WHAT IS A WORLD CLASS UNIVERSITY?

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I. Introduction

As many industrializing nations enter an age of prosperity through rapid economic growth, it is common for them to have significant societal and educational aspirations. Among these are the quests to raise their existing universities to "World Class" stature or to establish "World Class" universities. This call is heard from those who head universities all the way to ministers of education. In many cases, spokespersons for individual universities believe that they have already attained world class status in a specific field of study. Although the term "World Class" has been used widely in conversations about academic institutions, there has been little attempt to define the term carefully. What does it mean to be a World Class University? Is this simply a public relations claim or does it have substance? What are the criteria for World Class status, and how would we know that a university has reached that lofty height? These questions are the focus of this paper.

In order to provide some tentative answers, we have organized the paper in the following way. The next section attempts to review speeches and written works that refer to world class universities to analyze the implicit or explicit criteria that they use. The following section evaluates the criteria used in ranking universities internationally and provides comparative analysis of the determinants and outcomes of two world rankings of universities. The next section addresses the statistical determinants of reputational ratings for one of the two major world surveys as well as a few categories of professional schools and academic departments in the U.S. It is believed that the more detailed results on professional schools and academic departments provide additional findings and hypotheses that may be applicable to international comparisons. The final section attempts to provide a tentative summary of findings.

II. Views on World Class Universities

In general, there is wide agreement that great universities have three major roles: (1) excellence in education of their students; (2) research, development and dissemination of knowledge; and (3) activities contributing to the cultural, scientific, and civic life of

society. By excellence in education we refer to the resources and organization of undergraduate, graduate, and professional instruction and educational opportunities for students. Clearly, this goal requires outstanding faculty, high quality teaching and other instructional activities, and availability of good libraries, laboratories, and other pertinent facilities as well as highly prepared and motivated students who serve to educate through their peer influence. Research, development, and dissemination of knowledge refer to the embryonic identification, growth, and extension of concepts and ideas as well as their transformation into applications, goods, and services that enhance understanding and welfare. Activities contributing to the cultural, scientific, and civic life of society are many and varied, but include conferences, publications, artistic events and forums as well as provision of services (e.g. medical clinics and hospitals or museums) that engage and contribute to the larger community including the regional, national, and international communities.

In order to obtain perspectives on what different spokespersons believe comprises a World Class University, we did a search of both written and internet sources. In both cases we entered "World Class University" and several variants to identify sources. Table One provides classifications and short excerpts of some of the findings.

1. General definition

As Table One shows, definitions are vague or even tautological. They are highly subjective, but revolve around putative research, instruction, and community contributions. They also emphasize the reputational aspects rather than concrete examples.

[Table One about here]

2. Benchmarks

Typical benchmarks referred to are publications to and citations of faculty as well as the devotion of the university to research activities. Other foci include academic freedom, facilities, funding, diversity of faculty, students, and fields of study including internalization of students, staff and curriculum. Competition for faculty and students as well as selection of the most talented students, teaching quality, and connection to society are also prominent as benchmarks.

III. International Rankings of Universities

The two main studies of international ranking of universities are those of the Shanghai Jiaotong University (SJU) and the Times Higher Education Supplement (THES).

1. Shanghai Jiaotong University[1]**:**

The Institute of Higher Education at Shanghai Jiaotong University established a world-wide ranking of universities starting in 2003. Rankings are based upon several indicators of academic or research performance, including alumni and staff winning Nobel prizes and Field medals, highly cited researchers, articles published in *Nature and Science*, articles indexed in major citation indices, and the academic measures for each institution when divided by professional or staff. Articles indexed in the Arts & Humanities Index were added in the 2005 ranking. When calculating the total number of articles indexed in the three citation indices, a special weight of two was introduced for articles indexed in Social Science Citation Index and Arts & Humanities Citation Index. The table of criteria and weights is shown in Table Two and in Appendix I.

For each indicator, the highest scoring institution is assigned a score of 100, and other institutions are calculated as a percentage of the top score. The distribution of data for each indicator is examined for any significant distorting effect; and standard statistical techniques are used to adjust the indicator if necessary. 17 of the 20 top-ranked universities are in the U.S., and 2 are in the U.K., a phenomenon that we will discuss later (See Table Three).

[Table Two and Table Three about here]

2. Times Higher Education Supplement

The Times Higher Education Supplement, a British publication, published the Times Higher World University Rankings in 2004 and 2005, a list of 200 ranked universities from around the world. The 2005 ranking was based on a survey of 2,375 academics[2] from across the world, which accounts for forty per cent of the total score. The selection was to account for weights of one-third each for academics from Asia, Europe and North America. The number of principal academic areas represented included science, technology, social science, biomedicine, and arts, approximately, equally represented in

[1] For more information, visit website: http://ed.sjtu.edu.cn/ranking.htm.
[2] They did not include institutions that do not teach undergraduates.

the survey.. Further, data were supplemented by opinions from the previous year to increase the consistency and reliability. These are combined with a series of measures including the number of times that research papers are cited by academics, staff-to-student ratios and number of students and staff from abroad. The 2005 analysis includes, for the first time, a measure based on the views of international employers on which universities they prefer to recruit from. According to the THES rankings, the world's top 200 universities are in 31 countries. All but two are in Europe, Australasia, the US or Canada. The exceptions are the National Autonomous University of Mexico and Sao Paulo in Brazil. No African university made the top 200, and only two Russian universities Are ranked from the region of Eastern Europe.

3. Criteria that are used

Based on the literature on World Class Universities, we think that a World Class University evaluation should consider: (i) Institutional characteristics that may affect quality; (ii) Instructional quality; (iii) Research quality; and (iv) Student quality. Accordingly, we have sorted the ranking criteria of the two studies into four categories (Table Two).

Institutional characteristics[3] might include, but not be limited to, the number of professional and academic areas of study and research, number of faculty and students, academic facilities. These measures also reflect size and scale. As for undergraduate program, such measures as faculty-student ratios, faculty qualification, libraries and computer facilities and student selectivity are often used as proxies for educational quality (Grunig 1999). It should be noted that these do not describe the educational process, only available resources that might affect it. And, even these resources are measured incompletely. As for graduate education, it is often argued there is a strong correlation between the quality of faculty research and the quality of education4 (Ostriker & Kuh, 2003). Nevertheless, the measures of faculty research do not tell us how well a program is structured, whether it offers a nurturing environment for students. “Faculty-student ratio” is used to capture the teaching quality of an institution based on the methodology of the THES ranking. However, it is not a strong indicator because it tells nothing about the

[3] Cartter, A.M.(1966). An assessment of quality in graduate education. American Council on Education, Washington D.C.
[4] For this reason, it is hard to separate the quality of instruction from the research quality.

teaching process or its effectiveness. Student selectivity is not only an indicator of the prestige and attractiveness of a university, but also the quality of fellow students which are believed to have an educational impact or peer effect. As is evident from Table Two, the indicators for most of these dimensions are incomplete or, even, absent. For example, the SHJT ranking does not have any indicators that reveal instructional quality.

In addition, there are other perspectives that the two studies have considered in terms of the rankings of World Class University. The SHJT's study used an "Alumni" score, prestigious prizes received by alumni, to capture the reputation and academic quality of a university. The THES ranking, on the other hand, uses a subjective measure, "Peer Review" score, to evaluate the overall reputation of a university by selected experts in the field. This is the "core analysis" of THES, which is set for "gauging institutional quality."[5]

In all, the THSE ranking criteria covers more categories, but the peer review score carries a very large influence among all the indicators. While the SHJT ranking gives a greater weight to direct indicators, it is largely restricted towards scientific research.

4. Top 20 and top 40 and rank correlations between two lists

Table Four shows a list of the top 40 universities according to each survey.

[Table Four about here]

In comparing the two rankings for 2005, Harvard University is ranked unanimously as the top institution internationally. Cambridge is in the top 3 in both rankings. Stanford is in the top 5 in both rankings. California Institute of Technology (CIT), Oxford, and Princeton are in the top 10. Though 14 universities are listed in the top 20 according to both rankings, there are some large disparities between the two surveys. Columbia University, for instance, is ranked number seven by the SHJT ranking, but number twenty by the THES

[5] See The Times Higher Education Supplement, October 28, 2005, WORLD UNIVERSITYRANKINGS; METHODOLOGY; No.1715; Pg.6. Even in the U.S. News and World Report, reputation received a high weight among the various measures for rating institutions. The U.S. News & World Report ranking formula gives greatest weight (25 percent) to reputation. It was believed that a degree from a highly regarded institution is of utmost importance in terms of assisting graduates toland good jobs or gain admission to top graduate programs. On another hand, the reputation survey might also allow top academics to account for aspects of an institution that are difficult to quantify, such as faculty dedication to teaching. Presidents, provosts, and deans of admission are asked to rank a school's reputation. Participants were asked to rate peer schools' academic programs on a scale from 1 (marginal) to 5 (distinguished). If an individual was unfamiliar with an institution, they were asked to mark "don't know."

ranking. Another example is the University of Chicago, ranked number nine by the SHJT, but only number seventeen by THES.

The diversity on regions/countries within the THES ranking is more pronounced than within that of the SHJT, especially among the top 20 to 40 universities. Some 15 of 20 universities (75%) are US institutions in the SHJT ranking, but only 25% of the 20 universities in the THES ranking are from the United States. Note that among all the top 40 universities, only three on the SHJT list and seven on the THES list are from non-English speaking countries or countries that do not employ English as a first official language[6].

There are very large differences in the rankings of the next twenty universities, i.e. top 21 to top 40 universities. Only six out of twenty (30%) are common to both rankings, none of which are at the same positions though. The largest difference of rankings would be University of Michigan (Ann Arbor): it is ranked number twenty-one by SHJT, but number thirty-six by THES. Three American universities (John Hopkins, University of Pennsylvania, UCLA), which are among the top 20 in SHJT, appear only in the top 20-40 in THES.

[Figure One about here]

Figure One shows the joint ranking of universities for the two surveys with the top 40 universities from the SHJT evaluation on the vertical axis and the ranks of the same universities where they appear on the THES survey. For the top 12 schools on the SHJT ranking there is reasonable agreement with the THES survey. However, when one reaches universities at the 13th rank and above, there is a wide disagreement with a severe fanning out of the points. The disparities are large. For example, the University of Minnesota is ranked 32nd on the SHJT, but only 150th on the THES survey. In general, beyond the first small group of universities, the disagreement in results is very substantial between the two systematic surveys. This should give pause for those who would argue that the rankings are "objective" because they are done using mostly objective criteria.

5. Conclusions on consistency of criteria and results

In 2005 the Shanghai Jiaotong University held a conference on World-Class Universities (Liu 2005). At that conference, researchers, scholars, and institutions (Liu and

[6] Singapore here is viewed as an English-speaking country. Non-English speaking countries include China, France, Japan, and Switzerland.

Cheng 2005, Sundqvist , 2005, Rann 2005) were critical of the rankings. For example, Liu and Cheng (2005) and Sundqvist (2005) pointed out the world class university rankings done by Shanghai Jiaotong University do not distinguish between comprehensive and specialized institutions or research-oriented institutions. Further, they pointed out the lack of measurement on undergraduate education and teaching service in the ranking criteria.

However, despite the technical problems and methodological problems of their ranking system, these web-published academic rankings of world universities have received great attention. They present a picture of the leading higher institutions around the world and provide guidance for universities that are striving to improve their education quality under the competition of globalization.

Proulx (2005) has emphasized the important roles of data consistency, reliability and comparability, especially for university with the complexities of various affiliated components. Even though Raan (2005) suspected that there was a problem of confidentiality using the Thomson Scientific Highly Cited Scientists database in the rankings (for example, there might be problems with the identification of individual scientists by their names), we found that these two ranking systems are comparable[7].

As pointed out by THES in their methodology[8], both rankings are biased toward English-speaking countries: Besides the publication bias towards English and dominance of U.S. academic journals, international reputation or orientation is also limited by the teaching language of a university. This is consistent with the study by Filliatreau & Zitt (2005) that general characteristics of the ISI set of references are biased for some non-mainstream countries by their reliance on a non-English language.

Despite the fact that most of the indicators are "internationally comparable", , the SHJT ranking does not include any measures on social science and the humanities. Even though THES selected five indicators to reflect strength in teaching, research and international reputation, its faculty-student ratio provides no direct evidence of teaching quality. In addition, peer review score based on an expert survey constitutes 50% of the

[7] We combined data from SHJT and THES rankings to test the correlations of all indicators. We found a positive and statistically significant correlation between "size" and "citation per faculty." "Size" in the SHJT ranking is the weighted score of research quality indicators, which places a large weight on citations averaged by number of full-time faculty. Hence, the correlation coefficient of both indicators tells us the comparability of these two rankings as well as the quality of the data sources.

[8] See The Times Higher Education Supplement, October 28, 2005, WORLD UNIVERSITYRANKINGS; METHODOLOGY; No.1715.

Times ranking. University staffs from different countries submitted ratings of the top institutions in their field. As Rann (2005) pointed out, “the experts will more tend to judge on the more general basis of established reputation, instead of actual knowledge of recent past performance.” Therefore, we need to be cautious about the cognitive distance between the evaluator and evaluated object in obtaining reputational ratings.

IV. Multivariate Analyses of Rankings

This section will employ more quantitative techniques to address the question of what are determinants of world-class universities. More specifically, multiple regressions will be applied to both international and national rankings of universities and rankings of professional schools or doctoral programs. This will allow us to explore which aspects of student, faculty, and institution are statistically associated with ranking outcomes. Presumably the components that lead to the highest ranking outcomes become the components of the highest category of status, those of 'world-class.'

1. Methodology

Data that will be analyzed in this section are world university rankings published by the *Times Higher Education Supplement* (THES, 2005), national rankings of graduate and undergraduate universities by *U.S. News and World Report* (USWR, 2005), and national rankings of Ph.D. programs by the National Research Council (NRC 1995). Those data sets not only provide unique information of ranking outcomes for particular schools / programs, but they also present information about characteristics of students, faculty, and institution. The scope of information contained in the data sets varies depending upon the methodology that each used. These diverse methodologies for rankings may prohibit us from directly comparing results from particular rankings to those from other rankings. In addition, the generalization from our findings may be subject to data limitations. In this regard, we would say that our statistical analyses are exploratory, not exhaustive. Nonetheless, multivariate analyses on the various rankings will provide useful information as to what does matter for top rankings.

Among ranking outcomes, our principal dependent variable from international and national rankings will be academic peer review that is based on survey responses from 'peers,' such as faculty members. Rankings based upon specific criteria are mechanically based on a simple summation of component values, whether weighted or not. Peer review provides subjective ratings that are legitimate perceptions of school quality because juries of individual peers are regarded as experts with respect to the quality of university. Martin Ince (THES, 2005) says "… peer review, which has long been accepted in academic life and across social research [is] the most reliable means of gauging institutional quality." Based on this belief, many publishers of university rankings conduct surveys of academics

or employers and place weight on their review score. For example, world university rankings presented by *Times Higher Education Supplement* weight academic peer review by 40 percent in 2005 and 50 percent in 2004. In addition, *the U.S. News and World Report* ranking formula also puts the greatest weight[9] on peer assessment of academic excellence.

However, van Raan (2005) questions whether all individual peers involved in large-scale surveys can be considered as knowledgeable 'experts' in all areas of evaluated institutions because of the large 'cognitive distance' between evaluating peers and evaluated objects. He argues that the reliability of such subjective evaluation is quite sensitive to the composition of the sample (e.g. own institution, geographic distribution, and fields of expertise). Despite its potential inaccuracy, however, academic peer review is noteworthy in that its assessment of 'academic reputation' is influential. More importantly, it provides a window to examining which objective measures in institutional quality are highly valued by academic experts.

The basic model for our analyses assumes that peer review is a simple linear function of characteristics of student, faculty, and institution as follows.

$$PR_i = \alpha + \beta\, Stu_i + \gamma\, Fac_i + \delta\, Inst_i + \varepsilon_i \qquad (1)$$

where PR_i is peer review score, Stu_i is student characteristics, Fac_i is faculty characteristics, $Inst_i$ is institution characteristics, and ε_i is error.

Individual variables will be specified as linear or quadratic depending upon the joint distribution of the independent and the dependent variables. Then, Equation (1) will be first estimated via Ordinary Least Squares that produces unbiased and efficient estimates as long as the Gauss-Markov assumptions hold. One of the assumptions is that errors (ε_i) are independently distributed with a mean of zero and a constant variance. However, when one examines international rankings of universities, this assumption may not hold due to some potential correlations among universities within countries. To address this issue, we will create and enter country dummies as right-hand-side variables in Equation (1).

$$PR_i = \alpha + \beta\, Stu_i + \gamma\, Fac_i + \delta\, Inst_i + \theta_j\, Cont_{ij} + \varepsilon_i \qquad (2)$$

[9] The weight on peer review varies depending on level of education and discipline area; for example, 25% for rankings of undergraduate schools; 25% for rankings of graduate schools in education, law, and engineering; 100% for rankings of graduate schools in sciences, social sciences, humanities, and public affairs.

where $Cont_{ij}$ refers to the j[th] country that the i[th] university belongs to.

Those dummies may account for potential heteroskedasticity of errors, thus providing unbiased and efficient estimates. More importantly, inclusion of country dummies will allow us to estimate country-specific fixed effects that affect peer ratings of universities in particular countries independently of characteristics of students, faculty, and institution specified in the model.

On the other hand, the OLS estimates could be biased if some of the explanatory variables are skewed, thus violating the normality assumption. In other words, the estimated coefficients could be sensitive to some universities with extreme values on those variables. To address this issue, we will check the robustness of the OLS estimates through logarithmic transformations of independent variables to correct for the skewness. Little difference between the two estimates would suggest that the OLS estimates are robust independently of the presence of some universities with extreme values of independent variables.

Finally, we will address another issue of robustness by recasting the dependent variable a bit as suggested by Jackman and Siverson (1996). First of all, it is assumed that the distinctions of peer ratings among the very top universities are of little consequence. For example, we will right-censor (omit) the peer review scores of the top 10 universities, schools, or programs. Thus our new observation scheme is following:

$$PR_i^{'} = \begin{cases} c \quad if \quad PR_i \geq c \\ PR_i \quad if \quad PR_i < c \end{cases} \qquad (2)$$

where $PR_i^{'}$ is newly observed peer review, c is a right-censoring point beyond which the top 10 universities are placed, d is a left-censoring point under which the bottom 10 universities are positioned.

Then Equation (1) with $PR_i^{'}$ substituted for PR_i will be re-estimated via the Tobit estimator[10]. Similarly, little differences between Tobit and OLS estimates would suggest that the OLS estimates are robust with inconsequential differences in peer ratings for those two groups of universities.

[10] The Tobit model that was first proposed by Tobin (1958), after whom it is named, can be estimated by maximum likelihood estimator.

2. Analysis of International Rankings of Universities.

The Times Higher Education Supplement (2005) provides information on international peer ratings of universities along with their institutional characteristics. Peer review is based on survey responses from 2,375 research-active academics that were chosen by QS Quacquarelli Symonds, consultants to the THES and who are presented as experts in international rankings of MBA courses. The sample was selected and weighted according to peers' geographical distribution and field of expertise. The selected peers were asked to name the top universities in their discipline areas and the geographical regions where they have expertise. Survey responses from them were used to create peer review scores that have been normalized to show the top institution scoring 100 as with the scoring of the other variables (for more details, see THES, 2005).

Institutional characteristics include citation per faculty, faculty-teacher ratio, and the percentages of international student and faculty. Citation per faculty, defined as the number of citations for academic papers published by each faculty member, was intended to measure universities' research prowess. The citations data from Thomson's Essential Science Indicators cover the period of 1995 through 2005. Faculty-to-student ratio was used to measure universities' commitment to teaching. Finally, the THES used the percentage of international faculty and the percentage of international student to quantify universities' international orientation. Table Five shows summary statistics of world university rankings data.

[Table Five about here]

We divide the sample into two groups according to the language spoken in the countries where universities are located. The second column reports descriptive statistics for universities in English-speaking countries (ESC) while the third column shows those in non-English (NESC) speaking countries. In the last column, F-statistics indicate whether there are statistically significant differences by language. According to Table Five, there exist substantial differences favoring universities in English-speaking countries in peer review ratings, international students, and citations per faculty. This may reflect actual differences in research productivity. Or, it may simply reflect some systematic biases that disadvantage NESC universities, especially those in Asia, as suggested by Martin Ince (THES, 2005). These universities are likely to publish fewer papers in the high-impact

journals surveyed, mostly international journals in English (Filliatreau and Zitt, 2005; van Leeuwen et al, 2001)[11].

[Figure Two about here]

Figure Two shows scatter-plots between peer review and citation per faculty by language. Each of the scatter-plots not only describes the structural relationship of the two variables, but it also provide further information as to how much variation in subjective ratings of universities is accounted for by their bibliometric measure of research productivity. In principle, subjective evaluation by 'knowledgeable' experts is expected to correlate with actual performance of the institution. Moreover, if there were few systematic biases related to language, the amount of explained variance in peer review should make no difference by language. However, surprisingly, as shown in Figure Two, there exists considerable difference by language. The scatter-plots show that in English-speaking countries, universities' research productivity appears to have a positive and significant correlation with their peer ratings; whereas there seems to be little correlation for universities in non-English countries. More specifically, when specified as quadratic, citation per faculty accounts for 27 percent of variance in peer ratings among ESC universities while explaining at best one percent among NESC universities.

[Table Six about here]

In Table Six, Panel A demonstrates the estimates from OLS regressions of peer ratings of universities on their characteristics without country-specific fixed effects. We see that citation per faculty is statistically significantly associated with peer assessment while other variables including faculty-to-student ratio are not. The next three columns show the results of regressions for sub-samples. The first two report the OLS estimates by language. First, we see that there is enormous difference by language in the amount of explained variance in peer review by a combination of institutional characteristics. Specifically, about a half of the variance in peer evaluation is accounted for by all explanatory variables for ESC universities; while little variance is explained by the same variables for NESC universities. Second, in English-speaking countries the percentage of international faculty, the percentage of international student, and citation per faculty are

[11] For example, the use of German-language journals covered by the citation indices may lead to 25 percent lower measured impact (van Leeuwen et al, 2001).

positively and significantly related to peer review; yet none of them are associated with peer assessment in non-English-speaking countries. In other words, universities' international orientation and research prowess do count in subjective ratings of universities in English-speaking countries, but not in non-English-speaking countries. Third, a classical measure of universities' commitment to teaching, faculty-to-student ratio, has nothing to do with peer ratings regardless of language. Consequently, the OLS results for the first two sub-samples suggest that there exist heterogeneous effects of universities' international orientation and research productivity on academic reputation by language. The last column of Panel A reports the OLS results for the top 50 universities on the list. Citation per faculty alone is statistically associated with peer ratings of universities.

Panel B of Table Six reports the results of OLS regressions with country-specific fixed effects for overall sample and sub-samples. First, we see also large difference in explanatory power by language; specifically, adjusted R-squared is .446 for ESC universities while the number for NESC universities is .04. Interestingly, once controlling for country dummies, citation per faculty turns out to have a statistically significant impact on peer ratings among NESC universities. Combined with the results from Panel A, this suggests that there is a significant language influence that affects the statistical relation between research productivity and academic reputation.

Finally, the inclusion of country fixed-effects through dummy variables not only accounts for some potential correlations of errors among within-country universities, but it also provides useful information as to which country has large or small fixed effects on academic reputation relative to a particular country, for instance the United States. Figure Three describes country-specific fixed effects on academic fixed effects in comparison to the US. China, Russia, Italy, Germany, and Japan have significantly larger fixed effects on peer ratings of universities relative to the U.S., while Switzerland has a substantially smaller fixed effect than the United States.

Are those OLS estimates robust? The first issue of robustness is associated with a potential bias that comes from the presence of distributional skewness of some explanatory variables. To address this issue, we make logarithmic transformations of explanatory variables and re-run the OLS regressions. Not surprisingly, the estimates that are reported in Appendix 2 confirm our findings based on the OLS numbers in Panel B of Table Five.

This suggests that the OLS estimates are robust even in the presence of some universities with extreme values on explanatory variables.

The second issue of robustness is whether or how much the OLS estimates are sensitive to little distinctions among the very top universities or among the very weak universities. To address this issue, we right-censored the universities with scores of 66 or more in peer review so that the top eight universities are held constant (see Appendix 3 for the list of censored universities). Table Seven reports Tobit estimates of Equation (1) employing this censoring. The Tobit estimates are quite similar to the corresponding OLS estimates. This result suggests that the OLS estimates are also robust even in the absence of distinctions among the very top universities or among the very bottom universities. As a consequence, the presence of some universities with extreme values on peer assessment would not distort the OLS estimates.

[Table Seven about here]

In sum, our findings of multivariate analyses on international rankings of universities are threefold. First, there exists considerable difference by language in explaining variation in subjective ratings of universities by objective measures of institutional quality. Second, universities' international orientation and research productivity are statistically significantly in explaining subjective ratings in English-speaking countries; however, there are few associations in non-English-speaking countries. Those differences by language may suggest a potential bias of English in peer ratings of universities as well as even some objective measures of the quality of institution, especially citation per faculty. Last, universities' commitment to teaching measured by faculty-to-student ratio is not statistically related to peer assessment regardless of the language. Importantly, those findings are robust according to auxiliary analyses employing logarithmic transformation and the Tobit estimator.

3. Analysis of National rankings of graduate schools/doctoral programs

(1) National rankings of graduate schools (*The U.S. News & World Report,* 2005)

In 2005, *The U.S. News and World Report* published the national rankings of professional schools in education, engineering, medicine, business, and law. Those rankings are based on the expert surveys about school quality by over 9,600 academics

along with statistical measures of the quality of schools' students and faculty. Three professional schools are selected for our analyses: Education, Engineering, and Medicine.

As for the peer assessment, deans, program directors, and senior faculty were asked to judge the quality of schools in their field on a 1 to 5 scale in fall 2004. In addition a variety of statistical measures of school quality are used and presented by discipline area. Among them, we choose five common attributes of schools for the comparison: average GRE score of doctoral students, Ph.D. acceptance rate in the 2004-05 academic year, student-to-faculty ratio in 2004, the number of Ph.D.'s granted in 2004, and funded research in million dollars over fiscal years of 2003 and 2004. Lastly, we exploit the external information about the overall peer ratings of universities that professional schools belong to or are affiliated with[12]. This will account for 'Halo effects' of universities; more specifically, the subjective ratings of special schools may be influenced independently by the overall academic reputation that their universities have established.

Summary statistics of the rankings data sets are reported in Table Eight. The attributes of schools vary much depending upon discipline area.

[Table Eight about here]

Table Nine reports the estimates of multiple regressions of peer ratings of schools on institutional characteristics.

[Table Nine about here]

The peer ratings of the professional schools are related statistically the peer ratings of their university, regardless of discipline area. This implies the presence of the Halo effects that the quality ratings for particular schools are substantially affected by the overall academic reputation of their universities independently of the schools' own characteristics. Second, the selectivity of the student body appears to be important in the peer ratings of schools. For schools of engineering and medicine, the OLS estimates of GRE and MCAT are significant at levels of 0.05 and 0.10, respectively. Third, the size of school measured by the number of Ph.D.'s granted does count in expert evaluation of school quality. This may reflect the fact that larger schools are likely to command sizable resources and be more visible on the national scene. Fourth, the amount of research grants

[12] *The U.S. News and World Report* also presents overall peer ratings of research universities in *America's Best Colleges* (2005)

in dollars is strongly associated with the peer ratings of schools. This may reflect the fact that high productivity of research induces a large amount of funds for research from outside or vice-versa.

Finally, we test the robustness of the OLS estimates by re-estimating with the Tobit estimator. We first right-censored the ratings of 4.4 or more, 4.8 or more, and 4.6 or more for Education, Engineering and Medicine, respectively, in the dependent variable so that the very top schools are not represented in the estimates (see Appendix 3 for the list of censored schools). The last three columns of Table Nine report the Tobit estimates. Interestingly enough, we see that there are small differences between the Tobit and OLS estimates as found in international rankings of universities. This suggests that the OLS estimates are robust in the absence of distinctions among the very top programs and among the very weak programs.

(2) National rankings of Ph.D. programs (The National Research Council, 1995)

The National Research Council (NRC, 1995) uniquely provides the national ratings of all doctoral programs in the United States. Data assembled in the NRC report present quality ratings of programs as well as such attributes for Ph. D. programs as the size and the productivity of faculty. Among them, we select and analyze three programs: Economics, Chemistry, and Electrical Engineering representing social sciences, natural sciences, and engineering, respectively.

Our key dependent variable, the quality rating, is based on survey responses from more than 100 faculty members per each program ranking in the spring of 1993. Respondents were asked to rate the scholarly quality of program faculty on the 0 to 5 scale. We use as explanatory variables the number of total faculty in the 1992-1993 year, the proportion of fulltime faculty, publications per faculty in the years of from 1988 to 1992, Gini index of the concentration of publications within programs, citations per faculty in the years of 1988 to 1992, Gini index of the concentration of citations, and the number of Ph.D.'s granted in the years from 1987 to 1992. The purpose of measuring the concentration is to differentiate between a few faculty producing most of the publications or citations and a broader representation of faculty in these endeavors.

[Table Ten about here]

Table Ten reports summary statistics of quality ratings and explanatory variables. The attributes regarding the size and the productivity of faculty are quite diverse from program to program. For instance, the means of publications/faculty and citations/faculty in Chemistry are 10.49 and 55.68, respectively, much greater than the corresponding numbers, 2.72 and 5.43, in Economics while the size of faculty in the two programs seem to be similar. It may reflect their different conventions of publishing, including co-authorships, and citing academic papers according to discipline area.

[Table Eleven about here]

Estimates of multiple regressions are demonstrated in Table Eleven. The first three columns report the estimates of OLS regressions of the institutional characteristics on the overall quality of programs. First, the productivity of faculty seems to matter in the ratings of program quality. Citations per faculty representing the quality of publications are strongly associated with the peer ratings for programs in economics and chemistry. However, surprisingly, publications per faculty, referring to the quantity of publications, are little related to the program ratings regardless of discipline. This may suggest that the quality of research, not the quantity, does count in peer ratings of program quality.

Second, Gini measures of citations and publications within programs appear to have a negative and significant relationship with the ratings of program quality. Gini indices were created to reflect the inequality of distributions of the two measures of research productivity within programs; specifically, the higher the Gini index, the more concentrated or unequally distributed among faculty is productivity within programs. The negative relationships of this index with peer ratings indicate that the equal distributions of research productivity within programs are significantly related to the high ratings of program quality. This would imply that there is no 'super star' effect; specifically, the programs with a few big names, are not ranked as high in the ratings as programs that are equally productive with more faculty representation. Last, we see that the number of Ph.D. recipients for the past five years is strongly associated with the peer ratings. This is consistent with our finding from the rankings of professional schools that the size of the program does count in the peer assessment of doctoral program quality.

The last three columns of Table Eleven report the Tobit estimates for the robustness check of the OLS estimates. We first right-censored the ratings of 4.7 or more, 4.54 or

more, and 4.4 or more for Economics, Chemistry, and Electronic Engineering respectively, in the dependent variable, so that the very top programs are not represented; we left-censored the ratings of 0.7 or less, 0.93 or less, and 1.15 or less for Economics, Chemistry, and Electronic Engineering, respectively, so that the bottom programs are absent from the analysis (see Appendix 3 for the list of censored universities). The Tobit estimates are similar to the OLS numbers in the first three columns across programs. This indicates that the OLS estimates are robust in the absence of distinctions among the very top programs and among the very weak programs.

4. Analysis of national rankings of undergraduate schools

The U.S. News and World Report (2005) provides the national rankings of undergraduate schools independently of those of graduate schools. Universities or colleges in the United States are first categorized by mission based on the Carnegie Foundation for the Advancement of Teaching, and their rankings in each category are presented in the forms of 'best national universities,' 'best liberal art colleges, and the like. The remaining section will go over both rankings of research universities and liberal arts colleges.

Besides the peer ratings of universities or colleges, *The U.S. News and World Report* gives us information on schools, such as graduation and retention, faculty resources, student selectivity, financial resources, and alumni giving rate. For the top 50 universities or colleges, the information for particular schools is presented in the form of rankings on each component. Rankings of graduation and retention are determined by schools' average graduation rate for the past 6 years and average freshman retention rate from 2000 through 2003. The rankings of faculty resources are based on data for 2004-05 for faculty salary, the proportion of fulltime faculty, the proportion of professors with the highest degree in their fields, etc. Student selectivity rankings depend on test scores of students on the SAT or ACT tests, the proportion of enrolled freshmen who were in the top 10 percent of their high school classes, and the acceptance rate. The rankings of financial resources are based on the average spending per student on instruction, student services, and the related educational expenditures in the 2003 and 2004 fiscal years. Lastly, alumni giving rankings are determined by average percentage of alumni who gave to their school during 2002-04.

[Table Twelve about here]

The estimates of multiple regressions of peer assessment on the rankings of schools' characteristics are demonstrated in Table Twelve. The first two columns report the OLS estimates for research universities and liberal arts colleges. First, we see that student selectivity is strongly associated with the peer ratings of schools regardless of their missions. For interpretational purposes, we remind you that all explanatory variables except for student-to-faculty ratios are in the form of rankings; the lower value a particular school has, the higher the quality of school is rated. Thus the selectivity of student does count for the best national universities or liberal arts colleges.

Moreover, most importantly, we see that student per faculty and graduation and retention rank are significantly related to the peer assessment among liberal arts colleges while those are not among research universities. It may reflect schools' different missions; specifically, liberal arts colleges emphasize undergraduate education whereas national universities strongly stress research.

For the robustness check of the OLS estimates, we right-censored the ratings of 4.7 or more and 4.4 or more for research universities and liberal arts colleges, respectively, in the dependent variable so that the very top schools have no distinctions (see Appendix 3 for the list of censored universities or colleges). As shown in other rankings, there are similarities between the Tobit and the OLS estimates. This implies that the OLS estimates obtained are not distorted by some universities or colleges with extreme values on the dependent variable.

V. Summary

The definition of what makes a world class university is subjective. By definition, a world class university is one on which there is widespread agreement of a world class reputation—that it is one of the best in the world. Clearly, this a tautology in the sense that there is less agreement on what makes that reputation than the fact that there are a limited number of universities on which widespread agreement of "world class" is likely. The lack of an absolute set of performance criteria and measures may mean that world class will always be positional, referring to those universities that are at the top in terms of academic reputation rather than those that fit a class of standards. Indeed, even when criteria are used to rank and measure university performance, they are incomplete and difficult to measure; and the ones that do exist are not very powerful predictors, especially for universities in non-English speaking countries. However, we offer the following tentative conclusions:

1. The subjective nature of world class status means that institutions will attempt to address those dimensions that are considered in assessing reputations and that are visible. In this respect, research activity, publications, citations, and major faculty awards are highly visible and measurable while the quality of the educational process is not. Thus, it is not surprising to see a focus on research criteria in the surveys and in the efforts of institutions to promote their importance and little or no attempt to measure and assess teaching quality or educational activities. Indeed, there is a tacit assumption that if an institution is highly competitive in its admissions that the educational quality is also very high, even without measuring that quality. Yet, student competition for admission may be based upon a prestigious reputation that is largely due to the research visibility of a university rather than its educational virtues.
2. Although teaching, service to society, and research are all emphasized in the statements on what makes a great university, reputational ratings seem to be limited largely to the research dimension on the basis of our statistical analysis.

3. With the exception of the reputational rankings of the top 10-12 institutions there is relatively wide disagreement on the status of other institutions.
4. English-speaking countries have an advantage in the reputational rankings of their universities by virtue of the fact that the leading international journals are published in English. English has become the *lingua franca* of worldwide academia. This has also led to an advantage in competing for talent on a worldwide basis for universities in English-speaking countries.. To the degree that talent is widely distributed around the world, the top English-speaking institutions have an edge in attracting that talent internationally. The statistical determinants of ratings of universities in English-speaking countries do not appear to hold for those in non English-speaking countries. Indeed, the ratings in non English-speaking countries appear to be almost random with respect to the criteria used to rank universities in international surveys.
5. When viewing individual professional schools within a university or academic departments in the U.S., it appears that the overall reputation of the university has an independent influence or "halo effect" beyond the attributes of the schools or departments. That is, a school or department in a prestigious university will be rated more highly than a statistically identical unit at a less prestigious university.

These findings are tentative ones in an on-going project that is devoted to continuing study of the use and meaning of the world-class descriptor for universities.

Appendix 1. Indicators of SHJT Ranking and THES Ranking

1) Shanghai Jiao Tong University Rankings 2005:

Alumni: The total number of the alumni of an institution winning Nobel Prizes and Fields Medals. Alumni are defined as those who obtain bachelor, Master's or doctoral degrees from the institution. Different weights are set according to the periods of obtaining degrees. The weight is 100% for alumni obtaining degrees in 1991-2000, 90% for alumni obtaining degrees in 1981-1990, 80% for alumni obtaining degrees in 1971-1980, and so on, and finally 10% for alumni obtaining degrees in 1901-1910. If a person obtains more than one degrees from an institution, the institution is considered once only.

Award: The total number of the staff of an institution winning Nobel prizes in physics, chemistry, medicine and economics and Fields Medal in Mathematics. Staff is defined as those who work at an institution at the time of winning the prize. Different weights are set according to the periods of winning the prizes. The weight is 100% for winners in 2001-2004, 90% for winners in 1991-2000, 80% for winners in 1981-1990, 70% for winners in 1971-1980, and so on, and finally 10% for winners in 1911-1920.

HiCi: The number of highly cited researchers in broad subject categories in life sciences, medicine, physical sciences, engineering and social sciences. These individuals are the most highly cited within each category.

N&S: The number of articles published in Nature and Science between 2000 and 2004. To distinguish the order of author affiliation, a weight of 100% is assigned for corresponding author affiliation, 50% for first author affiliation (second author affiliation if the first author affiliation is the same as corresponding author affiliation), 25% for the next author affiliation, and 10% for other author affiliations. Only publications of article type are considered.

SCI: Total number of articles indexed in Science Citation Index-expanded, Social Science Citation Index, and Arts & Humanities Citation Index in 2004. Only publications of article type are considered. When calculating the total number of articles of an institution, a special weight of two was introduced for articles indexed in Social Science Citation Index and Arts & Humanities Citation Index.

Size: The weighted scores of the above five indicators divided by the number of full-time equivalent academic staff. If the number of academic staff for institutions of a country cannot be obtained, the weighted scores of the above five indicators is used. For ranking 2005, the numbers of full-time equivalent academic staff are obtained for institutions in USA, Japan, China, Italy, Australia, Netherlands, Sweden, Switzerland, Belgium, Slovenia, etc.

2) Times Higher Education Supplement Rankings 2005:

International Faculty Score: the percentage of international faculty.

International Student Score: the percentage of international students.

Faculty Student Ratio Score: Staff-to-student ratio.

Citation per faculty: The number of citations for academic papers generated by each staff member. This has been compiled from staff numbers collected by QS and citations data supplied by Evidence Ltd on the basis of data from Thomson Scientific (formerly the Institute of Scientific Information, www.isinet.com), cover the period between 1995 to 2005. A lower cut-off of 5,000 papers has been applied to eliminate small specialist institutions.

Peer Review Score QS surveyed 1,300 academics in 88 countries. Each was asked to nominate both the academic subjects and the geographical areas on which they felt able to comment, and QS sought other respondents to balance nominations in academic discipline and location. The academics were each asked to name the top institutions in the areas and subjects on which they felt able to make an informed judgment. The survey took place during August and September. This unique and groundbreaking material is weighted at half of the total score. The sample used to compile the peer-review column of this table comprises 2,375 research-active academics. They The selection was weighted so that just under a third of the academics came from each of the world's major economic regions — Asia, Europe and North America — with a smaller number from Africa and Latin America. It also had to yield roughly equal numbers from the main spheres of academic life: science, technology, biomedicine, social sciences and the arts. The selected academics were asked to name the top universities in the subject areas and the geographical regions in which they have expertise. Data collected in 2005 were supplemented by opinions from our 2004 survey, where the same question was asked but no individual's opinion was counted twice. We believe that this two-year rolling average provides improved statistical reliability.

Recruiter Review Score the opinion of major international employers of graduates. The sample of employers was generated by QS from its own extensive knowledge of graduate recruiters and from universities, which provided names of companies that are frequent recruiters of their graduates. All the companies involved recruit either around the world or on a national scale in large countries. They were asked to identify up to 20 universities whose graduates they prefer to employ most. The respondents were guaranteed anonymity. They include banks and financial organizations, airlines, manufacturers in areas such as pharmaceuticals and the automotive industry, consumer goods companies, and firms involved in international communications and distribution. There were 333 respondents.

Appendix 2. The OLS regressions of peer ratings on logarithmic explanatory variables

Variables	Overall	Sub-samples		
		English	Non-English	Top 50
Logged international faculty	4.04*	4.08*	-4.11	2.35
	(1.92)	(2.37)	(3.12)	(4.14)
Logged international student	6.45**	12.81***	-.010	17.32*
	(2.26)	(3.39)	(2.39)	(6.99)
Logged faculty-student ratio	5.604*	2.758	6.20	-1.51
	(2.23)	(3.04)	(3.27)	(5.09)
Logged citation per faculty	11.64***	14.80***	6.48*	16.84***
	(1.34)	(2.36)	(2.59)	(3.96)
Constant	-59.13***	-42.78**	7.25	-63.06
	(13.28)	(14.18)	(20.19)	(34.71)
Country dummies	Yes	Yes	Yes	Yes
R-squared	.241	.387	.075	.300
(sample size)	(187)	(104)	(83)	(49)

Note: standard errors are in parentheses; * < .05, ** < .01, *** < .001

Appendix 3. Censored Universities, Colleges, or programs in the Tobit models.

Rankings	Universities, Colleges, or programs	
	Left-censored	**Right-censored**
Times Higher Education Supp.		Harvard U., Cambridge U., U.C. Berkeley, Oxford U., MIT, Stanford U., Tokyo U., Yale U., Beijing U., and Princeton U.
US News & World Report (grad.)		
Education		Harvard U., Stanford U., U.C. Berkeley, and TC Columbia
Engineering		MIT, Stanford U., UC Berkeley, and Cal. Tech.
Medicine		Harvard U., Johns Hopkins U., Washington U., U. of Pennsylvania, Duke U., Stanford U.
National Research Council		
Economics	Northeastern U., Clark U., Utah State U., Colorado School of M, U. Missouri, Rensselaer Polytech.	U. of Chicago, Harvard U., MIT, Stanford U., Princeton U., and Yale U.
Chemistry	New Mexico Inst. of M., U. of Detroit, Philadelphia C. of Pharm., Wichita State U., and Worcester Polytech.	USC, Cal Tec, Harvard U., Stanford U., MIT, and Cornell U.
Electrical Engineering	U. of Mass-Lowell, U. of Vermont, U. of Idaho, Tennessee Tech. U., and Tulane U.	Stanford U., MIT, UC Berkeley, Cal. Tech., and U. of Illinois UC
US News & World Report (und.)		
National universities		U.C. Berkeley, Harvard U., Princeton U., Yale U., Stanford U., and MIT
Liberal arts colleges		Carleton C., Bowdoin C., Swarthmore C., Wellesley C., Williams C., and Amherst C.

Reference:

Asian Development Bank News (2001). "Viet Nam to Build its First World-Class University." http://www.adb.org/Documents/News/VRM/vrm_200107.asp

Altbach, Philip (2005). "A world class country without world class higher education: India's 21st century dilemma," *International Higher Education* Summer 2005.

Altbach, Philip (2003). "The costs and benefits of world-class universities," *International Higher Education* (Fall 2003)

Business Weekly (2002). "Building top-notch universities." (April 24, 2002) Web-site: http://www.chinadaily.com.cn/chinagate/doc/2002-04/24/content_247215.htm

Cai, N.C.& Cheng, Y. (2005). "Academic ranking of world universities – methodologies and problems." In Liu, Nian Cai, ed. (2005) Proceedings of the First International Conference on World-Class Universities (WCU-1) (Shanghai: Shanghai Jiao Tong University).

Cheng, Y & Liu, N.C. (2005). "Forecasting world class universities from GDP perspective," In Liu, Nian Cai, ed. (2005) Proceedings of the First International Conference on World-Class Universities (WCU-1) (Shanghai: Shanghai Jiao Tong University).

Dahrouge, Brandy (2003). "A world-class university is…" Letter

Eaton, Judith (2004). "The opportunity cost of the pursuit of international quality standards," *International Higher Education* (Summer 2004)

Filliatreau, Ghislaine and Michel Zitt (2005). "Being a World-Class University: Bibliometric Considerations," In Liu, Nian Cai, ed. (2005) Proceedings of the First International Conference on World-Class Universities (WCU-1) (Shanghai: Shanghai Jiao Tong University).

Finkelstein, Martin (2003). "Japan's National Universities gird themselves for the latest wave of reform," *International Higher Education* (Fall 2003)

Fong, Pang, & Linda Lim (2003). "Evolving great universities in small and developing countries," *International Higher Education* (Fall 2003)

Frazer, Malcolm (1994). "Quality in Higher Education: An International Perspective," in Diana Green, ed., *What Is Quality in Higher Education?* London: Society for Research into Higher Education, 1994, pp. 101-111

Guohua, Deng (1999). interviewed with the University of Science and Technology of China Alumni Foundation. Web-site: http://af.ustc.edu/interview/99/deng_gh.html

Hobbs, Arthur (1997). "World Class University and cultural diversity," Web-site: http://www.math.tamu.edu/~arthur.hobbs/3d.html

Jackman, W. Robert and Randolph M. Siverson (1996). "Ratings the Rating: An Analysis of the National Research Council's Appraisal of Political Science Ph. D. Programs." *PS: Political Science and Politics*, Vol. 29, No. 2 (Jun., 1996), 155-160.

Jiang, Xueqin (2001). "China's Top 2 Universities Try for 'World Class' Status." *The Chronicle of Higher Education* Web-site: http://chronicle.com/weekly/v48/i17/17a03301.htm

King, Christine (2003). "World Class?" Web-site: http://education.guardian.co.uk/worldclass/story/0,14048,1085324,00.html

Lang, Daniel (2004). "World Class or the curse of comparison?"

Lee, Gilton (2000). "Brain Korea 21: A development-oriented national policy in Korean higher education," *International Higher Education* (Spring 2000)

Liu, Nian Cai, ed. (2005). Proceedings of the First International Conference on World-Class Universities (WCU-1) (Shanghai: Shanghai Jiao Tong University).

Liverpool, Patrick (1995). "Building a world class university positioning Virginia Tech to compete in the international arena," *Virginia Tech Spectrum* (Oct. 1995)

Mohrman, Kathryn (2005). "World-class universities and Chinese higher education reform," *International Higher Education* (Spring 2005)

National Research Council (1995). *Research-Doctorate Programs in the United States: Continuity and Change*. Washington, DC: National Academy Press.

Niland, John (2000). "The challenge of building world class universities in the Asian region," *On Line opinion* (Australia's e-journal of social and political debate) Web-site: http://www.onlineopinion.com.au/view.asp?article=997

Proctor, Lita M (2005). "Presentation to the President's commission of the future of FSU," Web-site: http://www.fsu.edu/~future/proctor.html

Proulx, R. (2005). "Criteria for ranking universities with affiliated components" In Liu, Nian Cai, ed. (2005) Proceedings of the First International Conference on World-Class Universities (WCU-1) (Shanghai: Shanghai Jiao Tong University).

PKU News (2004). "Oxford Day Report (1): Chancellor of Oxford Lectured at PKU," PKU News. Wednesday, March 24th, 2004. http://ennews.pku.edu.cn/news.php?s=80099374

Robinson, David (2005). "GATS and the OECD/UNESCO Guidelines and the Academic Profession," *International Higher Education*.

Sasaki, Takeshi (2005). "The message from the President, the University of Tokyo," Web-site: http://www.e.u-tokyo.ac.jp/finance-g/english/irregular/aisatsu.html

Shanmugaratnam, Tharman (2002). "Shanghai Jiao Tong University joins in world class universities program," Speech at the inauguration ceremony of Shanghai Jiao Tong University's Graduate school in Nanyang Technological University

Sundqvist, B. (2005). "Monitoring a comprehensive research university." In Liu, Nian Cai, ed. (2005) Proceedings of the First International Conference on World-Class Universities (WCU-1) (Shanghai: Shanghai Jiao Tong University).

Tan, Eric (2003). "Curtin's new Chancellor describes his vision of a world-class university," Curtin University of Technology, Web-site: http://announce.curtin.edu.au/release2003/c2203.html

The U.S. News and World Report. (2005). America's Best Colleges, 2006 edition.

The U.S. News and World Report. (2005). America's Best Graduate Schools, 2006 edition.

Tobin, James (1958). "Estimation of Relationships for Limited Dependent Variables." *Econometrica* 26: 24-36.

University of Minnesota (1993). University of Senate Minutes. Web-site: http://www1.umn.edu/usenate/usen/931004sen.html

University of Oxford News Archive (2004). "Vice-Chancellor pledges to preserve Oxford's international reputation." Web-site: http://www.admin.ox.ac.uk/po/041005.shtml

van Raan, A FJ. (2005). "Challenges in ranking of universities," In Liu, Nian Cai, ed. (2005) Proceedings of the First International Conference on World-Class Universities (WCU-1) (Shanghai: Shanghai Jiao Tong University).

Vest, Charles (2005). "World class universities: American lessons," *International Higher Education* (Winter 2005)

Wang, Yingjie (2001). “Building the world-class university in a developing country: universals, uniqueness, and cooperation.*” Asia Pacific Education Review* (2001), Vol. 2, No.2

Water, Jack (2005). “Building a world class university: Reality vs. Rhetoric,” presentation at Thai

Tables:

Table One. World Class University Literature

Category	*Literature*	*Sources*
General definition	**(1) No agreed-upon definition**	
	- Ambrose King, former vice chancellor of the Chinese University of Hong Kong: "it has faculty regularly publishing their research in the top defining journals in their respective disciplines; the graduate student body is truly international in origin; and the graduates are employable anywhere in the world"	(Mohrman, 2005)
	- Ruth Simmons, president of Brown University: "a peer review system in which standards are set by leaders of the field and those leaders are themselves challenged and judged by this process."	
	- "For universities, world-class standing is built on reputation and perception – often seen as subjective and uncertain – and it requires outstanding performance in many events."	(Niland, 2000)
	(2) World class defined by dictionary as **"ranking among the foremost in the world; of an international standard of excellence"**	(Altbach, 2003)
	(3) An absolute term or a relative term?	
	- "A minimum standard" or "a relative position in the form of ranking"	
	- " industrial definition of quality means a guarantee that something meets a certain basic standard"	(Robinson, 2005)
	- "top of the world rankings"	
	(4) Unit of concept: an institution or a system?	(Lang, 2004)
	- "Being world class must have a system dimension"	
	(5) Different definitions for different stakeholders:	(Frazer, 1994)
	- government & taxpayers: a cost-benefit view (efficiency, productivity)	(Lang, 2004)
	- employers of grads: a qualification of graduates (effectiveness)	
	- students and their parents: the quality of instruction	
	- faculty and administrators: the quality of research (research university)	
	(6) Who defines?	
	- i.e. "International Association of University Presidents (IAUP) to establish a worldwide quality register" UNESCO & OECD	(Eaton, 2004)

Benchmarks	**1. Excellence in research (i.e. top-quality faculty)**	
	- "the social science citation index"	(Altbach, 2003)
	- "publication in peer-reviewed academic journal"	(Fong&Lim,2003)
	- quality of faculty: "as a place where top staff will wish to congregate"	(Niland, 2000)
	- research reputation	
	- "academic credentials of faculty, research productivity, scholarly publications"	(Water, 2005)
	- " a group of excellent faculty is the very fundamental for a university"	(Lucas, 2004; cited in PKU news)
	- "the power of the universities comes from their sustainable creativity….To create a system that allows the gathering of top-ranking professors and the making of brilliant brains is the core of institutional reform.."	(Bus. Weekly, 2002)
	- "This means such a university will almost certainly be a research-intensive university. It also must teach well."	(Niland, 2000)
	-"A world-class reputation attracts the best faculty and students and so perpetuates high-quality research and teaching."	(Hobbs, 1997)
	- There are extremely few world-class universities that are not also strong research universities."	
	- "……Top-ranked academic departments; nationally recognized faculty and students; very high rankings in sponsored research, patents, and private fund raising. We have the basic ingredients of a world-class university……"	(U. of Minnesota, 1994)
	2. Academic freedom & an atmosphere of intellectual excitement	
	- "the quality of university is positively correlated with academic autonomy and academic freedom"	(Wang, 2001)
	- President Casper of Stanford University: "an open secret for Stanford to become a world class university in a relatively short time is that Stanford treasures academic freedom as the soul of the university"	
	- "The degree of freedom of speech at universities is among the highest in Chinese society, but it is still limited"	(Jiang, 2001)
	3. Self-governance	
	- "the authorization for the national universities to incorporate as public corporations with a Board of Trustees, independent of the ministry": Japan	(Finkelstein, 2003)
	4. Adequate facilities & funding	
	- "Support for frontier research": U.S.	(Vest, 2005)
	- "An investment on the principle of selection and concentration": Korea	(Lee, 2000)
	- "concentrate resources on a handful institutions with great potential for success": China '985 project'	(Mohrman, 2005)

- "the title of world class won't come at a discount price, and without world-class funding the goal of reaching, and preserving, that high standard will be rhetoric alone"	(Niland, 2000)
- "sustained financial support, with an appropriate mix of accountability and autonomy"	(Altbach, 2003)
- "Oxford remains 'world class' in the students and academics it recruits, the quality of its research, and its collaborations with other leading international institutions." (student/faculty selectivity/funding support)	(Hood, 2004; U. of Oxford News Archive)
5. Diversity	
- "A holistic learning/research/teaching environment where diverse fields of knowledge are studied, respected and revered"	(Dahrouge, 2003)
- "world class university must be inclusive; it covers all kinds of fields including not only traditional basic disciplines, but also new inter-disciplines, or those obsolete disciplines without much practical value"	(Wang, 2001)
- "If a university wishes to attain world-class status, its faculty and students must understand the divergent cultures that inhabit the world."	(Hobbs, 1997)
6. Internationalization: students, scholars, and faculty from abroad	(Vest, 2005)
- "it must strive to develop **world citizens**: we increasingly find that we need comparative knowledge of many cultures to answer the questions we ask"	(Niland, 2000)
- "internationalizing programs; internationalizing the curricula, increasing student exchange and the number of international students, and implementing faculty development and exchanges "	(Liverpool, 1995)
- "international connections to other institutions to create world class program"	(Shanmugaratnam, 2002
- "world class universities recruit first rate professors and enroll students from throughout the world"	(Wang, 2001)
- "The other nine factors include reputation, international relations and communication, fund, creativity of research and so on."	(Lucas, 2004)
- "USTC also supports, financially and administratively, 200 or so short-term visitors from all over the world (including other places in China) to Hefei every year. In addition, there is a plan to send our about 100 core USTC faculty on short-term visits to institutions around the globe."	(Guohua, 1999)
- "we are world class in that we have students from all over the world and, importantly, we have partnerships with universities, colleges and businesses all over the world."	(King, 2003)
7. Democratic leadership	
- "open competition for faculty and students"	(Vest, 2005)
- "collaborating with external constituents"	(Liverpool, 1995)
8. A talented undergraduate body	
- "a special uplift effect from having thousands of really talented undergraduates on the one campus	(Niland, 2000)

sparking off each other and keeping the rest of us, including the postgraduate students, on our toes"	
- "the investment to students is the investment to the university and moreover, the investment to the future."	(Lucas, 2004)
-" Although [research] is integral to the perception of being deemed a world-class institution, the true measurement is in the success of a university's graduates"	(Min in Jiang, 2001)
-" World-class also means having a very full range of programs that help educate all our students as widely as possible"	(Hobbs, 1997)
9. Use of ICT, efficiency of management, Library	(Niland, 2000)
- "utilizing information technology"	(Liverpool, 1995) (Water, 2005)
10. Quality of teaching	
- "most graduates are ill equipped to work in a market economy which requires skills in interpreting and applying information. The project will strengthen and 'scale up' university education and will offer comprehensive curricula that will address these issues."	(ADB, 2001)
- "The reputation of a university is decided by its students' quality and contributions to society. Therefore, universities should pay extra attention to quality education."	(Bus. Weekly, 2002)
- "World class for us is about the right teaching, innovation and skills, rather than Nobel prizes."	(King, 2003)
-" …..As a result, we are a world-class university based on quality of education and research, and are achieving our historic mission to lead progress in learning….."	(Sasaki, 2005)
-"…the quality and currency of curricula, the effectiveness of teaching and the quality of research"	(Tan, 2003)
11. Connection with Society /community needs	
- "There is little linkage between teaching and research and neighboring universities often offer duplicate courses."	(ADB,2001)
- "universities should relate to the private sector and engage in setting public research strategies"	(Hood, 2004)
- "Although there is a general awareness in the wider community that university research delivers worthwhile outcomes, there is a particular need in medium-scale economies for the benefits flowing from research to be realized."	(Niland, 2000)
- "relevance and agility….Knowledge per se is transient and quite useless unless it can be applied."	(Tan, 2003)
12. Within Institutional Collaboration.	
- "collaborative research efforts between departments on this campus and between this school and other schools"	(Proctor, 2005)

Table Two. A Comparison of Ranking Criteria between Shanghai Jiao Tong University (SHJT) & Times Higher Education Supplement (THES)

Category	*Shanghai Jiao Tong University*	*Times Higher Education Supp.*
Institutional Characteristics		**International Faculty score:** percentage of international staff (5%)
Instructional Characteristics		**Faculty/Student score:** staff-to-student ratio (20%)
Research reputation	**Award score:** The total number of the staff winning Nobel prizes in physics, chemistry, medicine and economics and Fields Medal in Mathematics (20%) **Nature and Sciences score:** The number of articles published in Nature & Science between 2000 and 2004 (20%) **HiCi score:** The number of highly cited researchers in broad subject categories in life sciences, medicine, physical sciences, engineering and social sciences (20%) **SCI score:** Total number of articles indexed in Science Citation Index-expanded, Social Science Citation Index, and Arts & Humanities Citation Index (20%) **Size:** The weighted scores of five indicators divided by the number of full-time equivalent academic staff (10%)	**Citation/faculty score:** The number of citations for academic papers generated by each staff member (20%)
Student Characteristics		**International Student score:** percentage of international students (5%)
Others	**Alumni score:** The total number of the alumni winning Nobel Prizes and Fields Medals. (10%)	**Peer/Recruiter review score:** a scale from 1 to 5 (distinguished) to rate peer schools' academic programs (40%/10%)

Table Three. Regional Distribution of Universities According to Rank

Region	Top 20	Top 100	Top 200	Top 300	Top 400	Top 500
North and Latin America	17	57	100	140	165	198
Europe	2	35	79	123	168	205
Asia/Pacific	1	8	23	36	65	93
Africa				1	2	4
Total	**20**	**100**	**202**	**300**	**400**	**500**

Country	Top 20	Top 100	Top 200	Top 300	Top 400	Top 500
USA	17	53	90	119	140	168
UK	2	11	19	30	36	40

Source: Retrieved from http://ed.sjtu.edu.cn/rank/2005/ARWU2005Statistics.htm

Table Four. List of Top 40 Universities of SHJT and Time Rankings 2005

	SHJT 2005			TIMES 2005	
Rank	Institution	Country	Rank	College	Country
1	Harvard University	USA	1	Harvard University	US
2	University Cambridge	UK	2	MIT	US
3	Stanford University	USA	3	Cambridge University	UK
4	University California - Berkeley	USA	4	Oxford University	UK
5	Massachusetts Inst Tech (MIT)	USA	5	Stanford University	US
6	California Inst Tech	USA	6	UC Berkeley	US
7	Columbia University	USA	7	Yale University	US
8	Princeton University	USA	8	California I T	US
9	University Chicago	USA	9	Princeton University	US
10	University Oxford	UK	10	Ecole Polytech	France
11	Yale University	USA	11	Duke University	US
12	Cornell University	USA	11	London School of Econ	UK
13	University California - San Diego	USA	13	Imperial Col London	UK
14	University California - Los Angeles	USA	14	Cornell University	US
15	University Pennsylvania	USA	15	Beijing University	China
16	University Wisconsin - Madison	USA	16	Tokyo University	Japan
17	University Washington - Seattle	USA	17	UC San Francisco	US
18	University California - San Francisco	USA	17	University Chicago	US
19	Johns Hopkins University	USA	19	Melbourne University	Australia

20	Tokyo University	Japan	20	Columbia University	US
21	University Michigan - Ann Arbor	USA	21	ETH Zurich	Switzerland
22	Kyoto University	Japan	22	Nat. Univ. of Singapore	Singapore
23	Imperial College London	UK	23	Australian Nat. Univ.	Australia
24	University Toronto	Canada	24	Ecole Nor Sup Paris	France
25	University Illinois, Urbana Champaign	USA	24	McGill University	Canada
26	University College London	UK	26	U Texas Austin	US
27	Swiss Fed Inst Tech - Zurich	Switzerland	27	Johns Hopkins U	US
28	Washington University - St. Louis	USA	28	Univ. College London	UK
29	New York University	USA	29	University Toronto	Canada
30	Rockefeller University	USA	30	Edinburgh University	UK
31	Northwestern University	USA	31	Kyoto University	Japan
32	Duke University	USA	32	U Pennsylvania	US
32	University Minnesota - Twin Cities	USA	33	Monash University	Australia
34	University California - Santa Barbara	USA	34	Ec Polyt Fed de Laus	Switzerland
35	University Colorado - Boulder	USA	35	Manchester Univ. & Um	UK
36	University Texas - Austin	USA	36	University Michigan	US
37	University British Columbia	Canada	37	UCLA	US
38	Univ. Texas Southwestern Med Center	USA	38	Univ. of British Columbia	Canada
39	Pennsylvania State Univ.	USA	38	Sydney University	Australia
39	Vanderbilt University	USA	40	Univ. New South Wales	Australia

Table Five. Descriptive Statistics of World University Rankings (THES 2005)

Variables	Overall	Sub-samples		
		English [a]	Non-English	F-statistic
Peer review (0-100)	33.07	36.01	29.79	7.55**
	(16.29)	(19.04)	(11.77)	
International faculty (0-100)	28.74	30.15	27.16	.75
	(24.48)	(21.54)	(27.43)	
International student (0-100)	21.80	25.09	18.13	11.06**
	(15.20)	(14.83)	(14.83)	
Faculty-student ratio (0-100)	16.97	15.60	18.48	2.28
	(13.56)	(11.90)	(15.12)	
Citation per faculty (0-100)	11.53	14.87	7.58	18.43***
	(12.29)	(14.87)	(6.41)	
Sample size	201	106	95	

Note: a. English-speaking countries include U.S., England, Canada, Australia, New Zealand.

b. Standard deviations are in parentheses; * < .05, ** < .01, *** < .001

Table Six. OLS Regressions of World University Rankings (THES 2005)

Variables	Overall	Sub-samples		
		English	Non-English	Top 50
Panel A: OLS				
International faculty	.066	.303**	.012	.044
	(.058)	(.090)	(.059)	(.118)
International student	.181	.474**	-.120	.136
	(.095)	(.133)	(.118)	(.178)
Faculty-student ratio	-.027	.020	-.047	-.233
	(.080)	(.123)	(.090)	(.117)
Citation per faculty	.664***	1.856***	.256	1.005*
	(.201)	(.280)	(.490)	(.399)
Citation per faculty squared	-.002	-.015***	-.015	-.009
	(.003)	(.003)	(.016)	(.005)
Constant	21.244***	-5.733	32.572***	40.421***
	(3.03)	(5.33)	(3.69)	(9.24)
Country dummies	No	No	No	No
Adj. R-squared	.164	.442	-.025	.162
(sample size)	(194)	(105)	(89)	(50)
Panel B: OLS with Country Fixed Effect				
International faculty	.270**	.318**	-.036	.279
	(.099)	(.120)	(.158)	(.194)
International student	.264*	.439**	-.132	.199
	(.113)	(.145)	(.160)	(.235)
Faculty-student ratio	.134	.043	.207	-.207
	(.094)	(.129)	(.125)	(.164)
Citation per faculty	1.509***	2.022***	1.583*	1.938***
	(.244)	(.307)	(.628)	(.500)
Citation per faculty squared	-.011***	-.017***	-.039*	-.017**
	(.003)	(.004)	(.019)	(.005)
Constant	-1.117	-7.855	52.263**	12.443
	(4.880)	(5.800)	(17.226)	(13.798)
Country dummies	Yes	Yes	Yes	Yes
Adj. R-squared	.278	.446	.040	.273
(sample size)	(194)	(105)	(89)	(50)

Note: 1. US is used as a reference group in regressions with country fixed effects except for the non-English-country sample (China is used instead).
2. Standard errors are in parentheses; * < .05, ** < .01, *** < .001

Table Seven. Tobit Estimates of World University Rankings (THES 2005)

Variables	Overall	Sub-samples		
		English	Non-English	Top 50
International faculty	.259**	.333**	-.036	.389*
	(.085)	(.111)	(.127)	(.167)
International student	.243*	.406**	-.133	.112
	(.127)	(.126)	(.128)	(.168)
Faculty-student ratio	.127	.044	.207*	-.219
	(.078)	(.112)	(.101)	(.110)
Citation per faculty	1.309***	1.780***	1.568**	1.547***
	(.205)	(.276)	(.504)	(.364)
Citation per faculty squared	-.010***	-.015***	-.038*	-.014**
	(.003)	(.003)	(.015)	(.004)
Constant	4.351	-4.184	52.308	19.515
	(4.072)	(5.102)	(13.827)	(9.570)
Country dummies	Yes	Yes	Yes	Yes
LR Chi-squared	98.66***	71.51***	40.89	41.11***
(sample size)	(194)	(105)	(89)	(50)

Note: 1. Top ten universities are censored so that they are of little consequence in peer ratings.

2. Standard errors are in parentheses; * < .05, ** < .01, *** < .001

Table Eight. Descriptive statistics of national rankings of professional schools (2005)

Variables	***Graduate Schools***		
	Education	Engineering	Medicine
Peer review score (school)	3.71	3.76	3.77
	(.42)	(.52)	(.57)
Peer review score (university)	3.71	4.01	3.88
	(.60)	(.55)	(.64)
Average GRE /MCAT [a]	1161.6	758.6	10.72
	(82.7)	(12.4)	(.55)
Ph. D. acceptance rate	36.07	25.72	8.36
	(14.61)	(9.07)	(3.87)
Student per faculty	7.45	3.65	.44
	(4.81)	(.86)	(.17)
Number of Ph.D. granted for 2003-2004	58.16	88.9	-
	(36.91)	(56)	
Research grants (millions, $)	15.34	792.7	238.3
	(7.57)	(492.3)	(174.5)
Sample size	50	49	44

Note: a. GRE verbal plus math for education, GRE math for engineering, and MCAT score for medicine.

b. Standard deviations are in parentheses.

Table Nine. Regression analyses of national rankings of graduate schools (2005)

Variables	***OLS***			***Tobit estimator***		
	Education	Engineering	Medicine	Education	Engineering	Medicine
Overall peer rating of University ('halo effect')	.530*** (.081)	.329*** (.076)	.219* (.106)	.543*** (.078)	.354*** (.074)	.215* (.099)
Average GRE /MCAT	.00003 (.0033)	.007* (.003)	.211 (.143)	-.00001 (.0007)	.007* (.003)	.289* (.134)
Ph. D. acceptance rate	-.001 (.003)	-.003 (.004)	.020 (.018)	-.002 (.003)	-.002 (.004)	.020 (.017)
Student per faculty	-.005 (.008)	.037 (.419)	.368 (.410)	-.004 (.008)	.040 (.040)	.376 (.383)
Number of Ph.D. granted	.002 (.001)	.006*** (.001)	-	.002 (.001)	.007*** (.001)	-
Funded research (millions, $)	.060*** (.018)	.0001 (.0002)	.004*** (.001)	.058** (.017)	.0001 (.0003)	.004*** (.001)
Funded research Squared	-.0014*** (.0005)	-.00000001 (.0000001)	-.000002** (.000001)	-.001** (.0005)	-.00000004 (.0000001)	-.000002* (.000001)
Constant	1.194 (.759)	-3.532 (2.263)	-1.205 (1.441)	1.201 (.722)	-3.634 (2.172)	-1.261 (1.345)
R-squared / Chi-squared (Sample size)	.711 (50)	.863 (49)	.747 (44)	62.88*** (50)	95.49*** (49)	58.16*** (44)

Note: standard errors are in parentheses; * < .05, ** < .01, *** < .001

Table Ten. Descriptive statistics of national rankings of Ph.D. programs (1993)

Variables	***Doctoral Programs***		
	Economics	Chemistry	Electronic Eng.
Quality of program	2.38	2.60	2.63
	(1.17)	(1.03)	(.92)
Number of total faculty	25.18	23.10	27.33
	(11.44)	(10.45)	(16.13)
Proportion of fulltime faculty	54.03	61.44	48.60
	(13.68)	(13.21)	(14.69)
Publications per faculty	2.72	10.49	5.03
	(1.22)	(5.34)	(3.52)
Gini index of publications	12.33	12.43	13.37
	(11.09)	(7.21)	(9.81)
Citations per faculty	5.43	55.68	13.71
	(5.96)	(48.56)	(17.63)
Gini index of citations	25.48	17.28	25.03
	(19.13)	(10.84)	(17.76)
Number of Ph.D. recipients	38.89	60.62	50.29
	(28.57)	(56.80)	(58.85)
Sample size	106	167	126

Note: standard deviations are in parentheses.

Table Eleven. Regression analyses of national rankings of Ph.D. programs (1993)

Variables	***OLS***			***Tobit estimator***		
	Economics	Chemistry	Electronic E.	Economics	Chemistry	Electronic E.
Number of total faculty	-.001	.004	.006	-.002	.003	.008
	(.006)	(.004)	(.004)	(.007)	(.004)	(.004)
Proportion of fulltime faculty	.001	.002	.004	.00003	.002	.005
	(.004)	(.002)	(.003)	(.004)	(.002)	(.003)
Publications per faculty	-.070	-.019	.046	-.077	-.018	.046
	(.061)	(.012)	(.035)	(.065)	(.013)	(.037)
Gini index of publications	.005	-.025**	-.016*	.005	-.025**	-.016*
	(.006)	(.008)	(.007)	(.006)	(.008)	(.007)
Citations per faculty	.214***	.016***	.012	.217***	.015***	.013
	(.030)	(.002)	(.011)	(.031)	(.008)	(.011)
Citations/faculty Squared	-.005***	-.00002***	-.00002	-.005***	-.00002	-.00002
	(.001)	(.000006)	(.0001)	(.001)	(.00001)	(.0001)
Gini index of citations	-.040***	-.008	-.010	-.045***	-.010	-.009
	(.010)	(.010)	(.008)	(.011)	(.011)	(.008)
Gini index of citations Squared	.0002**	.00002	.0001	.0003**	.0001	.0001
	(.0001)	(.0002)	(.0001)	(.0001)	(.0002)	(.0001)
Number of Ph.D. recipient	.028***	.013***	.013***	.026***	.013***	.013***
	(.006)	(.002)	(.003)	(.007)	(.002)	(.003)
Number of Ph.D. recipient Squared	-.0001*	-.00003***	-.00003	-.0001	-.00003***	-.00003
	(.00004)	(.000005)	(.0000007)	(.0001)	(.000006)	(.0000008)
Constant	1.511**	1.685***	1.775***	1.717***	1.727***	1.704***
	(.429)	(.242)	(.253)	(.446)	(.241)	(.262)
R-squared / LR Chi-squared	.866	.916	.835	206.5	405.5	23.15
(Sample size)	(106)	(167)	(126)	(106)	(167)	(126)

Note: standard errors are in parentheses; * < .05, ** < .01, *** < .001

Table Twelve. Regression analyses of national rankings of Undergraduate schools

Variables	***OLS***		***Tobit estimator***	
	National Univ.	Liberal Art C.	National Univ.	Liberal Art C.
Selectivity of student rank	-.016***	-.010**	-.017***	-.010**
	(.004)	(.003)	(.004)	(.003)
Student per faculty	-.017	-.087*	-.017	-.085*
	(.015)	(.036)	(.015)	(.035)
Gradation & retention rank	-.005	-.006*	-.005	-.006*
	(.004)	(.003)	(.004)	(.002)
Faculty resources rank	.002	-.002	.002	-.002
	(.002)	(.002)	(.002)	(.002)
Financial resources rank	-.004	-.0001	-.004	-.0001
	(.002)	(.0020)	(.002)	(.002)
Alumni giving rank	.002	.0002	.002	.0002
	(.001)	(.0015)	(.001)	(.0014)
Constant	4.795***	5.227***	4.806***	5.209***
	(.140)	(.329)	(.139)	(.328)
R-squared / LR Chi-squared	.625	.668	48.19***	52.42***
(Sample size)	(51)	(50)	(51)	(50)

Note: standard errors are in parentheses; * < .05, ** < .01, *** < .001

Figures:

Figure One. Joint Distributions of Rankings (Top 40 institutions from SJU)

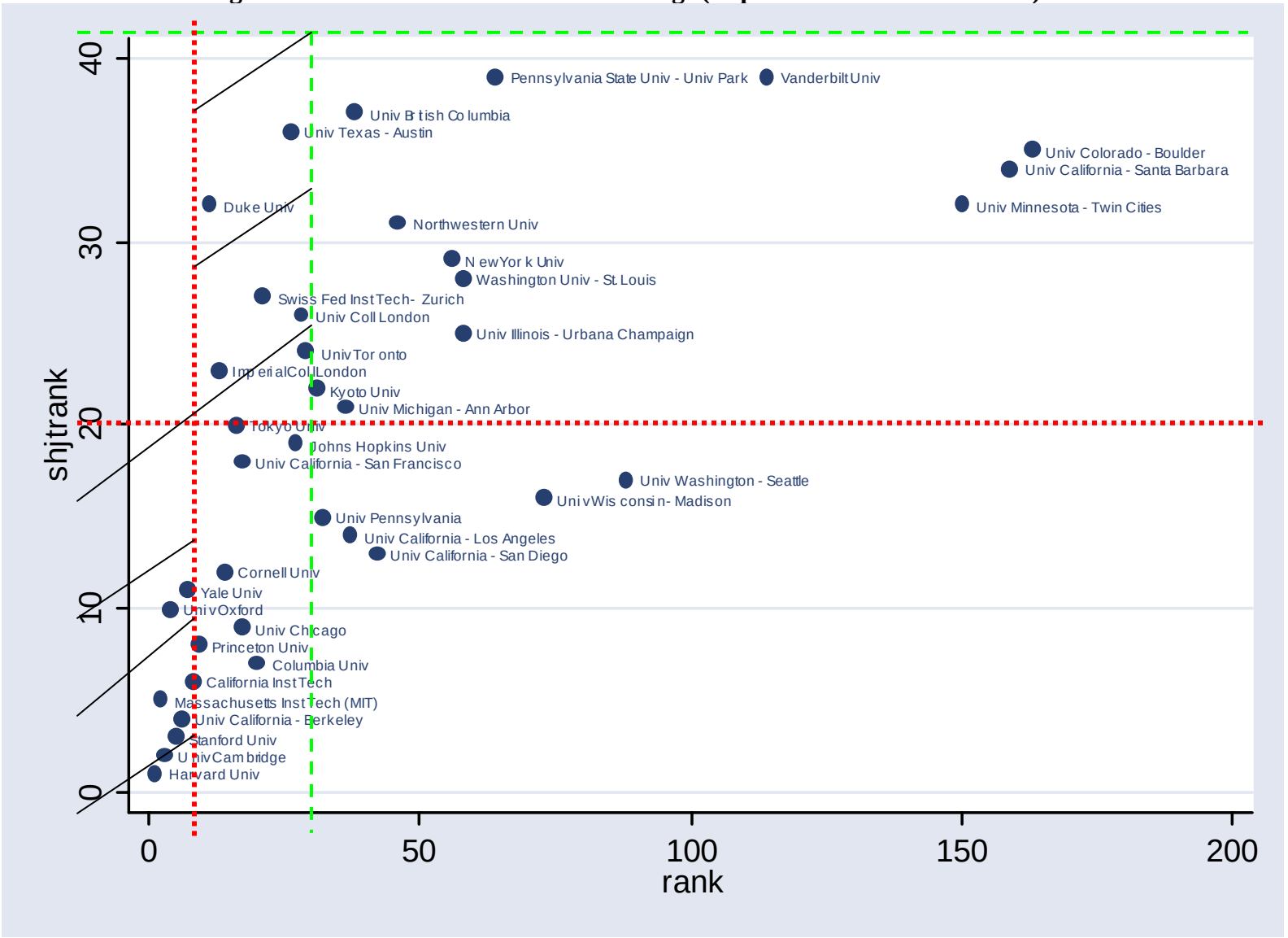
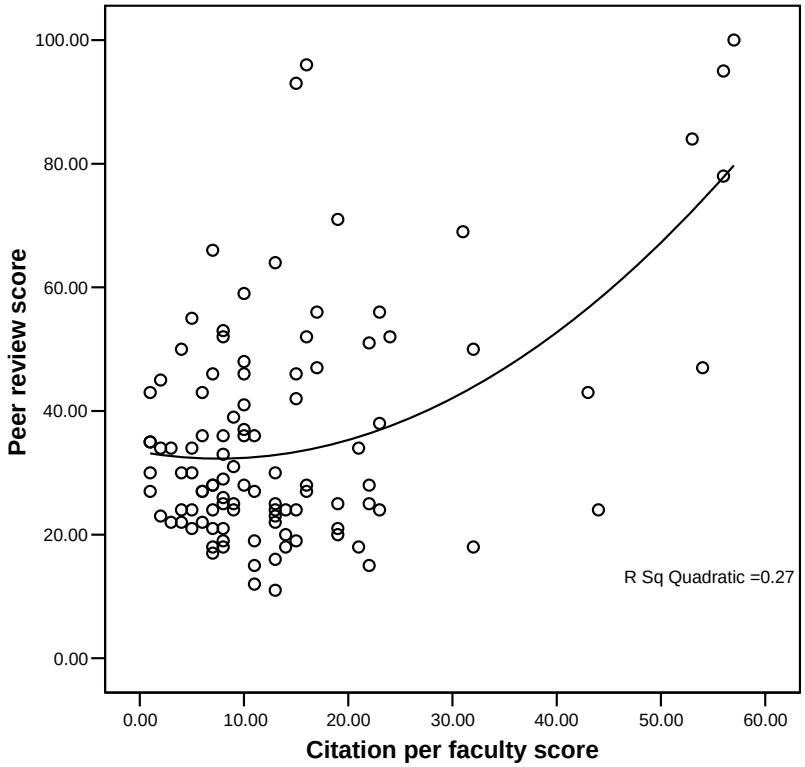
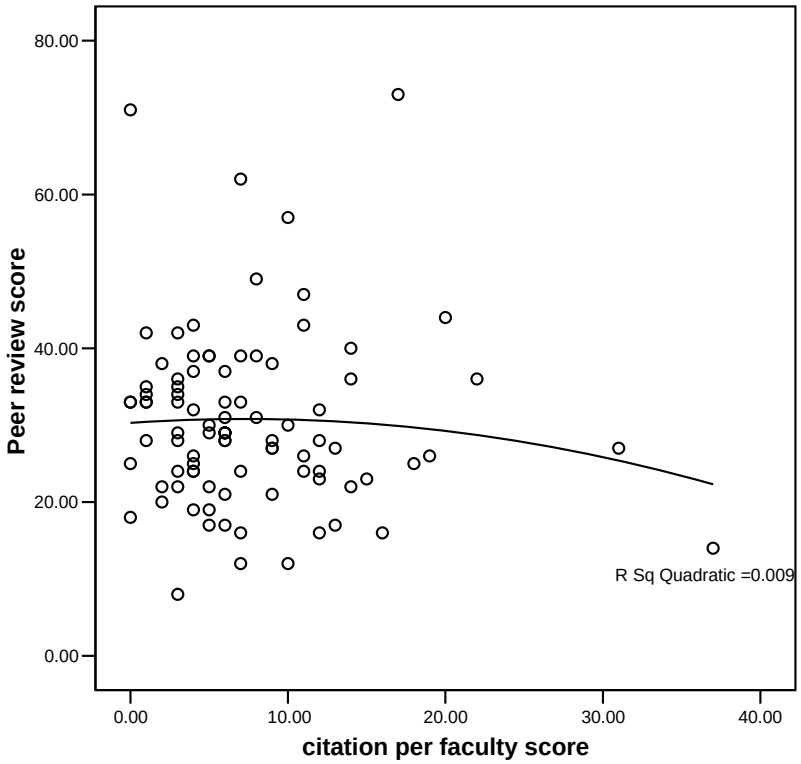


Figure Two. Scatter-plots between peer review and citation/faculty by language



(a) English-speaking countries



(b) Non-English-speaking countries

Figure Three. Estimates of Country-specific Fixed Effect