Scientometrics (2014) 98:369–385
DOI 10.1007/s11192-013-1015-7

Impact of bibliometric studies on the publication behaviour of authors

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Received: 7 January 2013 / Published online: 30 April 2013

Abstract It has been widely discussed how individuals change the way they act and react in studies just because they are under observation. In this paper, we try to analyse how this so-called Hawthorne effect applies to researchers that are the subject of bibliometric investigations. This encompasses individual assessments as well as international performance comparisons. We test various bibliometric indicators for notable changes in the last decade from a world-wide perspective and deduce explanations for changes from the observations. We then concentrate on the behaviour of German authors in particular, to show national trends. The German publication behaviour is evaluated in regard to citation rates and collaborations in publications and size, publisher country and impact of the journals chosen for publication. We can conclude that authors adapt their publication behaviour to aim for journals that are more internationally known and have a US publisher. Also, a trend from more specialized journals to journals with a broader scope can be observed that raises the question whether the implicit penalization of specialized fields in the bibliometrics leads to undesired shifts in conducted research.

Keywords Bibliometrics · National studies · Research evaluation · Author behaviour · Hawthorne effect

Introduction

It has been confirmed in the social sciences that subjects under observation change their behaviour, making a genuine observation of their behaviour almost impossible. This phenomenon, called Hawthorne effect (Jones 1992), is more pronounced in cases where the results of the observation have consequences for the observed subjects. In the science

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system a major example is the increasing use of bibliometrics for evaluation purposes and its consequences for the analyzed subjects. The influence of the outcome of bibliometric analyses on science funding in countries such as Australia, Norway, the UK or Spain led to a change of behaviour of scientific authors with positive and inadvertent counter-productive consequences (Weingart 2005; Bornmann 2011; Butler 2003; Schneider 2009; Evidence Ltd 2007; Jimenez-Contreras et al. 2002). However, even in a broader set of countries, in which such a direct link of scientific activity and funding might not always exist, steadily increasing citation rates can be observed in most cases. Apparently, authors change their behaviour world-wide and the question arises whether an objective comparison of the country performance in terms of publications and citations is still possible. A further question is by which mechanisms a country-wide adaption to the better fulfilment of the bibliometric metrics can be achieved.

This paper describes first the world-wide changes in publication behaviour at an aggregate level. Then the change of the behaviour of German authors is examined in more detail.

Methodology and data

The bibliometric analyses are conducted on the Web of Science, which is provided by Thomson Reuters. Subparts of this database are the Science Citation Index Expanded (SCIE) as well as the Social Science Citation Index (SSCI). Both form a multi-disciplinary database with a broad coverage of fields including natural and engineering sciences, the medical and life sciences as well as the social sciences.

We used a citation window of three years to calculate citation rates. Thus, the citations of the respective publication year of the article are considered as well as those of the two subsequent years. In principle, other studies use citation windows of five years. From a methodological perspective, these figures are certainly more precise, but they do not allow for really topical results. As Adams pointed out, early citation rates reflect the overall citation rate of a publication well (Adams 2005). Also, there is no bias due to variability of citedness (cf. Aksnes and Sivertsen 2004). For this reason citation windows of three years were used in the present context.

For publications with authors from multiple countries, each author country was counted as one publication for each of these countries. This corresponds to the argumentation by Moed that publications of a country should not count less just because more foreign authors were involved in the writing process (Moed 2005). Furthermore, the number of citations were computed without self-citations (cf. Aksnes 2003; Glänzel et al. 2004).[1]

In citation analysis, the use of field normalisation is a broadly accepted standard to cope with different citation behaviours in different fields. In this context, the most frequent approach is standardizing the observed citation rates with field- or discipline-specific average citation rates. This field-specific average value is determined by calculating the average citation rate for all publications in journals belonging to the field of the publication considered (van Raan 2004).

This field- or discipline-specific standardization is—without any doubt—a substantial improvement on the consideration of pure citation rates. However, it does not take into account that the databases by Thomson Reuters primarily cover publications by American authors as well as American publishers (cf. Fig. 1). These publications achieve especially

[1] For more methodological details cf. Schmoch et al. (2012).

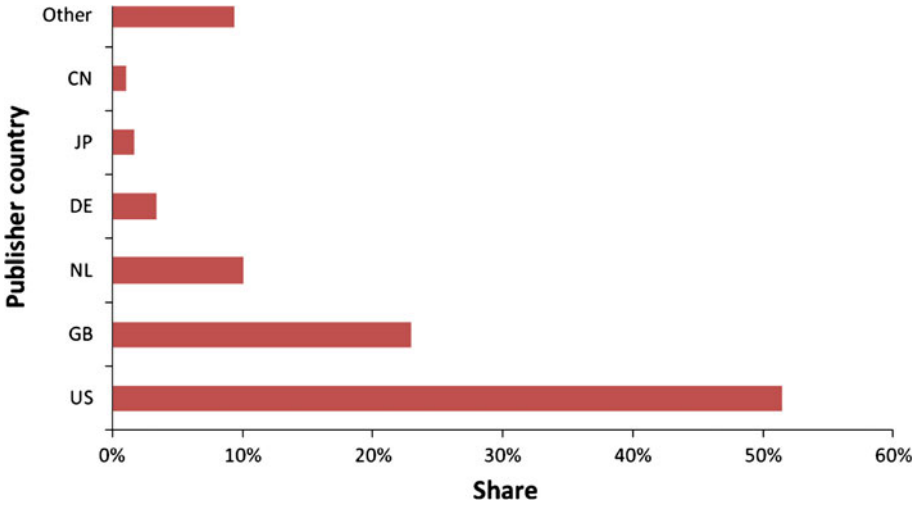

Fig. 1 Share of publications in the Web of Science by publisher country, 2010. *Source* Web of Science, searches and calculations by the authors

higher citation rates because in general citations are received more often from authors from the same country (Gondal 2011). Also, US journals tend to have a broad readership and good visibility. Figure 2 shows the citation rate for four countries (including the US) and worldwide in comparison. The general dominance of US publications can be observed even after the database enhancement. For this analysis, we used the publisher countries recorded in the Web of Science referring to the head quarter of the publishers. Although many publishers have subsidiaries in other countries, in particular in the US, they do not achieve the citation level of US-based journals. A similar difference between the citation rates of US and non-US journals was found by Mueller et al. (2006).

Consequently, the average values of citation rates and other bibliometric indicators (for all disciplines) are dominated by American standards. As a result, the citation rates for domestic non-US-journals are lower than those for US (domestic) ones because of the lower dissemination, the smaller readership and the smaller community (at least in terms of language if not of interest, e.g. in the case of Law). It has to be asked whether such a reference is appropriate for countries like Germany, France or Spain that have a relatively large community and thus many publications in the domestic language (see, e.g., Van Leeuwen et al. 2001). Even after appliance of standardization methods (like field normalization of citation rates) a publication (set) in a domestic journal will come off worse in a direct comparison with one in a US journal. However, one might argue that science needs diversity and also smaller communities and thus, the favouring of one kind of publication output might always hinder the knowledge creation process on the large scale.

A second problem is the enhancement of data coverage of SCIE and SSCI for which a number of very small journals was added (Michels and Schmoch 2011). Small, specialized journals have a smaller readership and therefore have lower citation rates than big, mainstream ones.

Figure 3 shows the citation rates for all publications in our dataset in 2008 differed by the size of the journal they appeared in. For this, we built five groups, i.e. the quintile of the journals according to page size. The page length underlying this classification and analysis

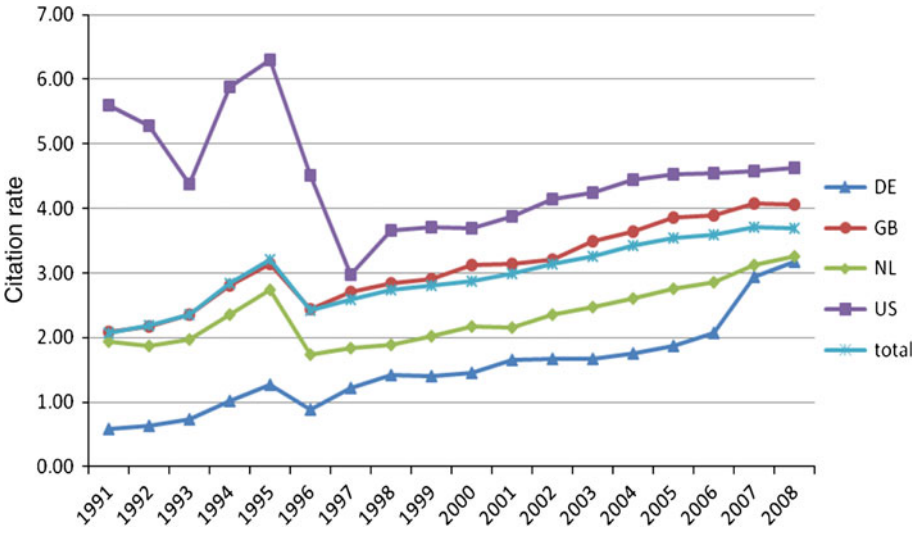

Fig. 2 Citation rate for publications in German (DE), British (GB), Dutch (NL) and American (US) journals in comparison with the total citation rate in our data set. *Source* Web of Science, searches and calculations by the authors

was calculated based on the page size information in the Web of Science. In addition to the citation rate of all publications, we distinguish between four publication countries: Germany, Great Britain, the Netherlands and the USA. Even though the levels of citation rates vary for the different publishing countries, the trend of diminishing citation rates for diminishing journal size is ubiquitous. To corroborate this notion, we conducted an unpaired *t* test with the distribution of citation rates per journal in the first and the fifth quantile, i.e. for the smallest and the biggest journals in our distribution. Values for means and standard deviation account for $\mu \approx 3.81$ and $\sigma = 25.66$ for the big journals and $\mu \approx 1.30$ and $\sigma = 7.97$ for the small journals. The two-tailed P value was less than 0.0001 showing a statistically significant difference for the two distributions which accounted for approximately 15,000 observations each.[2] Thus, smaller journals indeed attract fewer citations, which indicates that they might be more specialized than bigger ones and thus attract a smaller readership.

To verify the thesis that smaller journals are more specialized than big ones, we looked at two sets of 100 randomly selected journals of the fifth and first quintiles in more detail (Fig. 4). The analysis was conducted by two experts independently from each other. In the fifth quantile the number of annual pages[3] of the journals lies between 201 and 9,362 pages, in the first quintile page size is 76 pages or less.[4] Thus the number of pages in the first quintile is distinctly smaller than in the fifth one. This analysis revealed two major reasons for the limited volume of small journals: the specialisation in terms of scientific content and the limited international relevance. We classified the journals in the categories "specialized" and "broad coverage". Examples for the three categories are the journals

[2] However, the high standard deviation values indicate that there are also some exceptions to this rule where the citation rate is extremely high in both cases.

[3] I.e. of all volumes that were covered in the Web of Science for the publication year 2008.

[4] The median of the first quintile is 56.42 pages and the median of the fifth quintile is 329.94. The overall median in the set of 66,615 journals is a page size of 152.38.

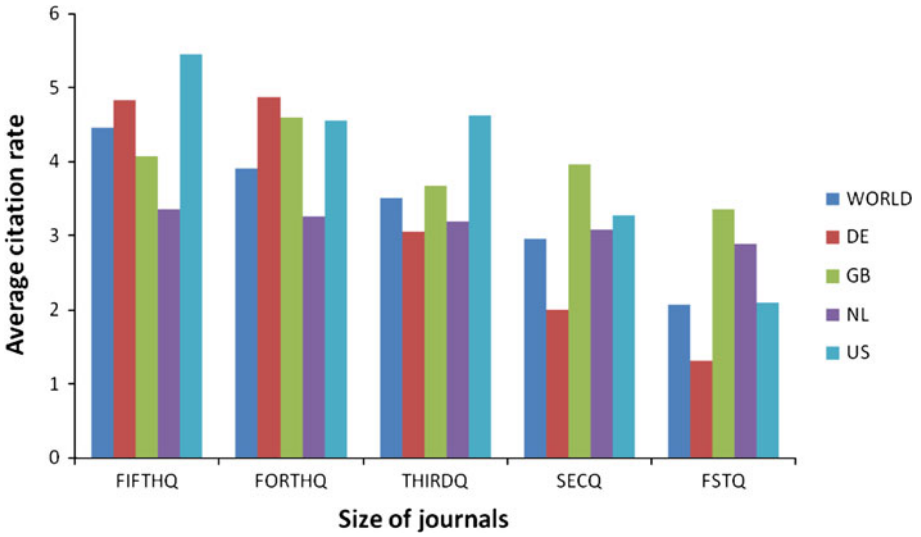

Fig. 3 Citation rate of publications in journals of different sizes (page length). Journals were grouped by their size in five quintiles, with the smallest journals in the first quintile. *Source* Web of Science, searches and calculations by the authors

"Ultrasound in Obstetrics & Gynaecology",and "Physical Review". Of course, the classification in one of the categories is to a certain extent sometimes arbitrary. However, the assessments the two experts are consistent as to the high share of specialised journals in the case of small journals and of broad coverage in big journals. The congruence of the expert assessment in the total sample of small and big journals was 82 %. Cohen's Kappa test leads to 0.61 which is generally classified as good inter-rater reliability. The strong trend that smaller journals are more specialised is obvious. There are some cases where small journals have broad field coverage. Here the international relevance is generally limited like in the "Journal of Contemporary Physics of the Armenian Academy of Sciences".

In consequence, the field average in recent years consists increasingly of a fluctuating mix of large and small journals which have quite different citation rates.

Grupp et al. (2001) suggested to use journal-specific expected citation rates Different citation rates within fields are taken into account by restricting the expected citation rates to the specific journal. This problem is discussed by various authors and one alternative solution is the normalization based on sources. Here, the citation rates are normalized with reference to the journal specific values. However, according to Waltman and Van Eck (2013) the journal-based normalization proves to be the less sumptuous alternative.

The derived indicator "Scientific Regard" (SR) shows whether the publications of a country/region are cited above or below average compared to the other articles in the respective journal (cf. Grupp et al. 2001). The indicator is calculated as follows:

$$SR_k = 100 \tanh \ln (OBS_k/EXP_k).$$

In this formula OBS_k refers to the actual observed citation frequency of publications of country *k*. EXP_k is the expected citation rate resulting from the average citation frequency of the journals where the authors of this country published their papers. Here positive indices show above-average citation rates; values of 0 represent a citation rate that is equivalent to the average citation rate of the journals in which the articles are published.

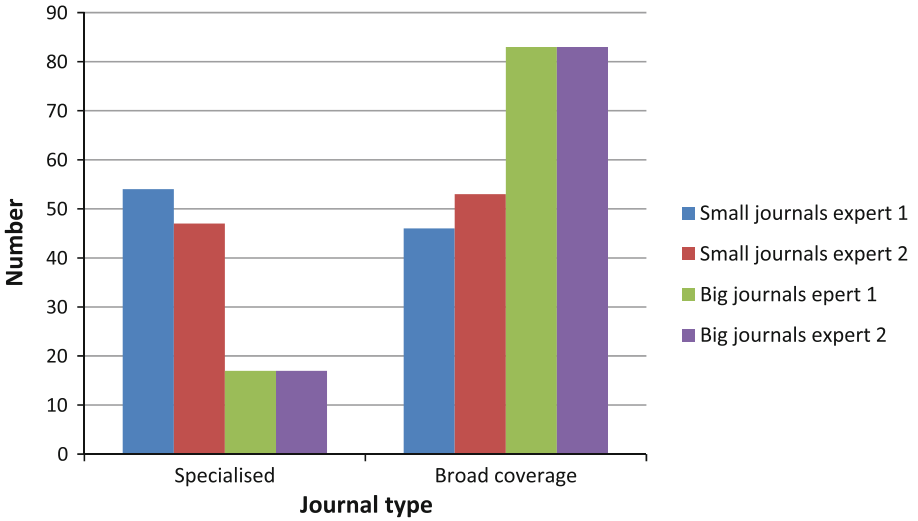

Fig. 4 Classification of samples of small and big WoS journals by specialization, 2008. *Source* Web of Science, searches and calculations by the authors

The differences induced by the calculation of field- and journal-specific expected citation rates are illustrated in Table 1. In the analysis, the USA obtains a field-specific index (F index) of 1.41 compared to a journal-specific index (J index) of 1.15. For Germany, this implies values of 1.31 respectively 1.19. The J indices are mostly lower than the F indices. However, it is decisive that the countries are affected differently. According to the F index, the USA has a rank of 3 and a J index rank of 9. Germany has a rank of 8 according to the F index and a rank of 4 according to the J index. This reflects the improved consideration of the language bias by the J index. Smaller countries, such as the Netherlands where the authors have a generally stronger orientation towards English-language journals, are less affected by the differences between the F and the J index in any case.

For the purpose of illustration, the observed citation rates are documented in Table 2 as well. These would again imply a different ranking, in particular in favour of the USA. Then the good position of the USA could be linked to a pure size effect: Without putting the citation rates in relation to the field- or journal-specific expected citation rates, it becomes apparent that the USA employ a high number of researchers living in this language area who cite each other extensively. It has to be taken into account that the USA have some excellent universities, but also many less research-active ones, so that the lower average position with regard to the F or J indices appears to be adequate.

A second indicator in this context, the "International Alignment (IA)", shows whether the authors of a country publish in internationally more or less visible journals, compared to the world average. A high share of publications in internationally visible journals documents an intensive participation in the international scientific discourse. Similarly to the SR index, positive values point to an above-average orientation. Values of 0 correspond to the world average. The IA index is calculated as follows (cf. Grupp et al. 2001):

$$\mathrm{IA_k} = 100 \tanh \ln \left(\mathrm{EXP_k}/\mathrm{OBS_w}\right).$$

The same definitions as for the SR index apply. The index *w* refers to the world in total.

Table 1 Indices of expected citation rates according to different definitions for selected countries for all fields, 2007

Country	J index	F index	Obs. cit.rate	Rank J index	Rank F index	Rank obs. cit. rate
Switzerland	1.26	1.59	6.2	1	1	1
Finland	1.20	1.34	4.8	2	6	8
Netherlands	1.20	1.52	5.8	3	2	2
Germany	1.19	1.31	4.8	4	8	6
Great Britain	1.19	1.37	5.1	5	4	5
Sweden	1.17	1.37	5.2	6	5	4
France	1.16	1.26	4.5	7	9	9
Canada	1.16	1.32	4.8	8	7	7
USA	1.15	1.41	5.5	9	3	3
Italy	1.14	1.21	4.4	10	10	10
China	1.10	0.83	2.8	11	13	13
Korea	1.04	0.88	3.0	12	12	12
Japan	1.01	0.96	3.5	13	11	11

J index relation of observed to journal-specific expected citation rates, *F index* relation of observed to field-specific expected citation rates

Source Web of Science, searches and calculations by the authors

Table 2 Observed average citation rates for selected countries and regions in the SCIE and the SSCI without self-citations

Country/region	2000	2001	2002	2003	2004	2005	2006	2007	2008	Relation 2008/2000
USA	4.6	4.8	5.0	5.1	5.3	5.4	5.4	5.6	5.6	1.22
Japan	2.7	2.8	2.9	2.9	3.2	3.3	3.4	3.5	3.6	1.33
Germany	3.5	3.8	4.0	4.1	4.3	4.6	4.6	4.9	5.1	1.46
Great Britain	3.8	3.9	4.3	4.3	4.6	4.8	4.9	5.2	5.4	1.42
France	3.3	3.5	3.6	3.7	3.9	4.1	4.2	4.6	4.6	1.39
Switzerland	5.2	5.4	5.6	5.4	5.9	6.3	6.1	6.3	6.7	1.29
Canada	3.8	3.8	4.0	4.2	4.4	4.5	4.7	4.9	5.0	1.32
Sweden	3.9	4.1	4.3	4.5	4.8	5.0	5.1	5.3	5.5	1.41
Italy	3.3	3.3	3.7	3.6	3.9	4.2	4.2	4.4	4.5	1.36
Netherlands	4.2	4.4	4.6	5.1	5.2	5.4	5.5	5.9	5.9	1.40
Finland	3.9	3.7	4.2	4.0	4.2	4.3	4.6	4.9	5.2	1.33
South Korea	2.0	2.1	2.2	2.4	2.6	2.7	2.8	3.0	3.1	1.55
China	1.3	1.5	1.7	2.0	2.2	2.4	2.5	2.9	3.1	2.38
Brazil	1.6	1.6	1.9	1.9	2.0	2.4	2.3	2.3	2.2	1.38
India	1.2	1.2	1.5	1.5	1.8	2.0	2.2	2.2	2.3	1.92
South Africa	1.9	2.0	1.9	2.3	2.6	2.8	3.1	2.9	3.3	1.74
EU15 countries	3.2	3.3	3.5	3.7	3.9	4.1	4.1	4.3	4.4	1.38
EU12 countries	1.6	1.8	1.9	2.0	2.2	2.3	2.5	2.5	2.3	1.44
EU27 countries	2.9	3.0	3.2	3.3	3.5	3.7	3.8	3.9	3.9	1.34
World	2.9	3.0	3.1	3.3	3.4	3.5	3.6	3.7	3.7	1.28

Source Web of Science, searches and calculations by the authors

In any case, the usage of journal-specific instead of field-specific expected citation rates allows for a better analysis and interpretation of citation rates via the SR and IA indices. We can examine whether they are based on scientifically valuable publications or the (strategic or unintentional) placement of publications in internationally highly visible journals.

Change of citation levels on a worldwide scale

In a time series of observed citation rates for various countries and regions (Table 2) for the publication years 2000 to 2008, a steady increase for all countries considered can be stated. Since the world-wide average of the citation rate grew by 28 percent, the growth rate for the USA appears to be moderate at 22 percent. For Germany the highest growth rate among the industrialised countries of 46 percent could be observed. China showed the highest growth rate among threshold countries world-wide of 138 percent.

In contrast, the SR index paints a different picture in contrast to that of the observed citation rates (Table 3). For this citation index, the change between 2000 and 2008 appears to be less dramatic, a certain decrease for the USA, Great Britain, Switzerland, Canada and others can be observed, while an increase for Germany and Italy and in particular for the threshold countries is notable. The threshold countries diminished the gap to the world average. South Africa and China even exceeded the world average in 2008 despite their low starting values in 2000.

Table 3 Index of the journal-specific Scientific Regard (SR) for selected countries and regions in the SCIE and SSCI without self-citations

Country/region	2000	2001	2002	2003	2004	2005	2006	2007	2008
USA	9	9	9	8	8	8	7	7	7
Japan	−6	−5	−8	−9	−7	−8	−7	−7	−8
Germany	7	9	8	7	8	8	7	8	9
Great Britain	9	8	10	8	9	8	9	8	8
France	3	3	3	2	2	2	3	4	3
Switzerland	17	16	16	14	16	16	16	14	15
Canada	9	3	5	7	5	5	6	6	8
Sweden	9	9	11	11	11	10	11	8	8
Italy	−1	−2	3	−4	0	1	1	3	3
Netherlands	7	10	8	13	10	9	9	10	9
Finland	9	8	13	4	5	4	10	9	10
South Korea	−10	−9	−7	−4	−1	−3	−1	−3	−1
China	−21	−10	−9	−1	0	3	2	5	7
Brazil	−25	−27	−21	−20	−20	−12	−14	−12	−9
India	−23	−27	−18	−17	−15	−12	−8	−10	−7
South Africa	−9	−6	−13	−5	−3	−3	1	−4	5
EU15 countries	2	2	2	2	2	2	2	2	2
EU12-countries	−17	−11	−13	−11	−8	−9	−7	−3	−9
EU27 countries	0	0	0	0	0	0	0	0	0
World	0	0	0	0	0	0	0	0	0

Source Web of Science, searches and calculations by the authors

Table 4 Index of the International Alignment (IA) for selected countries and regions in the SCIE and SSCI without self-citations

Country/region	2000	2001	2002	2003	2004	2005	2006	2007	2008
USA	36	36	36	35	34	33	33	34	34
Japan	−1	0	−1	−1	1	0	0	2	5
Germany	14	13	14	16	16	18	19	20	23
Great Britain	18	18	21	21	21	23	22	25	28
France	10	12	10	11	11	14	13	17	18
Switzerland	39	40	38	35	38	38	36	38	41
Canada	18	20	19	19	19	19	20	22	22
Sweden	22	21	20	22	23	23	24	27	30
Italy	14	12	13	13	13	15	15	15	17
Netherlands	30	27	28	30	31	32	33	35	37
Finland	21	14	17	16	16	16	14	18	23
South Korea	−25	−28	−27	−27	−28	−25	−24	−16	−16
China	−54	−52	−48	−44	−43	−40	−37	−29	−24
Brazil	−29	−32	−30	−30	−31	−26	−28	−35	−39
India	−57	−55	−53	−52	−44	−44	−39	−40	−40
South Africa	−32	−32	−35	−29	−24	−19	−16	−20	−16
EU15 countries	9	9	10	10	10	12	12	13	15
EU12-countries	−38	−40	−36	−34	−34	−31	−29	−33	−36
EU27 countries	3	2	3	3	3	4	4	4	4
World	0	0	0	0	0	0	0	0	0

Source Web of Science, searches and calculations by the authors

Looking at the second indicator, the International Alignment (IA, Table 4), a general move towards internationally highly visible journals can be observed. This applies to industrialized countries such as Japan, Germany, Great Britain, Canada, Sweden, Italy and others. The major exceptions are the USA with a slight decrease and Switzerland with a weak increase only.

The combination of the SR and IA indexes reveal the reasons underlying the growth of the observed citation rates. For instance, the growth of the observed citation rates for France is related to a stagnation of the Scientific Regard, but a distinct improvement of the International Alignment. Thus, French authors do still receive only a little more citations than expected in the journals they publish in, but now choose internationally more visible journals. A similar observation can be made for Germany, for which the growth of the Scientific Regard is at least moderate, but the increase of the International Alignment is tremendous. In the case of China, the growth of the citation rates is linked to a relevant improvement of both the Scientific Regard as well as the International Alignment. Thus it proves to be illustrative to look at the combination of the SR and IA indexes for understanding the level of observed citation rates. In any case, a general move towards a higher International Alignment world-wide is obvious. In the next section we will analyze in detail how this increase in International Alignment is achieved for Germany.

Below we speak of various strategies the German authors might pursue to influence the citation rate of their articles. Therefore, we distinguish between different kinds of journals, especially small specialized journals in contrast to large, more versatile journals. We

separate these journals by their page numbers. Since a smaller journal attracts less readers–probably due to its narrower focus–citation rates can be influenced by this factor as well.

Change of behaviour of German authors

For many years, the observed citation rates of German authors have increased steadily over time in the Web of Science as described above (Table 2) and a more detailed analysis shows that this is primarily reflected in an increase of the IA index, an effect which can be noted for many other countries as well (Table 4). Thus, although the German citation rate improved steadily, Germany does not have a higher ranking with regard to citation rates in an international comparison. In order to understand the underlying reasons, it has to be taken into account that the bibliometric performance has become increasingly important for the individual careers of scientists in Germany and in other countries as well. For instance, when applying for a high academic position, it is the default procedure to submit publication lists, indicating either the citation rate or the Impact Factor of the journal in which the articles were published.[5] Thus, it follows naturally that scientists strive to improve their bibliometric performance and discuss appropriate strategies with their colleagues. Therefore, the overall increase in the German citation rate may be a mere side effect of an adaption by the German authors to a general change in science policy. It is noteworthy that the individual goals (e.g. publications in journals with a higher Impact Factor) and the individual means (e.g. submitting to more visible journals) might differ from this effect at the country level (e.g. higher citation rates). For the single author it is neither desirable nor observable what influence his change in submission/publication behaviour might have on the overall citation rates, especially since citation rates cannot be calculated in advance.

Also, a change in the submission/publication strategy might demand also a change in the publications' quality, since it is not possible to simply submit one's papers to another journal and then receive higher citation rates. Among others, the most profound adaption would be an increase in submission quality, since a more international, larger journal with an implicit larger readership also has more submissions.

As done in Schmoch et al. (2012), we assume that there are no methods to evaluate the quality of publications on a large scale, thus ruling out the general analysis of such an adaption.

Various means can be used in order to try to achieve higher citation rates:

(1) Submitting an article to a more general journal with a larger readership, thus to move from specialist to mainstream journals. Michels and Schmoch (2012) provided evidence that articles in larger journals (in terms of page numbers) are cited more frequently than smaller ones (see also Fig. 3 and the related reasoning). Since we assume, as explained above, higher submission rates for these journals as well, this would go hand in hand with a potential adaption of the submission itself.
(2) Submitting the articles to US-American journals, as these journals have a broader readership and are more highly cited than the world average (see Fig. 2).
(3) Submitting the article to a journal with a (current) high impact factor, i.e. journals which are highly cited independent of their nationality.

[5] In particular, in the medical sciences, the impact factor is generally asked, although the impact factor includes no information on the real citation rate of the respective article.

(4) Aiming at co-publications with highly cited authors, in particular American ones.

To verify the first hypothesis, the average number of pages of the journals in which German authors published their articles was analyzed. According to this, the average size of these journals steadily increased, in particular between 2001 and 2007 (Fig. 5). Thus, there is strong evidence for a trend towards mainstream journals and a move away from more specialized ones, but also, as shown above, a weak trend towards journals with higher international relevance. From the perspective of science policy, one might ask whether this side effect of a growing use of bibliometric indicators is really intended or even desirable. In this context, Bornmann argues that "the mainstream will align with the most important research questions in the field" (Bornmann 2011 p. 176), but we rather see an exclusion of specialised fields of research. This issue may be illustrated by an anecdote where a proposal to a founding agency was rejected by a reviewer putting forward the argument that the results of the project could be published "only" in Research Policy and not in a leading economic journal. However, Research Policy is leading in the specific field of innovation research.

Clear evidence can be found for attempting to increasingly publish in US journals. Looking at the share of publisher countries within the publications of German authors, a strong trend towards US journals can be observed in particular in the most recent years (Fig. 6). The sudden increase between 1997 and 1998 is due to a change in the database coverage and thus considered an artefact. The database coverage of the publisher information increased from 56.7 percent in 1997 of the publications having a publisher assigned to 95.8 percent in 1998 (see Table 5). Obviously, this change in coverage or additional information concerned especially US journals, since publications without that specific information were now mostly assigned to US publishers. However, the changes in the period between 2008 and 2010 are noteworthy with an increase of approx. 6 % of US

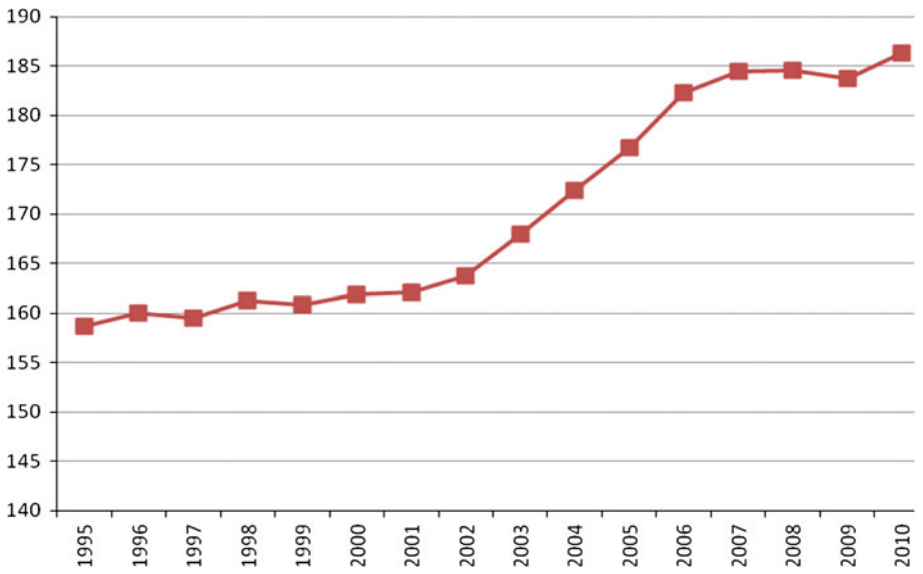

Fig. 5 Average annual number of pages of journals in which German authors published their articles. *Source* Web of Science, searches and calculations by the authors

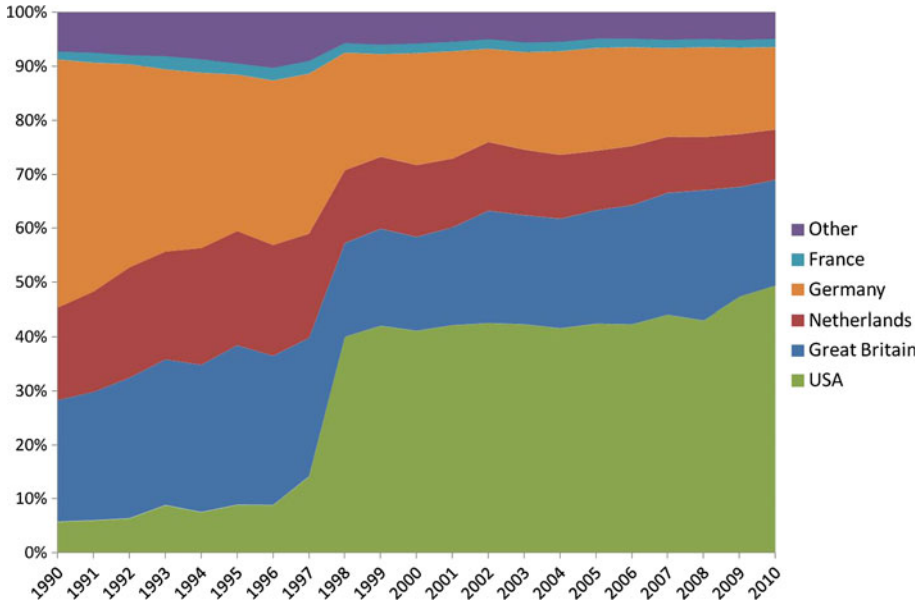

Fig. 6 Share of publisher countries within publications of German authors (staple diagram). *Source* Web of Science, searches and calculations by the authors

Table 5 Percentage of publications in the Web of Science with publisher country information

Publisher country	1997 (%)	1998 (%)
DE	3.74	4.14
GB	20.85	19.95
NL	9.43	10.06
US	8.68	47.64
Overall	56.70	95.77

Source Web of Science, searches and calculations by the authors

publications. The other countries in that period are either decreasing (Great Britain) or stable.

However, since 1998 the share of US journals has steadily increased by 20 percent in total, whereas the share of German journals has decreased by 30 percent during the same period. In addition, the share of British journals has increased by 10 percent. There are good reasons to focus on American journals, as the citation rate that German authors achieve there is the highest compared to other publisher countries (Fig. 7), as could be expected from generally higher citation rates in these journals (cf. Fig. 2). The citation rates in American journals are higher than those in British ones and much higher than in Dutch ones, although the Dutch journals are generally published in English.[6] Researchers from other countries seem to pursue a similar strategy so that American papers in US journals are displaced from their "own" journals by and by (Fig. 8).

It could be assumed that the move towards American journals is substantially slower in the social sciences, as here the domestic language and the analysis of domestic problems

[6] The main Dutch publisher is Elsevier.

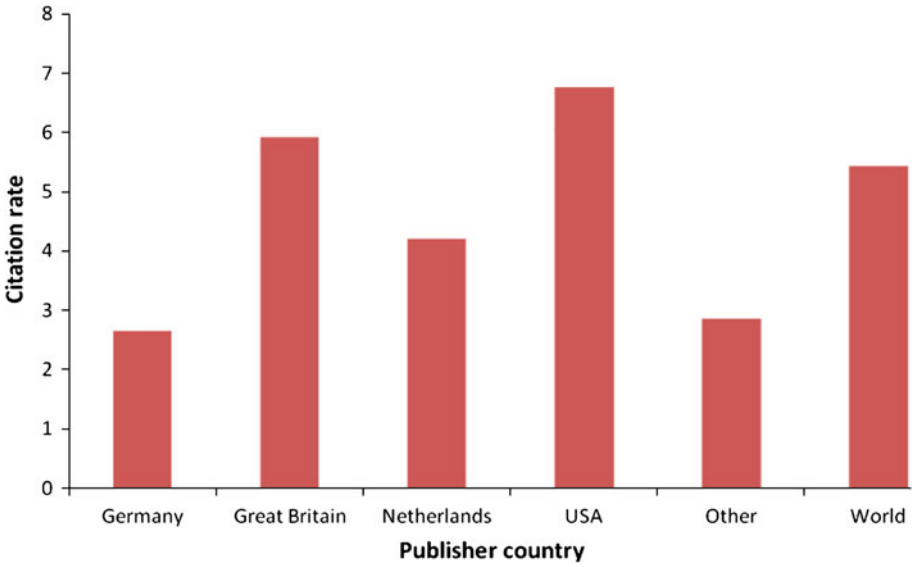

Fig. 7 Average citation rates of German authors by publisher country of the publishing journal in the SCIE, 2008. *Source* Web of Science, searches and calculations by the authors

may be more important than in the natural sciences. However, the German publications in the SSCI show a similar trend to those in the SCIE and achieve nearly the same share of American journals as the publications in the SCIE (Fig. 9). Of course, this observation only applies to articles covered by the SSCI, and the share of non-covered articles in the social sciences may be much higher than in the natural sciences.

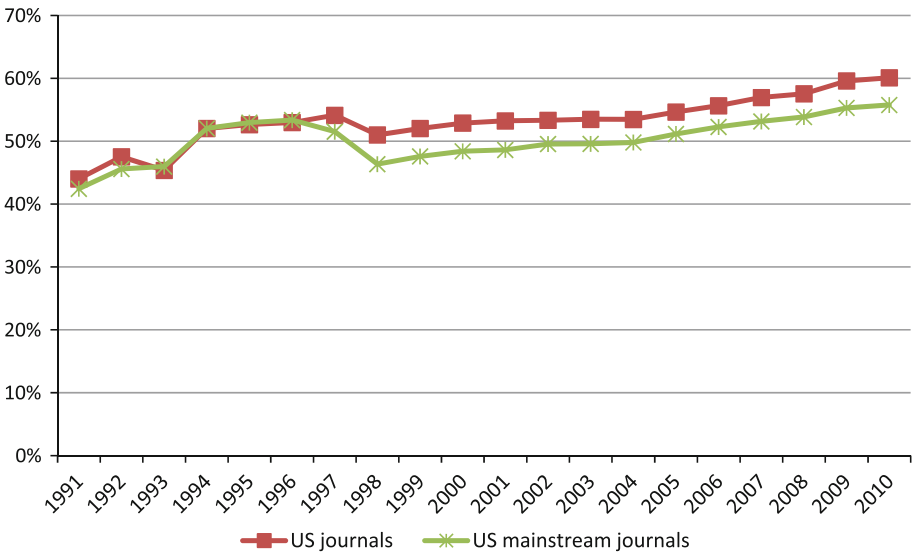

Fig. 8 Share of publications in US journals for which no author has an American affiliation. *Source* Web of Science, searches and calculations by the authors

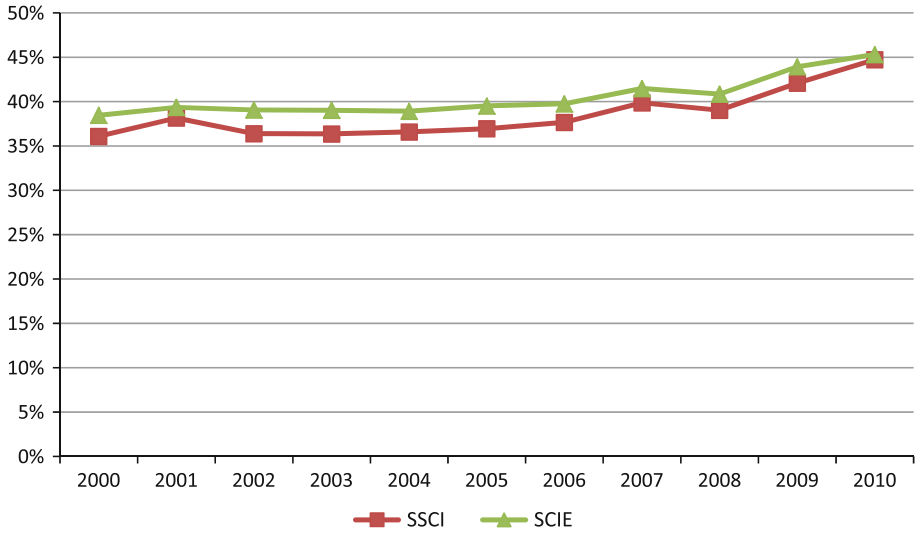

Fig. 9 Share of articles by German authors published in journals with the USA as publisher country. *Source* Web of Science, searches and calculations by the authors

In order to check the assumption that German authors submit their papers to journals with higher impact factors, the share of German papers within the top 10 percent of the highest cited journals in each field was determined (Fig. 10). The share of German articles in highly cited journals is very high, but is no longer increasing in a substantive way. In any

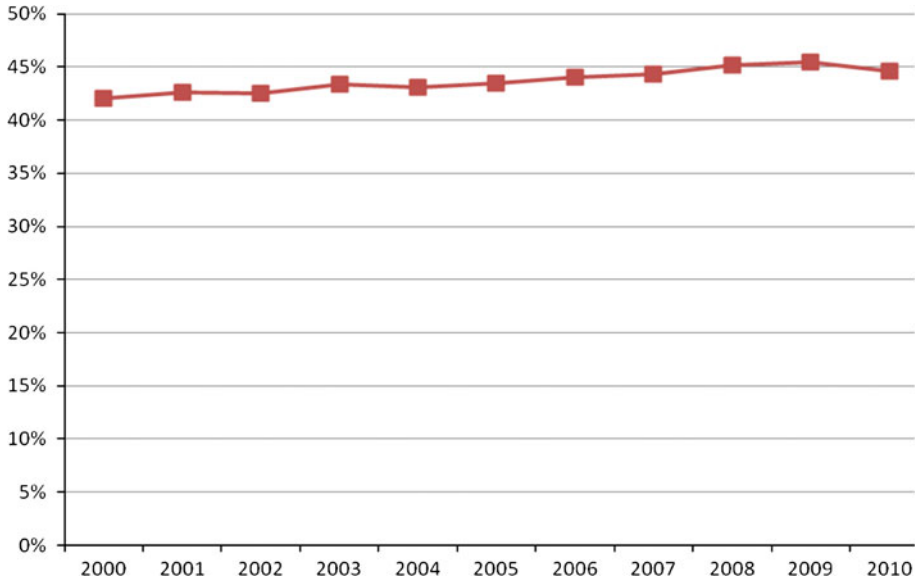

Fig. 10 Share of articles by German authors published in one of the 10 percent most highly cited journals per field. *Source* Web of Science, searches and calculations by the authors

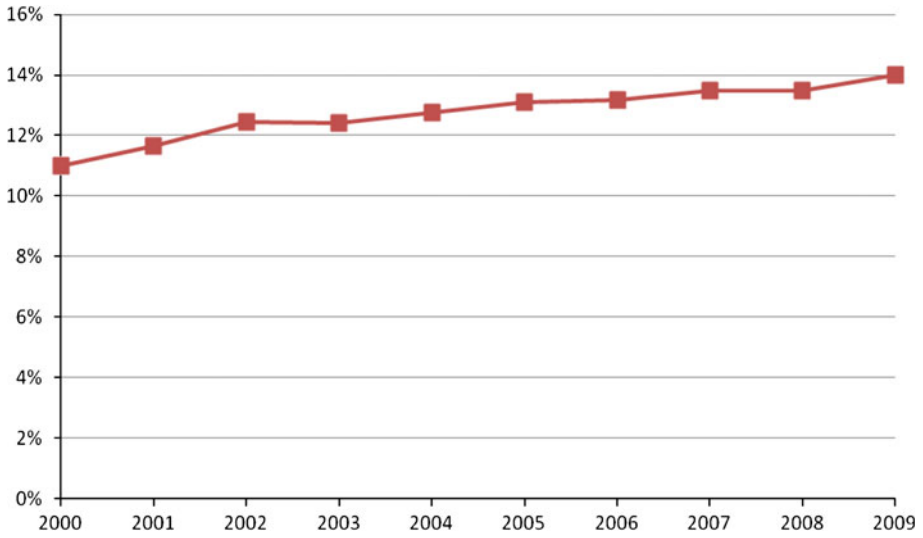

Fig. 11 Share of articles by German authors co-published with at least one American co-author. *Source* Web of Science, searches and calculations by the authors

case, this slow increase cannot explain the relevant growth of the IA index since the year 2000.

As a last hypothesis, we checked the share of co-publications with American authors. In general, the number of German publications in the SCIE grew by 30 percent between 2000 and 2010. In the same period, the number of co-publications with American authors increased by 73 percent. In total, the share of co-publications with American authors rose from 11.0 to 14.7 percent (Fig. 11). In consequence, an inert but noteworthy move towards co-authorships with Americans can be observed.

Conclusions

All in all, German authors have substantially changed their behaviour in the last 20 years. In the early 1990s, they already attempted to have their articles published in journals with a high Impact Factor. In later years, in particular between 2000 and 2007, they moved from specialized to more mainstream journals, Also, the strong upward trend of the average citation rates linked to a growth of the IA index might merely be a result of a growing share of articles published in US and mainstream journals and co-published with American researchers. It must be mentioned that this change has not affected the SR index in a negative way. Thus German authors achieve a high Scientific Regard also in journals with a high Impact Factor. As a general statement, German authors seem to adapt to the requirements of bibliometrics on various levels. The effect of a better representation in internationally highly visible journals—leading to higher citation rates in turn—may be intended, as it promotes the inclusion in international discourses. The trend towards mainstream journals may be assessed as counter-productive for the science system, although a slightly better international relevance is achieved.

As to the comparison of countries, the general increase of the International Alignment does not invalidate international comparisons, since all countries show a similar behaviour and the ranking is therefore not affected. In the long run, countries with a large domestic language basis will improve relatively to smaller countries which already now have a strong orientation towards US journals, as their potential of a further move towards US journals is limited. The big looser in terms of citation rates are yet the USA, as they are increasingly displaced from their own journals by the pressure of foreign authors (cf. Fig. 7).

The research for this paper shows that the simple association of highly cited journals with high quality needs more differentiation. The size or the publisher country of the journal are other factors influencing the level of the Impact Factor. However, of course there are also US journals with low and medium Impact Factors, and in various cases, non-US journals achieve high Impact Factors as well. With the general move towards high impact US journals, the publication profiles of countries will converge, so that the biases in country comparisons will become less important. However, in the present situation, they still play a relevant role.

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