The World University Rankings: Do Country Characteristics Matter?

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Abstract

This paper investigates the number of universities a country had ranked in the QS Top 500 World Universities in 2008. While income, population size, and being industrialized all contribute to having more universities ranked, illiteracy is strongly negatively correlated with the number of universities ranked from a particular country. Economic freedom and ethnic fractionalization are both positively correlated with the number of universities a country had ranked in the top 500.

Keywords: Experience goods, higher education, rankings, Poisson model.

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1. Introduction

One aspect of higher education is that it is an experience good. Not until the student actually matriculates to an institution of higher education will that individual be able to judge the quality of the education, or more broadly the higher education experience. If a student's education is financed by a third party, e.g., parents or the government, then higher education also resembles a credence good in that even after the education is purchased it may be impossible for the paying customer to know the true quality of the education purchased.

One way to overcome the limited information available to customers of experience and credence goods is to provide third-party, independent reviews of the various products offered in the market. Such independent reviews have become a commonplace in consumer electronics markets and the markets for wine, beer, and cigars, to name just a few. In recent years, rankings of institutes of higher education and, at times, specific departments, have become popular. Arguably one of the reasons for the popularity of these rankings is the increasing uncertainty of the quality of a particular school's educational offerings relative to the increased nominal and opportunity cost of purchasing an educational experience from one school over another.

Even while colleges and universities strive to differentiate themselves on a large number of dimensions, e.g., sports, arts, culture, and service, the agencies providing rankings of institutions of higher education are likewise differentiating themselves. Some rankings are country specific, e.g. the U.S. University rankings by *U.S. News*[1], the UK University Guide by *The Guardian*[2], and the China University Ranking by China

[1] Available at colleges.usnews.rankingsandreviews.com/college, last accessed August 2009.
[2] Available at education.guardian.co.uk/universityguide2009/02276673,00.html, last accessed August 2009.

Academy of Management Science.[3] Still other rankings are degree specific, e.g., the Global MBA Rankings by *Financial Times*[4] and Computer Science University Rankings by GRE Guide.[5]

However, as relocating from one country to another becomes less complicated and young people are willing to explore different cultures and academic environments, world-wide university rankings are becoming more popular. Such rankings are interesting not only to students, but have also become a point of focus for academic institutions and international organizations. UNESCO CEPES (European Center of Higher Education), for example, has periodic meetings of the International Rankings Expert Group (IREG) to discuss the issue of university rankings.[6]

One aspect of various university rankings is the different criteria with which schools are ranked. As pointed out by Gualberto Buela-Casal, et al. (2007), the variety of ways used to rank universities leads to possible confusion on the part of those who consume the rankings.[7] For example, indicators included in the various rankings range from the research achievements of the university to the number of international faculty/staff in the university to the rates of employment of students after graduation, to alumni achievements. This wide range of variables used to measure the quality of institutions suggests the possibility that rankings could be biased towards different regions of the world or specific countries. However, no matter which methodology is used or the variables used to measure quality, the United States and the United Kingdom

[3]Available at cnreviews.com/min_guo/2008_china_university_ranking_by_china_academy_of_management_science_20080604.html, last accessed October 2009.
[4] Available at rankings.ft.com/businessschoolrankings/global-mba-rankings, last accessed October 2009.
[5] Available at www.greguide.com/comps.html, last accessed October 2009.
[6] The third meeting was held in October, 2007 and the fourth in June, 2009.
[7] See Buela-Casal, et al. (2007).

are two countries with consistently the greatest number of colleges ranked near the top. Is there something unique to these two countries which contributes to their success in the rankings system or are there observable socio-economic characteristics of a country that help explain the variation in the number of universities ranked? This is the empirical question addressed in this paper.

2. Contributions to the Number of Ranked Universities: Testable Hypotheses

The university ranking used herein is that by Times Higher Education (THE) QS World University Rankings. This ranking system involves a weighted average of six different measures. Forty percent of a university's score is derived from a survey of academics who offer their estimate of the quality of the institution. Ten percent of a university's score is based on a survey of employers concerning their view of the school's quality. Twenty percent is based on the student to faculty ratio, twenty percent is based on the citations per faculty, which attempts to control for the quality of the faculty's research, and a five percent weight is placed on both the percentage of the school's faculty that is international and the percentage of a school's students that are international.

The methodology used to create the university rankings incorporates the specific characteristics of each individual university. However, because different nations have different endowments and institutions, different nations will likely have differing abilities to "create" high scores or enough "high" scores to merit their institutions being ranked in the top 500 in the world. The question addressed here is whether non-academic socio-economic characteristics of a country indirectly influence the number of schools a country enjoys in the top 500 ranking.

For instance, citizens of nations that are generally considered relatively freer might view the investment in human capital through post-secondary education as having greater expected returns. This, in turn, might create a larger demand for higher quality education which would be reflected in both the academic and employer review system. Countries that are relatively freer might also have a stronger tradition of academic pursuit and academic freedom which might translate into higher quality research and therefore more citations. Finally, countries that are relatively freer might allow easier and more access to foreign nationals, both in the faculty and student ranks, which would translate into higher proportions of international faculty and students, *ceteris paribus.* Combined, these influences suggest that countries that are relatively freer would be expected to have more universities in the top 500, *ceteris paribus.* Thus, our first null hypothesis is:

H1: *Economic freedom is not correlated with the number of ranked universities.*

A second influence on the general academic environment might be what is termed "fractionalization." Fractionalization, as defined by Alesino et al. (2003), measures the odds that any two individuals selected at random would come from the same ethnic group. Fractionalization therefore has a theoretical, if not practical, lower bound of zero and an upper bound of one. Countries with greater levels of fractionalization might be able to enjoy greater gains through specialization and division of labor which might translate into a post-secondary education system which is both deeper and broader in terms of subjects studied and taught relative to less fractionalized countries. If this is the

case, then a positive relationship between fractionalization and the number of universities ranked in the top 500 is expected. This leads to our second null hypothesis:

H2: *Fractionalization is not correlated with the number of ranked universities.*

Another influence on the size and quality of a country's post-secondary education system might be the level of literacy of the adult population. A lower literacy rate would be expected to reduce the demand for post-secondary education, all else equal. Therefore countries with lower literacy rates might be expected to have fewer universities ranked in the top 500. This leads to our third null hypothesis:

H3: *Adult illiteracy is not correlated with the number of ranked universities.*

Countries that have greater per-capita gross domestic product, and countries with more population, might be expected to have larger post-secondary education systems, all else equal. As a country's post-secondary education system grows, one or more of the country's universities might become of sufficiently high quality to merit inclusion in the top 500 ranking. Moreover, countries with higher incomes and greater populations might be less isolated and also more attractive destinations for faculty and students alike. These influences, in turn, would contribute to a higher score and an increased probability that a school would be ranked in the top 500. This leads to two additional null hypotheses:

H4: *A country's per-capita gross domestic product is not correlated with the number of ranked universities.*

H5: *The population of a country is not correlated with the number of ranked universities.*

There are additional cultural differences across religious and sectarian dimensions which might also reduce the likelihood that one country's universities would be ranked in the top 500 versus another country's universities. For instance, researchers that do not publish in English-language journals might find themselves cited less often. Countries in which non-natives can face a difficult time with the local language, particularly in Arabic and Asian countries, might find themselves less attractive destinations for foreign-born students and faculty, which would in turn reduce the weighted average scores of a country's universities. We control for these differences with two identifiers: whether the country's primary religion is Islam and whether the country is considered industrialized by the World Bank. This leads to the final two null hypotheses tested:

H6: *Being predominantly Islamic has no correlation with the number of ranked universities.*

H7: *Being industrialized has no correlation with the number of ranked universities.*

3. Empirical Specification and Data

To test the enumerated null hypotheses, the following estimating equation is proposed:

$$NUMRANK_i = \beta_0 + \beta_1 FRAC_i + \beta_2 FREEDOM_i + \beta_3 ILLITERACY_i + \beta_4 GDPPC_i + \beta_5 POP_i + \beta_6 ISLAM_i + \beta_7 INDUSTRIALIZED_i + \beta_8 EURO_i + \varepsilon_i, \quad (1)$$

where the dependent variable is the number of ranked universities located in country *i*, the β's are parameters to be estimated and ε is a zero-mean error term.

The dependent variable reflects the number of universities for each country in the 2008 Quacquarelli Symonds (QS) Ltd university rankings.[8] Fractionalization was obtained from Alesino, et al. (2003), economic freedom from the Heritage Institute, illiteracy from the UNESCO (United Nations Educational, Scientific and Cultural Organization) Institute for Statistics, GDP per capita from the World Bank, population from the United Nations, whether a country is majority Islamic from the Central Intelligence Agency, and whether a country is considered industrialized from the United Nations.

One concern with the specification in equation (1) as it is originally presented is the discrete nature of the dependent variable which renders the standard linear estimator inappropriate. Therefore, we initially utilize the Poisson count-data estimator. However, many of the countries of the world have no universities ranked in the top 500. Because including only those countries with one or more ranked universities would introduce sample selection bias it is desirable to include all countries in the world for which there are complete data. However, doing so will introduce a large number of observations with zero which can distort the standard Poisson results. To accommodate this potential problem the zero-inflated Poisson model is also estimated.[9]

[8] Available at www.topuniversities.com, last accessed September 2009.

[9] An independent and contemporaneous analysis of these rankings is provided by Li, Shankar and Tang (2009). They include only four variables to explain the number of ranked universities per country: income, population size, language, and national level of R&D spending. However their analysis might suffer from misspecification as they do not utilize the zero-inflated Poisson model, which may be more appropriate given the preponderance of zeroes in the dependent variable. Furthermore, their use of R&D restricts their sample to 93 countries whereas our approach allows for a larger sample.

The zero-inflated Poisson model utilizes a first-stage regression which is used to help explain why a particular observation has a zero value and others do not, akin to a Heckman-type sample selection model. Three variables are used to identify whether a country has a non-zero number of universities ranked in the top 500: population, whether the nation has a legislative and political history with the United Kingdom, and whether the country is a member of the European Union.

Table 1 reports the summary statistics of the 142 country sample used in this analysis.[10] The average country in the sample had 3.5 universities in the top 500 ranking, however of the 142 countries only 37 actually have one or more universities ranked. Among those 37 countries the average country had 13.59 universities ranked, the least was one (Argentina, Armenia, Chile, Czech Republic, Egypt, Mexico, Slovenia, and Turkey) and the most was 159 (the United States). The average fractionalization score was .44, the average freedom score was 61, the average level of adult illiteracy was 17%, the average per-capita GDP was 14.76 thousand US dollars, the average population was 44.99 million, about one third of the sample is predominantly Islamic, 23% of the countries are considered industrialized by the United Nations, 25% have a legislative history associated with the United Kingdom, and 19% of the countries are members of the European Union.

[10] In 2008 there were 201 countries in the world according to the United Nations. However, many of these countries had one or more variables for which there were no values in 2008 (or 2007 for that matter). For example, the country of Afghanistan did not have an economic freedom score because of a dearth of reliable data with which to score the country's legal, political, and economic environment. Another variable for which 14 countries have a missing value is the fractionalization measure. Many of these countries are small island countries although Montenegro and Yemen were two noted countries without a fractionalization score. We therefore work with the 142 country sample for which complete data are available.

4. Empirical Results and Discussion

The empirical results are presented in Table 2. The second column reports the results using the Poisson estimator. Each regressor has a statistically meaningful relationship with the number of universities in the top 500 except for the fractionalization measure and whether the country is Islamic. That fractionalization is not statistically related to the number of universities ranked in the top 500 is somewhat unexpected as countries with more heterogeneous populations might be expected to have a more intellectually vibrant and diverse post-secondary education system which is also a a stronger draw to international students and faculty, and to have a better reputation with their academic peers and potential employers, all of which would contribute to higher scores. The lack of significance concerning whether a country is Islam runs counter to some critics who asset these countries stifle free speech and intellectual pursuits as to preclude their universities being ranked in the top 500.[11]

As mentioned, the Poisson model is only appropriate when the mean and variance of the dependent variable are equal. From Table 1, however, the variance of the number of universities ranked in the top 500 is more than four times the mean. This lends credence to using, instead, the zero-inflated Poisson model which accommodates the over-dispersion of the dependent variable. The third column of Table 2 reports the estimation results of the zero-inflated Poisson.

The bottom of the third column of Table 2 reports the results of estimating the "inflation" equation as specified, that is, the equation that predicts excess zeroes in the data. Whether a country has no universities ranked in the top 500 is statistically and negatively related to the country's population; but using English as a primary language

[11] See for example the Academic Freedom Conference (2005).

and having a legislative history tied to the United Kingdom have no statistical relationship with the odds of having no universities ranked. The results suggest that bigger countries are less likely to zero universities in the rankings.[12]

The upper portion of column (3) in Table 2 reports the parameters obtained for the primary equation in the zero-inflated Poisson. The results are essentially the same as in the standard Poisson with one exception. Having accounted for the excess number of zeroes in the dependent variable, the impact of fractionalization on the number of universities ranked is positive and statistically significant, more in line with intuition. The Vuong test comparing the zero-inflated Poisson with the standard Poisson yields a z-score of 2.16 (p=0.01), indicating that the zero-inflated version is superior to the standard Poisson.

The parameter estimates themselves are not directly interpretable. However, one way to interpret the results is to consider the impact of a one half standard deviation change in each regressor on the number of universities ranked in the top 500, holding the other variables constant at their sample means. These impacts are reported in the final column of Table 2. For instance, a one-half standard deviation increase in fractionalization increases the number of universities ranked in the top 500 by 1% and a similar change in economic freedom increases the number of ranked universities by 3.4%. On the other hand, a one-half standard deviation increase in the rate of adult illiteracy corresponds with a 15.5% reduction in the number of universities in the top 500. For the remaining variables, a similar change yields a 5.8% increase in the case of per-capita GDP, a 14.8%

[12] Other specifications of the "inflation" equation were estimated, including legislative lineage associated with the Soviet Union, Scandinavia, and Germany. These were likewise insignificant in explaining having zero universities in the top 500. Other insignificant regressors included per-capita GDP and economic freedom. The specification reported was chosen as it was parsimonious while conveying the essence of the failed search for significant regressors.

increase in the case of population, and a 12.8% increase in the case of being industrialized. Islamic countries have, on average, 6% fewer universities ranked, however that impact is not statistically significant.

5. Conclusions

This paper provides empirical evidence that certain country specific characteristics are significantly correlated with the number of universities a country had among the world's top 500 universities, as determined by the THE QS World University Rankings 2008. The methodology used to determine each university's score depends on the quality of its faculty, as reflected by research citations, the quality of its graduates, as reflected in employer surveys, but also on how "international" the school's students and faculty are. Thus, schools that are in countries that more strongly attract international scholars have a greater chance of having one or more schools ranked in the top 500, *ceteris paribus.*

A larger population, greater economic (and perhaps academic) freedom, more level of fractionalization (which might correlate with a more moderate reaction to heterogeneous individuals), and being industrialized are all country characteristics that are positively and statistically related to the number of universities a country had ranked. However, given the cross sectional data used here whether economic freedom, for instance, is a cause or effect with respect to the number of universities ranked is not identifiable. To test this contention will require additional investigation.

References

Alesino, A., A. Devleeschauwer, W. Easterly, S. Kurlat and R. Wacziarg (2003), "Fractionalization," *Journal of Economic Growth*, 8, 155-194.

Academic Freedom Conference (2005), "Proceedings: Problems and Challenges in Arab and African Countries," Abdalla R. Bubtana, editor. Available online at *unesdoc.unesco.org* (last accessed October 2009).

Buela-Casal, G., O. Gutiérrez-Martínez, M. Paz Bermúdez-Sánchez, and O. Vadillo-Muñoz (2007), "Comparative study of international academic rankings of universities," *Scientometrics*, **71**(3), 349–365.

Li, Mei, Sriram Shankar, and Kam Ki Tang (2009), "Why does the US dominate university league tables?" School of Economics Discussion Paper No. 391, School of Economics, University of Queensland, Australia.

Long, J. S. (1997), *Regression Models for Categorical and Limited Dependent Variables*, Sage Publications

Rothman., S., S. M. Lipset, and N. Nevitte (2003), "Does Enrollment Diversity Improve University Education?" *International Journal of Public Opinion Research*, **15**(1), 8-26.

Table 1: Descriptive Statistics of the Sample

Variable	Description	Mean	Std. Dev.	Min	Max
TOP500	Number of universities ranked in the World Top 500 in 2008	3.542	14.874	0	159
FRAC	Ethnic fractionalization from Alesino, et al. (2003)	0.448	0.249	0.002	0.93
FREEDOM	Economic Freedom Score from the Fraser Institute	61.058	9.728	38.661	87.38
ILLITERACY	Illiteracy Rate among those 15 years and older	17.036	19.918	0.200	76.40
GDPPERCAPITA	GDP Per-capita (thousands U.S. dollars)	14.767	15.907	0.389	86.66
POPULATION	Population (millions)	44.998	152.611	0.316	1327.65
ISLAM	Country's primary religion is Islam (1=Yes)	0.302	0.461	0	1
INDUSTRIALIZED	Country is considered industrialized by the World Bank	0.232	0.423	0	1
LEGOR_UK	Country has a legislative lineage with the United Kingdom	0.246	0.432	0	1
EURO	Country is a member of the European Union	0.190	0.393	0	1
Notes: Sample comprised of 142 observations. Data sources are listed in the text.					

	(1)	(2)	(3)
	Poisson	Zero-Inflated Poisson	Impact of one half standard deviation on log(top500)
FRACTIONALIZATION	-0.158	0.508*	0.0119
	(0.247)	(0.263)	
FREEDOM	0.058***	0.037***	0.034
	(0.010)	(0.010)	
ILLITERACY	-0.075***	-0.081***	-0.168
	(0.022)	(0.022)	
GDP PER CAP	13.503***	37.874***	0.057
	(4.354)	(7.683)	
POPULATION	0.006***	0.005***	0.138
	(0.000)	(0.000)	
ISLAM	-1.239	-1.339	-0.058
	(1.030)	(1.037)	
INDUSTRIALIZED	4.115***	2.874***	0.121
	(0.487)	(0.430)	
EURO	-0.260**	0.027	0.001
	(0.114)	(0.124)	
Constant	-6.319***	-4.451***	
	(0.731)	(0.683)	
Inflation Equation			
POPULATION		-0.965**	
		(0.436)	
LEGOR_UK		-2.046	
		(2.998)	
ENGLISH		-0.343	
		(3.696)	
Constant		3.986**	
		(1.957)	
Observations	142	142	

Notes: Dependent variable is the number of universities ranked in the QS World Top 500 (top500). The final column reports the marginal impact on the log of the dependent variable due to a one-half standard deviation increase in the regressor. Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%