

R-square=0.7828

p<.0001

Answer: Research Question #1

- Obtained parameter estimates differed from those reported by USN
- Amount of variance accounted for is nearly the same 81% versus 78%
- Using error to rank graduation performance

Alternate models of predicted graduation rates

- Reviewed literature: Porter (1999); Ryan (2004); Scott, Bailey, and Kienzl (2006); Gansemer-Topf and Schuh (2006)
- Additional variables
 - Percent minority
 - Percent female
 - Undergraduate enrollment
 - Acceptance rates

Alternate models of predicted graduation rates (cont.)

- Additional variables (cont.)
 - Discount rates
 - NSSE benchmarks
 - Religious affiliation

Control/constraints variables

- Expenditures: Amount of money an institution is able to spend on its students
- Gender: % female – standard control variable in models of retention and should also be in graduation rate models
- Public/private: public overseen by state agencies; budgets controlled at state level; hence more constraints than private
- Total undergrad enrollment: in theory colleges have ability to grow as desired but in reality infrastructure supports a certain student body size
- Religious affiliation: provide different atmosphere & student body (can not be changed)

Alternate Model Regression

	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	0.63931	0.30753	2.08	0.04
Expenditures for Instruction	1	-0.00188	0.02931	-0.06	0.949
Expenditures for Academic Support	1	0.02332	0.01517	1.54	0.1273
Expenditures for Institutional Support	1	-0.00958	0.02083	-0.46	0.6466
Expenditures for Student Services	1	-0.01119	0.0181	-0.62	0.5378
SAT cubed	1	-0.01885	0.01019	-1.85	0.0671
SAT z-score	1	0.17586	0.03373	5.21	<.0001
Percent Pell	1	-0.28692	0.06893	-4.16	<.0001

F Value=39.72 R-square=0.8386

p<.0001

Alternate Model Regression (cont.)

	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Top 25%	1	0.00031385	0.000397	0.79	0.431
Percent Female	1	-0.03444	0.10899	-0.32	0.7526
Percent Minority	1	0.08265	0.04573	1.81	0.0735
Discount Rate	1	0.12589	0.05525	2.28	0.0247
Acceptance Rate	1	-0.11918	0.04475	-2.66	0.0089
Religious affiliation	1	0.00328	0.01393	0.24	0.8141
Undergraduate enrollment	1	0.00004034	0.00001083	3.72	0.0003

Partial Correlations controlling for SAT z-score

	Alternate Regular Correlations		Alternate Partial Correlations	
	Actual Grad Rate	p-value	Actual Grad Rate	p-value
Expenditures for Instruction	0.72018	<.0001	0.14965	0.0521
Expenditures for Academic Support	0.66585	<.0001	0.19984	0.0094
Expenditures for Institutional Support	0.3784	<.0001	0.12607	0.1024
Expenditures for Student Services	0.52397	<.0001	0.15196	0.0486
SAT cubed	0.63444	<.0001	-0.21632	0.0047

Partial Correlations controlling for SAT z-score (cont.)

	Alternate Regular Correlations		Alternate Partial Correlations	
	Actual Grad Rate	p-value	Actual Grad Rate	p-value
Percent Pell	-0.73362	<.0001	-0.25684	0.0026
Top 25%	0.69549	<.0001	0.15788	0.0455
Percent Female	0.14345	0.0521	0.10018	0.195
Percent Minority	-0.31035	<.0001	0.00201	0.9793
Discount Rate	-0.01479	0.8482	0.11713	0.1454
Acceptance Rate	-0.38236	<.0001	-0.13948	0.0705
Religious Affiliation	-0.16189	0.0281	0.184	0.0166
Undergraduate Enrollment	0.14276	0.0532	0.0339	0.6617

Summary Alternate Model Results

- Alternate model explained slightly more variance (84% Alternate vs. 81% USN)
- SAT z-score and Percent Pell remained in the model
 - Be wary of suppressor effect of SAT
- Additional significant predictors
 - Discount rate
 - Acceptance rate
 - Undergraduate enrollment

NSSE Benchmarks

- Level of Academic Challenge
- Active and Collaborative Learning
- Student-Faculty Interaction
- Supportive Campus Environment
- Enriching Educational Experiences

Inclusion of NSSE Benchmarks with USN variables

	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	0.44503	0.18612	2.39	0.019
Expenditures	1	-9.28E-05	0.0004316	-0.21	0.8303
SAT z-score	1	0.13104	0.03647	3.59	0.0005
SAT cubed	1	-0.02109	0.01087	-1.94	0.0556
Percent Pell	1	-0.19869	0.066	-3.01	0.0034
Top 25%	1	0.00223	0.0005644	3.95	0.0002
Level of Academic Challenge: FY	1	0.0052	0.00349	1.49	0.1391
Active & Collaborative Learning: FY	1	-0.000959	0.00311	-0.31	0.7587
Student-Faculty Interaction: FY	1	-0.00878	0.00244	-3.6	0.0005
Enriching Educational Experiences: FY	1	0.00292	0.00295	0.99	0.3256
Supportive Campus Environment: FY	1	0.00118	0.00229	0.52	0.6075

F Value=34.02 R-square=0.8001
p<.0001

Inclusion of NSSE Benchmarks with Alternate model

	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	1.07036	0.47136	2.27	0.0272
Expenditures for Instruction	1	-0.04535	0.04095	-1.11	0.2732
Expenditures for Academic Support	1	0.01356	0.01992	0.68	0.499
Expenditures for Institutional Support	1	0.00413	0.0271	0.15	0.8793
Expenditures for Student Services	1	-0.03464	0.0259	-1.34	0.1869
SAT cubed	1	-0.02419	0.01809	-1.34	0.1869
SAT z-score	1	0.13569	0.05054	2.68	0.0097
Percent Pell	1	-0.26722	0.07505	-3.56	0.0008
Top 25%	1	0.0006864	0.0006041	1.14	0.261
Percent Female	1	0.29857	0.17735	1.68	0.0981

F Value=14.66 R-square=0.8275
p<.0001

Inclusion of NSSE Benchmarks with Alternate model (cont.)

	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Percent Minority	1	0.1563	0.07736	2.02	0.0484
Discount Rate	1	0.1032	0.05832	1.77	0.0825
Acceptance Rate	1	-0.12152	0.06946	-1.75	0.086
Religious Affiliation	1	-0.01262	0.01653	-0.76	0.4487
Undergraduate Enrollment	1	2.969E-05	1.585E-05	1.87	0.0666
Level of Academic Challenge: FY	1	0.00565	0.00409	1.38	0.1734
Active & Collaborative Learning: FY	1	0.0003431	0.00348	0.1	0.9218
Student-Faculty Interaction: FY	1	-0.0085	0.00265	-3.21	0.0022
Enriching Educational Experiences: FY	1	-0.00147	0.0031	-0.47	0.6386
Supportive Campus Environment: FY	1	0.0003521	0.00245	0.14	0.8861

Summary of NSSE results

- USN & Alternate models: Student Faculty-Interaction significant, negative predictor
 - Indicates that less interaction increases predicted graduation rates
- Take all with a grain of salt given reduced sample sizes

Actual vs. Predicted Graduation Rates

	Actual USN	Actual IPEDS	Predicted USN published	Predicted USN replicated	Predicted Alternate
School A	66%	66%	77%	76%	71%
School B	90%	90%	88%	88%	95%
School C	67%	67%	76%	74%	74%
School D	61%	72%	58%	58%	59%
School E	72%	71%	75%	71%	75%
School F	85%	86%	81%	79%	85%
School G	62%	63%	68%	66%	63%
School H	70%	70%	63%	64%	64%
School I	88%	87%	85%	85%	82%
School J	92%	92%	95%	91%	92%
School K	61%	34%	37%	29%	33%

Southwestern Actual vs. Predicted Graduation Rates

Actual Graduation Rate (USN & IPEDS)	73%
Predicted Graduation Rate (USN published)	82%
Predicted Graduation Rate (USN replication model)	78%
Predicted Graduation Rate (Alternate model)	76%

USN Difference Between Actual and Predicted

	Count	%
Under-performance	114	44%
At expected	20	8%
Over-performance	128	49%
TOTAL	262	100%

Alternate Model Differences Between Actual and Predicted

	Count	%
Under-performance	86	46%
At expected	20	11%
Over-performance	81	43%
TOTAL	187	100%

USN, Alternate Model “Regular”, Alternate Model “95%”

	USN	Regular	95%
Under-performance	44%	46%	31%
At expected	8%	11%	28%
Over-performance	49%	43%	42%

USN vs. Alternate 95% Confidence Interval Performance

USN Classification

Alternate
95%
Classification

	Under	At expected	Over	TOTAL
Under	35 22.4%	3 1.9%	10 6.4%	48 30.8%
At expected	18 11.54%	7 4.5%	28 18.0%	53 34.0%
Over	5 3.2%	6 4.0%	44 28.2%	55 35.3%
TOTAL	58 37.2%	16 10.3%	82 53.0%	156 100.0%

USN “Under” vs. Alternate “At Expected”

	IPEDS Grad Rate	Alternate Predicted Rate	Lower Bound	Upper Bound	USN Grad Rate	USN Predicted Rate
School A	65%	66%	64%	68%	65%	66%
School B	88%	86%	84%	89%	88%	92%
School C	85%	87%	84%	90%	85%	96%
School D	54%	55%	53%	57%	56%	66%
School E	66%	66%	64%	68%	67%	71%
School F	92%	92%	89%	94%	92%	95%
School G	81%	82%	80%	84%	78%	84%

USN “Over” vs. Alternate “At Expected”

	IPEDS Grad Rate	Alternate Predicted Rate	Lower Bound	Upper Bound	USN Grad Rate	USN Predicted Rate
School A	84%	83%	81%	84%	84%	80%
School B	86%	87%	85%	89%	86%	83%
School C	75%	74%	72%	77%	75%	72%
School D	92%	89%	87%	92%	92%	91%
School E	85%	85%	82%	88%	85%	79%
School F	86%	87%	84%	89%	86%	85%

Answers: Research Questions #2 - #4

- In addition to SAT scores and Percent Pell, the following may be variables to examine more closely at your own institution:
 - Percent minority
 - Discount rate
 - Acceptance rate
 - Undergraduate enrollment
 - First-year NSSE benchmark scores

Answers: Research

Questions #2 - #4 (cont.)

- Difference between Actual and Predicted for Southwestern as well as others were notable using the different models
 - Discrepancies in reporting graduation rates to USN or IPEDS
 - Issue of Under/Over or At Expected performance levels

Conclusions

- Data accuracy is pivotal to modeling
- Retention rates should also be included
- Confidence intervals are highly recommended since there is clearly error associated with the modeling process
- Model across cohort years
 - Challenging with USN because the equation changes frequently



Contact Information

Alicia Betsinger, Ph.D.

Director of Institutional Research

Southwestern University

betsinga@southwestern.edu

(512) 863-1939