8-2014

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Economics Working Paper Series 2014
http://business.uow.edu.au/aef/UOW010552.html

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WP 14-03

August 2014

The contribution of Australian academia to the world's best economics research: 2001-2010.

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Abstract

This paper investigates the output of top-tier economics research by Australian academic economists from 2001 to 2010. By constructing and analysing a unique database of all substantive publications in the world's top 45 economics journals, we compare Australia's output with those of over 100 other countries, determine whether Australia's output has increased since 2001, and rank Australian universities based on their output. Our analysis suggest that Australia's output of top-tier economics research, both in absolute and relative terms, increased over the study period and that on a per capita basis, appears to be converging to the levels of the most research intensive countries. Our analysis also suggests that the long standing dominance of the top one or two Australian universities is diminishing.

I Introduction.

Australia's higher education sector has experienced substantial reform in recent decades. From 1988 universities were allowed to set fees for, and determine enrolments of, international students leading to double-digit growth rates in international student numbers. In 1989, colleges of advanced education were transformed into new universities and income-contingent student loans were introduced. As the number of government-funded places increased domestic student enrolments also increased rapidly. A major justification for these reforms was the growing awareness that higher education is an important driver of international economic competitiveness because it increases the supply of highly trained labour and increases the quantum of top-tier research, both of which boost labour productivity.

The drive to increase university research accelerated post 2000. The Australian Research Council (ARC) was established in 2001 as an independent body to advise the federal government on research quality and expenditure across the sector. An early ARC scheme to increase quality research output was the Research Quality Framework (RQF) which initiated a move to outcomes-based funding. This was replaced in 2007 by the current Excellence in Research Australia (ERA) program which, according to the ARC website, "…will assess research quality within Australia's higher education institutions and will give government, industry, business and the wider community assurance of the excellence of research conducted. It will also provide a national stocktake, by research discipline area, of research strength against international benchmarks". This stocktake lead to the production of journal rankings by discipline area so as to judge research strengths but the rankings also provided signals to researchers on the perceived quality of domestic and international publication outlets.

This paper investigates whether the post-2000 reforms have had the desired effect in the field of economics. The following questions are addressed. How does Australia compare with other countries in the production of top-tier economics research? Has Australia increased its quantum of top-tier economics research since 2000, a period during which the institutional emphasis on quality research has increased substantially? Which Australian universities have produced the greatest quantum of high quality economics research and are there any discernable trends since 2000. And finally, which top-tier publication outlets are most favoured by Australian academic economists?

These are important questions given the nature of the ongoing ERA exercise and the resources devoted to it. The ranking of universities by discipline under the ERA exercise can affect the ability of departments to recruit new staff, to retain existing staff and attract high quality graduate students. The journal rankings produced under the ERA exercise can impact negatively on

submission rates to some long standing publication outlets now regarded as being of insufficient quality. Journal rankings may also affect individuals' career prospects, and may even influence the type of research that academics conduct.

Any analysis of the quality and quantity of university research is likely to be controversial.[1] There is often disagreement regarding the definition and measurement of top-tier research. Furthermore, influential research is sometimes published in lesser regarded outlets whilst a surprisingly large proportion of research published in highly regarded outlets is largely ignored.[2] Despite the controversy we assume, as have many Australian and international studies, that the quality of published research is highly positively correlated with the international ranking of the outlet in which it is published.[3] Therefore we begin our analysis by constructing our own list of the world's top economics journals and documenting all research articles published in those journals for the period 2001-2010 inclusive.[4] We then analyse that data to determine the absolute and relative performance of Australian universities in producing top-class economics research and we conduct sensitivity analyses to determine whether our results change as our list of top-tier journals becomes more restrictive and thus less disputable.

The remainder of this paper is organised as follows. In the next section we selectively review the extant literature on the production of economics research in academia, much of which is from the USA, to get a sense of the journal selection criteria that others have used. We then review some prior studies of the research output of Australian economics departments to establish a context within which to interpret our findings. In Section III we explain our approach to the journal selection problem and our method of data collection. In Section IV we answer the questions of interest noted above, and conduct sensitivity analyses of our results. Finally, Section V concludes.

[1] Indeed controversy was present from the early literature in this area. Fusfeld (1956) accused the American Economic Association of parochialism in the manner in which participants for the AEA annual meetings were selected. See Hinshaw and Siegfried (1995) for details.

[2] Laband and Tollison (2003) show that by 2001, over 26% of papers published in 91 leading international economics journals in 1996 had received zero citations and that a further 59% had received ten or fewer citations by 2001.

[3] In Australia, studies that have produced metrics of quality-adjusted research output at either the individual or department level include Sinha and Macri (2002, 2004), Pomfret and Wang (2003), and Neri and Rodgers (2006).

[4] We follow almost every other related study and concentrate only on research published in journals because, as noted by Neary, Mirless and Tirole (2003), "only published journal articles undergo a widely accepted process of peer review which is the essence of quality control in any scientific discipline" (p.1241). Clearly by focusing only on journals we exclude research books and thereby, it has been argued, discriminate against economic historians in particular.

II Literature Review.

Academic economists have a long tradition of measuring and analysing the research activities and outputs of their peers.[5] One common objective has been the ranking of universities, economics departments or academic economists based on aggregate or per capita publications in top-tier journals.[6] For example, Graves *et al.* (1982) rank 240 US economics departments on the basis of total pages published and pages published per academic staff in the top 24 economics journals over the period 1974-78. The authors provide no journal selection criterion, which suggests that there may have been little disagreement at that time as to the identity of these journals.[7] In fact, in a footnote the authors dismiss the problem of journal selection by claiming that only the rankings of lowly ranked schools would be affected by changes to their set of journals.[8]

Similarly, Scott and Mitias (1996) rank economics departments in the US in part on the basis of the number of quality adjusted pages published in 36 top economics journals. The authors omitted three journals from the list in Graves *et al.* (1982), added fifteen newer journals that they deemed to be highly regarded at that time, but again provided no explanation for these changes.[9] More recently, Kim *et al.* (2006) compiled a list of papers published in 41 top-tier economics journals that, from 1970, had received more than 500 citations. Their objective was to determine favoured fields of economics research and the types of articles that generate most interest. According to the authors, "The choice of the particular 41 journals results from the union of journals that have been used in previous studies…" (p.190), the earliest of which is Graves *et al.* (1982).[10] Again no further justification is provided for the selection of their journals.

[5] As an indication of the considerable interest in this line of research since 1956, Graves *et al.* (1982) note results from thirteen prior rankings studies, an average publication rate to that time of at least one paper every two years.
[6] Other objectives include examination of trends in characteristics such as co-authorship rates, author age and gender (see, for example, Rodgers and Neri 2007, and Hamermesh 2013) and determination of changes over time in research fields and methodologies (see, for example, Pieters and Baumgartner 2002, and Hamermesh 2013).
[7] Their top 24 journals are American Economic Review, Econometrica, Economic Development and Cultural Change, Economic Inquiry, Economic Journal, Economica, Industrial and Labor Relations Review, International Economic Review, Journal of Business, Journal of Economic History, Journal of Economic Theory, Journal of Finance, Journal of Human Resources, Journal of Law and Economics, Journal of Money, Credit and Banking, Journal of Political Economy, Journal of Regional Science, Journal of the American Statistical Association, National Tax Journal, Oxford Economic Papers, Quarterly Journal of Economics, Review of Economic Studies, Review of Economics and Statistics, Southern Economic Journal.
[8] As our focus is on the performance of Australian universities, most of which have not been very highly ranked in past international studies (for example, see Hirsch *et al.* (1984)), journal selection is of considerable importance to us.
[9] From the journals used in Graves at al. (1982), Scott and Mitias (1996) dropped Economic Development and Cultural Change, Journal of the American Statistical Association, and Oxford Economic Papers. They included Journal of Business and Economic Statistics, Journal of Development Economics, Journal of Econometrics, Journal of Economic Dynamics and Control, Journal of Financial Economics, Journal of Labor Economics, Journal of International Economics, Journal of International Money and Finance, Journal of Law, Economics and Organisation, Journal of Legal Studies, Journal of Monetary Economics, Journal of Public Economics, Journal of Urban Economics, Public Choice, and RAND Journal of Economics.
[10] See their Table 1 for the list of 41 journals.

These three studies suggest that within this strand of the literature, many authors rely on, but modify as deemed appropriate, the precedents set by prior studies when selecting top journals. Perhaps not surprisingly, over time the number of journals regarded as top-tier has increased, although some authors such as Scott and Mitias (1996) have also used smaller subsets of journals to determine sensitivity of results.[11] We follow a similar but more explicit methodological approach to the journal selection problem in the next section. However, we end this section by briefly reviewing prior findings on the research performance of Australian universities.

An early study that sheds some light on the performance of Australian universities is Hirsch *et al.* (1984) who replicated the methodology and updated the rankings of the top 240 departments in Graves *at al.* (1982), but also provided a list of the top 40 departments outside the USA, for the period 1978-83. Only three Australian universities, ANU (654 pages published), UNSW (196 pages) and Monash (185 pages), made that list, with their respective worldwide rankings being approximately 30, 90 and 94.[12] This suggests that the majority of Australian departments were performing below the top 280 or so departments worldwide in the early 1980's. Towe and Wright (1995) ranked 23 Australian economics departments on the basis of per capita pages published in sub groups of up to 332 journals from 1988 to 1993.[13] The authors found that, for a set of 35 top journals which contains 19 of the 24 journals in Graves *et al.* (1982), the four most research productive departments were ANU (125 pages), Monash (105 pages), Melbourne (102 pages) and UNSW (74 pages). As these outputs are for a much larger set of journals than those considered by Hirsch *et al.* (1984), they indicate a likely drop in research productivity from the results ten years earlier. The authors also found that (apart from Australian Economics Papers and Economic Record) the most favoured outlets were Journal of Econometrics, Economics Letters, Oxford Economic Papers and History of Political Economy.

Sinha and Macri (2002) ranked 27 Australian economics departments based on research output in any of 400 journals included in the ECONLIT database, with adjustments for article length, number of authors, word counts per page and journal quality.[14] The authors found that from 1994-2000 the most research productive departments were at ANU (102 pages), Melbourne (49 pages), Sydney (44 pages) and UNSW (43 pages). Sinha and Macri's outputs are not directly comparable with

[11] Other studies have used a much smaller set of 'core' journals. For example, Kocher and Sutter (2001) analysed the institutional concentration of authors in only 15 journals regarded as top-tier.

[12] The University of Canterbury, NZ also made this top-40 group and was ranked at about 126 worldwide. By comparison, the top ranked department, at the University of Chicago, published nearly 3000 pages whilst fifteen departments published over 1000 pages each. We note that no adjustment for department size was made by Hirsch *et al.* (1984).

[13] To take account of differences in page sizes, Hirsch *et al.* (1984) and Towe and Wright (1995) standardised page counts to the mean size of one page in American Economic Review.

[14] The authors use the citations based rankings for over 100 journals from Laband and Piette (1994), where only 30 journals were ranked at better than 10% of the 'quality' of the top ranked journal, American Economic Review.

those from earlier studies: they will be biased downwards because of the quality adjustment process but will be biased upwards because of the much larger set of journals included and the slightly longer time period. However, on balance, it is at least plausible that the research productivity of Australia's top economics departments had declined in absolute terms, and likely declined relative to the productivities of the world's top departments, from the late 1970's to 2000. If this is so then it is of some interest to determine whether the reform efforts since 2000 mentioned above have had the desired effect. But before we can address this question, we need to determine what journals qualify as top-tier research outlets.

III The World's Best Economics Journals.

In this section we follow, but make more explicit, the methodology of most prior research in this area. Specifically, we compare, contrast and consolidate six recent journal ranking studies (three Australian and three international) so as to construct our list of the world's best economics journals. We begin with a recent international journal ranking exercise by Kalaitzidakis *et al.* (2010), which is an update of their 2003 study. The authors use the Journal of Citation Reports (JCRs) to firstly construct a list of (up to 209) economics journals to be ranked in each year from 2003 to 2008. They then use the JCRs to construct an annual index based on the number of citations to journal *i* from all journals *j* in their list (where $j \neq i$, hence excluding self-citations) over the preceding ten year period. The authors exclude citations received more than ten years prior to publication in an attempt to adjust for the longevity of journals. Additionally the authors correct for the size of the journal, as journals with more pages tend to receive more citations, and for the impact of citations by taking account of the professional influence of the citing journal.

The authors find, for example, that the second ranked journal in 2008, The Quarterly Journal of Economics, had 76% of the citations and 60% of the citations per article received by the top-ranked journal in 2008, The American Economic Review (AER), over the preceding ten year period (1998-2007). By way of comparison The Economic Record, the highest ranked Australian journal in 2008 (129^{th}) had, over the same period, 38% of the citations, and 27% of the citations per article, received by the AER. Kalaitzidakis *et al.* (2010) provide rankings of between 169 journals (for 2003) and 209 journals (for 2008) as well as a (geometric) mean ranking for the 219 journals included in one or more of their six annual lists. The first two columns of Table 1 lists their 42 highest ranked journals (in alphabetical order) based on mean rank for the period 2003-2008. We considered the top 42 journals as this is approximately equal to the maximum number of top-ranked economics

journals in each of the three Australian studies discussed below.[15] A further six journals appear at the bottom of Table 1, which were ranked highly by at least one of the other three ranking studies and which are considered for inclusion below.

The Australian Business Deans Council undertook a review of the international literature on journal quality rankings and subsequently published their own rankings in 2008, followed by a revised ranking in 2010 (ABDC 2008, 2010). Relevant criteria for ranking included the relative standing of the journal in other lists, citation counts, the international standing of the editorial board, the rigour of the peer review process, and whether the journal has sustained a high reputation over time. The ABDC list includes over 900 economics journals (Field of Research (FoR) code 14 from the Australian and New Zealand Standard Research Classification) of which 49 received the highest (A*) ranking. Of these, 20 are in our view specialist journals in the areas of mathematics and statistics, computer science, engineering, ecology, environmental science and political science which would likely not be targeted by most academic economists.[16] Excluding these, the ABDC list contains 29 A* economics journals. These are included (in alphabetical order) in the third column of Table 1, along with other journals that were ranked A by the ABDC and were in the top 42 list from Kalaitzidakis *at al.* (2010). The ABDC also coded the Journal of Financial Economics as an A* non-economics journal but we have included it in column 3 of Table 1. [17]

In 2009 the Economic Society of Australia (ESA, 2009) published a ranking of economics journals in response to a 2007 request by the Academy of Social Science of Australia (ASSA), which was involved at that time in the Australian Commonwealth Governments' Research Quality Framework (RQF). The ESA ranking of economics journals was based on survey responses from up to 82 Australian economics professors (from 137 that were surveyed) who were asked to rank, in consultation with colleagues and with explicit knowledge of the published 2008 ABDC list, each of

[15] For example, the ERA list contains 38 A* economics journals, plus three other A* journals coded as statistics or banking, finance and investment journals (FoR code 15) by ERA but regarded as economics journals by at least two of the other three Australian studies we use. These three journals are: Journal of Business and Economic Statistics, Journal of Financial Economics, and Journal of Risk and Uncertainty. Adding these three brings the ERA list of A* journals to 41.

[16] These journals and their ERA 2010 classification codes are as follows: American Journal of Political Science (1606), American Political Science Review (1606), Annals of Applied Probability (0104), Annals of Probability (0104), Annals of Statistics (0104), Bioinformatics (0104), Biometrics (0104), Biostatistics (0104), Ecology (0602), Environment and Planning A (1205), Environment and Planning B (1205), Foreign Affairs (not ranked), Foreign Policy (1606), Journal of the American Statistical Association (0104), Journal of the Royal Statistical Society: B (0104), Numerische Mathematik (0103), Probability Theory and Related Fields (0104), SIAM Journal of Control and Optimization (0906), SIAM Journal of Numerical Analysis (0103), and SIAM Journal of Optimization (Society for Industrial and Applied Mathematics) (0103).The journal rankings for the ERA (2010) exercise did not code these journals as economics (FoR code 14) journals.

[17] A recent updated review, ABDC (2013), omits the 20 specialist A* journals noted in the previous footnote, includes 20 other A* journals, and demotes three prior A* journals to the rank of A, to arrive at a list of 46 A* journals. Whilst this review is outside our study period, it is also in our view problematic as a number of the newly ranked A* journals, such as the American Economic Journal series, Quantitative Economics, and Theoretical Economics, have been in existence for only eight years or less. Hence we ignore ABDC (2013) from here on.

602 journals as either A* (reserved for the top 5%), A (the next 15%), B (the next 35%) or C (the remaining 50%). The ESA then assigned numerical values of 1-4 corresponding to the four quality grades obtained from survey respondents and computed mean scores and standard deviations to arrive at a final list of ranked journals which they subsequently recommended to the government for consideration within its RQF. The ESA rankings contain 36 A* journals which are included (in alphabetical order) in the fourth column of Table 1.

In 2010 the Australian Research Council (ARC) released the Excellence in Research Australia (ERA, 2010) journal list which contains a single quality rating for over 570 economics (FoR code 14) journals. The list was constructed on the basis of "...expert review and public consultation" (ARC, 2011). Journals were ranked on the basis of citation counts, expert input from discipline peak bodies, and feedback following public consultation. In 2011 this list was used, along with other criteria such as competitive research income, to rate the economics discipline in every participating Australian university on the basis of research performance relative to the world's best departments. The ERA 2010 Journal List contains 39 A* ranked economics journals and these are included (in alphabetical order) in column 5 of Table 1, which also includes two other A* journals from the ERA list which in our view are economics journals but which were coded differently (see footnote 30 in the ERA report).

From Table 1 we can now consider consistencies and discrepancies across the four individual journal ranking exercises. Firstly, 23 journals are regarded as top tier by all four studies. Additionally, the Journal of Business and Economic Statistics, the Journal of Financial Economics and the Journal of Risk and Uncertainty, whilst not being consistently coded across the three Australian studies, are also regarded as top-tier in all four studies. We note in particular the citation based rankings for these three journals in Kalaitzidakis *et al.* (2010) and conclude that if academic economists are consistently citing research in these three journals over a significant period of time then they should be regarded as economics journals. So including the first two of these three journals increases the number of top-tier journals to 26, these being indicated by a clear 'Yes' in column 6 of Table 1.

Determining the status of the remaining journals in Table 1 is more problematic. For example, the American Journal of Agricultural Economics is rated as an A* journal in the three Australian studies but is ranked 61st in Kalaitzidakis *et al.* (2010). Conversely, The World Bank Economic Review is ranked 40th in Kalaitzidakis *et al.* (2010) but is rated as an A journal in each of the three Australian studies. Because the methodology used by Kalaitzidakis *et al.* (2010) is explicit, relatively objective and replicable, we decided to include all of the remaining top 42 journals in

Kalaitzidakis *et al.* (2010) in our list (indicated in Table 1 by Yes' in column 6).[18] All bar one of these additional sixteen journals were rated no lower than A by any of the three Australian studies.[19] This leaves only six journals for further consideration.

The American Journal of Agricultural Economics and the Journal of Risk and Uncertainty are both very highly regarded by the Australian studies and are quite highly ranked in Kalaitzidakis *at al.* (2010). And although not quite as highly ranked, the Economic History Review also fits this description. Hence we add these three journals to our list in Table 1 (indicated by Yes$^{\#}$ in column 6). On the other hand the History of Political Economy and the International Journal of Urban and Regional Research are not highest ranked in three of the four studies and so we exclude them. Finally, the BE Journal of Theoretical Economics is A* ranked in the ABDC and ERA lists but is not ranked at all in the other two studies. Given this wide disparity of opinion, and as this journal first appeared just 13 years ago (in 2001), we decided to exclude it. Hence our final list contains 45 journals that, because of their generally high rankings across the four studies considered here, and their apparent import for Australian economists, we believe deserve to be regarded as the most likely outlets for Australian academic economists aiming to publish in top-tier journals in the world today.

Two recent international studies that examine top economics research have arrived at a similar number of top journals. Pieters and Baumgartner (2002) document information flows between economics journals in order to gain "…insights into the social networks through which academic knowledge diffuses in economics" (p.483), whilst Kim *et al.* (2006) compile a list of articles published since about 1970 in prominent journals that have received at least 500 citations. In both studies the number of journals regarded as top-tier is approximately equal to the number in our list (42 and 41 respectively). So we seem to have about the right number of journals. But do we have the right journals? In the first three columns of Table 2 we compare our list of top-tier journals with those in each of these two studies, and note that whilst between 24 and 28 of our journals are included in each of the other studies, there are nevertheless substantial differences of opinion, both between our list and those in the two other studies, and between the two other studies themselves. This is not uncommon in this area of research, where a range of different approaches have been used across different time periods. So whilst all would likely agree on which journals make up the top six or so, beyond that the correlation between studies falls sharply.

[18] Other studies in this area of research have also relied upon the findings in Kalaizidakis *et al.* (2003, 2010). See for example, Stern (2013).
[19] The only exception is The Journal of Industrial Economics which was rated B by the ESA.

This is made even clearer by noting the rankings of our journals in Stern (2013), who computed standard errors for the five year impact factors for 230 journals in the 2011 Journal Citations report.[20] We have included these rankings in the fourth column of Table 2. Whilst these rankings are based on a short citation window, there are nevertheless substantial differences of opinion between our list and the rankings in Stern (2013). This is especially so for Economics Letters, Canadian Journal of Economics, and Journal of Economic Dynamics and Control. Given such differences of opinion as to what constitutes the best economics journals, we measure the success of Australian economics departments in publishing in any of the journals in our list of 45 because, given the signals about journal quality provided by the Australian studies, we believe that these are likely to be highly targeted by Australian academics seeking top-tier publications. However we also test the sensitivity of our findings to reductions in the number of top journals.

We downloaded information on all research articles published from 2001 to 2010 inclusive in each of our 45 journals from the Scopus database, which is a large abstract and citation database of peer reviewed literature that captures articles in 20,000 peer reviewed journals from approximately 5000 publishers.[21] For each research article in each of our 45 journals, we retrieved data on the number of authors, their identities, their stated affiliation(s), article title, volume, year and issue of publication and the number of pages. For each journal article, proportionate shares were allocated in cases of multiple authorships,[22] and unique and consistent nomenclatures were developed for first stated institutional affiliation and the country in which it is located. Institutions were classified as academic or non-academic. Academic institutions are universities, not Economics departments, so authors may be located in various departments or schools within each university. Finally, we merged our 45 journal files and constructed pivot tables so as to answer the questions of interest stated in the introductory section of this paper. In the next section we present and discuss our findings.

[20] Stern (2013) ranks all but one of our included journals, that being the NBER Macroeconomics Annual.

[21] We exclude book reviews, comments, replies, etc. We also exclude conference editions, such as the May edition of the American Economic Review, unless editorial statements make it clear that all articles in such editions have undergone the standard peer review processes used by that journal.

[22] In line with much previous research, for articles with m authors ($m \geq 1$), each author and hence university is 'credited' with $1/m$ publications.

IV Australia's Contribution to the World's Best Economics Journals

How does Australia compare with other countries in the production of top-tier economics research? A related question is which countries, if any, dominate the global production of top-tier economics research. Our data reveal that authors from 106 countries had some output in one or more of the 45 journals over the period 2001 through 2010.[23] Not surprisingly, the vast majority of economics research at this level originated in a relatively small number of countries. Table 3 contains the relevant data for the top 25 countries which, between them, published nearly 97% of all articles.[24] Countries are listed according to their number of articles, which appears in the column headed 'Total'. [25] The USA had 52.7% of all articles published across the ten year period, followed in descending order by UK (9%), Canada (5.1%), Germany (4.1%), France (3.7%), Spain (2.7%), Netherlands (2.4%), Italy (2.4%), Japan (1.9%) and Australia (1.5%). These top ten countries together account for over 85% of all articles published during this period. The rankings based on annual output are stable across the ten year period: USA and UK were first and second, respectively, in every year whilst Canada, Germany, France, Spain, The Netherlands and Italy were in the top ten in every year. Japan was in the top ten in every year bar one (2004). By comparison, Australia was in the top ten in three years (2004, 2007 and 2010). China and Brazil increased their research productivity significantly over this period, with China's ranking improving from a low of 33 in 2004 to a high of 16 in 2010. Similarly Brazil improved from a low of 30 in 2001 to a high of 18 in 2008 and 2009.

An obvious question is whether the dominance of the USA reflects a simple scale effect. Whilst a detailed examination of this question is outside the scope of this study, we took a 'back of the envelope' approach by dividing each country's total research output by its (arithmetic) mean population over the ten-year study period and then normalising the result relative to that of the USA. The results, labelled 'per capita research', are included in the last column of Table 3.This process reduces research disparities substantially. Indeed Israel published at a greater per capita rate than did the USA (119.5%), while UK, Canada, Netherlands, Sweden, Switzerland, Denmark, and

[23] Overwhelmingly, these authors are affiliated to universities, but not solely to economics or closely related departments. Also, some outputs were produced by authors at non-academic institutions such as government research facilities and private sector 'think tanks'.

[24] On the assumption that shorter articles can be at least as important as longer articles, we concentrate on the number of articles, rather than the number of pages.

[25] Each university's output of articles is likely to be composed of a number of article 'shares'. For simplicity, in the text we refer to the sum of these article equivalents as articles. The full dataset for all 106 countries is available on request.

Norway all published at 83% or more of the USA's per capita rate. By comparison, Australia published at about 42%, whilst Japan published at only 8%, of the per capita rate of the USA.[26]

The second question of interest is whether Australia increased its quantum of high-quality economics research over the decade under examination, a period during which the institutional emphasis on high quality research has, as noted above, increased substantially. The last row in Table 3 suggests that this has been the case: Australia's contribution to global output in the first two years of the study period averaged 1.35% whilst the comparable figure for the last two years of the study period is 1.80%. Furthermore, Table 4 displays the per capita research output for Australia relative to that of the USA for each year in the period 2001-10. It would seem that the increased Australian emphasis on quality research may have paid dividends: there is an evident positive trend and the average per capita output in the last two years of the decade was 50% higher than it was in the first two years of the decade. If this trend has continued since 2010 then top-quality Australian per capita research output may be converging to that of the USA.

We now address the third question, namely, which Australian universities have published in these top-tier journals, and whether there are any discernable trends over the study period. Table 5 sets out the annual data for the 29 Australian universities with any publications in the 45 journals.[27] The top Australian universities were ANU and Melbourne, each with around 18% of Australian publications. Monash and UNSW each produced approximately 12% of publications, whilst Queensland, Sydney, UWA and UTS make up a third grouping, each with approximately 6% of Australian publications. The only other universities with more than one percent of total publications each were Adelaide, La Trobe, QUT and Deakin. These twelve universities accounted for over 92% of national top-tier publications. Whilst some rankings vary considerably by year, ANU and Melbourne are in the top four in every year. Monash and UNSW are also in the top ten in every year.[28] Notable improvements were made by Monash and to a lesser degree Queensland, UTS and QUT whilst La Trobe's performance seems to have deteriorated over the period.

[26] These large variations could be due to national differences in the emphasis placed on top-quality research, in the extent to which non-research activities such as teaching and service crowd out research, and in the quantity and/or quality of academics' human capital. Additionally, China and Brazil in particular are at different stages of economic development to that of the other countries in Table 3. This will further contribute to variations in per capita research output if economic development is positively correlated with a nation's historical emphasis and cumulative expenditures on academic research.

[27] Whilst most authors were primarily affiliated to economics departments within these universities, some authors were from other fields such as statistics, psychology or environmental science. So the number of published article equivalents may overstate the publications of members of the economics department in each university. Also, as the second last row of Table 5 indicates, ten article equivalents were authored by researchers at non-academic institutions.

[28] These findings are broadly consistent with those found in the Australian studies noted above, such as Sinha and Macri (2002) and Pomfret and Wang (2003).

Although top-tier research is highly concentrated in a few leading Australian universities, from 2001-05 to 2006-10, the dominance of the top one or two universities fell, in large part due to an improved research performance by universities ranked 5-8. Table 6 presents the relevant concentration ratios. The dominance of the top one, top two and top four universities declined, whereas the dominance of the top eight was almost constant, over these two sub-periods. This suggests some convergence in research performance by the 'second four' to that of the 'top four' over the ten year study period.

We now investigate whether our findings are consistent with those from the first two ERA exercises, ERA (2010) and ERA (2012) which, as noted above, were designed to provide national stocktakes of research strengths against international benchmarks. These exercises include ratings of schools or departments of economics at participating Australian universities according to how their research performance compared against that of some fictional school or department operating at a notional world standard. According to the ERA website, "The indicators used in ERA include a range of metrics such as citation profiles…and peer review of a sample of research outputs...The data submitted by universities covers all eligible researchers and their research outputs. The precise set of indicators used has been developed in close consultation with the research community…and (so) the ERA results are both robust and broadly accepted". If this is so then we expect that our rankings based on publications in the top 45 economics journals would be highly positively correlated with those from the ERA exercises, especially for the top universities. The relevant data is presented in Table 7.

Columns 1 and 2 of Table 7 contain the Australian universities in order of total pages published in the top 45 journals for the study period 2001-10 inclusive. However, because ERA (2010) considered research outputs and other indictors of research strength for the period 2003-08, whilst ERA (2012) did so for the period 2005-10, we have also included total pages published in 2003-08 and 2005-10, in columns 3 and 5 respectively. We note that rankings based on our revised data are broadly consistent with the ERA results for the eight or nine most productive universities, but less so for some universities further down the table.[29] We suggest that, at least for the determination of the most research productive Australian departments or schools of economics,

[29] For less highly ranked universities, there are some significant anomalies. For example, our publications data are not consistent with the ERA (2010) conclusion that QUT, Bond and Charles Darwin were operating at world standard. Similarly our data are not consistent with the ERA (2012) conclusion that South Australia, Macquarie, Flinders and Charles Darwin were operating at world standard. Whilst we understand that the ERA exercise considered more than just journal publications, our view is that top-tier publications are a necessary and sufficient condition for research excellence.

top-quality publications are likely to be as informative but far less resource intensive as the on-going ERA exercise.

The fourth question of interest is which journals, if any, are most favoured by Australian authors. This is a potentially important question in light of the disagreement that exists concerning the composition of the world's top economics journals. Ideally Australian authors are publishing in a wide range of top journals, and especially in those whose inclusion in our list is least controversial. On the other hand if Australian publications are predominantly in a few journals whose 'pedigree' is widely disputed, this could put Australia's elite economics research performance in some doubt. Table 8 presents the relevant data.

Australian authors published in 40 of the 45 journals in our list.[30] However, their output was dominated by publications in Economics Letters, which alone accounted for 20% of all Australian publications over the period.[31] This could be viewed as cause for concern given that none of the three Australian journal rankings studies discussed above ranked this journal as A*. Also, neither Pieters and Baumgartner (2002) nor Kim *et al.* (2006) included this journal in their list of top journals, whilst Stern (2013) ranked it at only 190.[32] Other important outlets for Australian economics research include Journal of Econometrics (7.1% of Australian articles), Journal of Economic Behavior and Organisation (6.8%) and Journal of Health Economics (6.2%). In only four journals were Australian authors successful in publishing in every year in the study period, these being Economics Letters, Journal of Economic Behavior and Organisation, Journal of Applied Econometrics, and Canadian Journal of Economics. The top six (ten) journals in Table 8 together accounted for nearly 50% (64%) of all Australian publications in these journals.

Interestingly, the ranking of individual Australian universities is little affected by the exclusion of publications in Economics Letters. The relevant data are presented in Table 9. Two departments whose academics publish relatively heavily in Economics Letters, and whose ranking thus falls substantially when this journal is excluded, are Curtin University of Technology, whose ranking falls by four places, and Australian Catholic University, whose ranking falls by five places. Conversely University of New England had zero publications in Economics Letters and so its ranking

[30] Australian academics did not publish in Brookings Papers on Economic Activity, European Economic Review, NBER Macroeconomics Annual, Quarterly Journal of Economics, and World Bank Economic Review. Our data does not enable us to determine whether this is due to lack of success or lack of submissions.

[31] This is consistent with Towe and Wright (1995) who found that of the non-Australian journals in their quality groups 1 and 2, those with the most (size adjusted) pages published by Australian authors were the Journal of Econometrics (144.76 pages) followed by Economics Letters (138.27 pages).

[32] Articles in Economics Letters are typically brief so the dominance of the journal would diminish if page numbers, rather than number of articles, were used to measure research output.

improves by five places when this journal is excluded. Smaller rank changes are evident for Griffith University, Newcastle and Macquarie, whose rankings change by two places. All other university ranks are either unchanged or change by one place only. In the next section we conduct more systematic sensitivity analyses to determine the impact on our results of using a more restrictive and hence less disputable set of top-tier journals.

V Sensitivity Analysis

In this section we sequentially apply three decision rules so as to determine a list of the best economics journals that is less disputable than those identified in Table 1. For a journal to be included in our list in this section, it must firstly be ranked as an A* journal in all three of the Australian studies mentioned earlier. Secondly, the journal must also be ranked as an A* journal in Pieters and Baumgartner (2002) or in Kim et al. (2006) (see Table 2). Finally, the journal must also achieve a best ranking of 50 or better in Kalaitzidakis *et al.* (2010) or in Stern (2013). Sequentially applying these decision rules results in a list of just 21 journals, noted in the last column of Table 2.

Our data, presented in Table 10, reveal that authors from 81 countries contributed to these 21 journals over the ten-year period. The top 25 countries are identical to those in Table 3 except for the inclusion of Ireland and the exclusion of New Zealand. The dominance of the USA is now even greater with its percentage contribution increasing by 7.6 percentage points to 60.25%. In fact as Table 10 makes clear, apart from Norway, the contributions of all of the other 24 countries diminished compared to the case with 45 journals, with the sum of these decreases almost exactly matching the increase for the USA. Particularly notable is Germany whose contribution fell by 1.30 percentage points from 4.06% to 2.76%. In all other aspects the data in Table 10 are similar to that in Table 3.

Table 11 presents the data on the number of articles published in these 21 journals by Australian universities. We note that compared to the case with 45 journals, we now have 22, rather than 29, contributing institutions.[33] Apart from a few minor rank changes, the top ten universities are identical to those with 45 journals. However we note some big changes at the lower half of the list, with Griffith University increasing its ranking by five places to 11.[34] Consistent with the data for countries, the top institutions marginally increased their share of Australian publications in this more exclusive list of journals. ANU still tops the list, now with 20.4% of all Australian publications, closely

[33] Bond, Newcastle, Macquarie, RMIT, ACU, Charles Darwin and Charles Sturt had no publications in the 21 journals.
[34] U Tasmania, James Cook U, Murdoch U and Edith Cowan U also increased their rankings significantly but this was due to the fact that seven universities dropped off the list. This is not the case with Griffith University.

followed by U Melbourne with 19.3%. UNSW and Monash U each produced around 13% of all Australian publications whilst U Sydney and U Queensland each produced around 6% of all Australian publications. The make-up of the top eight is identical to what was the case with 45 journals.

Finally we investigate which of the 21 journals were most favoured. Table 12 presents the data. We note that Australian authors published in twenty of the top 21 journals with only the QJE omitted from our list. The two most favoured journals, by quite large margins, are the Journal of Econometrics and the Journal of Health Economics which between them account for over one third of all Australian publications.

VI Conclusions

This paper has summarised the main results from an analysis of a unique database on all articles published in up to 45 of the world's best economics journals from 2001 to 2010 inclusive. Perhaps not surprisingly we find that, whether counting publications in all 45 journals or in a restricted subset of the very best 21 journals, by far the most productive country on the basis of total articles published is the USA, followed by UK and Canada. When adjusting for population, the most productive country is Israel followed by USA and Sweden. Australia ranks 10th based on total articles and 14th based on per capita articles.

We also find that from 2001 through 2010 Australia's contribution to the world's best economics research has increased in absolute terms, as a percentage of global production, and in per capita terms compared to that of the USA. Our findings also indicate that the top two Australian universities over this period were ANU and Melbourne, with Monash and UNSW in a second group. These findings are largely consistent with prior findings, as discussed in Section II above, and suggest that research excellence at the institutional level displays remarkable stability over long periods of time. However, we also find that the dominance of the top four Australian universities diminished somewhat over the study period, with the universities ranked 5-8 publishing an increasing proportion of top-tier Australian output.

Finally, we find that Australian authors of top-tier research successfully publish in a wide range of journals, specifically in 40 of the top 45 journals, and in 20 of the very best 21 journals. Whilst in both cases a couple of journals seemed to be most favoured by Australian authors, nevertheless we find that Australian economics research is reasonably well dispersed across a range of discipline areas.

Our results provide some evidence that the higher education reforms introduced by the Australian government in the late 1980's and reinforced after 2000 may finally be having the desired effect. Whether these trends continue into the next decade remains the focus of on-going research. Future research will also focus on whether the increased publication rates of Australian academic economists in top-tier journals documented above have resulted in a diminished focus on Australian economic issues, both in the form of empirical and policy-orientated publications.

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Table 1. World's best economics journals according to four ranking studies

Journal	KMS (2010) [N=42]	ABDC (2010) [N=29+1]	ESA (2008) [N=36]	ERA (2010) [N=39+2]	Best?
Brookings Papers Econ Activity	27	A	A	A	Yes'
Canadian J Econ	41	A	A	A	Yes'
Econometric Theory	32	A*	A*	A*	Yes
Econometrica	4	A*	A*	A*	Yes
Econ Theory	36	A*	A*	A*	Yes
Econ Letters	22	A	A	A	Yes'
European Econ Review	12	A	A*	A*	Yes'
Games & Econ Behaviour	21	A*	A*	A*	Yes
International Econ Rev	17	A*	A*	A*	Yes
J Applied Econometrics	32	A*	A*	A*	Yes
J Business & Econ Stats	26	A*	A*	A* [(a)]	Yes
J Development Econ	21	A*	A*	A*	Yes
J Econometrics	12	A*	A*	A*	Yes
J Econ Behavior and Org	31	A	A	A	Yes'
J Econ Dynamics & Control	31	A	A*	A*	Yes'
J Econ Growth	30	A*	A*	A*	Yes
J Econ Literature	11	A*	A*	A*	Yes
J Econ Perspectives	8	A*	A*	A*	Yes
J Econ Theory	9	A*	A*	A*	Yes
J Financial Econ	14	A* [(b)]	A*	A*	Yes
J Health Econ	42	A*	A*	A*	Yes
J Human Resources	27	A	A*	A*	Yes'
J International Econ	14	A*	A*	A*	Yes
J Labor Econ	24	A	A*	A*	Yes'
J Law, Econ & Org	42	A	A*	A*	Yes'
J Monetary Econ	6	A*	A*	A*	Yes
J Money, Credit & Bank	23	A	A*	A*	Yes'
J Political Economy	3	A*	A*	A*	Yes
J Public Econ	13	A*	A*	A*	Yes
J Europe Econ Assoc	20	A	A	A	Yes'
J Urban Econ	36	A	A*	A*	Yes'
NBER Macro Annual	22	A	A	A	Yes'
RAND J Econ	18	A*	A*	A*	Yes
Review Econ Dynamics	28	A	A	A	Yes'
The American Econ Review	1	A*	A*	A*	Yes
The Econ J	10	A*	A*	A*	Yes
The J Industrial Econ	40	A	B	A*	Yes'
The J Law and Econ	42	A*	A*	A*	Yes
The Quarterly J Econ	2	A*	A*	A*	Yes
The Review Econ Studies	6	A*	A*	A*	Yes
The Review Econ & Stats	8	A*	A*	A*	Yes
The World Bank Econ Review	40	A	A	A	Yes'
J Risk & Uncertainty	56	A*	A*	A* [(b)]	Yes[#]
American J Ag Econ	61	A*	A*	A*	Yes[#]
Econ History Review	100	A*	A*	A*	Yes[#]
History Political Economy	180	A	A	A*	No
Int J Urban & Region Research	Not ranked	B	B	A*	No
The BE Journal Theoretical Econ	Not ranked	A*	Not ranked	A*	No

Notes: (a) coded Statistics; (b) coded Banking, Finance and Investment.

Table 2. 'Robustness' of our list of 45 journals

Our Top 45 Journals	In P&B 2002?	In Kim *et al.* 2006?	Stern ranking?	Elite list of 21?
American J Agricultural Econ	Yes		85	
Brookings Papers Econ Activity	Yes		66	
Canadian J Econ	Yes		124	
Econometric Theory			138	
Econometrica	Yes	Yes	9	Yes
Econ History Review	Yes		143	
Econ Theory			159	
Econ Letters			190	
European Econ Review	Yes	Yes	67	
Games & Econ Behaviour			104	
International Econ Rev	Yes	Yes	73	Yes
J Applied Econometrics			58	
J Business & Econ Stats		Yes	45	Yes
J Development Econ	Yes	Yes	33	Yes
J Econometrics	Yes	Yes	37	Yes
J Econ Behavior & Organisation			92	
J Econ Dynamics & Control		Yes	112	
J Econ Growth			13	
J Econ Literature	Yes		1	Yes
J Econ Perspectives	Yes		5	Yes
J Econ Theory	Yes	Yes	90	Yes
J Financial Econ		Yes	6	Yes
J Health Econ	Yes		23	Yes
J Human Resources	Yes	Yes	21	
J International Econ	Yes	Yes	27	Yes
J Labor Econ	Yes	Yes	19	
J Law, Econ & Organisation	Yes	Yes	96	
J Monetary Econ	Yes	Yes	34	Yes
J Money, Credit & Banking		Yes	74	
J Political Economy	Yes	Yes	7	Yes
J Public Econ	Yes	Yes	49	Yes
J Risk & Uncertainty			50	
J Europe Econ Association			31*	
J Urban Econ	Yes	Yes	28	
NBER Macro Annual			Not ranked	
RAND J Econ	Yes	Yes	43	Yes
Review Econ Dynamics			80	
The American Econ Review	Yes	Yes	4*	Yes
The Econ J	Yes	Yes	32	Yes
The J Industrial Econ			120	
The J Law and Econ	Yes		57	Yes
The Quarterly J Econ	Yes	Yes	2	Yes
The Review Econ Studies	Yes	Yes	14	Yes
The Review Econ & Stats	Yes	Yes	16	Yes
The World Bank Econ Review			29	
Our 'hit' rate?	28/42	24/41		

Notes: * In column (4), the rankings for both the Journal of the European Economic Association and The American Economic Review are those excluding the Papers and Proceedings edition(s).

Table 3. Number of article equivalents by year and country of affiliation, top 25 countries, top 45 journals

	Number of published articles												PC output
Country	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**	**% Total**	**USA=1**
USA	1260	1270	1352	1331	1346	1352	1490	1568	1436	1398	13804	52.66	1.000
UK	191.20	214.37	209.12	204.22	226.03	225.61	288.95	263.58	274.15	256.29	2353.01	8.978	0.834
Canada	123.33	122.05	131.52	125.00	96.17	147.20	155.42	164.82	125.92	150.59	1342.01	5.12	0.887
Germany	66.75	70.45	74.98	81.67	82.62	110.37	108.14	159.43	142.38	166.67	1063.45	4.06	0.278
France	83.57	101.66	84.13	94.25	81.80	88.08	116.70	123.33	100.04	102.61	976.18	3.72	0.332
Spain	42.25	57.39	58.95	74.25	59.25	80.07	80.49	100.65	75.17	78.95	707.42	2.70	0.346
N'lands	46.75	58.34	61.57	56.48	56.42	58.77	65.34	72.64	73.37	81.52	631.19	2.41	0.833
Italy	37.17	38.24	47.32	50.33	56.17	71.11	71.35	93.52	77.91	84.78	627.89	2.40	0.228
Japan	36.42	39.67	44.33	31.00	42.75	53.17	54.83	64.12	65.25	54.41	485.95	1.85	0.082
Australia	27.33	33.33	29.08	43.34	32.58	38.66	40.62	49.70	44.92	58.16	397.73	1.52	0.420
Sweden	33.25	31.66	31.98	31.92	46.67	39.50	38.92	53.73	46.78	34.53	388.95	1.48	0.915
Israel	32.75	43.17	47.33	41.62	28.58	33.78	37.90	37.28	38.75	36.58	377.75	1.44	1.195
Switz.	14.20	16.99	15.42	31.67	18.83	26.58	30.73	41.49	50.02	50.60	296.53	1.13	0.851
Belgium	23.74	19.50	26.32	22.50	26.00	20.52	28.84	30.42	34.00	28.58	260.42	0.99	0.541
Denmark	20.08	16.92	15.73	20.58	26.12	21.33	17.06	25.00	17.66	30.78	211.27	0.81	0.836
HKong	18.92	19.00	27.00	22.92	13.00	16.58	26.76	20.16	21.83	19.42	205.59	0.78	0.640
Norway	9.17	9.92	27.23	17.00	22.58	23.17	21.89	16.83	21.83	20.17	189.79	0.72	0.875
Sth Korea	16.50	18.33	14.83	20.50	17.92	24.42	17.50	20.33	13.92	20.45	184.69	0.70	0.083
Taiwan	15.25	15.50	14.75	11.50	12.17	13.83	20.25	28.04	8.33	15.42	155.04	0.59	0.147
Austria	7.00	9.42	17.92	15.33	20.10	12.52	17.58	18.73	14.33	20.15	153.09	0.58	0.403
Singapore	9.75	3.50	10.67	8.83	9.33	18.67	16.53	20.17	21.25	14.75	133.45	0.51	0.616
China	6.33	5.92	4.83	6.08	5.33	12.58	18.84	20.36	17.77	28.50	126.56	0.48	0.002
Portugal	8.80	8.00	8.83	10.75	7.50	11.36	14.17	22.00	12.17	14.87	118.44	0.45	0.241
Brazil	4.00	6.50	7.00	14.58	10.33	9.67	8.37	20.87	19.17	17.25	117.73	0.45	0.014
NZ	7.17	6.00	5.00	6.58	6.48	10.08	13.75	11.42	14.12	10.50	91.09	0.35	0.483
Aust%Total	**1.24**	**1.45**	**1.19**	**1.76**	**1.35**	**1.49**	**1.41**	**1.57**	**1.57**	**2.02**			

Table 4. Australia: Per capita article equivalents relative to USA

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Australian per capita output relative to USA per capita output	0.32	0.39	0.32	0.48	0.35	0.42	0.40	0.46	0.45	0.60

Table 5. Australia: Number of article equivalents by year and university affiliation, 45 journals

University	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total	% of Total	Cum Total	% of Cum Total
ANU	5.83	11.00	7.50	11.00	6.83	6.50	6.00	6.33	4.67	6.00	71.67	18.50	71.67	18.50
Melbourne	5.17	4.67	4.08	5.58	10.92	4.83	9.70	9.75	8.08	6.83	69.62	17.97	141.28	36.47
Monash	2.83	2.00	1.83	5.50	2.17	7.00	5.33	5.50	7.67	7.58	47.42	12.24	188.70	48.71
UNSW	5.50	3.50	4.00	6.50	3.33	3.66	3.83	3.67	5.75	6.66	46.41	11.98	235.11	60.69
Queensland	0.33	0.50	4.17	1.83	2.50	0.50	2.50	4.25	3.33	5.67	25.58	6.60	260.69	67.29
Sydney	0.00	0.50	0.50	3.50	0.00	5.25	3.50	3.92	2.33	4.00	23.50	6.07	284.19	73.36
UWA	1.00	2.50	0.50	0.50	2.67	0.00	3.17	3.12	3.83	1.83	19.12	4.93	303.31	78.30
UTS	0.00	0.33	1.50	0.50	1.50	3.08	2.75	1.08	3.17	5.00	18.92	4.88	322.23	83.18
Adelaide	0.50	0.50	1.33	0.67	0.83	2.00	0.83	3.00	0.83	3.17	13.67	3.53	335.89	86.71
La Trobe	2.33	2.50	0.00	0.67	0.00	0.50	0.00	1.00	0.33	1.33	8.67	2.24	344.56	88.94
QUT	0.33	0.00	0.00	0.67	0.00	0.00	0.33	1.33	1.33	2.58	6.58	1.70	351.14	90.64
Deakin	0.50	0.33	1.00	0.00	0.00	1.33	0.00	1.50	1.00	0.33	6.00	1.55	357.14	92.19
Curtin	0.00	0.50	0.00	0.00	0.00	0.00	0.83	0.50	0.00	2.00	3.83	0.99	360.98	93.18
Wollongong	0.00	3.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.67	0.95	364.64	94.13
Bond	0.00	1.00	0.00	1.00	1.00	0.00	0.00	0.50	0.00	0.00	3.50	0.90	368.14	95.03
Griffith	0.00	0.00	0.00	0.00	0.00	1.00	0.33	0.50	0.33	1.00	3.17	0.82	371.31	95.85
Newcastle	0.00	0.00	0.50	0.00	0.00	1.00	0.50	0.00	1.00	0.00	3.00	0.77	374.31	96.62
South Australia	0.00	0.00	0.00	0.50	0.00	1.00	0.00	0.00	1.00	0.00	3.00	0.77	377.31	97.39
UWS	0.83	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	2.83	0.73	380.14	98.12
Macquarie	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	2.00	0.52	382.14	98.64
UNE	1.00	0.25	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	1.75	0.45	383.89	99.09
RMIT	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.33	0.00	0.00	1.00	0.26	384.89	99.35
ACU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.13	385.39	99.48
Tasmania	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.13	385.89	99.61
Charles Darwin	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.33	0.09	386.22	99.70
Murdoch	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.33	0.09	386.55	99.79
James Cook	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.09	386.88	99.88
Edith Cowan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.25	0.06	387.13	99.94
Charles Sturt	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.06	387.39	100.0000
All academic	**26.50**	**33.33**	**28.8**	**40.42**	**31.75**	**38.2**	**40.3**	**47.0**	**44.7**	**56.5**	**387.39**	1.00		
All nonacademic	0.83	0.00	0.33	2.92	0.83	0.50	0.33	2.67	0.25	1.67	10.34			
Grand Total	**27.33**	**33.33**	**29.1**	**43.34**	**32.58**	**38.7**	**40.6**	**49.7**	**44.92**	**58.2**	**397.73**			

Table 6. Australia: Concentration ratios for the top eight universities

	2001-10	2001-05	2006-10
CR(1)	.185	.26	.17
CR(2)	.365	.45	.32
CR(4)	.607	.68	.55
CR(8)	.832	.84	.82

Notes: In line with Hirsch et al. (1984) we calculated the concentration ratio as

CR(m) = $\sum_{i=1}^{m} Publications / \sum_{i=1}^{30} Publications$.

The top eight universities in the earlier sub-period were, in descending order, ANU, Melbourne, UNSW, Monash, Queensland, UWA, Sydney and La Trobe. For the latter sub-period, the top eight universities were, in descending order, Melbourne, Monash, ANU, UNSW, Sydney, Queensland, UTS and UWA.

Table 7. Our rankings based on publications in top 45 journals, ERA (2010) and ERA (2012)

University	Total pages 2001-10	Total pages 2003-8	Rating ERA 2010	Total pages 2005-10	Rating ERA 2012
ANU	71.67	44.17	4	36.33	5
Melbourne	69.62	44.87	5	50.12	5
Monash	47.42	27.33	4	35.25	5
UNSW	46.41	25.00	4	26.91	4
Queensland	25.58	15.75	4	18.75	4
Sydney	23.50	16.67	3	19.00	4
UWA	19.12	9.95	4	14.62	4
UTS	18.92	10.42	4	16.58	5
Adelaide	13.67	8.67	3	10.67	4
La Trobe	8.67	2.17	2	3.17	3
QUT	6.58	2.33	3	5.58	3
Deakin	6.00	3.83	2	4.17	3
Curtin	3.83	1.33	2	3.33	2
Wollongong	3.67	0.67	1	0.00	2
Bond	3.50	2.50	3	1.50	2
Griffith	3.17	1.83	1	3.17	2
Newcastle	3.00	2.00	1	2.50	1
South Australia	3.00	2.00	1	2.50	3
UWS	2.83	1.00	1	1.00	2
Macquarie	2.00	1.00	2	1.00	3
UNE	1.75	0.50	2	0.50	2
RMIT	1.00	1.00	2	0.33	2
ACU	0.50	0.00	1	0.50	n/a
Tasmania	0.50	0.50	2	0.00	2
Charles Darwin	0.33	0.33	3	0.33	3
Murdoch	0.33	0.33	1	0.33	n/a
James Cook	0.33	0.00	1	0.00	1
Edith Cowan	0.25	0.25	2	0.25	2
Charles Sturt	0.25	0.00	1	0.00	2
Ballarat	*0.00*	*0.00*	*1*	0.00	*2*
Canberra	*0.00*	*0.00*	*1*	0.00	*1*
Central Queensland	*0.00*	*0.00*	*1*	0.00	*2*
Flinders	*0.00*	*0.00*	*1*	0.00	*3*
Sth Queensland	*0.00*	*0.00*	*n/a*	0.00	*2*
Swinburne	*0.00*	*0.00*	*2*	0.00	*n/a*
Victoria	*0.00*	*0.00*	*1*	0.00	*2*

Notes: ERA rating 5 = well above world standard, 4 = above world standard, 3 = at world standard, 2 = below world standard, 1 = well below world standard. The seven universities in italics had zero publications in these 45 journals across all years in our study period but were rated in ERA (2010) and/or ERA (2012) and so we include them here.

Table 8. Australia: Number of article equivalents by year and outlet: 45 journals

Journal	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total	% of Total	Cum Total	% of Cum Total
Econ Letters	8.17	3.50	5.50	9.00	4.67	7.33	5.50	9.83	8.50	15.50	77.50	20.00	77.50	20.00
J Econometrics	0.00	1.33	0.25	0.50	3.00	4.00	5.67	7.53	2.17	3.17	27.62	7.13	105.11	27.13
J Econ Behav & Organ	2.83	1.33	2.50	5.00	1.00	2.33	1.50	1.50	2.58	5.67	26.25	6.78	131.36	33.91
J Health Econ	0.00	2.50	1.00	2.33	1.00	3.50	3.78	3.17	4.67	2.00	23.95	6.18	155.31	40.09
J of Econ Dyn & Cont	0.00	0.50	4.83	0.83	1.50	1.50	3.00	1.50	2.00	1.33	17.00	4.39	172.31	44.48
J App Econometrics	1.33	2.00	0.50	1.42	3.33	2.00	1.50	1.67	1.83	1.33	16.92	4.37	189.23	48.85
J Public Econ	0.00	2.50	1.50	0.50	0.00	1.83	0.33	1.58	4.75	2.08	15.08	3.89	204.31	52.74
Canadian J Econ	1.33	0.50	0.67	1.00	0.83	1.83	0.50	1.00	4.25	2.50	14.42	3.72	218.73	56.46
The Econ J	2.00	1.17	0.00	3.33	2.00	1.83	1.00	0.58	1.50	0.00	13.42	3.46	232.15	59.93
J Development Econ	1.00	0.50	2.83	3.00	0.00	0.00	3.00	0.00	2.00	1.00	13.33	3.44	245.48	63.37
Econometric Theory	0.00	2.50	1.83	2.00	1.00	2.33	0.00	2.08	0.50	1.00	13.25	3.42	258.73	66.79
Games and Econ Behav	0.50	2.33	0.00	1.00	0.00	0.00	1.00	1.00	1.50	5.50	12.83	3.31	271.56	70.10
Econ Theory	0.00	1.50	1.00	1.83	4.00	1.00	1.00	1.50	0.00	0.00	11.83	3.05	283.40	73.15
J Business & Econ Stats	2.33	1.00	0.00	0.00	2.33	0.50	1.00	1.50	0.75	1.67	11.08	2.86	294.48	76.02
AJAE	1.83	2.50	0.50	0.00	1.50	1.00	0.83	0.00	0.50	1.50	10.17	2.62	304.65	78.64
J Econ Theory	1.83	1.00	0.00	1.83	0.00	1.00	1.58	0.33	1.00	0.00	8.58	2.22	313.23	80.86
International Econ Rev	1.00	0.00	0.50	0.00	0.00	1.33	2.00	0.00	2.00	1.33	8.16	2.11	321.39	82.96
RAND J Econ	0.00	0.33	0.00	1.00	2.00	0.00	1.00	0.00	1.00	0.50	5.83	1.51	327.23	84.47
J International Econ	0.00	0.00	0.50	0.33	0.33	0.50	1.50	1.50	0.67	0.33	5.67	1.46	332.89	85.93
J Monetary Econ	0.50	0.50	0.00	1.00	0.00	0.00	0.00	1.00	0.33	2.00	5.33	1.38	338.23	87.31
J Industrial Econ	0.00	0.00	0.00	0.00	0.00	0.50	2.00	1.00	0.00	1.33	4.83	1.25	343.06	88.56
The Review Econ & Stats	0.00	0.83	0.00	0.00	1.25	0.00	0.83	1.25	0.00	0.58	4.75	1.23	347.81	89.78
J Money, Credit & Bank	0.00	0.50	0.00	0.00	1.00	0.50	0.00	1.33	0.67	0.50	4.50	1.16	352.31	90.94
J Financial Econ	0.00	0.00	0.00	1.33	0.00	0.00	0.25	1.67	0.50	0.33	4.08	1.05	356.39	92.00
Econ History Review	0.00	0.00	1.50	0.00	0.00	1.50	0.00	1.00	0.00	0.00	4.00	1.03	360.39	93.03
The American Econ Review	0.50	1.00	0.00	1.67	0.00	0.00	0.50	0.00	0.00	0.00	3.67	0.95	364.06	93.98
J Econ Perspectives	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	2.50	0.65	366.56	94.62

Table 8 continued. Australia: Number of article equivalents by year and outlet: 45 journals

Journal	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total	% of Total	Cum Total	% of Cum Total
J Econ Growth	0.00	0.00	0.50	0.00	0.00	0.00	0.00	1.00	0.00	1.00	2.50	0.65	369.06	95.27
J Labor Econ	0.00	0.50	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	2.50	0.65	371.56	95.91
J Human Resources	0.33	0.50	0.33	0.67	0.00	0.50	0.00	0.00	0.00	0.00	2.33	0.60	373.89	96.52
Econometrica	**0.00**	**0.00**	**1.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.50**	**0.50**	**0.00**	2.00	0.52	375.89	97.03
J Risk & Uncertainty	0.50	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.52	377.89	97.55
J Urban Econ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	1.00	1.50	0.39	379.39	97.93
The J Law and Econ	**0.50**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.00**	**0.00**	**0.00**	**0.00**	1.50	0.39	380.89	98.32
J Law, Econ & Organ	0.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.39	382.39	98.71
J Europe Econ Assoc	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.50	0.00	0.50	1.33	0.34	383.73	99.05
The Review Econ Studies	0.00	0.00	0.00	0.50	0.00	0.33	0.00	0.00	0.00	0.50	1.33	0.34	385.06	99.40
J Econ Literature	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.33	1.00	0.26	386.06	99.66
J Political Economy	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.83	0.22	386.89	99.87
Review Econ Dynam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.50	0.13	387.39	100.00
All academic	**26.50**	**33.33**	**28.75**	**40.42**	**31.75**	**38.2**	**40.3**	**47.03**	**44.7**	**56.50**	**387.39**	**100.00**		

Table 9. Australia: Rank changes excluding Economics Letters (EL)

	Total	Rank 2001-10	EL Pubs	Excl EL	Rank Excl EL	Rank Change
ANU	71.67	1	11.83	59.83	1	0
U Melbourne	69.62	2	15.67	53.95	2	0
Monash U	47.42	3	8.17	39.25	3	0
UNSW	46.41	4	9.33	37.08	4	0
U Queensland	25.58	5	6.33	19.25	6	-1
U Sydney	23.50	6	0.33	23.17	5	1
UWA	19.12	7	6.50	12.62	8	-1
UTS	18.92	8	0.00	18.92	7	1
U Adelaide	13.67	9	2.17	11.50	9	0
La Trobe U	8.67	10	2.33	6.33	10	0
QUT	6.58	11	2.33	4.25	12	-1
Deakin U	6.00	12	0.50	5.50	11	1
Curtin U Technology	3.83	13	2.50	1.33	18	-5
U Wollongong	3.67	14	0.00	3.67	13	1
Bond U	3.50	15	1.50	2.00	15	0
Griffith U	3.17	16	0.33	2.83	14	2
Newcastle U	3.00	17	2.00	1.00	19	-2
U South Australia	3.00	18	1.50	1.50	17	1
UWS	2.83	19	1.83	1.00	20	-1
Macquarie U	2.00	20	1.50	0.50	22	-2
UNE	1.75	21	0.00	1.75	16	5
RMIT U	1.00	22	0.33	0.67	21	1
U Tasmania	0.50	23	0.00	0.50	23	0
Australian Catholic U	0.50	24	0.50	0.00	29	-5
Charles Darwin U	0.33	25	0.00	0.33	24	1
Murdoch U	0.33	26	0.00	0.33	25	1
James Cook U	0.33	27	0.00	0.33	26	1
Edith Cowan U	0.25	28	0.00	0.25	27	1
Charles Sturt U	0.25	29	0.00	0.25	28	1
All academic	**387.39**			**309.90**		

Table 10. Number of article equivalents by year and country of affiliation: top 25 countries: top 21 journals

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total	% Total	Mean rank	%total21 - %total45
USA	741.10	734.76	764.63	780.75	755.61	767.70	894.87	836.64	766.86	772.47	7815.40	60.25	1.0	7.60
UK	95.58	109.15	108.80	103.28	110.47	109.53	154.36	126.77	126.40	111.70	1156.04	8.91	2.0	-0.06
Canada	48.67	52.61	66.00	58.50	32.83	61.28	80.08	72.28	61.83	73.73	607.82	4.69	3.1	-0.43
France	38.66	47.33	41.13	35.83	36.47	41.29	54.45	49.08	41.99	50.61	436.85	3.37	4.0	-0.35
Germany	22.75	27.87	25.98	23.50	25.33	41.05	46.62	44.40	55.53	45.42	358.45	2.76	5.2	-1.30
Spain	13.83	26.19	23.12	30.92	26.17	22.93	32.57	33.73	30.58	37.00	277.04	2.14	6.5	-0.56
Netherlands	20.67	25.16	26.82	22.45	23.67	23.35	29.20	25.77	26.75	34.25	258.09	1.99	7.1	-0.42
Italy	16.33	14.41	15.90	23.00	21.83	23.60	28.92	32.17	27.07	22.78	226.01	1.74	8.0	-0.66
Sweden	20.92	15.16	15.57	16.42	16.00	17.33	20.42	20.78	15.43	12.83	170.87	1.32	10.2	-0.06
Israel	13.00	22.17	21.50	18.87	10.58	19.28	18.17	17.20	12.25	12.50	165.52	1.28	11.1	-0.16
Australia	9.67	13.17	8.42	17.92	12.42	14.83	23.78	23.28	21.83	18.50	163.82	1.26	11.1	-0.26
Japan	15.25	14.67	13.33	9.25	9.58	14.50	18.58	15.54	23.17	16.41	150.29	1.16	11.9	-0.69
Switzerland	6.67	8.32	5.17	12.42	9.83	11.75	13.83	21.24	24.41	22.50	136.13	1.05	13.1	-0.08
Belgium	11.33	12.66	9.65	8.00	12.92	7.27	10.09	17.67	15.08	10.17	114.83	0.89	13.8	-0.10
Denmark	8.25	6.92	6.40	10.17	9.17	13.33	7.56	9.67	7.66	15.00	94.12	0.73	15.3	-0.08
Norway	6.00	5.09	17.90	6.00	12.25	11.17	10.55	7.83	10.83	6.33	93.96	0.72	15.9	0.00
Hong Kong	5.33	6.17	9.17	13.25	8.00	6.67	16.58	5.58	10.25	11.58	92.58	0.71	16.4	-0.07
South Korea	8.92	5.33	6.17	7.33	4.42	5.67	6.67	7.83	4.67	5.75	62.74	0.48	18.8	-0.22
China	2.50	1.17	1.83	3.50	2.17	2.58	6.33	7.95	9.77	10.92	48.71	0.38	24.4	-0.10
Singapore	2.50	1.67	1.67	3.92	4.33	3.00	7.53	5.58	11.92	5.83	47.95	0.37	23.1	-0.14
Brazil	0.50	3.50	1.00	4.67	4.83	3.33	3.67	8.20	3.00	7.00	39.70	0.31	24.1	-0.14
Austria	2.00	2.25	2.50	4.50	3.83	2.93	3.75	5.58	4.67	5.42	37.44	0.2886	24.4	-0.29
Portugal	3.00	2.17	4.00	2.50	1.00	2.27	3.00	8.50	3.83	5.92	36.18	0.2789	25.0	-0.17
Taiwan	4.00	5.50	3.08	2.00	3.67	4.33	5.00	3.21	2.17	2.58	35.54	0.2740	25.1	-0.32
Ireland	4.33	1.75	3.50	3.75	1.50	2.66	5.58	4.83	3.50	3.08	34.50	0.2659	25.5	na

Table 11. Australia: Number of article equivalents by year and university affiliation: 21 journals

University	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total	% of Total	Mean rank	Years ranked<10
ANU	2.00	4.17	2.50	4.83	3.00	3.17	5.33	2.25	3.50	1.83	32.58	20.40	2.0	10
U Melbourne	0.83	2.67	1.25	2.67	4.25	0.50	5.03	6.42	4.33	2.83	30.78	19.27	2.9	10
UNSW	2.50	1.50	1.00	2.50	1.50	1.83	3.17	2.67	2.83	2.00	21.50	13.46	3.3	10
Monash U	1.17	1.00	0.50	2.50	1.33	2.83	3.50	1.67	3.17	3.08	20.75	12.99	3.7	10
U Sydney	0.00	0.25	0.50	2.00	0.00	2.00	2.00	1.58	0.83	1.50	10.67	6.68	6.3	10
U Queensland	0.00	0.00	1.33	1.83	1.50	0.00	0.33	1.25	2.00	1.17	9.42	5.90	7.7	8
UTS	0.00	0.00	0.50	0.00	0.00	1.00	0.75	0.33	1.50	3.50	7.58	4.75	8.1	8
UWA	0.00	0.50	0.00	0.00	0.00	0.00	1.67	1.62	2.50	0.00	6.28	3.93	9.3	5
U Adelaide	0.50	0.00	0.00	0.00	0.33	1.00	0.33	1.00	0.83	0.00	4.00	2.50	9.9	6
La Trobe U	2.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	2.67	1.67	14.8	2
Griffith U	0.00	0.00	0.00	0.00	0.00	1.00	0.33	0.00	0.00	1.00	2.33	1.46	13.3	3
Deakin U	0.00	0.33	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.33	2.17	1.36	12.3	3
U Wollongong	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	1.25	14.0	3
QUT	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.83	0.33	0.25	1.75	1.10	15.1	2
Curtin U Technology	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.25	0.00	0.00	1.08	0.68	12.4	1
U South Australia	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.63	16.5	1
UWS	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.63	15.5	2
UNE	0.00	0.25	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.75	0.47	14.8	2
U Tasmania	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.31	15.5	3
James Cook U	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.21	17.6	1
Murdoch U	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.33	0.21	18.5	0
Edith Cowan U	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.25	0.16	19.5	0
All academic	**9.67**	**13.17**	**8.08**	**17.33**	**11.92**	**14.83**	**23.45**	**21.62**	**21.83**	**17.83**	**159.73**	100		

Table 12. Australia: Number of article equivalents by year and journal: 21 journals

	Number of articles equivalents											% of	Years	Years
Journal	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**	**Total**	**pub>0**	**ranked<10**
J Econometrics	0.00	1.33	0.25	0.50	3.00	4.00	5.67	7.53	2.17	3.17	27.62	17.29	9	10
J Health Econ	0.00	2.50	1.00	2.33	1.00	3.50	4.12	3.83	4.67	2.67	25.62	16.04	9	10
J Public Econ	0.00	2.50	1.50	1.00	0.00	1.83	0.33	1.58	4.75	2.08	15.58	9.76	8	7
The Econ J	2.00	1.17	0.00	3.33	2.00	1.83	1.00	0.58	1.50	0.00	13.42	8.40	8	9
J Development Econ	1.00	0.50	2.83	3.00	0.00	0.00	3.00	0.00	2.00	1.00	13.33	8.35	7	8
J Business & Econ Stats	2.33	1.00	0.00	0.00	2.33	0.50	1.00	1.50	0.75	1.67	11.08	6.94	8	9
J Econ Theory	1.83	1.00	0.00	1.83	0.00	1.00	1.58	0.33	1.00	0.00	8.58	5.37	7	7
International Econ Rev	1.00	0.00	0.50	0.00	0.00	1.33	2.00	0.00	2.00	1.33	8.16	5.11	6	6
J International Econ	0.00	0.00	0.83	0.33	0.83	0.50	1.50	1.50	0.67	0.33	6.50	4.07	8	6
J Monetary Econ	0.50	0.50	0.00	1.00	0.00	0.00	0.00	2.00	0.33	2.00	6.33	3.97	6	5
RAND J Econ	0.00	0.33	0.00	1.00	2.00	0.00	1.00	0.00	1.00	0.50	5.83	3.65	6	6
The Review Econ & Stats	0.00	0.83	0.00	0.00	1.25	0.00	0.83	1.25	0.00	0.58	4.75	2.97	5	4
J Financial Econ	0.00	0.00	0.00	1.33	0.00	0.00	0.25	1.67	0.50	0.33	4.08	2.56	5	2
The American Econ Review	0.50	1.00	0.00	1.67	0.00	0.00	0.50	0.00	0.00	0.00	3.67	2.30	4	4
J Econ Perspectives	0.00	0.50	0.00	0.09	0.00	0.00	0.00	0.00	0.00	2.00	2.59	1.62	3	1
Econometrica	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	2.00	1.25	3	1
The J Law and Econ	0.50	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.50	0.94	2	2
The Review Econ Studies	0.00	0.00	0.00	0.50	0.00	0.33	0.00	0.00	0.00	0.50	1.33	0.83	3	1
J Econ Literature	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.33	1.00	0.63	2	1
J Political Economy	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.83	0.52	2	1
All academic	**9.67**	**13.17**	**8.08**	**17.33**	**11.92**	**14.83**	**23.45**	**21.62**	**21.83**	**17.83**	**159.73**	100		