Scientometrics (2015) 102:865–883
DOI 10.1007/s11192-014-1430-4

Cross-country differences in publishing productivity of academics in research universities

Peter James Bentley

Received: 24 March 2014 / Published online: 7 September 2014

Abstract The main bibliometric databases indicate large differences in country-level scientific publishing productivity, with high growth in many East Asian countries. However, it is difficult to translate country-level publishing productivity to individual-level productivity due to cross-country differences in the size and composition of the research workforce, as well as limited coverage of publications in the social sciences and humanities. Alternative data sources, such as individual-level self-reported publication data, may capture a wider range of publication channels but potentially include non-peer reviewed output and research republished in different languages. Using individual-level academic survey data across 11 countries, this study finds large differences across countries in individual-level publishing productivity. However, when fractionalised for English-language and peer-reviewed publications, cross-country differences are relatively smaller. This suggests that publishing productivity in certain countries is inflated by a tendency to publish in non-peer reviewed outlets. Academics in large, non-English speaking countries also potentially benefit from a wider range of domestic publication channels. Demographic, motivational and institutional characteristics associated with high individual-level publishing productivity account for part of the publishing productivity differences within and between counties in English-language and peer-reviewed publishing productivity, but not in total publishing productivity where such workforce characteristics only account for within-country differences.

Keywords Publication productivity · Research · Publishing · English-language publishing · Double-publishing · Peer-review

Introduction

Since the early 1990s the balance in global research has shifted away from North America and other established systems in Western Europe and Japan, towards emerging Asian

P. J. Bentley (✉)
LH Martin Institute for Tertiary Education Leadership and Management, The University of Melbourne, Level 1, 715 Swanston Street, Melbourne, VIC 3010, Australia
e-mail: pbentley@unimelb.edu.au; peter.bentley@unimelb.edu.au

countries. At an aggregate national level, this can be demonstrated based on input factors, such as total R&D expenditure or the number of scientists, or in terms of research outputs based on the number of scientific publications and citations (Larsen et al. 2008). The spectacular growth of China and other Asian nations against a relative decline in the USA and Europe has received considerable attention (Leydesdorff and Wagner 2009). For example, the USA's share of all scientific articles within the Web of Science declined from 38 % in the early 1990s (the period 1990–1994) to 29 % in recent years (2008–2012), while mainland China's share increased from 1 to 12 %. However, changes in national output do not directly reflect individual-level productivity of researchers. The exponential growth in China can be attributed in part to the sustained increases in funding, the tapping of an almost unlimited reservoir of highly-skilled human resources, and the return of overseas scholars (Zhou and Leydesdorff 2006).

Understanding how the relative output of countries reflects the productivity of individual academics is much more difficult to determine. Bibliometric databases, combined with national R&D statistics, may be used as a rough benchmark to compare individual-level productivity. For example a highly cited article published in *Nature* titled "The scientific impact of nations", showed that the UK published more scientific articles than Japan during 1997–2001, despite having fewer than one quarter the number of full-time researchers (King 2004). Thus on these aggregated metrics, the UK—along with USA, Canada, Italy, Germany and France—all dramatically outperformed Japan on a "publications per researcher" basis. However, the use of bibliometric databases for international comparisons of individual academic productivity has several limitations.

Firstly, the major scientific databases (Thomson-Reuters Web of Science or Scopus) lack coverage of publication channels in the humanities and social sciences (e.g. books and book chapters) and non-English language outlets (Harzing 2013). This means they are inappropriate for generalising the individual-level publishing productivity of academics outside the sciences. Therefore, international comparisons tend to be limited to a narrower range of scientific fields (Leydesdorff and Wagner 2009). Secondly, various types of researchers may be included in national-level personnel data, such as private sector R&D personnel and public research institute staff. These researchers will not always be engaged primarily (or on a full-time basis) in research leading to scientific publications, and unlike academics, will not have direct obligations to teach. Therefore, national differences in the structure of the R&D workforce will influence individual-level publication productivity derived from aggregated data. Finally, treating the number of full-time researchers as the primary input factor assumes homogeneity of researchers and institutional settings. This is clearly not the case within the higher education sector. Universities and colleges differ in their research profile, while academics within them differ in rank, qualifications, experience, and dedication to research relative to other duties.

The limited disciplinary and linguistic coverage of international databases mean that surveys of the academic profession may provide a more complete picture of scholarly publishing (Kyvik 2003). Although there are many single-country studies which account for differences between individual academics, international studies are rare (Teodorescu 2000). This is most likely due to the lack of detailed and comparable data on the characteristics shown to correlate with higher levels of productivity. Studies of individual research productivity in the USA and other countries suggest productivity is an outcome of a complex mix of individual background, behavioural and institutional factors (Fox 2005, 1983; Fox and Mohapatra 2007; Bland et al. 2005; Long 1992; Xie and Shauman 1998; Kyvik 1991). Given that national higher education systems and the profile of academics

within them differ on each of these attributes, accounting for cross-country differences in individual-level productivity requires data on these attributes.

International survey studies from the 1990s showed large national differences in individual-level research productivity (Altbach 1996; Enders and Teichler 1997). More recent studies based on 2007 survey data from the Changing Academic Profession (CAP) project, show USA academics publish around half the number of articles and book chapters as academics in some Western European and Asian countries (Bentley and Kyvik 2011; Cummings and Finkelstein 2012). It is, however, unclear whether publishing performance differs primarily due to the types of duties academics perform or their institution's support for research, rather than research effectiveness. In other words, countries may differ in the structure of their academic workforces with lower productivity countries containing a lower proportion of academics exhibiting characteristics generally associated with higher levels of research output. Secondly, publishing productivity may be lower in USA and other English-speaking countries because academics within these countries publish exclusively in English, limiting their range of potential publication outlets and the possibility to publish their results in multiple languages. This article investigates this possibility by examining mean individual-publishing productivity in its totality, as well as those within English-language and peer-reviewed outlets.

This study will provide a comprehensive picture of scholarly publishing across a range of academic disciplines in 10 countries and Hong Kong (a special administrative region of China, but hereafter referred to as a country). The purpose is to examine country-level differences in the mean publishing productivity of university academics, and attempt to account for these differences based on the structure and attributes of the academic workforce. Additional analyses will investigate how total publishing productivity relates to the propensity to publish in English-language and peer-reviewed outlets. The selection of countries includes the three largest and most mature research systems (USA, UK and Germany), two of the world's fastest growing systems (China and Korea), as well as four well-established medium-sized systems (Canada, Australia, Italy and Hong Kong) and two well-established smaller systems (Norway and Finland).

Determinants of publishing productivity

Rosser and Tabata (2010) comprehensively reviewed the conceptual and theoretical frameworks used to examine academic work and productivity. Many studies seeking to explain individual-level differences use a rather standard mix of variables, such as demographic characteristics, attributes or work habits, and organisational factors which reinforce behaviours (Fox 1983; Teodorescu 2000; Fox 1992). An abundance of studies show a persistent pattern of lower publishing productivity amongst women (Ward and Grant 1996; Creamer 1998). Various explanations have been given, including scientific ability, social selection (e.g. discrimination), self-selection (personal choice) and accumulated disadvantage (Zuckerman 2001). However, after controlling for other factors, gender is often a weak indicator of publishing productivity (Lee and Bozeman 2005; Teodorescu 2000).

Various studies have shown that academic rank is one of the strongest indicators of individual and departmental publishing productivity (Xie and Shauman 1998; Sheehan and Welch 1996; Kyvik and Teigen 1996; Kyvik 1991; Ramsden 1994; Bentley 2012; Dundar and Lewis 1998). As a predictor of publishing productivity, rank captures a variety of underlying attributes including the positive effects of research experience, as well as the

potentially negative impacts of aging on intellectual functioning (Stephan and Levin 1992) and research motivation (Cole and Cole 1973). Studies across a range of countries have found age and the aging effects to be relatively minor (Gingras et al. 2008; Kyvik and Olsen 2008; Teodorescu 2000), but the positive effects of seniority may mask this due to the endogeneity of research output in academic promotions (Mishra and Smyth 2012). Academics are promoted based on demonstrated research performance, and access to research resources (e.g. time, funding, research support staff) may be concentrated based on status criteria (Kyvik 2009). Other status criteria include doctoral training, particularly in countries where research has only recently emerged as a primary academic duty (e.g. China), or where teaching-focused institutions have become integrated into the university sector (e.g. Australia and the UK).

Academics also differ in their dedication and approach towards research. It is generally accepted that collaboration has a positive effect on scientific publishing and various studies have shown a positive correlation between high productivity and high levels of co-authorship (Katz and Martin 1997). However, when fractionalised based on number of co-authors, the relationship between collaboration and productivity is not always statistically significant (Lee and Bozeman 2005). Time spent on research is partly a residual category for what time remains after other duties such as teaching, but research time is also strongly related to research interest (Bentley and Kyvik 2013). Combined, research time and interest are strongly associated with publishing productivity across many countries (Fox 1992; Sax et al. 2002; Teodorescu 2000).

Publishing productivity is also influenced by the institutional support for research both in terms of time and resources. Academics are expected to at least partially engage in teaching and service and this comes at the cost of time available for research, which also differs between institutions and countries (Bentley and Kyvik 2012). A number of studies have reviewed and critically examined the relationship between teaching duties and research output, with some suggesting trade-offs between teaching and research (Fox 1992), while others finding no relationship (Hattie and Marsh 1996; Marsh and Hattie 2002). Generally, teaching hours have a much weaker relationship with research publishing than research hours (Teodorescu 2000). The amount of research funds one receives is a strong predictor of individual publishing productivity (Teodorescu 2000; Dundar and Lewis 1998), but unlike baseline research support resources (e.g. libraries and other infrastructure), research funding may be concentrated amongst those with past research performance and thus partly endogenous to research output. Nevertheless, there are large cross-country differences in national spending on R&D in higher education institutions which would likely lead to differential outcomes.

Beyond the workforce and institutional characteristics, the quantum of published output also reflects the availability and choice of publication channel. Peer-reviewed research takes longer to publish and academics in countries where this is the "gold standard" likely publish less (on a per researcher basis). Similarly, academics will have different ranges of domestic language publication channels. For academics in English-language systems, linguistic hegemony in science communication means they can communicate with international audiences in their local language, but this also means they cannot publish initially in their local language and subsequently in English. This is somewhat similar for academics in small countries with unique local languages in the "scientific periphery" due to their minimal local publication outlets and necessity for international collaboration (Kyvik and Larsen 1997). The potential benefit of double-publishing is most applicable in non-English speaking countries serving large domestic audiences.

Research questions and hypotheses

Consistent with previous within-country studies of individual-level publishing productivity (Fox 1983; Teodorescu 2000; Fox 1992), the determinants of higher productivity may be placed into three broad categories: demographic, motivational and institutional characteristics. Assuming that the factors associated with publishing operate in a similar fashion across countries, it may be expected that cross-country differences in individual publishing productivity will relate to these academic workforce characteristics. These form the basis of the first four hypotheses.

H1 Cross-country differences in individual publishing productivity can be attributed to the *demographic* profile of the academic workforce;

H2 Cross-country differences in individual publishing productivity can be attributed to the *motivation and achievements* profile of the academic workforce;

H3 Cross-country differences in individual publishing productivity can be attributed to the *institutional characteristics* of the academic workforce;

H4 Cross-country differences in individual publishing productivity can be attributed to the combined *demographic, motivation and achievements,* and *institutional characteristics* of the academic workforce;

If similar research is published concurrently in multiple languages, then individual publishing productivity would be inflated in non-English speaking countries where multi-language publishing possibilities are greatest. Therefore, one may expect that individual publishing productivity of English-language publications will be less variable across countries because it excludes research re-published across multiple languages.

H5 Cross-country differences in individual publishing productivity will differ less in English-language publications, controlling for the *demographic, motivation and achievements,* and *institutional characteristics* profile of the academic workforce.

Similarly, if research is both published in non-peer reviewed and peer-reviewed channels, or if countries differ in the extent to which they publish in these channels, total publishing would be inflated in countries where non-peer reviewed research is more common. Therefore, one may expect that individual publishing productivity will differ less across countries when publications are fractionalised for peer review.

H6 Cross-country differences in individual publishing productivity will differ less in peer-reviewed publications, controlling for the *demographic, motivation and achievements,* and *institutional characteristics* profile of the academic workforce.

Data and methodology

Data

The data analysed in this study comes from the CAP project, an international survey of the academic profession conducted in 2007–2008. The full sample included 26,000 higher education employees across Hong Kong and 18 countries, but this study is restricted to a subsample of university academics in Hong Kong and 10 countries: Australia, Canada, China, Finland, Germany, Italy, the Republic of Korea, Norway, UK, and the USA.

Argentina, Brazil, Japan, Mexico, Malaysia, Portugal, South Africa and the Netherlands were excluded due to insufficient respondents.

To avoid problems with mean research productivity being skewed by cross-country differences in the proportion of part-time or specialised (research-only and teaching-only) staff, data is restricted to full-time academics working at least 30 h of work per week and engaged in both teaching and research. Secondly, the sample includes only research universities and excludes colleges, polytechnics and universities of applied science.

The national samples were found to be broadly representative of the respective populations on strata such as gender, academic rank and institutional type (RIHE 2008), but response rates were mostly below 40 % and academics in senior ranks tended to be overrepresented in the majority of samples (Rostan et al. 2014). The relatively low response rates were likely due to the large number of survey questions and surveys not being received (particularly online invitations), while the overrepresentation of senior academics probably reflects their more stable forms of employment and greater contactability. Given the positive relationship between rank and published output, the original national samples (including part-time staff) were weighted according to the population estimates for rank. The 7,642 cases in the weighted sample is around 10 % less than the total number of respondents, mostly due to the exclusion of part-time staff from the subsample (who tended to be in lower ranks and receiving greater weightings).

Although the weighting process helps overcome non-response bias, self-selection bias is a potential problem if publishing behaviours influenced one's choice to respond. This is unlikely to be the case, given the CAP survey was comprehensive and not specifically targeted towards research behaviours, but due to confidentiality of respondent (and non-respondent) identity, it is not possible to estimate self-selection bias. Self-selection is more likely to be a problem in China where although response rate was high, so too was item non-response. Due to a relatively large number of partially completed surveys, only 61 % of respondents in China provided usable data on publishing (compared over 90 % of respondents in other countries). The sample characteristics are shown in Table 1, along with the means for the publishing productivity variables.

Dependent variable—Article equivalents

Individual publication productivity is based on "article equivalents", calculated as the weighted sum of self-reported articles in books or journals (1 point), edited books (2 points) and authored books (5 points) over the 3 years prior to the survey (typically, 2005–2007). The broadness of the measure captures publishing productivity in its entirety, rather than publications within a narrow range of outlets. A 3 year reference period is considered appropriate for assessing research performance and producing reliable results (Abramo et al. 2012). Using article equivalents and weighting of books more heavily reflects the relative contribution of the different publication types, minimises differences across disciplines and is consistent with similar multi-disciplinary studies of research output (Kyvik and Teigen 1996; Ramsden 1994).

English-language and peer-reviewed article equivalents are used as fractionalised versions of the dependent variable. In Australia, UK, USA, Hong Kong and English-language Canadian universities, English-language article equivalents is based on the proportion of one's publications in English. In other countries and French-language Canadian universities, it is based on the proportion "published in a language different from the language of [institutional] instruction", which is a close approximation. The vast majority of non-native English speakers who did not research primarily in their native language, reported

Table 1 Sample characteristics and response rates, mean article equivalents and English-language article equivalents

	Total sample	Sub-sample	Item response rate (%)	Survey response rate (%)	Article equiv.	English article equiv.	Peer-reviewed article equiv.
Australia	1,381	624	91	25	9.2	9.2	7.2
Canada	1,152	886	93	17	8.3	6.5	6.3
China	3,612	916	61	86	13.5	4.6	3.0
Finland	1,452	567	94	28	9.1	5.7	5.6
Germany	1,265	548	94	32	10.8	6.1	6.1
Hong Kong	811	394	90	13	11.8	10.5	9.7
Italy	1,701	1,441	98	35	14.5	8.5	8.3
Korea	900	797	99	13	16.7	6.6	8.4
Norway	1,035	392	95	36	11.0	8.1	8.2
UK	1,663	457	91	15	8.4	8.2	6.4
USA	1,146	619	95	21	6.5	6.4	4.9
Total	16,118	7,642			11.5	7.3	6.8

that they conducted their research in English (98 %). Therefore, it is reasonable to assume that publications in languages different from the language of instruction will overwhelmingly be in English. Peer-reviewed article equivalents are based on the proportion of one's publications which were peer reviewed. There is a risk that respondents engaged in non-scholarly publishing (e.g. reports and newspaper articles) may include these publications in their estimate of peer review, thus underestimating their percentage for scholarly publications. However, most academics reported either 100 or 0 % for peer review, and there was no meaningful correlation between peer review and the number of non-scholarly publications. Therefore, we may be confident that the peer review estimates are reliable.

Publication productivity is roughly normally distributed but positively skewed. Outliers on the dependent variable (more than 100 article equivalents) were removed. Just under 8 % of the sample reported no publications, while 15 % published more than 20 article equivalents. Alternative transformations of the dependent variable were also tested, such as articles-only or an unweighted sum of publications, but the OLS results were very similar. All of the models were also replicated with a square root transformation for article equivalents and its fractionalised variations. The square root transformation further normalised the distribution, strengthened the statistical significance and fit of the model (coefficient of determination), but had minimal impact on the overall results and conclusions. For space reasons, the complete OLS models for article equivalents (and fractionalised versions) are presented in the results section and the square root transformation models in "Appendix".

Limitations of the dependent variable

Publication counts do not measure impact or quality of publications, and the fractionalisation measure for peer review is imprecise. This is unavoidable due to the limitations of the survey data, but it is also necessary because the purpose of the study is to examine the total publishing productivity, rather than a narrower range of outlets in disciplines where citation impact is an acceptable proxy for quality. Secondly, this study is reliant on self-reported data and some may question its accuracy. Although imperfect, there are few reasons to believe self-reported publications would be subject to systematic error or bias. Publications are often reported as core performance criteria, and the anonymous nature of the survey provides detachment and neutrality, mitigating any social desirability response bias. Self-reported publications have also been found to highly correlate with verified publications in specified outlets (Clark and Centra 1985). Finally, articles and books cannot be fractionalised for co-authorship due to the lack of a specific question in the survey. This will overestimate publishing productivity in countries where co-authorship is more common.

OLS regression models

Each of the six hypotheses are examined based on an OLS regression model. Hypotheses 1, 2, 3 and 4, correspond, respectively, to model 1 (M1), model 2 (M2), model 3 (M3), and model 4 (M4). A reference model (M0) is also computed with only the control variables for country and academic field (social sciences as the reference category). For M0–M4, the dependent variable is raw article equivalents and the USA is the reference country, due to the lowest mean (see Table 1).

Hypotheses 5 and 6 follows the same methodological approach, but use fractionalised measures for English-language article equivalents (M5) and peer-reviewed article

equivalents (M6). China is the reference country in these models, due to having the lowest mean (Table 1). For space reasons, only the combined OLS models are listed in M5 and M6.

Independent variables associated with publishing productivity

As outlined above (under "Determinants of publishing productivity"), previous studies suggest that the factors associated with publishing productivity fall into three broad categories: demographic, motivation and achievement, and institutional characteristics. These form the theoretical rationale for the inclusion and grouping of independent variables, and their expected relationship with publishing productivity. Means for all independent variable means are listed in "Appendix".

Demographic characteristics include gender and experience. Males have routinely been found to publish more than females, but the experience has mixed effects. Older academics tend to benefit from increased seniority and research expertise which comes with career progression. Therefore, years of experience in the higher education or research sector (beyond research or teaching assistant) captures these positive linear effects. However, the aging process may lead to a gradual decline in productivity for reasons including declining research motivation and intellectual functioning. A squared transformation of years of experience is included to capture these negative non-linear effects.

The second block of variables for motivation and achievement include qualifications (PhD), research collaboration, research hours and research interest. It is expected that country workforces with higher a proportion of PhDs and those with stronger research engagement will tend to publish more. Research interest was defined on a 4-point Likert scale from primarily in teaching (1) to primarily in research (4). Research hours was computed based on a weighted average of self-reported hours during the teaching period and non-teaching period (with the teaching period weighted as twice the duration of the non-teaching period). Research collaboration was defined as having collaborators in any current research project.

The third block of institutional characteristics include self-reported hours spent on teaching, self-reported hours on administration and service (combined), and a constructed variable for institutional research support. Presumably, hours spent on non-research activities will not contribute to research output or exhibit a negative effect by leaving less time for research, though the effects of these variables have been weak in previous studies. Research support is expected to be positively related to publishing and constructed as a 5-point scale (from 1 to 5) based on self-reported satisfaction with up to five items: laboratories, research equipment, computer facilities, library holdings and faculty offices. Not all research support resources were relevant to all academics, so an index was created based on the mean across relevant resources. This index was internally consistent (Cronbach's Alpha = 0.78), indicating that each item of research support index measures a unique (but related) type of institutional research support.

Results

As shown in Table 1, academics in the four countries with the highest mean publishing productivity—Korea, China, Germany and Italy—were, on average, more than twice as productive as the American counterparts. What may account for these large differences across countries? Four possible workforce explanations are investigated, differences in: the

demographic and experience profile (H1), research motivation and associated behaviours (H2), institutional support for research (H3), and a combination of these (H4). Additionally, we examine whether cross-country differences found in total publishing productivity may be related to the propensity to publish in domestic-language publication outlets (H5) or non-peer reviewed outlets (H6). The results for the respective OLS regression models are listed in Table 2 (M1–M3) and Table 3 (M4–M6).

The model summary statistics indicate that the addition of each block of independent variables increases the explanatory value of the model beyond the use of control variables for country and academic field (M0). However, the inclusion of each block showed only a weak association with article equivalent productivity, increasing the adjusted R-square value from 0.08 in the reference model (M0) to 0.11 in M1, 0.13 in M2 and 0.09 in M3. The combined model accounted for the greatest share of variance in article equivalent publishing, with an adjusted R-square of 0.18, suggesting each block of variables captured distinct elements. Given the large ratio of cases to independent variables, statistical significance of each independent variable is less important than the relative size of the beta coefficients.

H1. Results for demographic characteristics

Hypothesis 1 received no support from our data. Males tend to publish around two additional article equivalents, while each additional year of experience translates into half of one article equivalent. The positive effect of experience declines in later years, as reflected by the negative beta coefficient for the squared transformation of this variable. This likely indicates that publishing productivity steadily increases throughout one's career, perhaps reinforced through the promotion and tenure system, but plateaus in later years. However, in terms of accounting for cross-country differences in publishing productivity, the inclusion of these variables has little effect on the size of the country beta coefficients.

Based on the 10 dichotomous countries variable beta coefficients, all countries differed significantly ($p < 0.01$) from the USA in their article equivalent publishing controlling for experience, gender and academic field. Compared to the model with only control variables (M0), the addition of these independent variables often strengthened the significance and size of the country beta coefficients. In other words, certain demographic characteristics are associated with greater levels of publishing, but cross-country differences in these factors do not account for differences in individual-level publishing productivity between countries.

H2. Results for individual achievement and motivation variables

Hypothesis 2 received only limited support. Collectively, all individual achievement and motivation variables exhibited statistically significant and meaningful relationships with article equivalent publishing, both in isolation (M2), and when combined with all other variables (M4). However, controlling for differences, qualifications, research collaboration, research hours and research interest, large statistically significant differences remain between highly publishing countries (Germany, Italy, China and Korea) and the rest. With the exception of Canada and UK, all country variable beta coefficients were statistically significant ($p < 0.01$). Even though the independent variables included in M2 account for variability between individual academics in ways which support previous within-country examinations (such as higher productivity amongst those with PhDs and stronger dedication or interest in research), there is little evidence to suggest they account for, or even

Table 2 OLS results for article equivalent publishing (M0–M3)

	M0		M1		M2		M3	
	B	SE	B	SE	B	SE	B	SE
(Constant)	6.05**	0.51	0.97	0.61	−5.59**	0.81	7.10**	0.89
Australia	2.34**	0.69	2.65**	0.71	1.93**	0.70	2.48**	0.69
Canada	1.52*	0.62	1.97**	0.63	0.44	0.63	1.78**	0.62
China	7.48**	0.62	7.85**	0.63	9.04**	0.65	8.28**	0.63
Finland	2.66**	0.71	3.70**	0.73	2.17**	0.72	2.92**	0.71
Germany	4.19**	0.69	5.00**	0.71	3.76**	0.70	4.02**	0.69
Hong Kong	5.33**	0.76	4.79**	0.78	4.31**	0.76	5.42**	0.76
Italy	8.04**	0.56	8.09**	0.56	8.56**	0.59	8.42**	0.57
Korea	10.36**	0.62	10.11**	0.64	9.64**	0.63	10.74**	0.63
Norway	4.45**	0.77	3.48**	0.78	3.99**	0.78	4.98**	0.77
UK	1.70*	0.72	2.23**	0.72	0.92	0.72	1.83*	0.71
Humanities	0.44	0.43	0.39	0.44	1.09*	0.43	0.62	0.43
Nat. sciences	0.08	0.37	−0.44	0.38	−0.91*	0.36	0.00	0.37
Technology	−0.58	0.44	−1.20**	0.45	−1.03*	0.43	−0.83	0.44
Medicine	3.42	0.46	3.13**	0.47	3.54**	0.45	2.70**	0.46
Male (%)			2.27**	0.30				
Experience			0.45**	0.04				
Experience squared			−0.01**	0.00				
PhD (%)					3.42**	0.34		
Research collaboration (%)					2.93**	0.36		
Research hours					0.10**	0.01		
Research interest (1–4)					1.80**	0.21		
Teaching hours							−0.12**	0.02
Admin and service hours							0.05**	0.02
Research support (1–5)							0.04	0.18
Adj R-square	0.08		0.11		0.13		0.09	
n	7,056		6,599		6,824		7,042	

Statistical significance * $p < 0.05$ ** $p < 0.01$; USA and social sciences as reference categories

minimise, cross-country differences in publishing productivity. Therefore, cross-country differences in publishing productivity cannot be attributed to large cross-country differences in these variables.

H3. Results for institutional characteristics

Hypothesis 3 also received no support from our data. The addition of variables for institutional characteristics were mostly insignificant in statistical and meaningful senses. On their own, there were no meaningful differences in the size of the country beta weights in M3 compared to the reference model (M0), and all country beta coefficients were statistically significant ($p < 0.05$). When all other independent variables were included (M4), most of the institutional characteristics variables lost their statistical significance and meaning, suggesting they neither account for between-country or within-country differences. The positive beta coefficient for hours spent on administration and service in M4 is counterintuitive and

Table 3 OLS results for article equivalent (M4), English language (M5), and peer-reviewed publishing (M6)

	M4		M5		M6	
	B	S.E.	B	S.E.	B	S.E.
(Constant)	−14.71**	1.29	−13.79**	1.08	−11.90**	1.08
Australia	2.58**	0.71	2.72**	0.62	2.19**	0.62
Canada	1.33**	0.63	0.17	0.56	1.59**	0.56
China	10.12**	0.67	N/A	N/A	N/A	N/A
Finland	4.02**	0.74	0.05	0.63	1.41*	0.64
Germany	4.82**	0.71	−0.84	0.61	0.87	0.61
Hong Kong	4.00**	0.77	3.73**	0.68	4.34**	0.68
Italy	9.35**	0.60	2.95**	0.49	4.23**	0.49
Korea	9.83**	0.65	0.49	0.56	3.87**	0.56
Norway	3.67**	0.78	1.09	0.68	2.85**	0.68
UK	1.95**	0.73	2.09**	0.64	1.65*	0.64
USA	N/A	N/A	0.66	0.60	0.50	0.60
Humanities	0.88**	0.44	0.20	0.38	−0.15	0.38
Nat. sciences	−1.35**	0.37	3.49**	0.32	2.07**	0.32
Technology	−1.47**	0.45	2.22**	0.39	0.50	0.39
Medicine	2.73**	0.47	5.15**	0.40	4.42**	0.40
Male (%)	1.61**	0.30	1.21**	0.26	1.10**	0.26
Experience	0.43**	0.04	0.27**	0.04	0.29**	0.04
Experience squared	−0.01**	0.00	−0.01**	0.00	−0.01**	0.00
PhD (%)	3.53**	0.36	2.93**	0.31	2.32**	0.31
Research collaboration (%)	2.36**	0.37	1.71**	0.32	1.90**	0.32
Research hours	0.17**	0.02	0.12**	0.01	0.10**	0.01
Research interest (1–4)	2.13**	0.22	2.14**	0.19	1.99**	0.19
Teaching hours	0.03	0.02	0.01**	0.02	−0.02	0.02
Admin and service hours	0.14**	0.02	0.12**	0.02	0.11**	0.02
Research support (1–5)	−0.03**	0.18	0.34*	0.16	0.14	0.16
Adj R-Square	0.18		0.16		0.14	
n	6,383		6,092		6,091	

Note: Statistical significance * $p < 0.05$ ** $p < 0.01$; USA and social sciences as reference categories in M4, China and social sciences M5–M6

should be treated with caution. There is no logical reason to interpret causation, it is more likely that highly publishing academics are sought out for leadership duties.

H4. Results for the combined model

Hypothesis 4 received very limited support. The model itself accounted for the greatest share of variance (adjusted R-Square 0.18) and many of the independent variables retained strong and meaningful relationships with publishing productivity, in particular the variables for experience, PhD, research time and research interest. These results are entirely consistent with former within-country studies of individual publishing productivity, but given that all ten country beta coefficients were statistically significant (nine at the 0.01

level), these workforce characteristics do not account for the differences in mean publishing productivity between countries. Similar results were found when using a square root transformed dependent variable, suggesting the results are not skewed by prolific or non-publishing academics (see results for M7 in "Appendix").

H5. Results for English-language publishing

Hypothesis 5 proposed that academics in large countries with unique local languages may benefit from publishing separately for their domestic and international audiences. Table 1 showed that the top-3 countries in terms of individual article equivalent publishing—Korea, China, and Italy—were all non-English-speaking countries with relatively large domestic audiences. These countries remained the most productive controlling for academic workforce characteristics in M4. However, the results for mean English-language publishing placed these countries nearer the bottom, with China and Korea ranked lowest and fourth-lowest, respectively (Table 1). Only Hong Kong had relatively high article equivalent publishing and high English-language publishing. This was due to the tendency for publications in English-speaking countries to be almost exclusively in English (99 % in Australia, 97 % in the USA, 96 % in UK, and 88 % in Hong Kong), compared to a minority of publications in Korea (35 %) and China (30 %). English language publishing was the dominant, but not exclusive, form of publishing in Norway (72 %), Italy (62 %), Finland (62 %) and Germany (60 %). Canada was different to other English-speaking countries with only 80 % of publications in English, but this was due to French-language publishing at French-language universities.

Hypothesis 5 received moderate support from the results in M5. Whereas all countries differed significantly from the lowest publishing country in article equivalents (USA in M4) only a four countries differed significantly from the lowest publishing country in English-language article equivalents (China in M5). In these four countries—UK, Australia, Italy and Hong Kong—academics may be expected to publish between two to four additional English-language article equivalents over a 3 year period. Although still relatively large, it is considerably smaller than the differences between China and these countries before controlling for workforce characteristics (shown in Table 1). The relative size of the country beta coefficients are also considerably smaller in M5 compared to M4 in their standardised format (not shown) as well as relative to the means. In other words, English-language publishing is less variable across countries and increasingly so when controlling for workforce characteristics. However, when using a square root transformation of the dependent variable, the results country level differences remained relatively large (see results for M8 in "Appendix"). This suggests that mean English-language publishing in China and other low-publishing countries may be more dependent on a minority of relatively prolific English-language publishers.

H6. Results for peer-reviewed publishing

Hypothesis 6 proposed that the propensity to publish in non-peer reviewed channels may account for the large observed differences in mean publishing across countries. This received moderate support from the results. Fractionalising total publications for peer review reduced the gap between the countries with relatively high total publishing (e.g. China and Germany) and the USA. After controlling for workforce characteristics, differences in mean peer-reviewed publications reduced even further in M6. Whereas all countries differed from China when controlling only for academic field, only six countries differed from China at a comparable level of statistical significance in M6 ($p < 0.01$, full

results not shown in Table 3). Therefore, there is evidence that peer-review publishing is less variable across countries than total publishing, and variation between countries in terms of peer-reviewed articles may be partly accounted for by differences in academic workforce characteristics. However, meaningful and statistically significant differences remained, particularly between Hong Kong, Italy, Korea and lower publishing countries. Academics in these high publishing countries may be expected to publish around four additional peer-reviewed article equivalents over a 3 year period. Further, all countries differ significantly from China when using a square root transformed version of this variable (see results for M9 in "Appendix"), suggesting that peer-reviewed publishing is more positively skewed in lower publishing countries.

Discussion

The main bibliometric databases indicate large differences in country-level scientific publishing productivity, with large increases in recent years in Asia and a relative stagnation in the USA. However, it is difficult to translate country-level productivity to the level of individual academics (or researchers more generally) because countries have different sized research labour forces containing different compositions of researchers. Bibliometric databases also do not capture the breadth of research output, particularly in the social sciences and in non-English publishing channels. Therefore, the purpose of this study has been to investigate cross-national differences in publishing productivity at the individual academic level across a range of academic fields. Previous cross-country studies of individual-level productivity differences have indicated large differences across countries (Cummings and Finkelstein 2012; Altbach 1996), but it remained unclear whether these differences were attributable to the structure of the workforce (e.g. balances between research and other duties) and domestic publishing opportunities.

The first four hypotheses specifically referred to the structure of the academic workforce in terms of the relationship between publishing productivity and cross-country differences in demographic, individual motivation and achievement, and institutional characteristics. None of the results suggested that high levels of individual publishing productivity found in China, Korea, Italy and Germany, can be attributed to workforce characteristics favouring high individual publishing, such as research time allocations or research qualifications. While these factors explained variation within countries, cross-country differences were persistent (or even greater) when controlling for such factors. For example, China and Italy had high levels of individual publishing productivity despite less than half of all academics included in the samples holding PhD qualifications. Therefore, academics in similar institutions, exhibiting roughly comparable individual-level roles and attributes, published at significantly different rates across countries. In other words, the CAP data suggested academics in China, Korea, Germany and Italy, create more tangible published outputs than academics in other countries, even when controlling for country differences in research capabilities, opportunities and support.

However, one limitation of these results is that publishing productivity is not analogous to (new) research productivity. High individual-level publishing productivity may reflect a greater tendency to republish existing results for different audiences in new publications. One example would be publishing similar research in different languages. Some consider it unethical for academics who have already published research results or ideas in their local language, to later publish similar research in an English book or journal. Such academics may be engaging in "double-publishing" or "redundant publishing" (Neate 2012). However, it is extremely difficult to determine what constitutes redundant publishing. For example,

researchers may initially release their descriptive research results in their local language, and subsequently analyse the results in more detail and through a theoretical lens for disciplinary community publications. Such publications may even include attributions to the original research publication. Research funded by national or local government agencies may even require or expect findings to be published in the local language (Schuckit 1997). Refining and repackaging research for multiple audiences is certainly not restricted to multiple-language publishing, but it is more difficult to detect such occurrences.

The fifth hypothesis of this study was that cross-country differences publishing productivity would be smaller when examining English-language publications, partly because it would remove some potentially overlapping research published in multiple languages. This approach towards fractionalising publications clearly favoured English-speaking countries because such academics published almost exclusively in English. English was also the dominant language for research in smaller European countries with unique local languages, perhaps due to their location within the "scientific periphery" where there are relatively weak domestic publishing opportunities and greater importance placed on publishing internationally (Kyvik and Larsen 1997). The greatest disadvantage was for China and Korea, where English publications were a minority, and to a lesser extent in Germany and Italy.

It is very difficult to address the role of non-English domestic-language publishing as an explanation for cross-country differences in published output, but it is unlikely to be mere coincidence that high publishing productivity was associated with countries where academics publish to a greater extent in a language other than English. After removing publications which can only be read by a domestic audience (i.e. produced in the local language of instruction in non-English language universities), publication productivity differed much less across countries. For example, China had the highest total publishing productivity but was bottom amongst the 11 countries in English-language publishing. Highly publishing Korea, Italy and Germany were also closer to the mean of all countries on this fractionalised measure.

A final possible reason for the large differences across countries in scholarly publishing is that certain countries may prioritise higher quality publications, whereas others emphasise quantity. This received some support from the data. Although peer review practices differ across (and within) disciplines and tends to be more dominant in English-language outlets for international audiences (Verleysen and Engels 2014), at the very least peer-reviewed research takes longer to publish and to some extent can be taken as a proxy for baseline scientific quality. In China and Korea the mean proportion of peer review reported by respondents was only 24 and 48 % respectively. This compared to a majority in other countries, including between 72 and 76 % in the UK, Australia, Canada and Hong Kong. When publications were fractionalised for peer review there were fewer differences across countries, partly because country-level mean individual publishing productivity was roughly inversely related to peer review. The additional independent variables for workforce characteristics further reduced country-level differences, which was not the case for total publishing. This provided evidence that peer review and workforce characteristics partly account for both within and between country differences in publishing productivity.

Overall, cross-country differences in mean publishing productivity remained statistically significant across all of the publication types examined in this study, even after controlling for workforce characteristics. However, the importance of international and peer-reviewed outlets offers a partial explanation. Countries tended to be either very high in total publishing but low-moderate in English-language or peer-reviewed publishing (China, Korea and Germany), or relatively low in total publishing but have higher levels of English-language or peer-reviewed publishing (Australia, Canada, Norway, UK). Only Hong Kong, and to a lesser extent Italy, stood out as countries with uniformly high levels

of publishing productivity across all categories. To some extent USA was low across all categories, though this was somewhat reduced when examining English-language or peer-reviewed publications after controlling for workforce characteristics. On the other hand, it could be argued that academics in many of the highly publishing non-English speaking countries are more productive *because* they publish for multiple audiences. For example, not only do academics in Germany or Korea publish a similar number of English-language and peer-reviewed publications as their American counterparts, they also publish widely in their local language and in non-peer reviewed outlets. Furthermore, certain research publications will be relevant only to a domestic audience in their local language or in a non-peer reviewed format, particularly books in the humanities or some social sciences. Therefore, restricting measured research output to peer-reviewed or English-language publishing is a blunt approach to quantifying publishing productivity, even if these choices offer a partial explanation for why academics in some countries publish more than others.

Finally, measurement of individual-level publishing productivity involves methodological choices, each with their own trade-offs and impacts on country-level comparisons. Depending on the types of publications and workforce characteristics included, countries performed differently in relative publishing productivity. This was evident in this study primarily because the self-reported data included more individual-level detail than is typically available in traditional bibliometric databases. The downside of attempting to capture publishing in its totality across all disciplines via self-reports is that it invariably includes a degree of inaccuracy and variability in the quality or originality of publications included. It also adds subjectivity based on how publications of certain types are weighted (or not weighted). In some ways this is the opposite of the trade-offs provided by traditional bibliometric databases. Such databases offer clearer, more accurate and verifiable estimates of published output, but individual-level publishing productivity can only be interpreted narrowly across countries due to inconsistent coverage and lack of information on individual-level attributes.

Appendix

See Tables 4 and 5

Table 4 Independent variable means by country

Country	AUS	CAN	CHI	FIN	GER	HK	ITA	KOR	NOR	UK	USA
Male (%)	54.4	58.4	67.8	55.7	74.6	68.3	67.0	82.0	68.4	51.8	57.4
Experience (years)	14.0	13.3	12.0	12.3	12.0	14.8	17.0	13.8	19.4	13.4	17.0
Experience squared	291.1	282.0	211.0	240.5	255.2	301.0	436.3	264.8	484.0	284.1	428.3
PhD (%)	77.9	93.0	45.1	63.4	76.7	89.3	48.2	97.8	77.5	81.1	84.9
Research collaboration (%)	87.5	86.7	76.1	90.2	72.7	83.4	83.4	75.6	83.5	84.5	82.8
Research hours	17.4	19.8	20.2	20.9	22.5	20.5	21.7	21.2	17.0	18.2	18.6
Research interest (1–4)	2.9	2.8	2.5	3.0	3.0	2.8	2.9	2.7	3.0	3.0	2.6
Teaching hours	15.5	16.4	19.6	14.8	12.3	16.1	15.5	17.3	17.6	15.1	15.1
Admin and service hours	12.9	11.3	8.7	7.2	11.5	12.7	7.2	10.7	9.7	11.0	12.8

Table 4 continued

Country	AUS	CAN	CHI	FIN	GER	HK	ITA	KOR	NOR	UK	USA
Research support (1–5)	3.6	3.3	3.2	3.8	3.6	3.7	3.2	3.1	3.8	3.2	3.5
Social sciences (%)	33.9	38.2	24.9	29.7	23.7	44.1	21.5	37.6	31.4	33.7	34.6
Humanities (%)	14.3	17.4	9.6	13.8	9.7	20.5	11.5	16.6	15.7	20.8	22.8
Nat. sciences (%)	23.1	21.7	34.0	26.3	30.8	12.3	39.4	20.2	24.7	18.7	19.5
Technology (%)	6.7	8.3	28.7	14.9	19.1	8.8	16.6	17.9	9.0	9.3	9.4
Medicine (%)	22.1	14.4	2.9	15.4	16.8	14.2	11.0	7.9	19.2	17.5	13.8

Table 5 OLS results for square root transformed article equivalents (M7), English language (M8), and peer reviewed publishing (M9)

	M7		M8		M9	
	B	S.E.	B	S.E.	B	S.E.
(Constant)	−1.24**	0.17	−2.14**	0.17	−1.96**	0.18
Australia	0.51**	0.09	0.91**	0.10	0.96**	0.11
Canada	0.30**	0.08	0.37**	0.09	0.86**	0.10
China	1.69**	0.09	N/A	N/A	N/A	N/A
Finland	0.71**	0.10	0.22*	0.10	0.67**	0.11
Germany	0.74**	0.09	0.02	0.10	0.48**	0.10
Hong Kong	0.64**	0.10	0.96**	0.11	1.18**	0.12
Italy	1.61**	0.08	0.81**	0.08	1.14**	0.08
Korea	1.59**	0.09	0.08	0.09	0.83**	0.10
Norway	0.60**	0.10	0.49**	0.11	0.95**	0.12
UK	0.42**	0.10	0.82**	0.10	0.87**	0.11
USA	N/A	N/A	0.49**	0.10	0.56**	0.10
Humanities	0.18**	0.06	0.06	0.06	−0.05	0.06
Nat. Sciences	−0.25**	0.05	0.75**	0.05	0.40**	0.06
Technology	−0.31**	0.06	0.48**	0.06	0.05	0.07
Medicine	0.26**	0.06	0.90**	0.06	0.66**	0.07
Male (%)	0.24**	0.04	0.21**	0.01	0.23**	0.04
Experience	0.07**	0.01	0.05**	0.00	0.05**	0.01
Experience squared	−0.00**	0.00	−0.00**	0.04	0.00**	0.00
PhD (%)	0.71**	0.05	0.74**	0.05	0.57**	0.05
Research collaboration (%)	0.38**	0.05	0.36**	0.05	0.42**	0.06
Research hours	0.03**	0.00	0.02**	0.00	0.02**	0.00
Research interest (1–4)	0.35**	0.03	0.41**	0.03	0.39**	0.03
Teaching hours	0.00	0.00	0.00	0.00	−0.01*	0.00
Admin and service hours	0.02**	0.00	0.02**	0.00	0.02**	0.00
Research support (1–5)	0.00	0.02	0.06*	0.03	0.03	0.03
Adj R-Square	0.24		0.24			0.19
n	6,383		6,092			6,091

Note: Statistical significance * $p < 0.05$ ** $p < 0.01$; USA and social sciences as reference categories in M7, China and social sciences as reference categories in M8–M9

References

Abramo, G., D'Angelo, C., & Cicero, T. (2012). What is the appropriate length of the publication period over which to assess research performance? *Scientometrics, 93*(3), 1005–1017. doi:10.1007/s11192-012-0714-9.

Altbach, P. G. (Ed.). (1996). *The international academic profession: Portraits of fourteen countries*. San Francisco: Jossey-Bass Publishers.

Bentley, P. J. (2012). Gender differences and factors affecting publication productivity among Australian university academics. *Journal of Sociology, 48*(1), 85–103. doi:10.1177/1440783311411958.

Bentley, P. J., & Kyvik, S. (2011). Academic staff and public communication: A survey of popular science publishing across 13 countries. *Public Understanding of Science, 20*(1), 48–63. doi:10.1177/0963662510384461.

Bentley, P. J., & Kyvik, S. (2012). Academic work from a comparative perspective: a survey of faculty working time across 13 countries. *Higher Education, 63*(4), 529–547. doi:10.1007/s10734-011-9457-4.

Bentley, P. J., & Kyvik, S. (2013). Individual differences in faculty research time allocations across 13 countries. *Research in Higher Education, 54*(3), 329–348. doi:10.1007/s11162-012-9273-4.

Bland, C. J., Center, B. A., Finstad, D. A., Risbey, K. R., & Staples, J. G. (2005). A theoretical, practical, predictive model of faculty and department research productivity. *Academic Medicine, 80*(3), 225–237.

Clark, M., & Centra, J. (1985). Influences on the career accomplishments of Ph. D'.s. *Research in Higher Education, 23*(3), 256–269.

Cole, J. R., & Cole, S. (1973). *Social stratification in science*. Chicago: University of Chicago Press.

Creamer, E. (1998). Assessing faculty publication productivity: Issues of equity (ASHE-ERIC Higher Education Report No. 26). Washington D.C.: ASHE-ERIC/George Washington University.

Cummings, W. K., & Finkelstein, M. J. (2012). Comparing the research productivity of US academics scholars in the changing American academy. In (Vol. 4, pp. 51–62, The changing academy: The changing academic profession in international comparative perspective), Springer Netherlands.

Dundar, H., & Lewis, D. (1998). Determinants of research productivity in higher education. *Research in Higher Education, 39*(6), 607–631. doi:10.1023/a:1018705823763.

Enders, J., & Teichler, U. (1997). A victim of their own success? Employment and working conditions of academic staff in comparative perspective. *Higher Education, 34*(3), 347–372.

Fox, M. F. (1983). Publication productivity among scientists: A critical review. *Social Studies of Science, 13*(2), 285–305.

Fox, M. F. (1992). Research, teaching, and publication productivity: Mutuality versus competition in academia. *Sociology of education*, *65*(4), 293–305.

Fox, M. F. (2005). Gender, family characteristics, and publication productivity among scientists. *Social Studies of Science, 35*(1), 131–150.

Fox, M. F., & Mohapatra, S. (2007). Social-organizational characteristics of work and publication productivity among academic scientists in doctoral-granting departments. *The Journal of Higher Education, 78*(5), 542–571.

Gingras, Y., Lariviere, V., Macaluso, B., & Robitaille, J.-P. (2008). The effects of aging on researchers' publication and citation patterns. *PLoS ONE, 3*(12), e4048.

Harzing, A.-W. (2013). A preliminary test of Google Scholar as a source for citation data: a longitudinal study of Nobel prize winners. *Scientometrics, 94*(3), 1057–1075.

Hattie, J., & Marsh, H. W. (1996). The relationship between research and teaching: A meta-analysis. *Review of Educational Research, 66*(4), 507–542.

Katz, J., & Martin, B. (1997). What is research collaboration? *Research Policy, 26*(1), 1–18.

King, D. A. (2004). The scientific impact of nations. *Nature, 430*(6997), 311–316.

Kyvik, S. (1991). *Productivity in academia: Scientific publishing at Norwegian Universities*. Oslo: Norwegian University Press.

Kyvik, S. (2003). Changing trends in publishing behaviour among university faculty, 1980–2000. *Scientometrics, 58*(1), 35–48.

Kyvik, S. (2009). Allocating time resources for research between academic staff: The case of norwegian university colleges. *Higher Education Management and Policy, 21*(3), 109–122.

Kyvik, S., & Larsen, I. (1997). The exchange of knowledge: A small country in the international research community. *Science Communication, 18*(3), 238–264.

Kyvik, S., & Olsen, T. (2008). Does the aging of tenured academic staff affect the research performance of universities? *Scientometrics, 76*(3), 439–455.

Kyvik, S., & Teigen, M. (1996). Child care, research collaboration, and gender differences in scientific productivity. *Science, Technology and Human Values, 21*(1), 54–71.

Larsen, P. O., Maye, I., & von Ins, M. (2008). Scientific output and impact: Relative positions of China, Europe, India, Japan and the USA. *Collnet Journal of Scientometrics and Information Management, 2*(2), 1–10.

Lee, S., & Bozeman, B. (2005). The impact of research collaboration on scientific productivity. *Social Studies of Science, 35*(5), 673–702.

Leydesdorff, L., & Wagner, C. (2009). Is the United States losing ground in science? A global perspective on the world science system. *Scientometrics, 78*(1), 23–36.

Long, J. (1992). Measures of sex differences in scientific productivity. *Social Forces, 71*(1), 159–178.

Marsh, H. W., & Hattie, J. (2002). The relation between research productivity and teaching effectiveness: Complementary, antagonistic, or independent constructs? *Journal of Higher Education*, *73*(5), 603–641.

Mishra, V., & Smyth, R. (2012). Are more senior academics really more research productive than junior academics? Evidence from Australian law schools. *Scientometrics*, *96*(2), 411–425.

Neate, P. (2012). Publishing ethics and intellectual property rights. In A. Youdeowei, P. Stapleton, & R. Obubo (Eds.), *Scientific writing for agricultural research scientists: A training resource manual* (pp. 161–168). Wageningen, The Netherlands: CTA.

Ramsden, P. (1994). Describing and explaining research productivity. *Higher Education, 28*(2), 207–226.

RIHE (Ed.). (2008). The changing academic profession in international comparative and quantitative perspectives. (Vol. 12, RIHE International Seminar Reports). Hiroshima: Research Institute for Higher Education, Hiroshima University.

Rosser, V. J., & Tabata, L. N. (2010). an examination of faculty work: Conceptual and theoretical frameworks in the literature. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 25, pp. 449–475). Dordrecht: Springer.

Rostan, M., Finkelstein, M., & Huang, F. (2014). Concepts and Methods. In The internationalization of the academy: Changes, realities and prospects (pp. 23–36, The changing academy: The changing academic profession in international comparative perspective 10). Dordrecht: Springer.

Sax, L., Hagedorn, L., Arredondo, M., & DiCrisi, F. (2002). Faculty research productivity: Exploring the role of gender and family-related factors. *Research in Higher Education, 43*(4), 423–446.

Schuckit, M. A. (1997). Editor's corner: Double publishing: A dilemma of language. *Journal of Studies on Alcohol and Drugs, 58*(3), 229–230.

Sheehan, B., & Welch, A. (1996). The Australian academic profession. In P. G. Altbach (Ed.), *The international academic profession: Portraits from fourteen countries* (pp. 51–94). Carnegie Foundation: Princeton.

Stephan, P. E., & Levin, S. G. (1992). *Striking the mother lode in science: The importance of age, place, and time*. New York: Oxford University Press.

Teodorescu, D. (2000). Correlates of faculty publication productivity: A cross-national analysis. *Higher Education, 39*(2), 201–222.

Verleysen, F., & Engels, T. E. (2014). Internationalization of peer reviewed and non-peer reviewed book publications in the Social Sciences and Humanities. *Scientometrics*, 1–14, doi:10.1007/s11192-014-1267-x.

Ward, K., & Grant, L. (1996). Gender and academic publishing. In J. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 11, pp. 172–222). New York: Agathon Press.

Xie, Y., & Shauman, K. (1998). Sex differences in research productivity: new evidence about an old puzzle. *American Sociological Review, 63*(6), 847–870.

Zhou, P., & Leydesdorff, L. (2006). The emergence of China as a leading nation in science. *Research Policy, 35*(1), 83–104.

Zuckerman, H. (2001). The careers of men and women scientists: gender differences in career attainment in studies. In M. Wyer (Ed.), *Women, science and technology: A reader in feminist science* (pp. 69–78). New York: Routledge.