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Anne E. Winkler
Sharon G. Levin
Paula E. Stephan
Wolfgang Glänzel

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**Anne E. Winkler**
*University of Missouri St. Louis and IZA*

**Sharon G. Levin**
*University of Missouri St. Louis*

**Paula E. Stephan**
*Georgia State University, NBER and University of Torino*

**Wolfgang Glänzel**
*MSI, ECOOM, K.U. Leuven*

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IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

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# ABSTRACT

# Publishing Trends in Economics across Colleges and Universities, 1991-2007*

There is good reason to think that non-elite programs in economics may be producing relatively more research than in the past: Research expectations have been ramped-up at non-PhD institutions and new information technologies have changed the way academic knowledge is produced and exchanged. This study investigates this question by examining publishing productivity in economics (and business) using data from the Web of Science (Knowledge) for a broad set of institutions – both elite and non-elite – over a 17-year period, from 1991 through 2007. Institutions are grouped into six tiers using a variety of sources. The analysis provides evidence that non-elite institutions are gaining on their more elite counterparts, but the magnitude of the gains are small. Thus, the story is more of constancy than of change, even in the face of changing technology and rising research expectations.

JEL Classification: A14, I23

Keywords: higher education, research productivity, publishing trends, inequality

Corresponding author:

Anne E. Winkler
Department of Economics
University of Missouri-St. Louis
One University Boulevard
St. Louis, MO 63130
USA
E-mail: awinkler@umsl.edu

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## I. Introduction

In recent years a "cottage industry" in economics has developed focused on compiling rankings of institutions (departments), based on article or citation counts (Thursby 2000).[1] Such counts typically focus on research productivity at PhD institutions. Others have looked at the concentration of publishing in top journals among economists at the most elite institutions (for example, Hodgson & Rothman, 1999; Kocher & Sutter, 2001; and Ellison, 2011). But, what has been happening to research productivity across a broader set of institutions over the last 20 or so years? There is good reason to think that non-elite programs in economics may be producing relatively more research than in the past, what we call "nibbling at the lion's share." First, research expectations have been "ramped-up" at non-PhD institutions (Laband & Tollison, 2003). Moreover, the development of information technologies has changed the way academic knowledge is produced and exchanged.

This study investigates this question, not heretofore addressed in the literature, by taking advantage of a unique data set constructed by the authors that contains publication data obtained from Thomson Reuters Web of Knowledge (formerly known as the ISI Web of Science) for economics and business for a broad set of institutions—both elite and non-elite—over a 17-year period, from 1991 through 2007. These data provide institutional counts of business and economics publications in ISI-selected journals, as well as those published in the top 5% most cited journals, thereby providing information on quality. These data allow us to examine publishing levels across institutions as well as to look at indicators of nibbling—changes in publishing concentration (inequality) over time and changes in the ratio of mean publications by

[1] Indeed, Coupé, (2003) points to the growing interest of economists studying our own profession, in a variety of dimensions.

tier. This research also fits within a larger body of research that has studied the "outer circle" of science, typically populated by women and minorities located at non-elite institutions (Zuckerman, Cole & Bruer, 1991).

The study proceeds as follows. Section II summarizes the previous literature on publishing patterns in economics and presents the nibbling hypothesis that non-elite institutions may be making productivity gains relative to their more elite counterparts. Section III outlines the data and methodology used. Findings and conclusions are presented in Section IV and Section V.

## III. Previous Work and the Nibbling Hypothesis

The economics profession has focused substantial attention on itself (see Coupé, 2004). Studies have focused on quantity, quality, institutional concentration, co-authorship and multi-institution collaboration, and explanations for trends and variations across institutions. Most, but not all, of the research on publishing productivity has focused on PhD institutions. Important exceptions are Hartley & Robinson (1997) and Bodenhorn (1997; 2003), which looked at select liberal arts institutions.[2] Institutional rankings have been constructed based on page or article counts, typically adjusted for journal quality (e.g. Scott & Mitias, 1996; Dusansky & Vernon, 1998, Kalaitzidakis et al. 2003; Coupé, 2003; Grijalva & Nowell, 2008), based on surveys (US News & World Report, National Research Council, 1995, 2010), and most recently, based on PhD placements (Amir & Knauff, 2008).

[2] While some studies have looked at Master's programs in economics, including McCoy and Milkman (2006), they have not focused on research productivity.

There appears to be consensus on the following points: 1) rankings of PhD programs based on survey data or publications are highly correlated (Thursby, 2000); 2) PhD institutions that are ranked at the top remain in that position over time, while there is much more movement among less-elite PhD. institutions (Scott & Mitias, 1996; Thursby, 2000; Coupé, 2003); 3) institutions that have rankings that are closely clustered together do not tend to be statistically different (Thursby, 2000); 4) there is substantial positive correlation between rankings and department size (Coupé, 2003); and 5) rankings of institutions (departments) are more "robust" than rankings of individuals since average department productivity varies less than the productivity of one person (Coupé, 2003).

Other work has tackled the question of journal rankings and the quality of what is produced (e.g. Coupé, 2003; Kalaitzidakis et al., 2003; Engemann & Wall, 2009; and Wall, 2009). A common method and the one relied on for the analysis here, focuses on citations. This approach is not without its limitations. As noted by Coupé (2003), citations typically include self-citations, while citations to books are generally not included. Moreover, citations distributions for journals tend to be skewed by the inclusion of exceptionally-highly cited papers, "stars" (Wall, 2009). Nonetheless, Wall (2009) finds that a simple measure of journal quality using total journal citations (such as the one employed here) is highly correlated (.98) with an h-index which measures overall impact of a journal and explicitly adjusts for "stars."[3]

Research has also consistently demonstrated considerable concentration of authors in top journals at the country-level and institution-level. Previously Hodgson & Rothman (1999) found

[3] Hirsch (2005) created the h-index to measure an individual researcher's output. Braun, Glanzel, and Schubert (2006) subsequently developed an h-index for journals.

that ten U.S. universities (Harvard, MIT, Chicago, University of Pennsylvania, Stanford, Northwestern, Princeton, Berkeley, Michigan, UC-San Diego) produced slightly more than 25% of all publications in the top 15 journals examined for 1995. This same figure is corroborated by Kocher & Sutter (2001) in their study of over 3,000 articles published in 15 top journals averaged over 5 years (1977, 1982, 1987, 1992, and 1997). Furthermore, Kocher & Sutter found that U.S. authors accounted for the top 72% of all "top 15 journal" authors over these same 5 years, evidence of substantial U.S. concentration from a country-wide perspective. Nonetheless, Cardoso, Guimaraes & Zimmerman (2010) found that Europe is making inroads. More recently, Amir & Knauff (2008) studied a different metric of institutional quality, PhD placements. They found that economics PhD graduates of seven U.S. universities (MIT, Harvard, Stanford, Princeton, Chicago, Yale, and UC-Berkeley) consistently placed at the top in the various placement measures constructed, and for the most part, well ahead of other U.S. institutions.[4]

Other research directly bears on what we have termed the "nibbling" hypothesis—that less elite institutions may be making productivity gains relative to their more elite counterparts. First, a number of studies have focused on the IT revolution and, specifically, how it is changing the way in which research is produced and disseminated in economics and business, as well as throughout academia. For one, IT has been found to enhance research productivity and co-authorship (e.g. see Butler, Butler & Rich, 2008; Hamermesh & Oster, 2002; Kim, Morse & Zingales, 2009; Winkler et al. 2011). Furthermore, it has been argued that IT may have a "democratizing" effect and may have benefited some subgroups (e.g. those at lower-tier institutions) relative to others, thereby helping to level the research "playing field." IT provides

[4] One of the measures examined by Amir & Knauff (2008) focuses on graduates since 1990 placed in economics departments only. For this measure, Northwestern is also included in the top set. See Table 1 of Amir & Knauff (2008).

researchers at non-elite institutions with access to knowledge and ability to communicate and network "virtually." It also, as noted above, facilitates access to data and materials (e.g. JSTOR). Indeed, quite a number of studies have found that IT enhances the research productivity of *individual* scientists located outside of the "inner circle" (e.g. Agrawal & Goldfarb, 2008; Kim, Morse & Zingales, 2009; Ding et al. 2010). Notably, however, Winkler et al. (2011) did not find a democratizing effect of IT at the *institutional* level; the explanation offered is that although IT is beneficial to active researchers working at lower-tier institutions, the fraction of research-active scientists (who would be affected by IT) at these institutions is relatively low.

Apart from the role of IT, two other factors may have affected the publication landscape, thereby enabling nibbling by the non-elites. First, increases in research expectations, notably among non-elite institutions, both in the U.S. (Zivney & Bertin, 1992; Whitman, Hendrickson & Townsend, 1999; and Laband & Tollison, 2003) and around the globe (Graber, Launov & Walde, 2008) have been noted.[5] Laband & Tollison point to reduced teaching loads, even at more teaching-oriented institutions, as having facilitated this shift.[6] From an individual standpoint, evidence also suggests that research productivity confers rewards in the form of higher salary, also serving to increase incentives for faculty at virtually all institutions to

[5] Franzoni, Scellato and Stephan (2011), for example, examine how changing incentives to publish, especially in English, have affected publishing patterns outside the United States.

[6] An exception is Harter, Becker and Watts (2004). In their study of a broad set of baccalaureate institutions, they found that from 1995 to 2000 self-reported time devoted to teaching increased and time devoted to research decreased.

reallocate time and effort to research (Hamermesh, 1989; and Ragan,Warren & Bratsberg, 1999, as cited in Coupé, 2004).[7]

Second, another contributing factor to increased research productivity at non-elite institutions may be related to labor market conditions for new economics PhDs. For the period from 2000 on, but for selected earlier years as well, Oyer (2006) identifies periods during which the number of job seekers (as measured by CVs in job market books) exceeded the number of positions available in *Jobs for Economists* (JOE). To the extent that top candidates cannot get positions at the highest ranked institutions they end up with positions outside this group. Their presence may increase productivity at their current institutions.[8] However, it is possible that their productivity may be diminished (compared to the counterfactual if they had landed a top position) by access to fewer institutional resources and higher teaching loads.[9] Further, Oyer (2006) makes the point that "where you land" may influence post-graduate school human capital investments regarding teaching vs. research. In the data at hand, we cannot disentangle these various explanations, but we can explore the extent to which "nibbling" has occurred.

## III. Data and Methodology

### Institutional Data and Publication Measures

The starting universe for the publication data are the set of 1,348 four-year colleges and universities that have been in existence since 1980 and have not undergone a "substantial"

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[7] What is more debated is whether increases in research productivity across the profession have resulted in greater quality of publications. Impact on research quality is questioned by Laband & Tollison (2003). They observe that the percentage of uncited papers ("dry holes") has remained constant. Mayer (2004) suggests flaws in this interpretation, pointing out that other papers may be cited more frequently than in the past.

[8] A notable statistic provided by Wu (1995) is that 45.8% of the positions in economics at the top 25 liberal arts institutions were held by faculty with doctorates from the top 10 schools (59.9% from the top 20 schools).

[9] In earlier work, Long (1978) also found that productivity is very dependent on location.

change in structure such as a major acquisition or merger.[10] Given that the purpose of the study is to examine publication productivity, we further restrict this group to those classified by the Carnegie Foundation (1994) as Doctoral, Master's, and Comprehensive, plus select liberal arts institutions, as identified by Bodenhorn (2003). This results in a set of 771 institutions. Further details are provided below in the section on assignment of institutions to tiers.

Institutional publication data on economics and business come from the Thomson Reuters Web of Knowledge (formerly referred to as the ISI Web of Science) for the period 1991-2007. The disciplines are defined according to a classification scheme developed by Glanzel & Schubert (2003), category 01, "Economics and Business." All bibliometric indicators are based on the Web of Science (WoS) volume year in order to avoid the problem that the last available year (in our case 2007) is incomplete because of delayed indexing.[11] A year therefore means WoS volume year, not publication year. This makes annual publication/citation counts more stable. The counts are whole, meaning that an article with authors at two institutions is counted twice while an article with two authors at the same institution is counted once. Furthermore, the counts are based on a select list of journals covered by the Web of Knowledge and do not include publications in other journals or in book chapters, reports, books or monographs.[12]

An advantage of using institutional publication data is that it is not based on department productivity, but rather institutional productivity in the field of economics and business. This circumvents the issue that some institutions such as Cornell have faculty doing research in

[10] Specialized institutions such as engineering schools and religious institutions were also excluded. Institutional data from the Integrated Postsecondary Education Data System (IPEDS) and college websites were reviewed to determine the final list of institutions.
[11] This delay can cause publications to be undercounted by 10 to 20%.
[12] For more on journals in economics and business that are included, see http://science.thomsonreuters.com/ [accessed 22 August 2011] .

economics who are housed in a variety of units. Also, in some institutions economists are located in the business school, in others, in arts and sciences, and sometimes even in both. With the institution as the unit of analysis, specific location does not matter. One drawback to the method used here is that counted publications are limited to those classified in economics and business by Glanzel & Schubert (2003). So, for example, if an economist publishes in *Science*, it is not counted here. Another is that economists may choose different publication types and venues depending on their tier. For instance, Hartley & Robinson (1997) suggest that liberal arts faculty may choose more interdisciplinary journals, and may more often publish monographs and textbooks as compared to their PhD counterparts. To the extent that this pattern holds, the data examined here may understate the publishing activity of liberal arts faculty.

We also collected whole count data for top publications defined in terms of the journal in which the article appears. Top journals for economics and business represent the top 5% of journals in that subfield based on citation impact in a three-year citation window, averaged over the entire period. While other methods of identifying top publications have been employed, as discussed earlier, Wall (2009) finds that alternative measures result in the identification of virtually the same set of top journals. Over the period studied, academic journals have proliferated in both economics and business. The database used to count publications reflects this trend. The advantage of the "top publication" measure is that it arguably disentangles quantity from quality: To what extent are non-elite institutions gaining not only in terms of total publications (of varying quality), but in terms of top publications?

Categorization of Institutions by Tier

The analysis requires categorization of the 771 institutions defined above into distinct tiers. Here we use a six-part categorization scheme (Top Economics PhD, Mid-PhD, Rest-PhD, Terminal Master's Level Economics,[13] Select Liberal Arts, and Other (Comprehensive Institutions)) and perform substantial sensitivity testing regarding the PhD groupings. The categorization scheme is based on Economics programs, but as noted earlier, the publication data include economics and business journals, venues for both economics and business faculty (and, of course, some economists are located in business schools). Thus, sensitivity testing is also conducted regarding overlap of rankings of Economics and Business programs.

*Rankings of Economics PhD Programs*--The main analysis categorizes economics PhD institutions into 3 tiers, Top-PhD, Mid-PhD, and Rest-PhD. These assignments are based on 2009 rankings of Economics PhD programs from *US News and World Report* and confirmed against programs listed on the American Economic Association (AEA) website (AEA, 2010). The institutions studied here were compared with 2010 NRC rankings (subsequently revised in April 2011), earlier 1995 NRC rankings, and other published lists.[14]

As identified in the literature review, rankings of the top group obtained from surveys and based on publication counts (using various approaches) are very highly correlated. Also, it is important to keep in mind that the analysis focuses on broad groupings of institutions, not specific rankings (e.g. 7$^{th}$ or 9$^{th}$). *US News and World Report* provides a single ranking of each

[13] The set of Terminal Master's programs in economics identified here are those that offer a Master's as the highest degree.

[14] NRC rankings were initially released in Fall 2010. A revision was released on 29 April 2011. All NRC 2010 figures discussed throughout this paper are based on the revised data. See NRC website http://www.nap.edu/rdp/ [Last accessed 30 June 2011].

program for 55 institutions; other institutions listed are unranked. In the analysis here, the top 30 from this list are referred to as Top-PhD and the next 25 as Mid-PhD. The AEA web site (2010) identified a total of 136 PhD programs; 135 institutions are included here.[15] In the instances in which the AEA identified PhD programs not listed or ranked, these institutions were assigned to the tier called Rest-PhD institutions. There are 80 such institutions. Appendix Table 1 indicates the specific set of institutions assigned to each tier.

The Appendix also provides a detailed discussion regarding sensitivity testing of the rankings of economics programs by *US News and World Report* with several others. To summarize, the overlap between the top 30 institutions in the 2009 *US News* list and 2010 NRC (regression-weighted rankings) list is 97% and the overlap between the 2009 *US News* list and 1995 National Research Council ranking based on faculty research quality is 83%. These findings are consistent with earlier literature that points to very little change in the set of PhD programs identified in the top grouping over long periods of time.[16]

As in the case of studies on income inequality, it is instructive to look not only at the top institutions, but those that are consistently ranked highest in this group. Although there is some debate regarding which institutions belong to this group (and there is movement in the rankings at the very top over time, albeit small), the key objective here is to track a specific set of schools that have tended to be among the most highly ranked over time. Based on a review of rankings from the 2010 NRC, 1995 NRC, 2009 *US News & World Report*, and Amir & Knauff (2008), in Table 1 we provide separate analysis for 7 selected elite institutions (from the top 30, in no

[15]The set of PhD institutions examined here differs from the AEA list as follows: Vanderbilt (with two PhD programs) is included as one institution in our analysis; and we include Drexel which, per its website, has a PhD program. University of New Orleans, which has a PhD program, is not included in our data set due to data issues.
[16]Amir & Knauff (2008) point to some programs that have made dramatic gains, but change is the exception rather than rule.

specific order): MIT, Harvard, Stanford, Princeton, Chicago, Yale, and UC-Berkeley.[17]

*Non-PhD Tiers*--Terminal Master's Institutions in Economics were identified based on information provided on the website of the AEA (AEA, 2010). The AEA identified 74 such programs in 2010, 70 of which are included as Master's here (see Appendix Table 1).[18] Select liberal arts institutions in economics were identified based on Bodenhorn (2003), Table 1. His list indicates 51 such institutions based on rankings from *US News & World Report* 2000. In a study of 161 liberal arts institutions, Hartley & Robinson (1997) identified a similar set of research–active institutions. Since the focus of this study is on publishing productivity, the remaining more teaching-oriented liberal arts institutions are omitted from the analysis. Finally, the "Other" category includes all institutions classified by Carnegie 1994 as "Comprehensive" (codes 21, 22) that are not otherwise included in the categorization scheme. There are 515 such institutions. A list of the tiers, the number in each, and descriptive publication statistics are provided in Table 1.

Inequality Measures

An important part of the analysis focuses on the degree to which the distribution of publishing productivity, in terms of quantity and quality, has changed over time.[19] Here we

[17]These institutions are included in the majority, but not all of the lists examined. For instance, in the Kalaitzidakis et al. (2003) ranking, Northwestern and University of Pennsylvania are included in the top 7 in lieu of Stanford and UC-Berkeley. In the NRC 2010 ranking examined here, NYU is in the top 7 in lieu of Yale. In their overall productivity score, Grijalva and Nowell (2008) include Michigan and NYU in the top 7 in lieu of Stanford and Chicago.

[18] While Trinity College and Williams College are included among Master's institutions on the AEA list, the decision was made to retain them in the set of 51 liberal arts institutions analyzed here. Our data set does not have full data for two other schools included in the AEA list, Miami University (OH) and Johns Hopkins-DC, so these schools are not included.

[19]Some prior research has used the Herfindahl-Hirschman Index (HHI), a measure of concentration often used in the industrial organization literature. In the case in which the number of institutions does not change over time, as is the

examine several measures of inequality often-cited in the literature: the Gini Coefficient, the Coefficient of Variation (CV), and GE(2), a member of the generalized entropy index (GE) family (for definitions, see Shorrocks, 1980).

The measures examined all possess certain desirable features: they are invariant to scale and meet the Pigou-Dalton Transfer principle. In the more well-known case of income inequality, these properties mean, respectively, that a doubling of household income leaves the inequality measure unchanged, and a transfer of income from a higher to lower income household leads to a reduction in measured inequality. In the analysis here, publications stand in for income and institutions stand in for households. The Gini coefficient ranges between 0 (no inequality) to 1 (perfect inequality). The CV ranges between 0 (no inequality) and infinity. The GE measures also show greater inequality as the metric increases. A particular advantage of a GE measure is that it can be used to decompose income inequailty (or, analogously publishing inequality) into within-group (within institutional tier) inequality and between-group (between institutional tier) inequality. The GE measure analyzed here is GE(2) rather than the better known Theil Index (GE(1)) because many institutions have zero publications in a given year, making it impossible to compute the Theil Index.[20] GE(2) is equivalent to ½ times the squared value of the CV.

## IV. Findings

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case here, both the HHI and the inequality measures examined here register a reduction in inequality if non-elite institutions increase their share of total publishing. In the case of industrial concentration, concentration ratios such as the HHI are preferred because they account for both the number of firms (instiututions here) and inequality. Since the number of institutions is unchanged in this analysis, inequality measures provide full information. Also, the inequality measure examined here can be decomposed, as described in the text.

[20] Specifically, the Theil formula takes the log of Y (where Y is income, or number of publications) and the log of zero is undefined. The GE(2) formula does not use logs. The STATA program INEQDEC0 (written by Stephen P. Jenkins, revised 24 February 2010) was used to produce the inequality results, including the decomposition.

Overview

Table 1 and Figure 1 summarize differences in publishing productivity across tiers and provide information on trends. The single most striking finding, to be expected based on faculty size alone, is the high level of publishing productivity at Top-PhD institutions. For the most recent period studied, 2006-07, the top 30 PhD institutions constituted just 4% of the total sample but accounted for 36% of total publications and 56% of all top publications. On average, these institutions produced 108 articles per year. Furthermore, as Table 1 shows, 7 elite institutions (1% of the total sample) from this group contributed 11% of all publications and 23% of top publications (top 5% most cited journals). Their average productivity was 138 articles for the period 2006-07.

The next tier—Mid-PhD—is a good distance behind, with an average of just 66 articles per year; Rest-PhD programs produced an average of 28 articles per year. The figure for Master's institutions was just 11.5 articles per year. Rounding out the set of institutions studied, Table 1 provides statistics on publishing productivity at 51 Select Liberal Arts institutions. The average annual rate at these institutions was 2-3 papers per year. Publishing productivity at these institutions is discussed in more detail shortly.

Despite considerable differences in publishing productivity across tiers, all tiers have experienced a common trend: a dramatic growth in publishing productivity from the 1990s to 2007 which can be seen in Figure 1 and in Table 2. Over the period 1994-96[21] to 2006-7, publications increased by as much as 28-39% for Top-PhD, Mid-PhD, Rest-PhD, Master's, and

[21] 1994-96 is used as the starting year because mean publications for the elite 7 institutions were 150.4 for 1991-1993, but 117 for the next three time periods, suggesting that the first time period was anomalous. (The means for the other tiers increased steadily from 1991-93 to 2006-07, as shown in Table 2.)

Select Liberal Arts institutions. In fact, productivity even increased among "Other" institutions (21%), the tier which produces the lowest average annual research output.

Figure 2 focuses on publishing productivity at PhD institutions, highlighting the similarities and differences in productivity across tiers at various points in the publication distribution for the year 2007. Differences in productivity by tier are most pronounced at the 90th percentile, where the publication count is 172 for Top-PhD, 108 for Mid-PhD and 49 for Rest-PhD. Nonetheless, the publication distributions across all three tiers overlap to some extent. For instance, the number of publications for Top-PhD institutions (102) at the $50^{th}$ percentile is very close to the number of publications for the top $90^{th}$ percentile of Mid-PhD institutions (108). Also, the publication count at the $10^{th}$ percentile for Top-PhD and Mid-PhD (38-42) overlaps with the publication count at the $80^{th}$ and $90^{th}$ percentiles for Rest-PhD (41-49).

Figure 3 next compares the distributions of publications at Rest-PhD and Master's Level institutions for 2007. While, as noted, *average* annual publishing productivity was more than twice as large at Rest-PhD versus Master's institutions (28 versus 11.5 publications per year), the publication distributions overlap substantially. The number of publications produced at the $60^{th}$ percentile and higher by Master's institutions (12-26) is similar to the number of publications produced by the $10^{th}$-$40^{th}$ percentiles for Rest-PhD (10-23). Taken together, Figures 2 and 3 illustrate the point that data on average publishing productivity mask considerable variation in research productivity by academics located within these tiers.

The remainder of this section examines publishing productivity at liberal arts institutions. Several caveats must be kept in mind in comparing publication rates at these institutions with other tiers. First, by definition, liberal arts schools tend to be more teaching-oriented. Second, it

has been suggested that liberal arts faculty tend to publish in somewhat different venues, more often publishing interdisciplinary work along with chapters in books, monographs, and textbooks (Hartley & Robinson, 2007). And third, most noteworthy, research productivity is highly correlated with faculty size.[22] Liberal arts institutions, for the most part, do not have graduate programs, and do not have business schools. Thus, they will likely have fewer publications in business (finance, accounting, management, etc.) outlets as well as fewer faculty members.

Table 3 sheds light on differences in average and median faculty size for selected tiers using data made available by The Committee on the Status of Women in the Economics Profession (CSWEP).[23] The advantage of these data is that they provide information for a consistent definition of faculty over time. Faculty is defined as tenure-track or tenured economic department faculty members holding the rank of assistant, associate or full professor. CSWEP provides information on 29-35 of the liberal arts institutions studied here for the years 2001, 2003, and 2007, and 69-102 PhD institutions for the selected subperiods from 1993-2007. One limitation of the CSWEP data on faculty size is that they are at the department level, not at the institution level, and consequently these figures understate the full set of faculty publishing in economics and business (e.g. faculty located in business schools).[24] The CSWEP data indicate a difference in faculty size of 3:1 for PhD versus liberal arts institutions. Unquestionably, this

[22]In the case of PhD institutions, faculty size is directly linked to the size of the PhD cohort. Indeed, Becker, Green, and Siegfried (2011) find that the key explanatory factor is the average expected size of the PhD student cohort, with an additional faculty member added for each additional increase in long-term cohort size. In contrast, at Bachelor's only institutions, faculty size is determined by the expected long-term number of undergraduate students, with one faculty member added for each long-term addition of 10 graduating majors.

[23] The authors gratefully acknowledge data provided by CSWEP, drawn from their annual surveys, 1993 – 2010, on faculty size for economics departments and percent female.

[24] Counting of faculty is also made difficult by the fact that some ranked faculty hold positions in both economics and business programs, and some economists are located in other programs entirely (public policy, consumer economics, schools of labor and industrial relations, etc.)

difference is even larger when faculty in business schools and other research units at PhD institutions are included.[25]

Within the set of Select Liberal Arts institutions, researchers (Hartley & Robinson, 1997; Bodenhorn, 1997, 2003) have observed that a small set of institutions produce the majority of the research. Table 4 revisits this finding, comparing average publishing productivity for all of the 51 Select Liberal Arts institutions (same set as Table 1) with the most research-active of this tier: the top ten institutions that produced the most papers published in economics and business in each of six selected subperiods, spanning the period 1991-2007. While the full set of Select Liberal Arts institutions produced 2-3 papers per year, the average output of the top ten (the set varies somewhat for each year) was closer to 5-7 publications per year. Further, the top ten institutions contributed about 50 percent of the total publications for this tier as measured by publication counts in economics and business in Web of Knowledge.[26] The schools most frequently included among the top ten for the 6 subperiods are: Williams, Wesleyan, Wellesley, Middlebury, Barnard, Claremont-McKenna and Swarthmore.[27] Another 13 institutions are included among the top ten most research active in at least one of the 6 subperiods studied.[28] Notably, our study identifies virtually the same set of institutions as Bodenhorn (1997, 2003) and

[25]Another trend, shown in Table 3, is that women's share of ranked faculty has increased over the period of study though women continue to remain extremely underrepresented among ranked faculty at Top-PhD institutions (and even at any other PhD institution). Regrettably, the data do not permit us to examine the relationship between the changing gender composition of ranked faculty and changes in publishing productivity within and across tiers.

[26] For the early 1990s, Hartley & Robinson (1997) find that 20 schools published the top 50% of papers. The figures are not fully comparable because the underlying set of journals differs (their dataset is the *Journal of Economic Literature(JEL)* now EconLit).

[27]The average faculty size of these institutions is around 16, as compared to 10 for a broader set of select liberal arts institutions as reported in Table 3. This is consistent with the prior literature, including Bodenhorn (2003), which shows that larger faculties produce more output.

[28] These institutions are (in no particular order): Amherst, Hamilton, Lafayette, Bucknell, Colgate, Washington & Lee, Trinity, Colby, Union, Oberlin, Skidmore, Bowdoin, and College of Holy Cross.

Hartley & Robinson (1997), despite differences in what output measure is being ranked (e.g. citations, quality-adjusted articles) and time period.

Trends in Publishing Inequality

Tables 5 and 6 focus on the degree of inequality across tiers, as well as how the extent of inequality has changed over time. Specifically, to what extent has inequality declined, as would be expected based on the effect of the IT revolution and increased research expectations at non-elite institutions? Table 5 shows trends in inequality for all institutions, and by tier, as measured by the Gini and CV. In separate work, we investigated whether the trend is statistically significant at the 5% level; this information is indicated in the table by an asterisk.[29]

Both inequality measures examined here indicate a slight reduction in overall inequality (all tiers combined), with the Gini falling from .83 to .81 and the CV falling from 2.41 to 2.27. These declines, although small, are statistically significant at the 5% level and provide evidence of "nibbling." Next, we look at trends within tiers. Notably, the greatest decline occurs for the Rest-PhD tier, with a decline in the Gini from .37 to .33 and a decline in the CV from .68 to .60, again both statistically significant trends. Statistically significant declines in inequality are also found for Master's and for Other (Gini measure only). Interestingly, there is no evidence of a statistically significant change in measured inequality for Select Liberal Arts institutions.

The left hand side of Table 6 more fully investigates the decline in overall inequality (all tiers taken together) in total publications, by decomposing the change into two parts: the part due to changes in inequality within tiers and the part due to changes in inequality between tiers. The

[29] We estimated each inequality series as a function of a time trend and constant for the 17-year period from 1991-2007.

measure analyzed is GE(2), discussed earlier, which is computed using the CV (from Table 5), and is calculated as ½ CV squared. Before discussing trends in the series, it is instructive to note that regardless of whatever year is examined, between-tier inequality is the largest component of total inequality (nearly 3/4ths). This finding is to be expected since factors underlying research productivity (research expectations, faculty size, and resources) differ significantly by tier.

As was found for the CV and Gini, we identify a statistically significant decline in overall inequality in total publications using GE(2) from 2.91 to 2.58. Notably, the decomposition results in Table 6 point to a significantly significant decline in between-tier inequality over the period 1991-2007 (indicated in the table by an asterisk), evidence of nibbling, though an insignificant trend for within-tier inequality.

The righthand side of Table 6 also provides evidence on inequality for top publications. Before focusing on trends, it is quite striking that the value of GE (2) for overall inequality in 2007, 6.31, is substantially higher for top publications as compared to just 2.58 for all publications. This reflects the fact, highlighted in Tables 1 and 2, that only a very small fraction of institutions (principally Top-PhD and to some extent, Mid-PhD) produce publications in the most highly cited journals. Returning to the main focus, trends in inequality, the analysis indicates no statistically trend in inequality for top publications from 1991-2007, in contrast to significant declines in measured inequality for all publications over the same period.

Changing Ratios of Mean Publications by Tier

Table 7 provides further evidence on the extent to which less elite institutions are nibbling at their more elite counterparts in terms of total and top publications produced. This

table shows the ratio of mean publications for the various tiers and reports whether the identified trends from 1991-2007 are statistically significant (as indicated by an asterisk in the table). For instance, column 2 shows that the ratio of mean publications at Mid-PhD institutions to Rest-PhD institutions declined from 2.58 to 2.34. Separate analysis indicates this trend is statistically significant at the 5% level. Also, a statistically significant decline is found for Top-PhD/Rest-PhD publications. These ratios indicate rising relative research productivity at less-elite PhD granting institutions. What is perhaps most striking is that when the quality of research is controlled for, the level of relative quality at Mid-PhD institutions compared to Rest-PhD institutions decreased as well (Panel B of Table 7). Specifically, top publications for Mid-PhD/Rest-PhD fell from 4.09 to 3.36, a statistically significant decline.[30] Nonetheless, the results in Table 7 and the modest declines identified in measured inequality in Tables 5 and 6, albeit statistically significant, suggest that considerable concentration remains the dominant story, especially for "top" publications.

## V. Conclusion

This study analyzed publishing productivity in economics and business for 771 colleges and universities for the 17-year period from 1991-2007. Several findings emerge. First, across all tiers, publishing productivity has increased. This general rise, regardless of tier, is consistent with the proliferation of journals. It is also consistent with a continuing increased emphasis on publication. Second, consistent with the "democratization" effects of IT as well as increased research expectations of less elite institutions, publishing inequality has declined from a

[30] This analysis was replicated using the PhD categorizations from the NRC 2010 rankings. This analysis also shows statistically significant gains made in terms of quantity and quality of publishing for Rest PhD relative to their more elite PhD peers.

statistical standpoint, though the magnitude of the change is very small. Also, consistent with observed evidence of a decline in publishing inequality is some evidence that lower-ranked economics PhD institutions are gaining in both quantity and quality-adjusted counts of publications relative to their more elite peers. Again, however, in terms of magnitude these gains are small. Thus, the story is more one of constancy than one of change, even in the face of changing technology and rising research expectations. The fact remains that the most elite PhD programs are far larger in size and possess many more resources than do programs at other institutions.

While some evidence of a statistically significant decline in inequality was also found among Master's and Other institutions, this was not the case among Select Liberal Arts institutions. Here it appears that a small group of these institutions continue to dominate publishing productivity as measured by publication counts from the Web of Knowledge.

This study has focused on research articles published in traditional venues—refereed, and for the most part, print journals. Looking forward, the IT revolution is changing the publishing landscape, not just by creating access to virtual research, data, and colleagues for those at less-elite institutions, as emphasized here, but it may also threaten the traditional peer-review process (Ellison, 2011). As the time from submission to acceptance has grown tremendously at top journals (Ellison 2002), the Internet provides electronic alternatives for dissemination, from papers made available on personal web pages to electronic paper series. In Ellison's (2011) study of researchers at top economics departments and Harvard in particular, he identifies a shift away from publishing in traditional peer-reviewed journals, consistent with changes in technology and the slowdown in the publishing process. Most relevant to the paper at hand, are

the long-term implications of this trend for researchers located at less high-profile institutions. IT may shift from having a potentially democratizing role on publishing productivity, to one that exacerbates differences by author's institutional affiliation; economists at less elite institutions will need to continue to rely on the peer-review process for "validation" of the quality of work, while this process may become less important for those at top institutions. To investigate this pattern, future research will need to systematically look at measures of publishing output and citations that go beyond peer-reviewed publications for a broad set of institutions.

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# Appendix: Sensitivity Testing of Institutions included in PhD Tiers

As discussed in the text, 2009 *U.S. News and World Report* rankings were used to construct the set of institutions included in the Top-PhD, Mid-PhD, and Rest-PhD tiers. The specific institutions included in each tier are listed in Appendix Table 1. For purposes of sensitivity testing, we compared the *US News* list with other rankings.

First, we looked at findings from the National Resource Council. The National Resource Council reported new rankings in Fall 2010 (subsequently revised in April 2011) based on data collected during 2005-2006 (National Academies Press website). Only the revised 2010 rankings are reported here, referred to as 2010 NRC rankings. These rankings update earlier rankings reported in 1995, which were based on data collected in 1993 (referred to as 1995 NRC rankings here). The NRC made a major change in its methodology from 1995 to 2010; for 2010 it reports rankings using a range ($5^{th}$ and $95^{th}$ percentile rankings) rather than reporting a single numerical score. This change was made to reflect the inherent difficulties and questions about meaningfulness in precisely ordering PhD programs. The 2010 NRC also reports two distinct rankings for users to choose from (as well giving the user the ability to change the weights assigned to each), one regression-based (R) and another survey-based (S). The rankings reported here for comparison purposes (see Appendix Table 2) were obtained using the regression-based measure (with the weight set equal to the maximum score, 5). The overlap between the top 30 institutions in the R and S-based methods (where weight is set = 5, respectively) is 80%.[31]

Appendix Table 2 lists the top 30 institutions identified in the 2010 NRC ranking (R-

[31]The survey-based measure includes several institutions in the top 30 that are not included on any other list examined: University of Wyoming, Syracuse, Pittsburgh, and Iowa State. And, notably, it excludes UCLA.

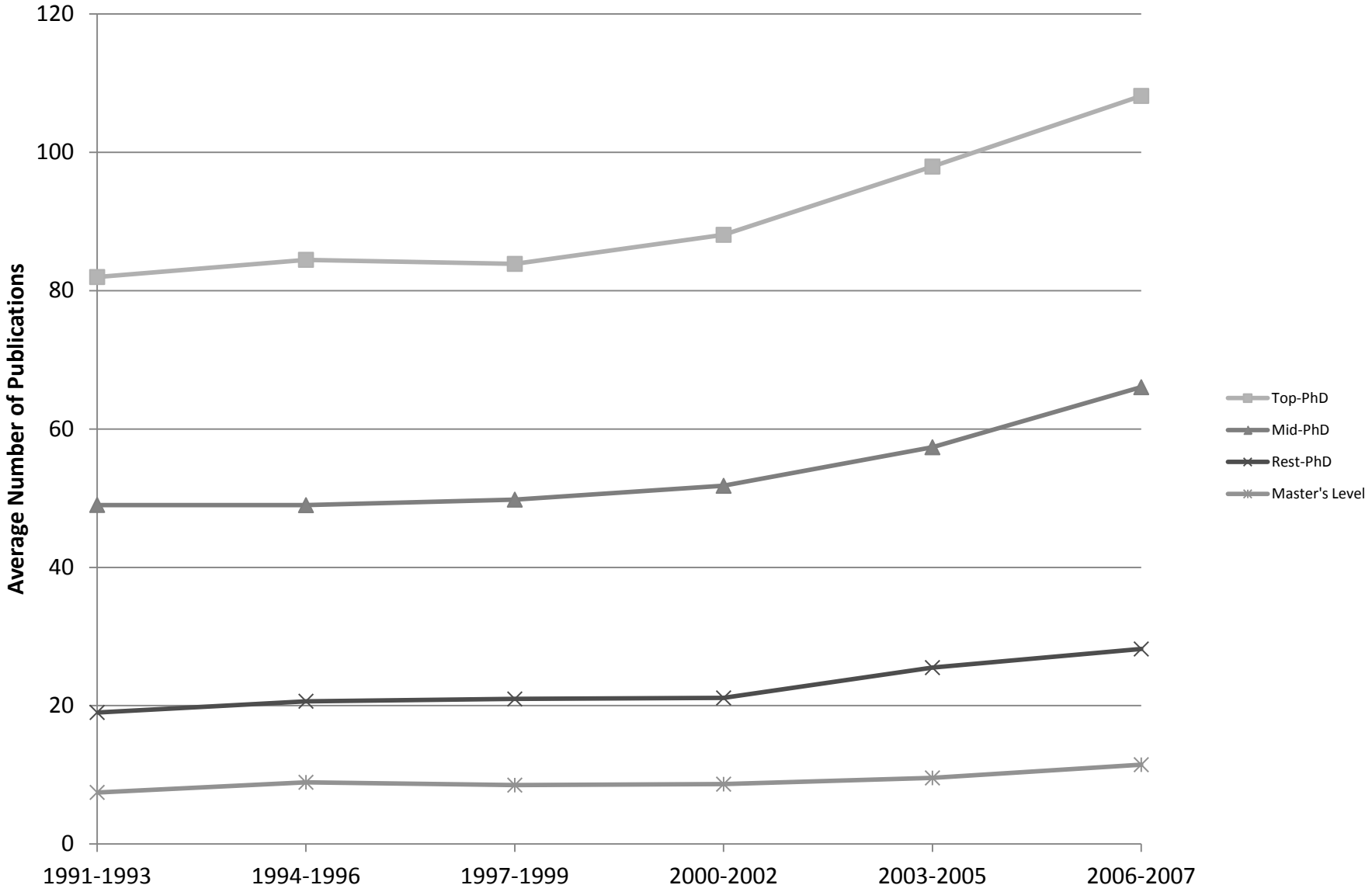
based method) alongside the top 30 institutions identified by the 2009 *US News and World Report*. There is a 97% overlap between these lists. To provide more information on the extent of overlap, Appendix Table 3 provides means and descriptive statistics for Top-PhD, Mid-PhD and Rest-PhD based on groupings from the 2010 NRC. The means for each PhD grouping are very similar to those reported in Table 2, which were constructed using economics PhD groupings from *US News*.

Next, we compared the 2009 US News list of top 30 institutions with a number of other rankings. As shown in Appendix Table 2, the overlap between the 2009 *US News* list and Amir & Knauff (2008) is 90%, and the overlap between the 2009 *US News* list and 1995 NRC based on faculty research quality is 83%. These findings are consistent with earlier literature that points to very little change in the set of PhD programs identified in the top grouping over long periods of time.

Finally, we compared the percentage overlap between the top 30 Economics PhD ranking from *US News* with the top 30 business school rankings from the same source and from Forbes (2005).[32] As shown in Appendix Table 2, these overlaps are 63% and 73% respectively. It is also instructive to note that virtually every institution that has a PhD program in economics also offers a business degree of some type. Important exceptions are Cal Tech, Brown, and Princeton.

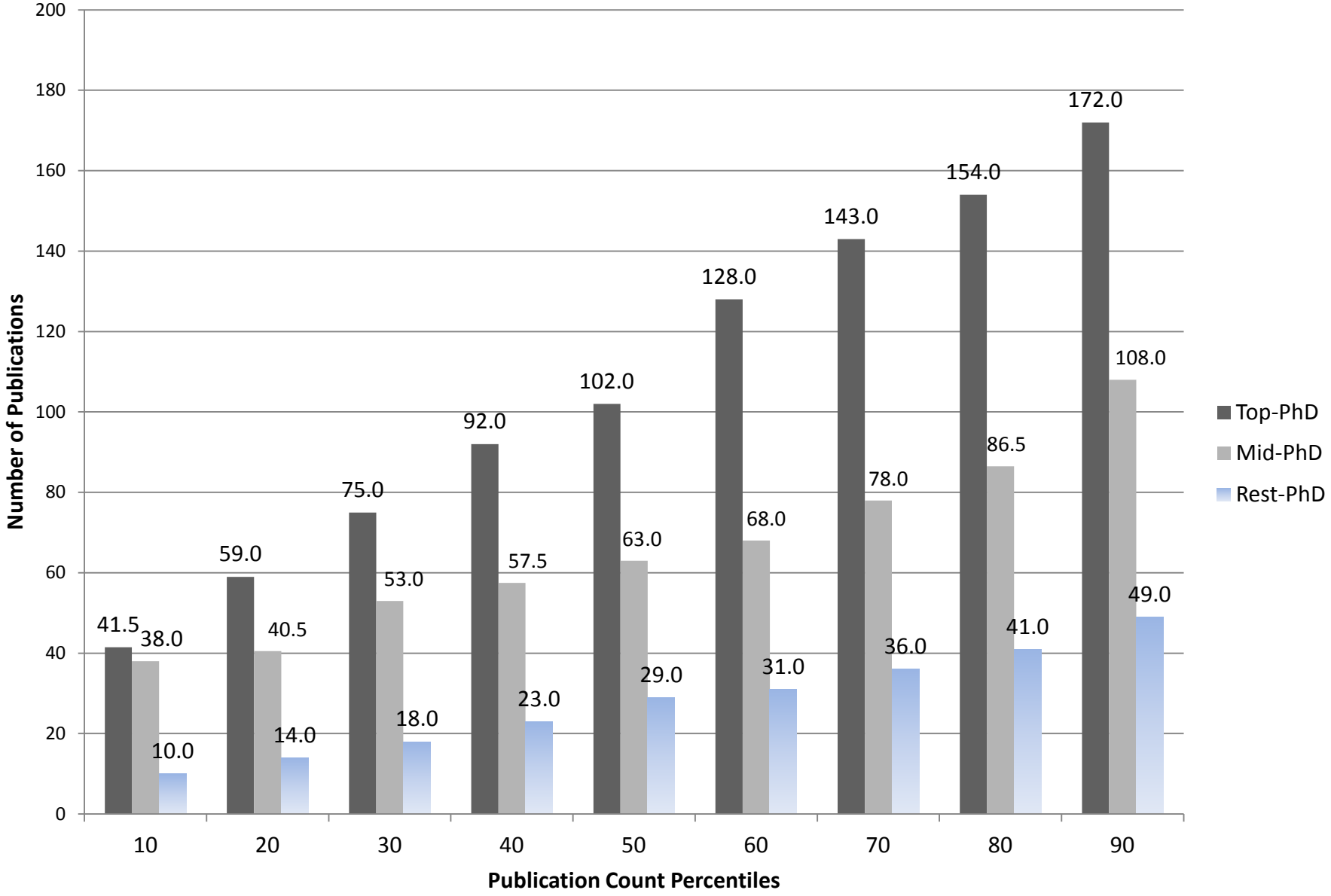
[32] Tracy & Waldfogel (1997) also produced a ranking for business schools, but its focus is on salary earned by students ("value added") rather than research quality.

## Figure 1. Average Number of Publications, 1991-2007, Selected Tiers



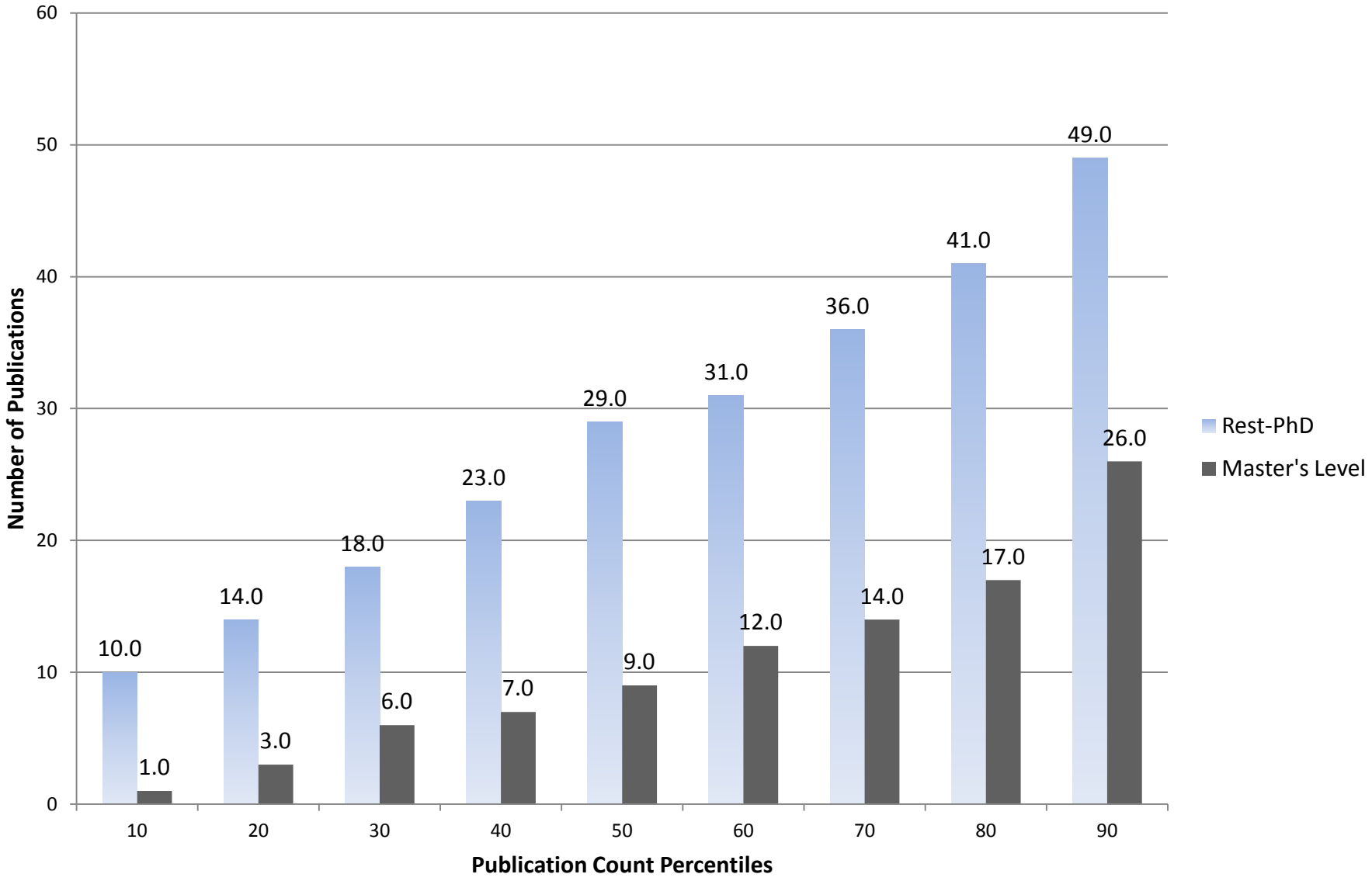

Data sourced from Thomson Reuters Web of Knowledge (formerly referred to as ISI Web of Science).

## Figure 2. Distribution of Total Publications for PhD Tiers, 2007




Data sourced from Thomson Reuters Web of Knowledge (formerly referred to as ISI Web of Science).

## Figure 3. Distribution of Total Publications for Master's and Rest-PhD Tiers, 2007




Data sourced from Thomson Reuters Web of Knowledge (formerly referred to as ISI Web of Science).

Table 1. Summary Statistics by Tier for Selected Subperiods

| | Number of Institutions per Tier | Share of Total Institutions | Share of Total Publications, 2006-07 | Share of Top Publications 2006-07 | Mean Number of Publications 2006-07 | % Change in Mean Number of Publications, 1994-96 to 2006-07 |
|---|---|---|---|---|---|---|
| Selected Elite PhD[a] | 7 | 0.01 | 0.11 | 0.23 | 138.1 | 18.2 |
| Top-PhD | 30 | 0.04 | 0.36 | 0.56 | 108.2 | 28.1 |
| Mid-PhD | 25 | 0.03 | 0.18 | 0.17 | 66.0 | 34.8 |
| Rest-PhD | 70 | 0.09 | 0.25 | 0.16 | 28.2 | 36.6 |
| Master's | 80 | 0.10 | 0.08 | 0.04 | 11.5 | 28.5 |
| Select Liberal Arts[b] | 51 | 0.07 | 0.02 | 0.01 | 2.7 | 38.5 |
| Other Comprehensive | 515 | 0.67 | 0.11 | 0.05 | 2.0 | 21.3 |

Notes: Data sourced from Thomson Reuters Web of Knowledge (formerly referred to as ISI Web of Science).

[a] These institutions, which are also included in the Top-PhD group below, include Yale, Chicago, Harvard, MIT, Stanford, UC-Berkeley, and Princeton.

[b] Select Liberal Arts Institutions do not have business schools, which affects both their share of total publications and mean publications in economics and business journals.

Table 2. Descriptive Statistics by Tier and Period

| | Top-PhD (n = 30, includes selected elite) | | | | | | Mid-PhD (n = 25) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All Publications | | | | Top Publications | | All Publications | | | | Top Publications | |
| Period | Mean | SD | Median | Share of Total | Mean | Share of Total | Mean | SD | Median | Share of Total | Mean | Share of Total |
| **1991-1993** | 82.0 | 40.0 | 83.0 | 0.38 | 19.4 | 0.58 | 49.0 | 18.9 | 49.0 | 0.19 | 7.2 | 0.18 |
| **1994-1996** | 84.5 | 42.7 | 80.5 | 0.36 | 18.7 | 0.57 | 49.0 | 18.3 | 47.0 | 0.18 | 7.0 | 0.18 |
| **1997-1999** | 83.9 | 42.7 | 77.0 | 0.36 | 19.1 | 0.54 | 49.8 | 18.1 | 49.0 | 0.18 | 7.5 | 0.18 |
| **2000-2002** | 88.1 | 45.5 | 85.5 | 0.37 | 23.0 | 0.57 | 51.8 | 17.9 | 51.0 | 0.18 | 8.4 | 0.17 |
| **2003-2005** | 97.9 | 48.3 | 98.5 | 0.36 | 24.9 | 0.59 | 57.4 | 22.1 | 54.0 | 0.18 | 7.9 | 0.16 |
| **2006-2007** | 108.2 | 57.0 | 102.0 | 0.36 | 24.7 | 0.56 | 66.0 | 23.7 | 62.0 | 0.18 | 9.2 | 0.17 |

| | Rest-Phd (n = 80) | | | | | | Master's Institutions (n = 70) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All Publications | | | | Top Publications | | All Publications | | | | Top Publications | |
| Period | Mean | SD | Median | Share of Total | Mean | Share of Total | Mean | SD | Median | Share of Total | Mean | Share of Total |
| **1991-1993** | 19.0 | 12.8 | 17.0 | 0.23 | 1.8 | 0.14 | 7.5 | 6.7 | 6.0 | 0.08 | 0.6 | 0.04 |
| **1994-1996** | 20.6 | 12.4 | 20.0 | 0.24 | 2.0 | 0.16 | 8.9 | 7.0 | 7.5 | 0.09 | 0.5 | 0.04 |
| **1997-1999** | 21.0 | 12.1 | 20.0 | 0.24 | 2.2 | 0.17 | 8.5 | 6.9 | 7.0 | 0.09 | 0.6 | 0.04 |
| **2000-2002** | 21.1 | 12.0 | 20.0 | 0.24 | 2.4 | 0.16 | 8.7 | 7.0 | 7.0 | 0.08 | 0.6 | 0.04 |
| **2003-2005** | 25.5 | 14.29 | 25.0 | 0.25 | 2.5 | 0.15 | 9.6 | 8.0 | 8.0 | 0.08 | 0.7 | 0.04 |
| **2006-2007** | 28.2 | 16.5 | 29.0 | 0.25 | 2.7 | 0.16 | 11.5 | 9.0 | 9.0 | 0.09 | 0.8 | 0.04 |

| | Select Liberal Arts Institutions (n = 51) | | | | | | Other Institutions (n = 515) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All Publications | | | | Top Publications | | All Publications | | | | Top Publications | |
| Period | Mean | SD | Median | Share of Total | Mean | Share of Total | Mean | SD | Median | Share of Total | Mean | Share of Total |
| **1991-1993** | 1.9 | 2.2 | 1.0 | 0.02 | 0.2 | 0.01 | 1.3 | 3.0 | 0.0 | 0.10 | 0.1 | 0.05 |
| **1994-1996** | 2.0 | 2.0 | 2.0 | 0.01 | 0.2 | 0.01 | 1.6 | 3.4 | 0.0 | 0.12 | 0.1 | 0.05 |
| **1997-1999** | 2.2 | 2.2 | 2.0 | 0.02 | 0.2 | 0.01 | 1.6 | 3.4 | 0.0 | 0.12 | 0.1 | 0.06 |
| **2000-2002** | 2.2 | 2.5 | 1.0 | 0.02 | 0.2 | 0.01 | 1.6 | 3.6 | 0.0 | 0.12 | 0.1 | 0.05 |
| **2003-2005** | 2.7 | 3.0 | 2.0 | 0.02 | 0.2 | 0.01 | 1.8 | 4.0 | 0.0 | 0.11 | 0.1 | 0.06 |
| **2006-2007** | 2.7 | 2.8 | 2.0 | 0.02 | 0.2 | 0.01 | 2.0 | 4.3 | 0.0 | 0.11 | 0.1 | 0.05 |

Notes: Data sourced from Thomson Reuters Web of Knowledge (formerly referred to as ISI Web of Science).

Table 3. Faculty Sizes for Selected Years and Tiers, based on Annual CSWEP Survey

| | number of institutions in CSWEP survey | Average Faculty Size | Median Faculty Size | % Female |
|---|---|---|---|---|
| 1993 | | | | |
| Selected Elite PhD | 7 | 39.2 | 38 | 9.4 |
| Top-PhD | 26 | 32.2 | 31 | 8.9 |
| Any-PhD | 81 | 26.8 | 25 | 12.3 |
| 2001 | | | | |
| Selected Elite PhD | 7 | 40.4 | 41 | 11.7 |
| Top-PhD | 22 | 36.7 | 35 | 11.1 |
| Any-PhD | 69 | 25.4 | 22 | 11.9 |
| Select Liberal Arts | 29 | 10.4 | 9 | 27.1 |
| 2003 | | | | |
| Selected Elite PhD | 7 | 42.5 | 41 | 10.7 |
| Top-PhD | 28 | 31.4 | 31 | 12.5 |
| Any-PhD | 95 | 25.0 | 23 | 14.7 |
| Select Liberal Arts | 29 | 10.1 | 9 | 27.1 |
| 2007 | | | | |
| Selected Elite PhD | 7 | 44.8 | 43 | 13.7 |
| Top-PhD | 29 | 35.2 | 34 | 12.7 |
| Any-PhD | 102 | 24.9 | 23 | 16.0 |
| Select Liberal Arts | 35 | 10.0 | 10 | 32.0 |

Notes: Data are based on CSWEP annual survey, 1993-2007.
Faculty refers to ranked faculty (tenured-track and tenured) at the assistant, associate and full professor levels. Visiting professors are not counted.
Selected Elite PhD refers to 7 institutions per Table 1; Top-PhD refers to 30 institutions per Table 1 and Appendix Table 1. Select Liberal Arts refer to institutions identified by Bodenhorn (2003). Any-PhD refers to any institution with an economics PhD program.

Table 4. Publishing Productivity Across 51 Select Liberal Arts Institutions

| | 1991-93 | 1994-96 | 1997-99 | 2000-02 | 2003-05 | 2006-07 |
|---|---|---|---|---|---|---|
| All 51 Select Liberal Arts Institutions | | | | | | |
| Mean Publications | 1.9 | 2 | 2.2 | 2.2 | 2.7 | 2.7 |
| Top Ten (of specified year)[a] | | | | | | |
| Mean Publications | 4.6 | 4.6 | 4.9 | 5.8 | 7.2 | 6.6 |
| Share of Liberal Arts Total | 0.47 | 0.46 | 0.44 | 0.52 | 0.53 | 0.48 |

Notes: Data sourced from Thomson Reuters Web of Knowledge (formerly referred to as ISI Web of Science).

[a]Over the 6 subperiods analyzed, the following 7 institutions were included in the top ten for 4 - 6 subperiods: Williams, Wellesley, Wesleyan, Claremont-McKenna, Middlebury, Barnard, and Swarthmore. Another 13 institutions were included in the top ten for 1-3 subperiods: Amherst, Hamilton, Lafayette, Bucknell, Colgate, Washington & Lee, Trinity, Colby, Union, Oberlin, Skidmore, Bowdoin, and College of Holy Cross.

Table 5. Trends in Inequality in Total Publications, 1991-2007

| | All | | Top-PhD | | Mid-PhD | | Rest-PhD | | Master's | | Liberal Arts | | Other | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Gini* | CV* | Gini | CV | Gini | CV | Gini* | CV* | Gini* | CV* | Gini | CV | Gini* | CV |
| 1991 | 0.83 | 2.41 | 0.27 | 0.48 | 0.23 | 0.41 | 0.37 | 0.68 | 0.48 | 0.93 | 0.56 | 1.08 | 0.83 | 2.49 |
| 1992 | 0.83 | 2.45 | 0.28 | 0.51 | 0.20 | 0.35 | 0.37 | 0.68 | 0.49 | 0.93 | 0.60 | 1.16 | 0.82 | 2.42 |
| 1993 | 0.82 | 2.39 | 0.27 | 0.49 | 0.22 | 0.41 | 0.36 | 0.68 | 0.45 | 0.85 | 0.53 | 1.10 | 0.79 | 2.21 |
| 1994 | 0.81 | 2.34 | 0.28 | 0.52 | 0.22 | 0.42 | 0.33 | 0.63 | 0.43 | 0.81 | 0.53 | 1.02 | 0.80 | 2.23 |
| 1995 | 0.80 | 2.28 | 0.28 | 0.52 | 0.20 | 0.35 | 0.31 | 0.57 | 0.43 | 0.78 | 0.53 | 1.01 | 0.78 | 2.06 |
| 1996 | 0.80 | 2.30 | 0.27 | 0.49 | 0.20 | 0.36 | 0.33 | 0.60 | 0.41 | 0.76 | 0.49 | 0.90 | 0.77 | 2.04 |
| 1997 | 0.80 | 2.30 | 0.28 | 0.51 | 0.20 | 0.38 | 0.31 | 0.56 | 0.44 | 0.85 | 0.53 | 1.04 | 0.77 | 2.08 |
| 1998 | 0.80 | 2.28 | 0.27 | 0.51 | 0.20 | 0.36 | 0.33 | 0.59 | 0.43 | 0.79 | 0.51 | 0.99 | 0.76 | 2.04 |
| 1999 | 0.81 | 2.32 | 0.28 | 0.52 | 0.21 | 0.37 | 0.32 | 0.59 | 0.41 | 0.77 | 0.51 | 0.95 | 0.78 | 2.13 |
| 2000 | 0.80 | 2.32 | 0.29 | 0.52 | 0.20 | 0.35 | 0.31 | 0.55 | 0.45 | 0.84 | 0.54 | 1.01 | 0.76 | 2.10 |
| 2001 | 0.81 | 2.34 | 0.28 | 0.53 | 0.21 | 0.37 | 0.30 | 0.54 | 0.44 | 0.79 | 0.54 | 1.07 | 0.80 | 2.42 |
| 2002 | 0.81 | 2.35 | 0.28 | 0.50 | 0.18 | 0.33 | 0.33 | 0.60 | 0.44 | 0.80 | 0.66 | 1.34 | 0.78 | 2.11 |
| 2003 | 0.81 | 2.29 | 0.26 | 0.47 | 0.21 | 0.38 | 0.31 | 0.55 | 0.46 | 0.86 | 0.52 | 1.01 | 0.78 | 2.25 |
| 2004 | 0.80 | 2.33 | 0.28 | 0.52 | 0.21 | 0.38 | 0.31 | 0.56 | 0.46 | 0.83 | 0.55 | 1.24 | 0.77 | 2.20 |
| 2005 | 0.81 | 2.28 | 0.27 | 0.50 | 0.22 | 0.39 | 0.32 | 0.57 | 0.43 | 0.81 | 0.56 | 1.09 | 0.77 | 2.18 |
| 2006 | 0.81 | 2.35 | 0.31 | 0.58 | 0.18 | 0.33 | 0.32 | 0.57 | 0.42 | 0.77 | 0.50 | 0.95 | 0.77 | 2.24 |
| 2007 | 0.81 | 2.27 | 0.27 | 0.48 | 0.21 | 0.39 | 0.33 | 0.60 | 0.44 | 0.81 | 0.54 | 1.08 | 0.77 | 2.11 |

* Statistically significant trend at the 5 percent level or better as determined based on a regression of the ratio as a function of a time trend and constant, estimated over the full 17-year period.

Notes: Data sourced from Thomson Reuters Web of Knowledge (formerly referred to as ISI Web of Science).

Table 6. Decomposition of GE(2) Across All Tiers

| Year | All Publications | | | Top Publications | | |
|---|---|---|---|---|---|---|
| | Overall Inequality[a] * | Within Tier Inequality | Between Tier Inequality* | Overall Inequality[a] | Within Tier Inequality | Between Tier Inequality |
| 1991 | 2.91 | 0.70 | 2.21 | 6.71 | 2.35 | 4.36 |
| 1992 | 2.99 | 0.74 | 2.26 | 6.82 | 2.40 | 4.42 |
| 1993 | 2.85 | 0.69 | 2.16 | 6.94 | 2.56 | 4.38 |
| 1994 | 2.74 | 0.71 | 2.03 | 6.16 | 2.29 | 3.87 |
| 1995 | 2.60 | 0.65 | 1.96 | 6.75 | 2.40 | 4.34 |
| 1996 ` | 2.65 | 0.63 | 2.02 | 6.96 | 2.49 | 4.47 |
| 1997 | 2.65 | 0.65 | 2.00 | 6.21 | 2.18 | 4.03 |
| 1998 | 2.59 | 0.64 | 1.95 | 6.38 | 2.43 | 3.95 |
| 1999 | 2.70 | 0.67 | 2.03 | 5.71 | 1.88 | 3.83 |
| 2000 | 2.70 | 0.67 | 2.03 | 7.29 | 2.94 | 4.35 |
| 2001 | 2.73 | 0.69 | 2.04 | 6.56 | 2.14 | 4.41 |
| 2002 | 2.76 | 0.66 | 2.11 | 6.18 | 1.97 | 4.22 |
| 2003 | 2.61 | 0.59 | 2.02 | 6.92 | 2.54 | 4.39 |
| 2004 | 2.70 | 0.69 | 2.02 | 6.35 | 2.14 | 4.21 |
| 2005 | 2.59 | 0.63 | 1.96 | 7.33 | 2.71 | 4.61 |
| 2006 | 2.76 | 0.76 | 2.00 | 7.22 | 3.04 | 4.18 |
| 2007 | 2.58 | 0.61 | 1.97 | 6.31 | 2.24 | 4.08 |

[a] Overall inequality is measured in this table as GE(2). It is equivalent to 1/2*CV squared. CV is reported in Table 5.

* Statistically significant trend at the 5 percent level or better as determined based on an OLS regression of the ratio as a function of a time trend and constant estimated over the full 17-year period.

Notes: Data sourced from Thomson Reuters Web of Knowledge (formerly referred to as ISI Web of Science).

Table 7. Ratios of Mean Publications by Tier and Period

Panel A: Total Publications

| Period | Top-PhD/ Mid-PhD | Mid-PhD/ Rest-PhD* | Mid-PhD/ Liberal Arts | Mid-PhD/ Master's | Mid-PhD/ Other | Top-PhD/ Rest-PhD* | Rest-PhD/ Liberal Arts | Rest-PhD/ Master's | Rest-PhD/ Other | Lib. Arts/ Master's | Lib. Arts/ Other | Master's/ Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991-1993 | 1.67 | 2.58 | 25.42 | 6.57 | 38.23 | 4.31 | 9.87 | 2.55 | 14.83 | 0.26 | 1.50 | 5.82 |
| 1994-1996 | 1.72 | 2.37 | 24.98 | 5.49 | 30.11 | 4.09 | 10.53 | 2.31 | 12.69 | 0.22 | 1.21 | 5.48 |
| 1997-1999 | 1.68 | 2.37 | 22.47 | 5.85 | 30.81 | 4.00 | 9.46 | 2.46 | 12.97 | 0.26 | 1.37 | 5.27 |
| 2000-2002 | 1.70 | 2.45 | 23.51 | 5.99 | 31.83 | 4.17 | 9.59 | 2.44 | 12.97 | 0.25 | 1.35 | 5.32 |
| 2003-2005 | 1.71 | 2.25 | 21.46 | 6.00 | 31.61 | 3.84 | 9.54 | 2.67 | 14.05 | 0.28 | 1.47 | 5.26 |
| 2006-2007 | 1.64 | 2.34 | 24.32 | 5.76 | 33.46 | 3.84 | 10.38 | 2.46 | 14.28 | 0.24 | 1.38 | 5.81 |

Panel B: Top Publications

| Period | Top-PhD/ Mid-PhD | Mid-PhD/ Rest-PhD* | Mid-PhD/ Liberal Arts | Mid-PhD/ Master's | Mid-PhD/ Other | Top-PhD/ Rest-PhD* | Rest-PhD/ Liberal Arts | Rest-PhD/ Master's | Rest-PhD/ Other | Lib. Arts/ Master's | Lib. Arts/ Other | Master's/ Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991-1993 | 2.67 | 4.09 | 31.65 | 12.46 | 74.08 | 10.94 | 7.74 | 3.05 | 18.12 | 0.39 | 2.34 | 5.94 |
| 1994-1996 | 2.67 | 3.53 | 41.11 | 13.84 | 67.46 | 9.43 | 11.65 | 3.92 | 19.11 | 0.34 | 1.64 | 4.87 |
| 1997-1999 | 2.53 | 3.41 | 38.49 | 12.10 | 63.02 | 8.62 | 11.28 | 3.55 | 18.48 | 0.31 | 1.64 | 5.21 |
| 2000-2002 | 2.75 | 3.54 | 44.25 | 13.87 | 69.66 | 9.71 | 12.51 | 3.92 | 19.69 | 0.31 | 1.57 | 5.02 |
| 2003-2005 | 3.13 | 3.23 | 39.15 | 11.73 | 54.48 | 10.13 | 12.11 | 3.63 | 16.85 | 0.30 | 1.39 | 4.64 |
| 2006-2007 | 2.69 | 3.36 | 42.47 | 11.15 | 70.94 | 9.05 | 12.63 | 3.32 | 21.10 | 0.26 | 1.67 | 6.36 |

* Statistically significant trend at the 5 percent level or better as determined based on an OLS regression of the ratio as a function of a time trend and constant, estimated over the full 17-year period.

Notes: Data sourced from Thomson Reuters Web of Knowledge (formerly referred to as ISI Web of Science).

Appendix Table 1. Listing of Institutions by Tier[a]

| Top-PhD | Mid-PhD | Rest-PhD | Master's | Select Liberal Arts |
|---|---|---|---|---|
| Boston University | Arizona State University | American University | Auburn University Main Campus | Amherst College |
| Brown | Boston College | Brandeis University | Baylor University | Bard College |
| Cal Tech | Georgetown University | Claremont Graduate School | Bowling Green State University | Barnard College |
| Carnegie Mellon Univ. | Indiana University | Clark University | California Polytechnic State Univ-San Luis Obispo | Bates College |
| Chicago | Iowa State University | Clemson University | California State Polytechnic University-Pomona | Beloit College |
| Columbia | Michigan State University | Colorado School Of Mines | California State University-East Bay | Bowdoin College |
| Cornell | North Carolina State University | Colorado State University | California State University-Fullerton | Bryn Mawr College |
| Duke | Purdue University | Cuny Graduate School And University Center | California State University-Long Beach | Bucknell University |
| Harvard | Rice University | Drexel University | California State University-Los Angeles | Carleton College |
| John Hopkins Univ. | Rutgers University-New Brunswick | Emory University | California State University-Sacramento | Centre College |
| Maryland | Syracuse University | Florida International University | Catholic University | Claremont Mckenna College |
| Michigan | Texas A & M University | Florida State University | Central Michigan University | Colby College |
| Minnesota | University Of Arizona | Fordham University | Cleveland State University | Colgate University |
| MIT | University Of California-Davis | George Mason University | Cuny Bernard M Baruch College | College Of The Holy Cross |
| Northwestern | University Of California-Irvine | George Washington University | Cuny Brooklyn College | Colorado College |
| NYU | University Of California-Santa Barbara | Georgia Institute Of Technology | Cuny City College | Connecticut College |
| Ohio State | University Of Colorado At Boulder | Georgia State University | Cuny Hunter College | Davidson College |
| Penn State University | University Of Florida | Howard University | Depaul University | Denison University |
| Princeton | University Of Illinois At Urbana | Indiana University Purdue University Indianapolis | East Carolina University | Depauw University |
| Rochester | University Of Iowa | Kansas State Univ | Eastern Illinois University | Dickinson College |
| Stanford | University Of North Carolina At Chapel Hill | Lehigh University | Eastern Michigan University | Franklin And Marshall College |
| UC-Berkeley | University Of Pittsburgh | Louisiana State U | Florida Atlantic University | Furman University |
| UCLA | University Of Southern California | Middle Tennessee State University | Illinois State University | Grinnell College |
| UC-San Diego | University Of Washington | Mississippi State University | Kent State University | Hamilton College |
| Upenn | Vanderbilt University | New School For Social Research | Michigan Technological University | Haverford College |
| UT-Austin | | Northeastern University | Montana State University | Kenyon College |
| Virginia | | Northern Illinois University | Morgan State University | Lafayette College |
| Washington University in St. Louis | | Oklahoma State University-Main Campus | Murray State University | Lawrence University |
| Wisconsin | | Oregon State University | New Mexico State University | Macalester College |
| Yale | | Rensselaer Polytechnic Institute | North Dakota State University | Middlebury College |
| | | Southern Illinois University-Carbondale | Ohio University Main Campus | Mount Holyoke College |
| | | Southern Methodist University | Old Dominion University | Oberlin College |
| | | Suffolk University | Pace University | Occidental College |
| | | Suny At Albany | Portland State University | Pomona College |
| | | Suny At Binghamton | Roosevelt University | Rhodes College |
| | | Suny At Buffalo | Saint Cloud State University | Sarah Lawrence College |
| | | Suny At Stony Brook | San Diego State University | Scripps College |
| | | Teachers College At Columbia University | San Francisco State University | Skidmore College |
| | | Temple University | San Jose State University | Smith College |
| | | Texas Tech University | South Dakota State University | Swarthmore College |
| | | Tulane University | Southern Illinois University-Edwardsville | Trinity College |
| | | University Of Alabama | Tufts University | Union College |
| | | University Of Arkansas | University Of Akron Main Campus | University Of The South |
| | | University Of California-Riverside | University Of Alaska Fairbanks | Vassar College |
| | | University Of California-Santa Cruz | University Of Cincinnati | Washington And Lee University |
| | | University Of Central Florida | University Of Colorado | Wellesley College |
| | | University Of Connecticut | University Of Denver | Wesleyan University |
| | | University Of Delaware | University Of Idaho | Wheaton College |
| | | University Of Georgia | University Of Maine | Whitman College |
| | | University Of Hawaii At Manoa | University Of Maryland-Baltimore County | Willamette University |
| | | University Of Houston | University Of Memphis | Williams |
| | | University Of Illinois At Chicago | University Of Missouri-St Louis | |
| | | University Of Kansas | University Of Montana-Missoula | |
| | | University Of Kentucky | University Of Nebraska At Omaha | |
| | | University Of Massachusetts-Amherst | University Of Nevada-Las Vegas | |
| | | University Of Miami | University Of North Carolina At Charlotte | |
| | | University Of Mississippi | University Of North Dakota-Main Campus | |
| | | University Of Missouri-Columbia | University Of North Texas | |
| | | University Of Missouri-Kansas City | University Of San Francisco | |
| | | University Of Nebraska | University Of Texas At Arlington | |
| | | University Of Nevada | University Of Texas At El Paso | |
| | | University Of New Hampshire | University Of Texas At San Antonio | |
| | | University Of New Mexico | University Of Toledo | |
| | | University Of North Carolina At Greensboro | Virginia Commonwealth University | |
| | | University Of Notre Dame | Virginia State University | |
| | | University Of Oklahoma Norman Campus | West Texas A & M University | |
| | | University Of Oregon | Western Illinois University | |
| | | University Of Rhode Island | Wichita State University | |
| | | University Of South Carolina | Williams College | |
| | | University Of South Florida | Wright State University | |
| | | University Of Tennessee | Youngstown State University | |
| | | University Of Texas At Dallas | | |
| | | University Of Utah | | |
| | | University Of Wisconsin-Milwaukee | | |
| | | University Of Wyoming | | |
| | | Utah State University | | |
| | | Virginia Polytechnic Institute And State Univ | | |
| | | Washington State University | | |
| | | Wayne State University | | |
| | | West Virginia University | | |
| | | Western Michigan University | | |

[a] Tiers are defined in the text. The 515 institutions included in Other are available upon request from the authors.

Appendix Table 2. Top 30 Institutions, Selected Rankings

| | Economics PhD | | | | | Business School | |
|---|---|---|---|---|---|---|---|
| | US News&World Report, 2009 | NRC 2010 | NRC 1995 | Kalaitzidakis et al., 2003 | Amir & Knauff, 2008 | US News&World Report, 2009 | Forbes 2005 |
| Yale | 1 | 6-15 | 6 | 6 | 6 | 11 | 5 |
| Chicago | 2 | 1-3 | 2 | 2 | 5 | 5 | 3 |
| Harvard | 3 | 1-2 | 1 | 1 | 2 | 1 | 7 |
| MIT | 4 | 2-5 | 3 | 3 | 1 | 3 | 18 |
| Stanford | 5 | 6-13 | 4 | 8 | 3 | 2 | 6 |
| UC-Berkeley | 6 | 3-8 | 7 | 9 | 7 | 8 | 15 |
| Princeton | 7 | 4-11 | 5 | 7 | 4 | NA | NA |
| UCLA | 8 | 13-25 | 11 | 14 | 14 | 15 | 19 |
| Northwestern | 9 | 10-17 | 9 | 4 | 9 | 4 | 10 |
| Michigan | 10 | 14-27 | 13 | 13 | 16 | 12 | 26 |
| Minnesota | 11 | 14-25 | 10 | 19 | 8 | 26 | NA |
| Columbia | 12 | 8-19 | 12 | 11 | 18 | 9 | 4 |
| Upenn | 13 | 7-18 | 8 | 5 | 11 | 6 | 2 |
| NYU | 14 | 5-14 | 17 | 10 | 25 | 10 | 13 |
| Wisconsin | 15 | 8-17 | 15 | 18 | 15 | 30 | NA |
| Cal Tech | 16 | 16-26 | 19 | 26 | 19 | NA | NA |
| UC-San Diego | 17 | 17-30 | 16 | 12 | 20 | NA | NA |
| Cornell | 18 | 19-29 | 18 | 15 | 27 | 18 | 9 |
| Duke | 19 | 18-29 | 22 | 22 | 17 | 14 | 20 |
| Virginia | 20 | NA | 24 | NA | 28 | 13 | 8 |
| UT-Austin | 21 | 25-48 | 31 | 16 | NA | 17 | 11 |
| Carnegie Mellon Univ. | 22 | 22-47 | NA | 24 | 12 | 16 | 16 |
| Maryland | 23 | 5-18 | 20 | 25 | 22 | NA | 29 |
| Penn State University | 24 | 26-46 | 45 | NA | 21 | NA | 23 |
| Rochester | 25 | 22-36 | 14 | 17 | 13 | 29 | NA |
| Washington University in | 26 | 17-26 | 29 | NA | NA | 20 | 27 |
| Ohio State | 27 | 22-34 | 35 | 29 | NA | 21 | NA |
| Boston University | 28 | 25-63 | 21 | 20 | 29 | NA | NA |
| Brown | 29 | 14-24 | 23 | 21 | 24 | NA | NA |
| John Hopkins Univ. | 30 | 24-44 | 32 | NA | 23 | NA | NA |

NRC 2010 ranking is calculated using the regression-based score set equal to 5, range shown is 5th-95th percentile, based on 29 April 2011 revision.

Appendix Table 3. PhD Institutions categorized using NRC 2010

| | Top PhD (n = 30, includes selected elite) | | | | | | Mid PhD (n = 25) | | | | | | Rest PhD (n = 80) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All Publications | | | | Top Publications | | All Publications | | | | Top Publications | | All Publications | | | | Top Publications | |
| Period | Mean | SD | Median | Share of Total | Mean | Share of Total | Mean | SD | Median | Share of Total | Mean | Share of Total | Mean | SD | Median | Share of Total | Mean | Share of Total |
| **1991-1993** | 81.1 | 41.3 | 83.0 | 0.38 | 19.2 | 0.57 | 44.0 | 22.2 | 43.0 | 0.17 | 6.6 | 0.16 | 20.9 | 14.3 | 18.0 | 0.26 | 2.0 | 0.16 |
| **1994-1996** | 83.4 | 44.1 | 80.5 | 0.36 | 18.5 | 0.56 | 44.6 | 21.8 | 44.0 | 0.16 | 6.3 | 0.16 | 22.4 | 13.3 | 21.0 | 0.26 | 2.2 | 0.18 |
| **1997-1999** | 82.6 | 44.4 | 77.0 | 0.36 | 18.8 | 0.53 | 46.2 | 21.9 | 46.0 | 0.17 | 6.7 | 0.16 | 22.6 | 12.7 | 21.0 | 0.26 | 2.6 | 0.20 |
| **2000-2002** | 86.7 | 47.1 | 85.5 | 0.36 | 22.8 | 0.57 | 47.1 | 23.0 | 50.0 | 0.16 | 7.2 | 0.15 | 23.1 | 12.9 | 21.0 | 0.26 | 2.8 | 0.19 |
| **2003-2005** | 96.5 | 50.1 | 98.5 | 0.36 | 24.5 | 0.58 | 53.7 | 26.5 | 55.0 | 0.16 | 7.3 | 0.14 | 27.1 | 14.6 | 27.0 | 0.27 | 2.8 | 0.18 |
| **2006-2007** | 107.0 | 58.6 | 102.0 | 0.35 | 24.3 | 0.55 | 60.0 | 31.1 | 60.0 | 0.16 | 8.1 | 0.15 | 30.4 | 16.6 | 30.0 | 0.27 | 3.2 | 0.19 |

Notes: NRC 2010 ranking is calculated using the regression-based score set equal to 5, based on 29 April 2011 revision.

Data sourced from Thomson Reuters Web of Knowledge (formerly referred to as ISI Web of Science).