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# **Bibliometric study in the disciplines Public Health and Epidemiology**

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# **Bibliometric study for German National Academy of Sciences Leopoldina in the disciplines Public Health and Epidemiology**

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June 2014



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# **1 Background and Methodology**

## **1.1 Background**

This study was conducted by the iFQ bibliometrics group on behalf of German National Academy of Sciences Leopoldina. It is intended for the Leopoldina working group on public health as a support instrument for their tasks of formulating recommendations with regards to the disciplines of public health and epidemiology in Germany, by providing quantitative data on the aspect of scholarly publications. Consequently, in the following sections descriptive statistics of German scientific output and impact are given. Advice on how to interpret the results of the analysis provided. The report covers the years 2000 to 2012 for output developments and 2000 to 2010 for impact assessment.

## **1.2 Discipline Delineation**

The data used in this study is taken from the publication and citation database Scopus. In the iFQ-headed project German Competence Centre for Bibliometrics the raw data was licensed and transferred into a custom relational database. It was furthermore enriched with additional data to make analyses specific to German contexts feasible and the data quality subjected to regular scrutiny and improvement.

A top-down approach is applied to define the scope of the disciplines under investigation. The All Science Journal Classification (ASJC) provided by Scopus is used as starting point to delimit the field of interest. The 128 journals in the category “Epidemiology” in ASJC are selected as the sources for the discipline *Epidemiology*. As for the discipline *Public Health*, the the journal classification of Science-Metrix (Archambault & Beauchesne, 2014) was used instead of the Scopus ASJC category “Public Health, Environmental and Occupational Health”, which was assessed as being not sufficiently specific. The Science-Metrix journal classification includes “Public Health” as a category, covering 163 journals, which were used as a starting point. The journal lists of the categories *Public Health* and *Epidemiology* were submitted to the Leopoldina for selecting those relevant for the fields under investigation. As a result of this verification process 156 journals relevant for the discipline *Public Health* and 76 journals relevant for *Epidemiology* were selected (see Appendices 1 and 3 for the full lists) as basis for the analysis.

## **1.3 Data collection and cleaning**

All publication data from 2000 to 2012 for the two disciplines was retrieved from the database, restricted to the document type “article” and the source type “journal.” This restriction is set to limit the study to focus only on sources reflecting original research results published in peer

reviewed journals. Citations of the above publications from 2000 to 2010 are obtained in the database from sliding three-year citation windows. Self-citations are not excluded.

The address data cleaning and matching scheme developed by the German Competence Centre for Bibliometrics (Schwechheimer & Rimmert, 2011) is applied to identify German institutions according to their address information and generate the lists of the most active German institutions.

## 1.4 Indicators

In this section we describe the used indicators and specific methods and give advice on how to interpret their results.

### Publications

- Whole publication count

The figure of ‘whole publications’ is the number of the publications published by a specific unit of investigation, which could be a researcher, an institution, a field, or a country. In this study, we report the whole publication counts of the ten most active countries including Germany in the disciplines *Public Health* and *Epidemiology*, respectively, as well as the totals for the each of the disciplines.

- Fractional publication count

The ‘fractional publication count’ in general refers the number of publications fractionalized based on each unit’s share of the author addresses in the publication. Thus, the credit of a paper is divided between all the contributing units (which could be authors, institutions, or countries). Fractional publication counts are awarded to units proportional to the relative shares of contributing units on a per-article basis. Thus the sum of the fractions to various units equals one, following the ‘one paper is one paper’ concept (Moed, 2000, p. 324).

Here, the reported number is at the country level, which is calculated based on the addresses of institutions. Thus, if an article is co-authored by three institutions, two from Germany and one from the USA, Germany would receive a score of 2/3 papers and USA 1/3 papers. Germany’s and the other nine most active countries’ fractional publication numbers in the two disciplines are reported.

Both the whole publication number and the fractional publication number show the scientific productivity of a given unit, but under somewhat different conditions. The whole count method gives the exact actual number of publications that a given unit was



involved in. The fractional count method gives a more balanced view in that it takes the numbers and shares of countries involved in each article into account. The fractional publication counts of all countries in a set of publications add up to the set's total publication count, unlike in the case of the whole count scheme.

The practice of reporting both methods' results is well-established and regarded as more comprehensive and useful for contrasting analyses in the bibliometrics community (Gauffriau & Olesen Larsen, (2005); Egghe, Rousseau & van Hooydonk (2000)). From the ratio of fractional to whole count publications we can also infer some approximate information about the magnitude of pure domestic publications to internationally coauthored publications.

- Relative share of German publications

The relative share of German publications is the proportion of articles in a given year and discipline authored by at least one author from Germany. In this study, we report the relative share of German publications using both the whole and the fractional counting schemes.

## **Dynamics of German publication output**

- Average annual growth of German publications

The annual growth in publications is calculated from the ratio of the number of publications in one year to the number in the previous year. Based on this, the average annual growth of the German publications is the mean of the annual growth rates of German publications.

- Sharpe Ratio

The *Sharpe ratio* (Sharpe, 1994) is an indicator adapted from financial portfolio management to quantify the normalized growth of publications in bibliometric studies (Schmoch, Wang & Stoica, 2006; Grupp, Hinze & Breitschopf, 2009). Apart from raw publication counts, it can also be applied to measure the dynamics of different indicators (Lietz & Riechert, 2013). Following the definition applied by Lietz and Riechert, the *Sharpe ratio* of a quantity  $N_i$  in discipline  $i$  and year  $t$  is defined as

$$S(N_i) = \frac{\overline{D_i(t)}}{\sigma_{D_i(t)}}$$

with

$$D_i(t) = \frac{N_i(t) - N_i(t-1)}{N_i(t-1)} - \frac{N_{total}(t) - N_{total}(t-1)}{N_{total}(t-1)}$$

where  $\overline{D_i(t)}$  is the average of  $D_i(t)$ , the differential of specific to general growth, and  $\sigma_{D_i(t)}$  is its standard deviation.

Here, this indicator is used to specify the normalized annual growth rate of the number of German publications in the two disciplines during 2000-2012, relative to the overall growth of these disciplines. Due to the inclusion of the standard deviation, steady annual growth above the discipline growth rate is rewarded (positive values) and highly fluctuating development and below-average growth is punished (negative values).

## Impact

- Absolute citation count

The absolute citation count is the number of citations received by the publications published by a specific unit of investigation. We report the citation numbers of the publications from Germany and six reference nations during 2000-2010, calculated from sliding three-year citation windows starting with the year of publication. The three year citation window is widely accepted in bibliometric analysis. This time frame is long enough to let articles accumulate enough citations to allow meaningful statements and short enough to enable timely assessments of research performance. Counting citations is restricted to those originating from the peer reviewed journal articles which are indexed in Scopus.

- Relative share of citations

The relative share of citations reported in this study is the proportion of citations by the countries analyzed to all citations in a given discipline and year. Again, three-year citation windows are used.

- Citations per paper

In order to make comparisons between countries feasible, we normalize for country size by dividing the citations by the numbers of publications. This indicator, citations per paper or average citation rate, reflects the average impact of the publications of a given country. In the corresponding figures, approximate standard error bars are drawn using the method described in Schubert & Glänzel (1983).

- Field normalized citations per paper

Citation behavior differs across disciplines. In order to allow for comparisons normalizations are introduced. Thus, the aforementioned indicator, citations per paper (of a country), is normalized by dividing by the corresponding annual average citation rate of the entire field, yielding the field normalized citation rate (Braun & Glänzel, 1990). It is on average 1.0 for the whole field, values above 1.0 show above-average citation impact. Values of this indicator may be compared across different disciplines, as opposed to not normalized indicators.

- Uncited rate

The uncited rate reports the share of papers which are not cited three years after publication. This indicator is regarded as a useful auxiliary measure revealing the magnitude of the low end of the citation distribution.

## 2 Results

### 2.1 Public Health

#### 2.1.1 Publication Output

##### Overview

There are 135,925 Scopus indexed items in total published in the 156 journals in public health from 2000 to 2012. Among these items, 135,350 are coded as journal items whereas 575 are book series items. Among the journal items, 98,084 (73%) are articles (Table 1). In this report, all analyses are based on these 98,084 journal articles.

Table 1. Document types of Scopus indexed journal items in public health (2000-2012)

Document Type	Items	Share
Article	98,084	72.47%
Conference Paper	2,793	2.06%
Editorial	6,547	4.84%
Erratum	1,090	0.81%
Article In Press	1,690	1.25%
Letter	5,228	3.86%
Note	4,090	3.02%
Review	13,787	10.19%
Short Survey	2,041	1.51%
Total	135,350	100.00%

The total number of journal articles in public health doubled from 2000 to 2012, reflecting a rapid increase of publication activity in this field during the past 13 years, cf. Table 9 in Appendix 2. The number of active journals per year increased from 111 in 2000 to a maximum of 136 in 2006 and was 128 in 2012.

##### Most productive countries in public health

The most productive countries in public health from 2000 to 2012 are the United States, the United Kingdom, Canada, Australia, Brazil, the Netherlands, Sweden, Spain, Germany, and France. Figure 1 shows the leading position of the United States in terms of the numbers of scholarly journal articles in this field. The amount of articles from the United States is more than three times that of research articles from the United Kingdom and around 27 times that of Germany. The four leading English-speaking countries contribute 70% of the articles. Spain,

Germany, and France have similar numbers of research articles in the field, see also Table 9 (Appendix 2).

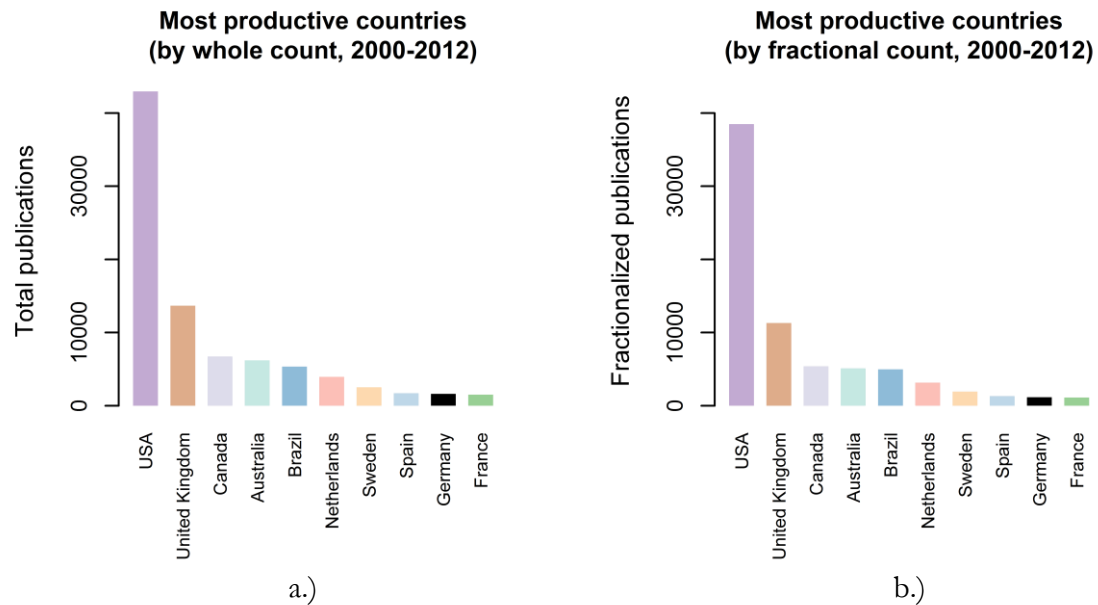


Figure 1. Whole counts and fractional counts of articles of the ten most productive countries in public health (2000-2012)

Figure 2 and Figure 3 show the temporal developments of the annual publication counts of the ten most productive countries. All countries show growth in their curves, especially the United States. Brazil, the UK, and the USA have a leap between 2005 and 2007, followed by a decrease for Brazil during the latest four years; this discontinuity could not be further investigated. For Germany a steady increase of publications can be observed from 2001 to 2012. In general, the situation is very similar if fractional counts of publications are taken into consideration (Figure 3).

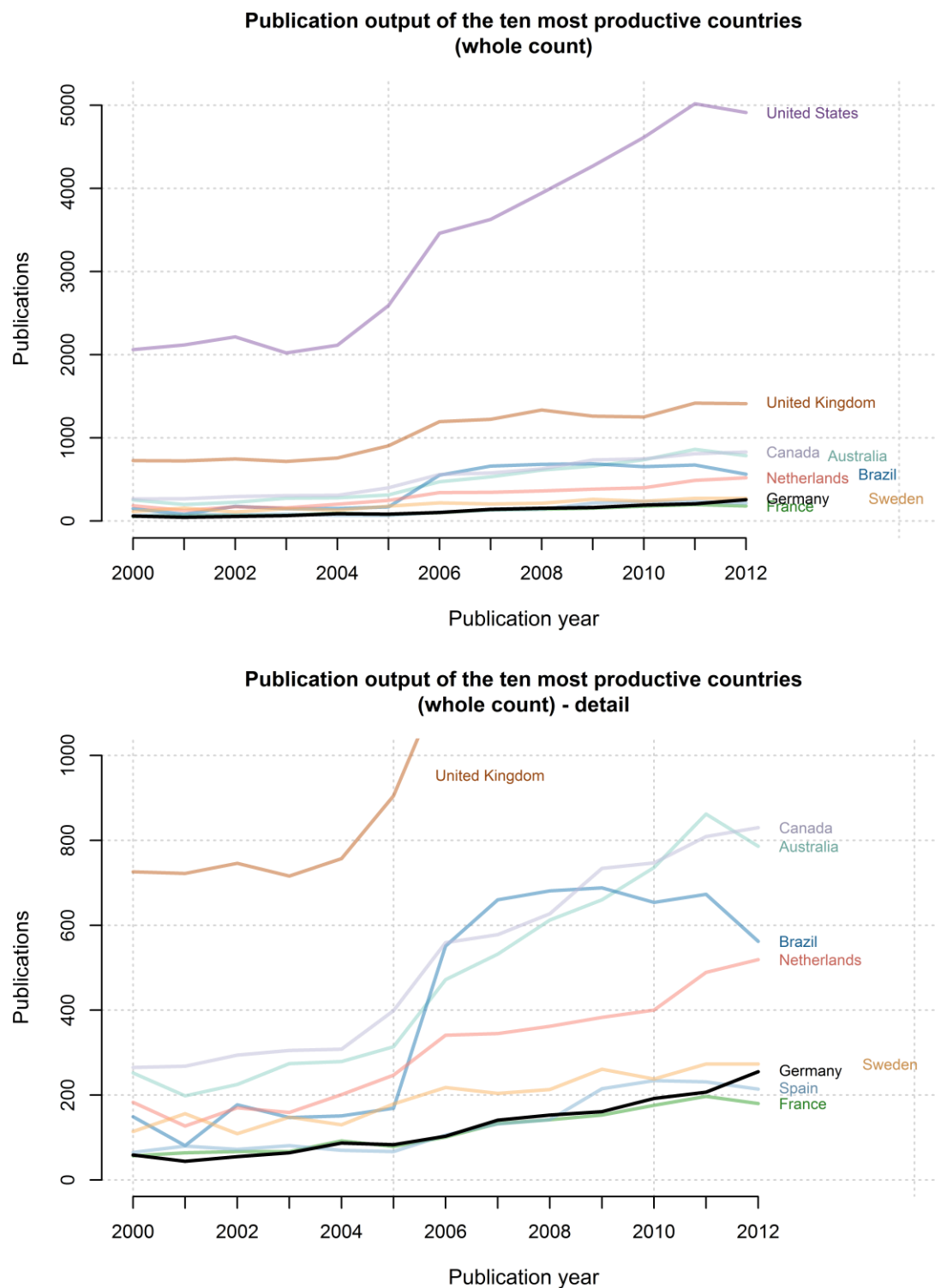


Figure 2. Annual whole counts of articles of the ten most productive countries in public health (2000-2012)

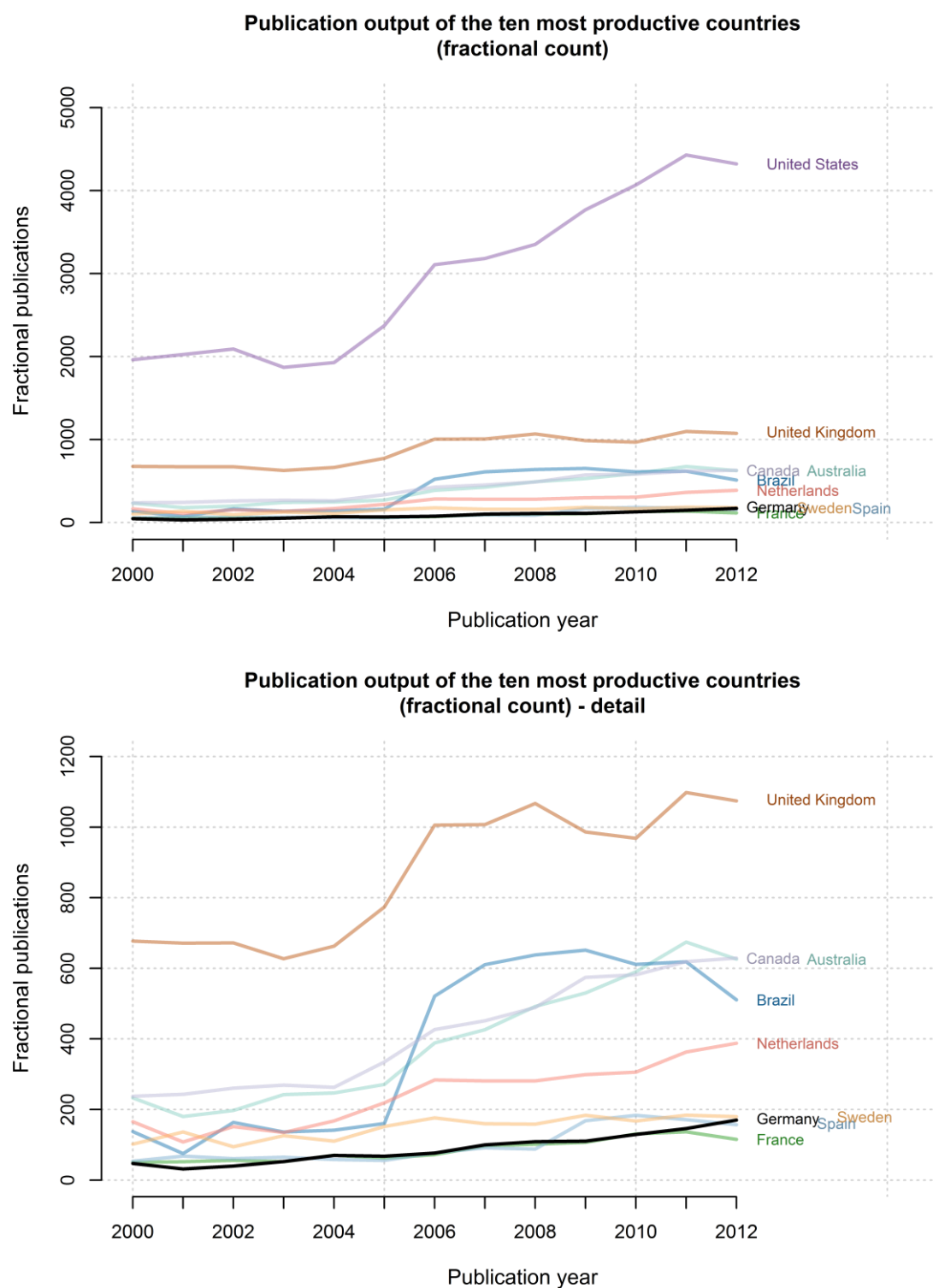


Figure 3. Annual fractional counts of articles of the ten most productive countries in public health (2000-2012)

Contrasting the fractional publication count with the whole count allows some insight into the approximate degree of international cooperation of the countries. Table 11 (see Appendix 2) shows that the ratios of fractional counts to whole counts of these ten countries are

approximately 0.8 (mean of the 10 countries = 0.805, SD = 0.067, range = 0.214). Brazil has the highest ratio of fractional counts to whole counts (0.93), while Germany has the lowest ratio (0.72) and thus the highest approximate degree of international collaboration among those countries

Figure 4 shows the development of both global and German publication counts in public health during the past decade (whole counting method). The total annual number of publications in public health doubled from 2000 to 2012. The increase is most striking especially after 2004. The increase is even more pronounced for publications from Germany in public health increased, from an initial 59 articles in the year 2000 originating from German authors to 255 articles in 2012.

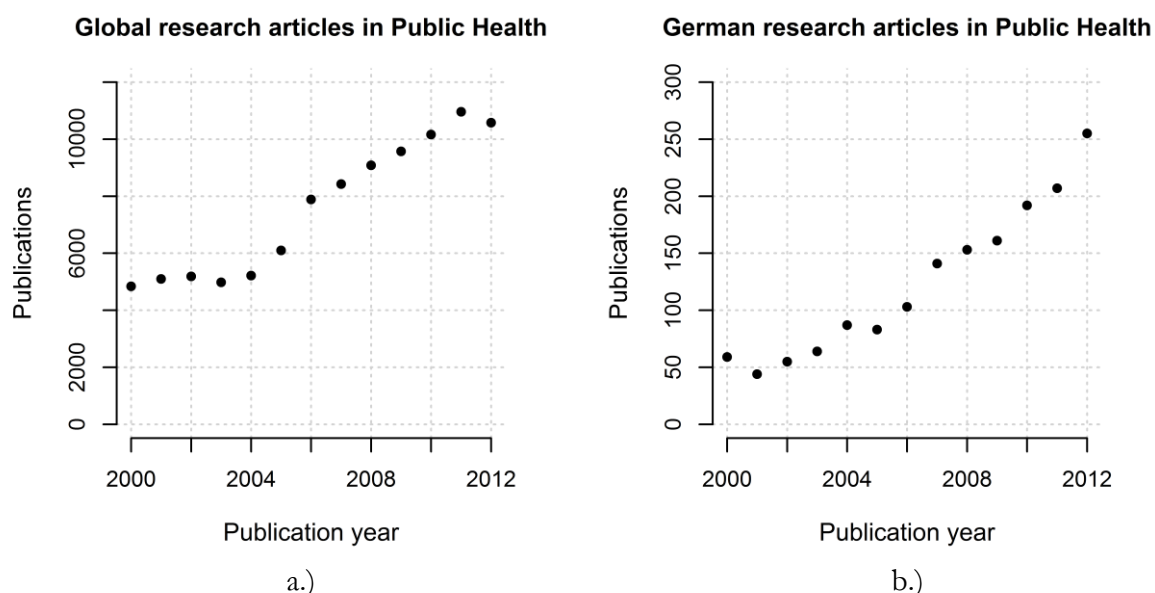


Figure 4. Global and German research articles in public health (2000-2012)

### Relative share of German publications

The relative share of German research articles in public health increases over time. Comparing the developments of whole count and fractional count of German articles, the relative share of whole counts is consistently higher than the fractional count's share, especially after 2010. This implies that the level of international cooperation of Germany increased in recent years.



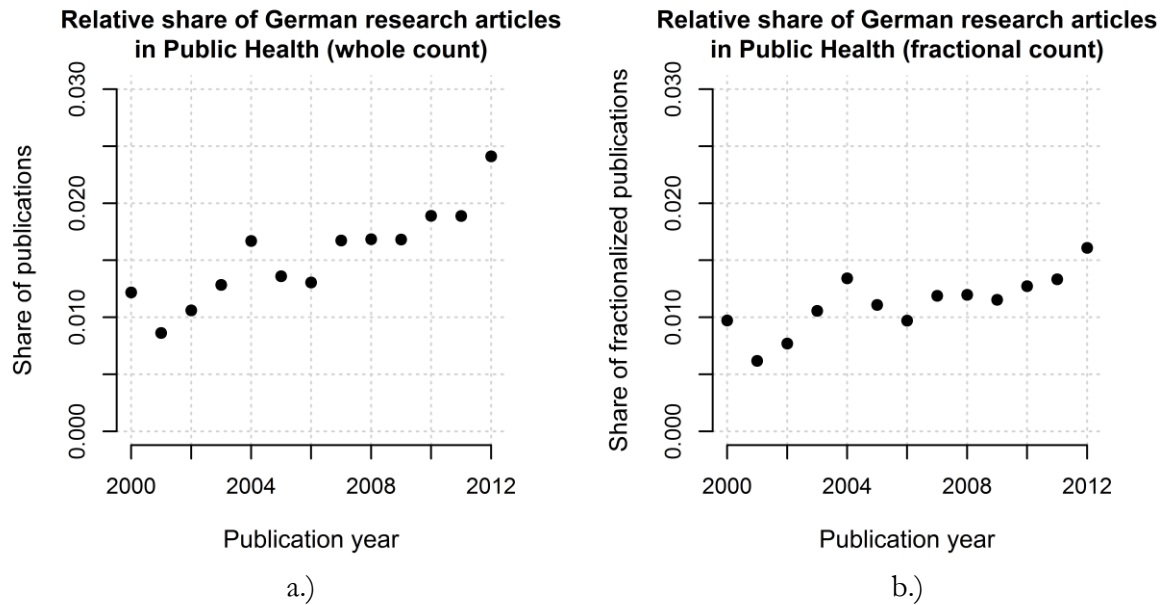


Figure 5. Relative shares of German research articles in public health (2000-2012)

## 2.1.2 Publication dynamics

Germany's average annual growth factor is 1.14, and thus is above those of the USA, the UK and France. The highest growth rate is exhibited by Austria, 1.45 (Figure 6a).

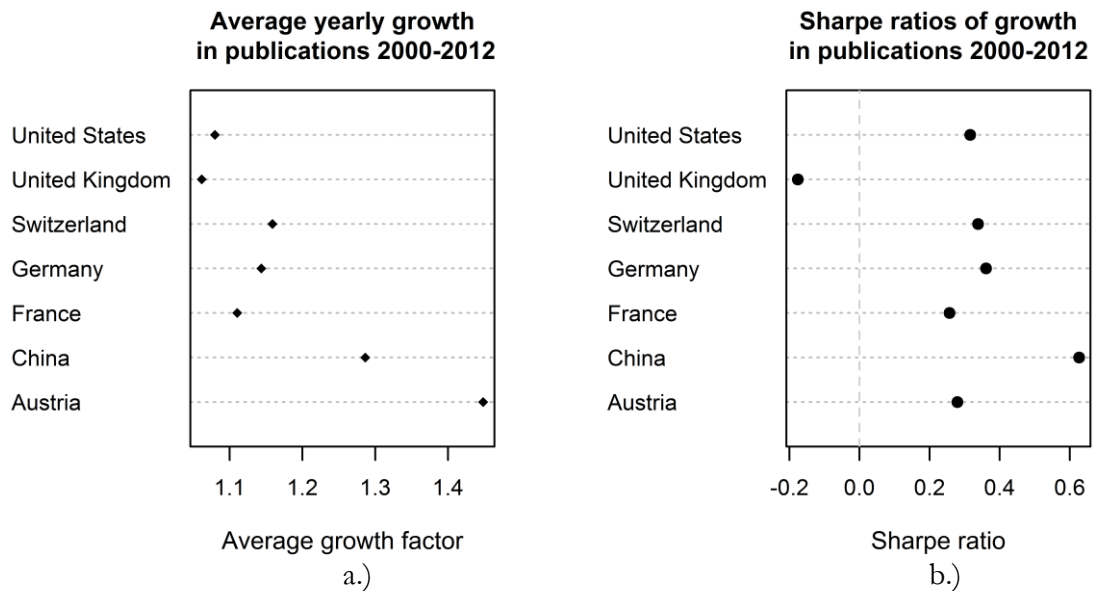


Figure 6. Average annual growth and Sharpe ratios of publications of seven countries in public health (2000-2012)

The Sharpe ratios of most of these seven countries fall between 0.2 and 0.4 (Figure 6b). The two extreme cases are the United Kingdom (-0.18) and China (0.63).

### **2.1.3 Impact analysis**

#### **Absolute citations**

Figure 7 shows the annual absolute citation numbers of publications published by Germany and the reference countries in the field from 2000 to 2010, for the numerical data see Table 12, Appendix 2. Almost all annual citation counts increase over time, with some degree of fluctuation. The United States has the highest citation counts in this field, followed by the United Kingdom. The growth in citations for Germany is comparatively strong.

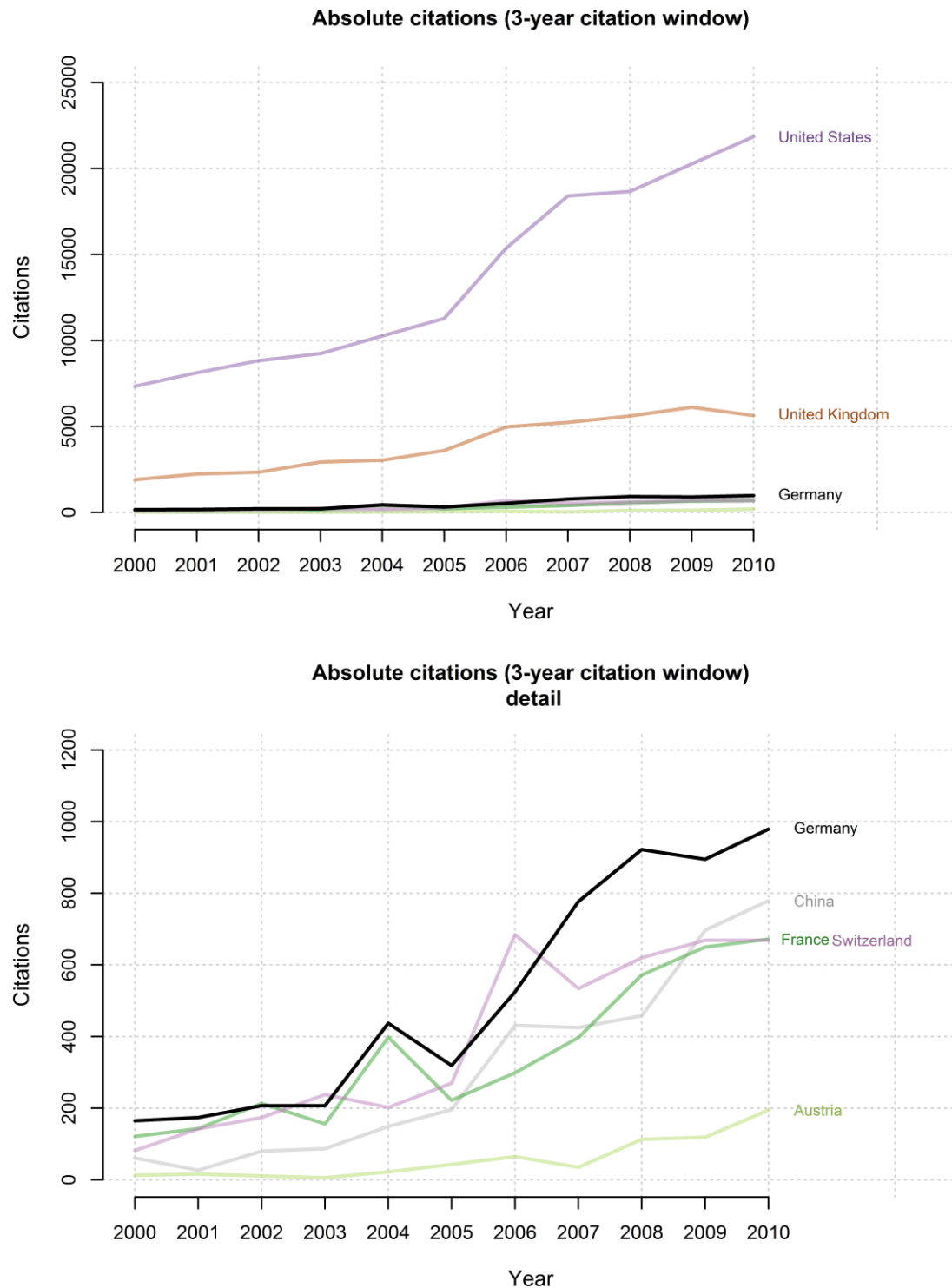


Figure 7. Absolute citations of seven countries in public health (2000-2010)

## Relative share of citations

Publications from the United States attracted more than 50% of the annual citations in public health, this share slightly declined as shown in Figure 8. The share of citations received by publications from the United Kingdom remained relatively stable during the time frame. The

share of citations to German publications doubles over the ten years which is concordant to the change in the share of publications. As the absolute number of citations received is not sufficient to assess the impact gained by publications from a certain country in the following section this number will be put into context.

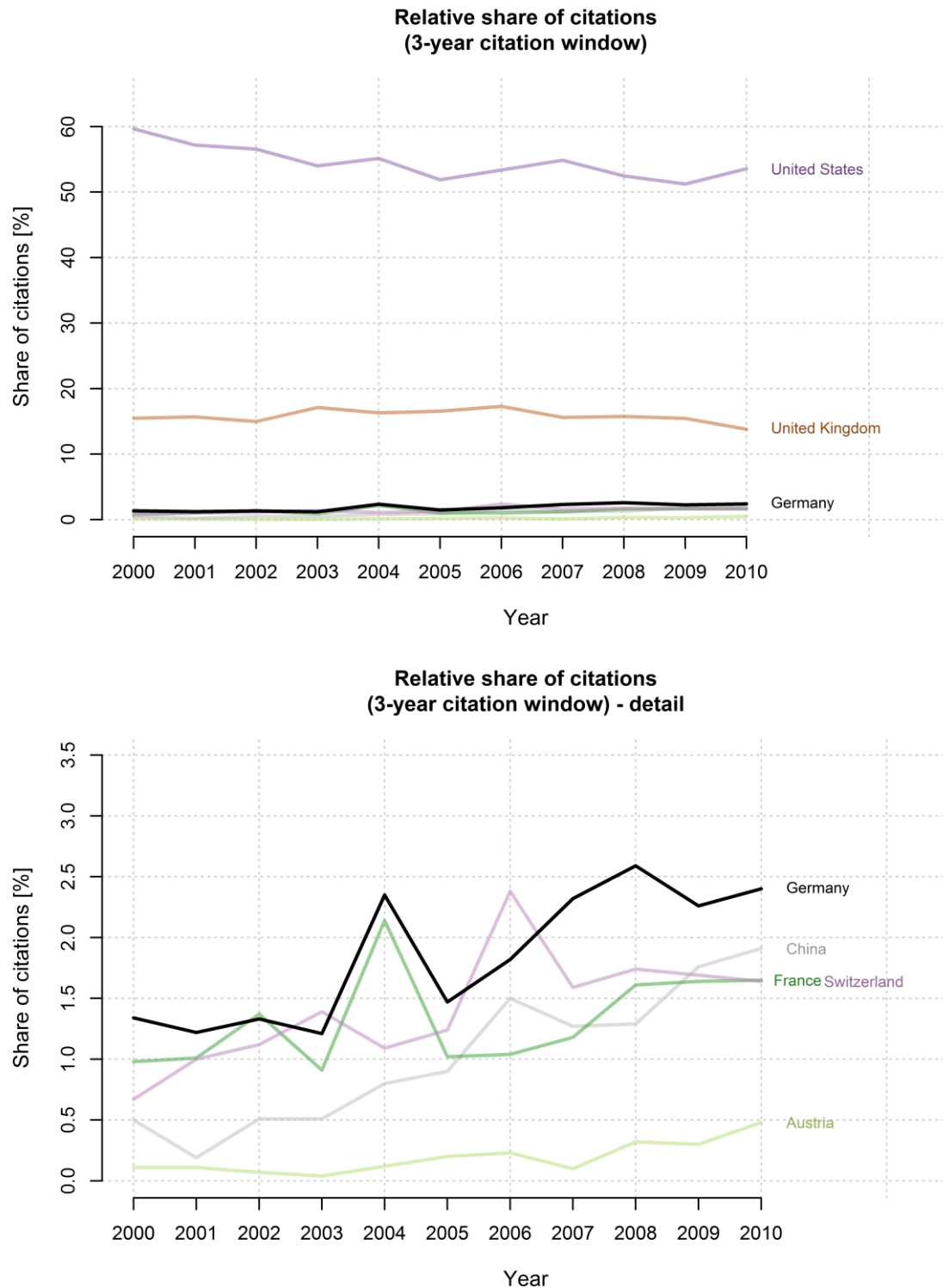


Figure 8. Relative shares of citations of seven countries in public health (2000-2010)

### Citations per paper

Table 2 shows that almost all countries under investigation tend to have higher annual average citation rates than the field average (column 'World'), the exceptions being France and, in the

early years, Austria. Germany has the best performance on the average citation rate across all 11 years among the selected countries (bottom row), followed by Switzerland, China, and the United States. All the countries have increasing average raw citation rates, cf. Figure 9, upper panel.

In terms of the field normalized relative citation rates, Figure 9, lower panel, shows that indicator values for Germany, Austria, and Switzerland are substantially increasing during the time frame. The respective value for the United States exhibits some decrease after 2007. Scores are aggregated with three-year running means due to fluctuating behavior in a single year plot. The field normalized citation rate of Germany exceeds the score of the United States starting in the 2004-2006 period. The strongest increase in indicator values is found for Austria. Starting from values well below the field average it now has the highest impact values.

Table 2. Average citation rates of seven countries in public health (2000-2010)

<b>Year</b>	<b>World</b>	<b>Austria</b>	<b>China</b>	<b>France</b>	<b>Germany</b>	<b>Switzerland</b>	<b>UK</b>	<b>USA</b>
2000	2.54	1.30	3.21	2.12	2.80	2.16	2.62	3.56
2001	2.79	1.60	2.45	2.23	3.95	2.84	3.09	3.84
2002	3.01	2.75	3.64	3.18	3.76	3.16	3.13	3.98
2003	3.43	3.00	3.22	2.33	3.23	3.84	4.09	4.57
2004	3.57	2.00	3.92	4.33	5.02	4.39	4.01	4.86
2005	3.57	5.38	4.78	2.81	3.84	4.35	3.98	4.36
2006	3.65	4.33	5.90	2.96	5.10	5.48	4.17	4.44
2007	3.98	2.69	4.83	2.98	5.51	4.73	4.28	5.08
2008	3.92	4.52	4.32	4.03	6.03	6.14	4.20	4.73
2009	4.13	5.17	5.05	4.25	5.56	5.92	4.85	4.75
2010	4.01	6.09	4.26	3.82	5.10	5.23	4.50	4.74
<b>Total</b>	<b>3.63</b>	<b>4.17</b>	<b>4.54</b>	<b>3.40</b>	<b>4.91</b>	<b>4.80</b>	<b>4.02</b>	<b>4.53</b>

Note: All values computed from 3-year citation windows.

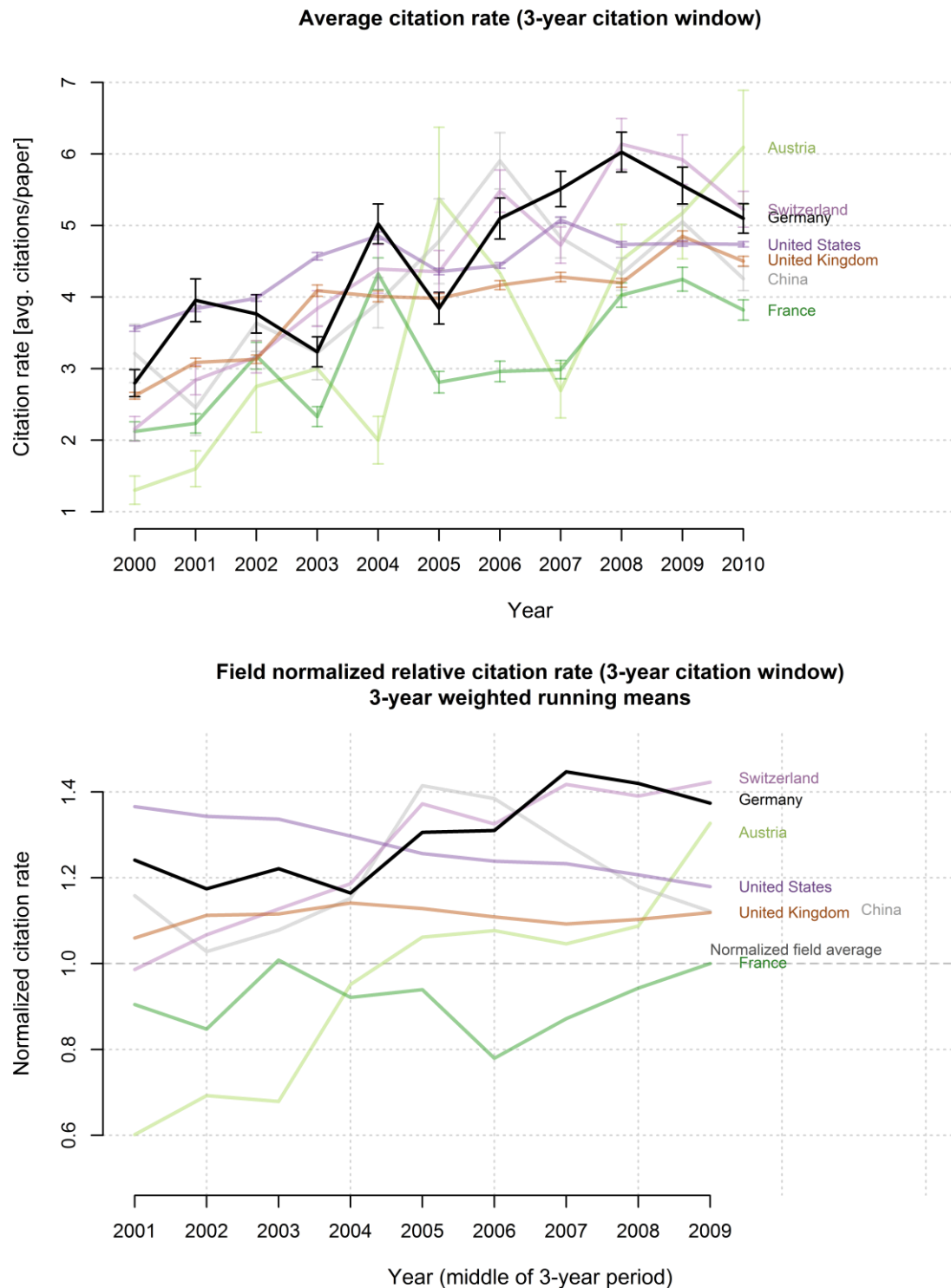


Figure 9. Average citation rates (raw and field normalized) of seven countries in public health (2000-2010).

Note: Vertical bars around the means in the upper panel are approximate standard errors calculated according to Schubert & Glänzel (1983).

## **Share of uncited publications**

As shown in Figure 10, for all countries except France the share of uncited publications in public health is below the field average. For Germany this share decreases over time to a greater degree than the field average rate. In other words, fewer German research results remain unused. However, this observation is influenced by the large increase in publications and citations in the field, the reduction in the share of dormant articles occurs is evident for several countries.



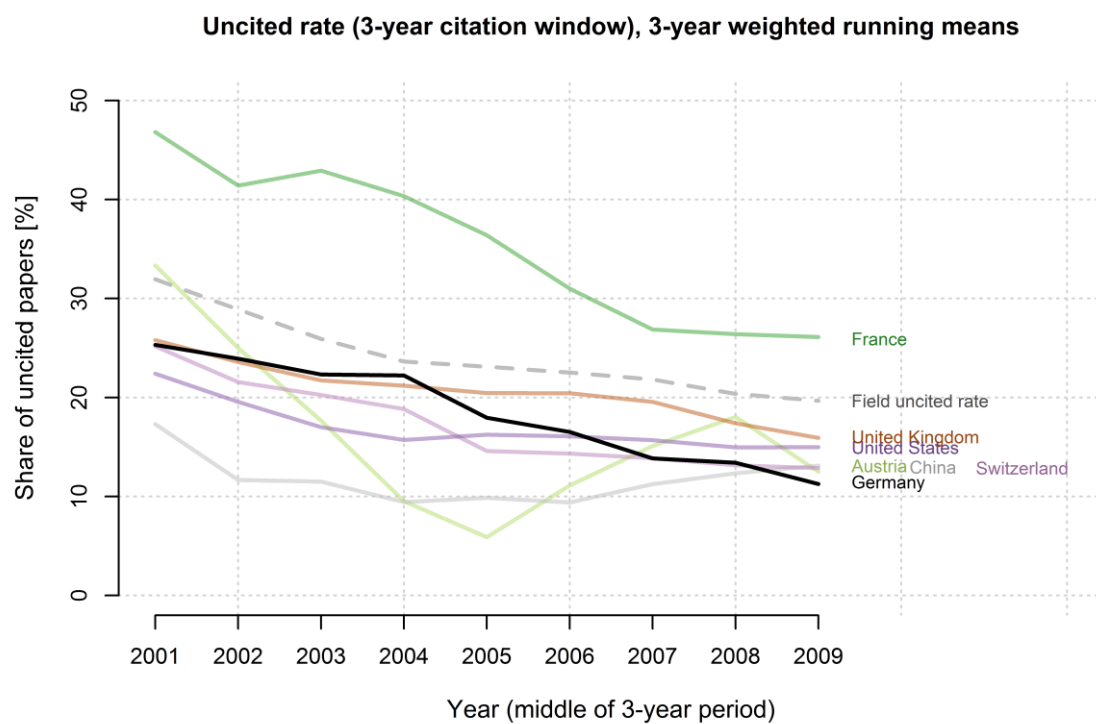
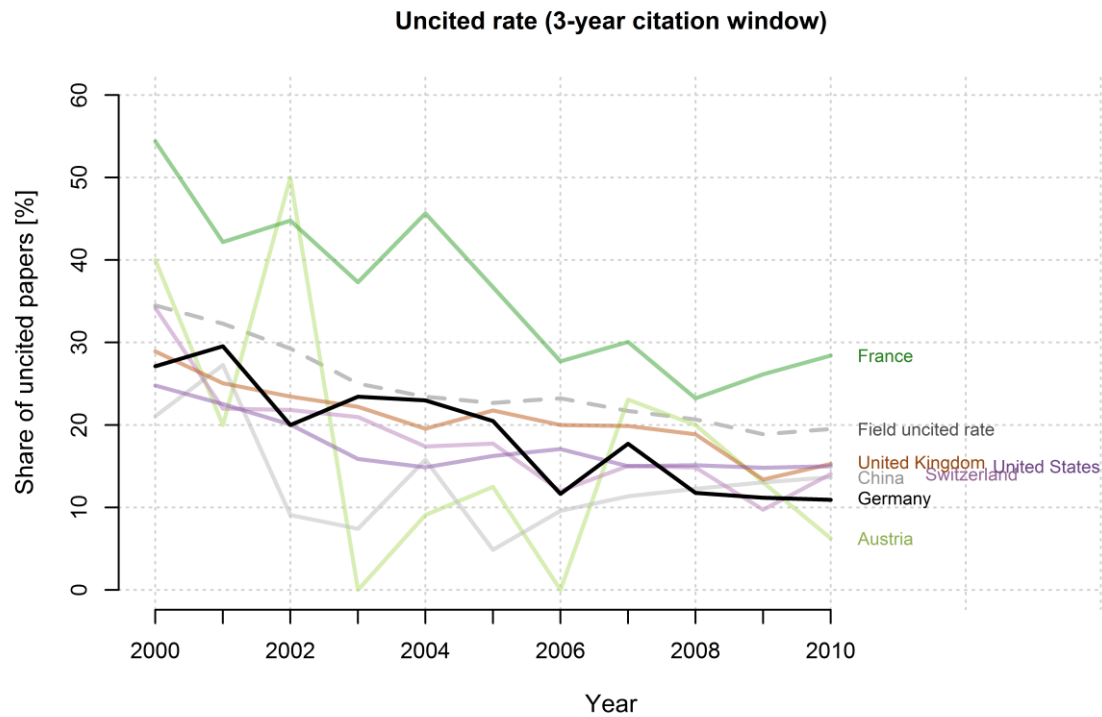


Figure 10. Share of uncited publications of seven countries in public health (2000-2010)

### 2.1.4 German institutions

The ten most productive German institutions in public health are listed in Table 3. The top five productive institutions each have more than 100 research articles in public health during the 13

years. The most productive institution, Ruprecht-Karls-Universität Heidelberg, contributed about 10% of German research articles in public health. Publication figures are given in whole count, thus articles will be credited fully to each involved institution.

Table 3. The ten most productive German institutions in public health (2000-2012)

<b>Institution</b>	<b>No. of Articles</b>	<b>Share of All German articles (2000-2012)</b>
Ruprecht-Karls-Universität Heidelberg	154	9.60%
Universität Bielefeld	130	8.10%
Charité - Universitätsmedizin Berlin	118	7.36%
Universität Hamburg	113	7.04%
Technische Universität Dresden	106	6.61%
Ludwig-Maximilians-Universität München	97	6.05%
Heinrich-Heine-Universität Düsseldorf	86	5.36%
Ernst-Moritz-Arndt-Universität Greifswald	83	5.17%
Universität Bremen	74	4.61%
Helmholtz Zentrum München - Deutsches Forschungszentrum für Gesundheit und Umwelt (GmbH) HMGU	73	4.55%

The ten most cited German institutions in public health in Table 4 are similar to the top ten productive German institutions in Table 3. However, there are some variations in the positions taken by the institutions. Heinrich-Heine-Universität Düsseldorf is the most cited German institution in public health, collecting 429 citations to their publications from 2000 to 2010 in 3-year citation windows, while according to publications it ranked 7th.

Table 4. The ten most cited German institutions in public health (2000-2010)

<b>Institution</b>	<b>Citations</b>	<b>Share of Citations of German articles</b>
Heinrich-Heine-Universität Düsseldorf	429	7.65%
Ruprecht-Karls-Universität Heidelberg	373	6.65%
Universität Hamburg	347	6.19%
Universität Bielefeld	345	6.15%
Robert Koch-Institut	319	5.69%
Charité - Universitätsmedizin Berlin	310	5.53%
Albert-Ludwigs-Universität Freiburg	270	4.82%
Ludwig-Maximilians-Universität München	244	4.35%
Technische Universität Dresden	236	4.21%
Freie Universität Berlin	235	4.19%

Note: All values computed from 3-year citation windows.

## 2.3 Epidemiology

### 2.3.1 Publication Output

#### Overview

There are 90,312 Scopus indexed items published in the 76 journals (with 98 unique ISSNs) in epidemiology from 2000 to 2012. Among these items, 90,274 have been published in journals, the rest are book series items (38). 67,171 of the journal items (74%) are original research articles, as shown in Table 5. In this report, all the analyses in epidemiology are based on these 67,171 journal articles.

Table 5. Document types of Scopus indexed journal items in epidemiology (2000-2012)

Document Type	Items	Share
Abstract Report	1	<0.01%
Article	67,171	74.41%
Conference Paper	1,733	1.92%
Editorial	2,254	2.50%
Erratum	1,213	1.34%
Article In Press	1,224	1.36%
Letter	4,823	5.34%
Note	3,594	3.98%
Review	7,458	8.26%
Short Survey	803	0.89%
Total	90,274	100.00%

The annual publication counts for the ten most productive countries and the World are given in Table 13 and Figure 11. In 2000 there were 38 active journals, this number increased steadily to 88 journals in 2011 and 2012. The number of publications in epidemiology doubled during the past 13 years.

#### Most productive countries in epidemiology

The United States, the United Kingdom, Canada, China, France, Australia, the Netherlands, Germany, Italy, and Japan are the most productive countries in epidemiology from 2000 to 2012, see Figure 11. The United States displays outstanding performance in publications with 28,889 research articles (whole counts), about four times the score of the second most productive country, the United Kingdom (7,341 articles). Taken over the whole period, 43% of all publications were published by authors from the United States, 11% from the United Kingdom, 6% from Canada, and 5% are from China and France each. Germany contributed about 4% of all

journal articles and tripled its annual figure during the period. Germany is ranked 8th in terms of whole counts of articles, but ranks lower in terms of fractional counts of articles (10th). Two Asian countries, China and Japan, are on the list of the most productive countries. China has the largest growth in terms of the number of journal articles in the field, from 33 in 2000 to 855 in 2012. In 2007, China's epidemiology journal article count leaped and reached the level of other productive countries.

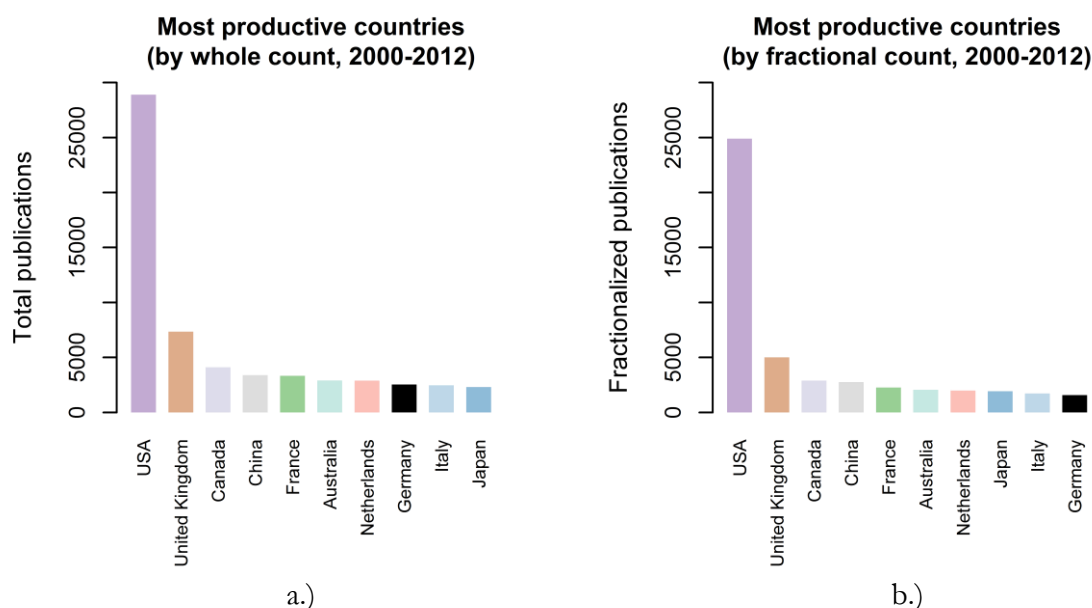


Figure 11. Whole counts and fractional counts of articles of the ten most productive countries in epidemiology (2000-2012)

Both Figure 12 and Figure 13 show the overall continuous growth of the publications of the most productive countries in epidemiology from 2000 to 2012. The number of annual publications of the USA increases markedly after 2004. China has a rapid increase after 2006. The exact numbers are given in Tables 13 and 14, Appendix 4.

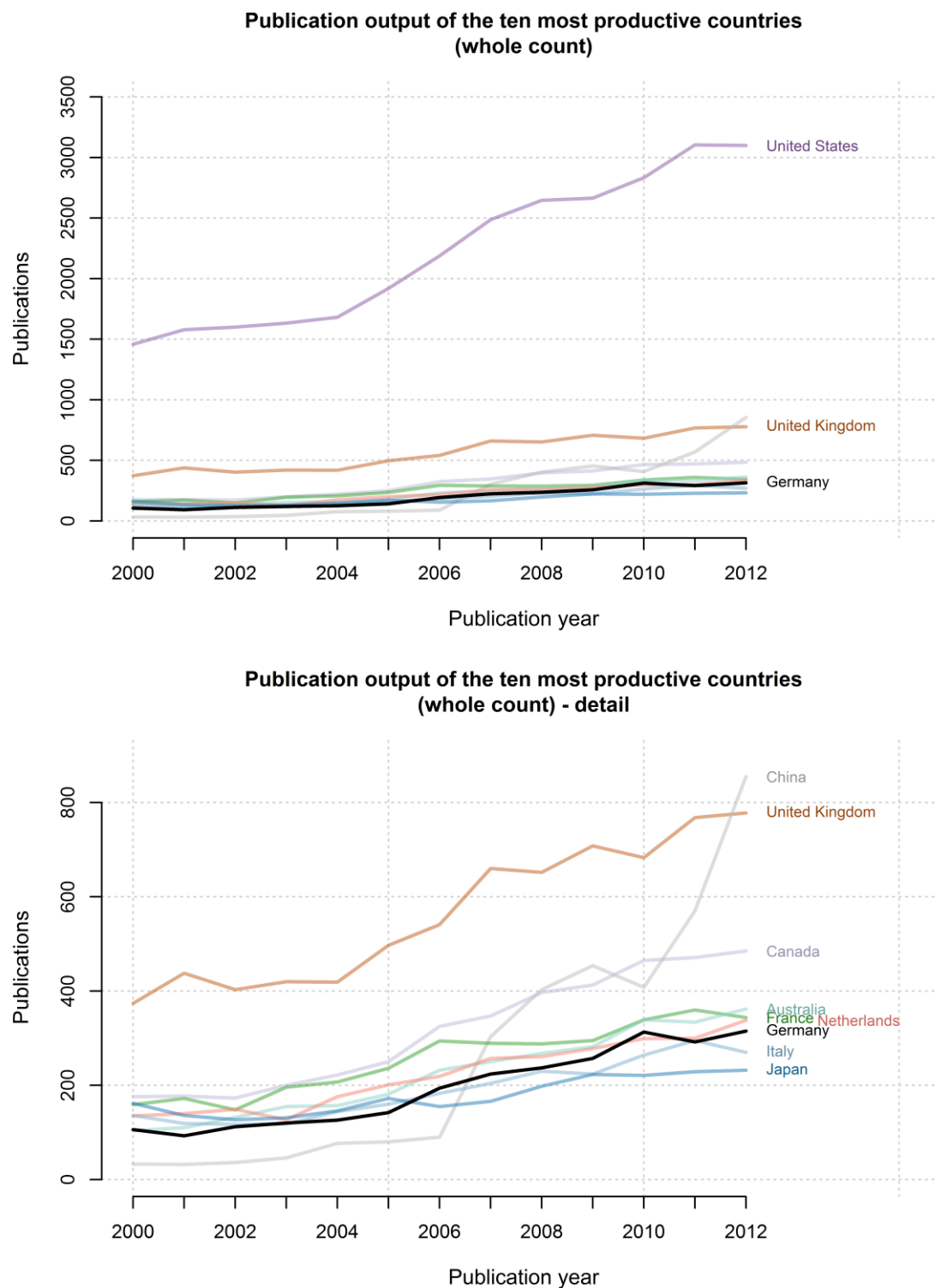


Figure 12. Annual whole counts of articles of the ten most productive countries in epidemiology (2000-2012)

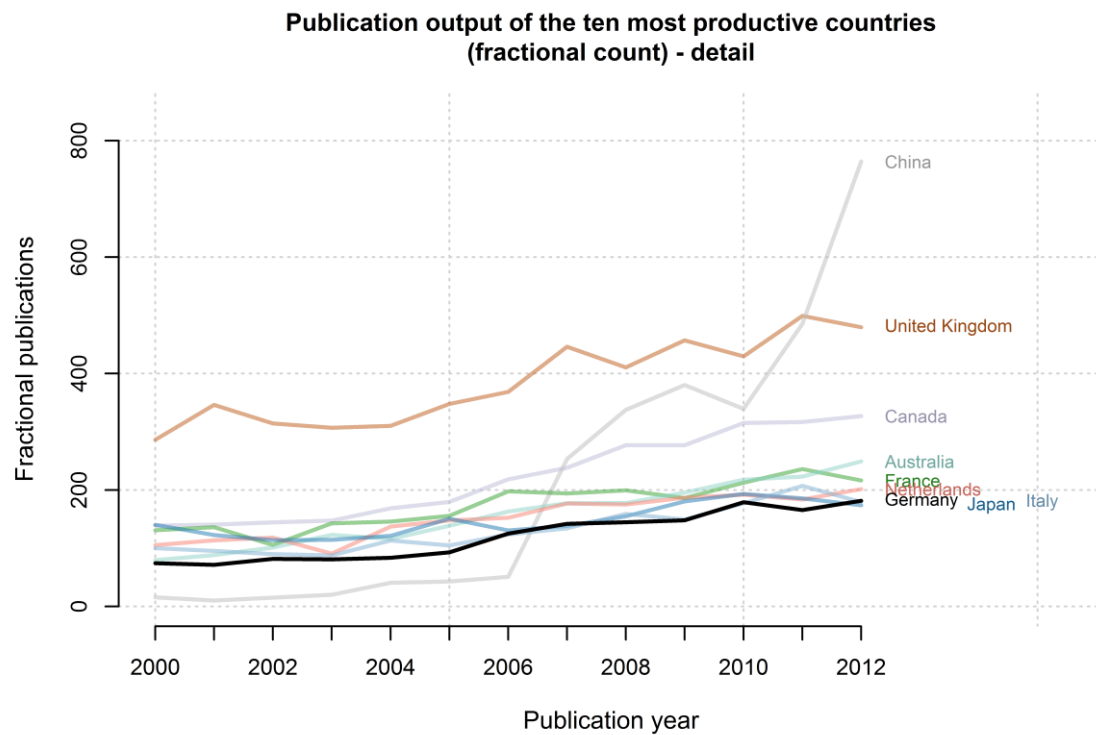
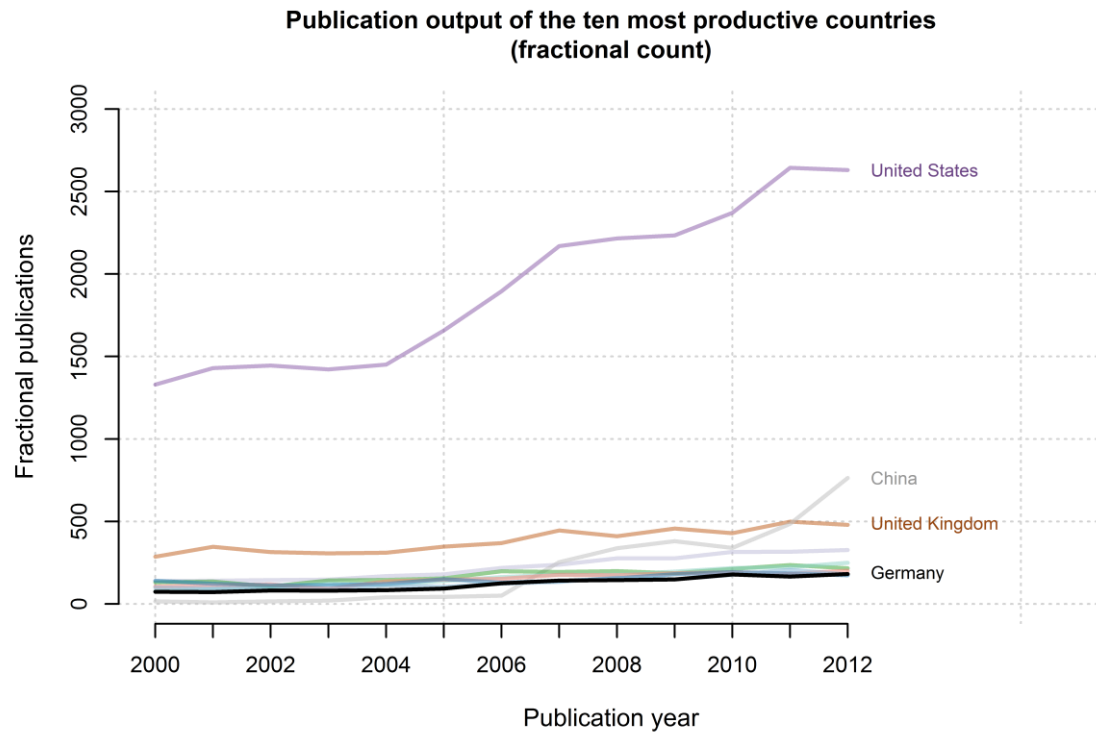


Figure 13. Annual fractional counts of articles of the ten most productive countries in epidemiology (2000-2012)

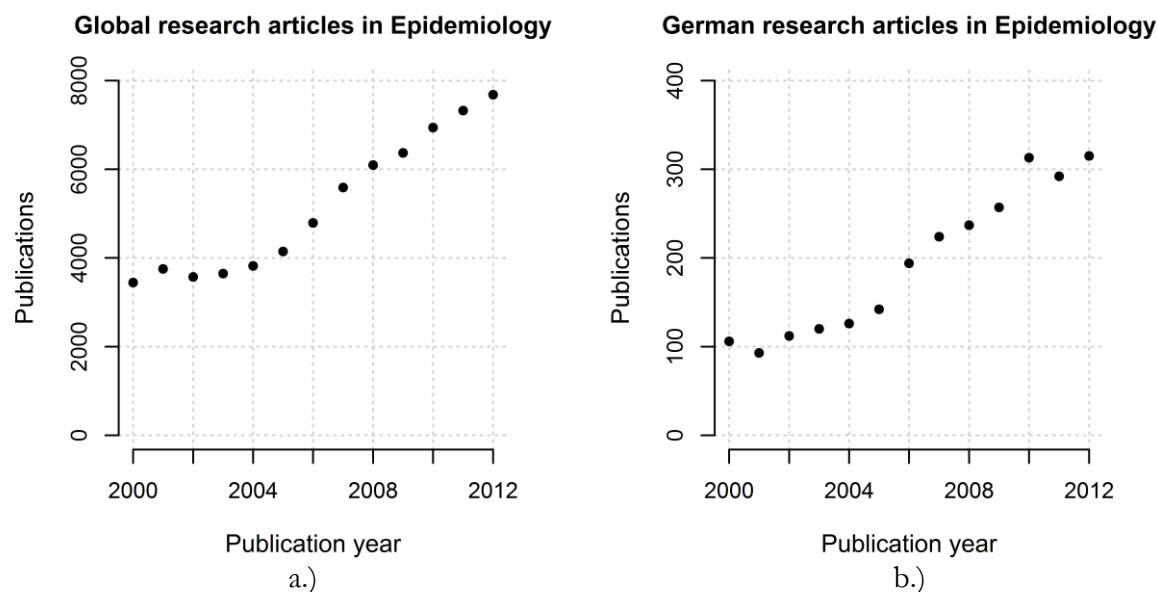


Figure 14. Global and German research articles in epidemiology (2000-2012)

Figure 14 shows the annual development of global (a) and German (b) publications in the field in detail.

### Relative share of German publications

Figure 15 illustrates that the growth of annual shares of fractionally weighted German articles in epidemiology is less pronounced than the shares calculated by whole count. This minor difference is can be attributed to increasing international collaboration.

The European countries have low ratios of fractional to whole publication counts, including Germany (0.68), suggesting high international co-publication activity. Across the seven countries the mean is 0.73 (SD = 0.042, range = 0.13), see Table 16, Appendix 4.



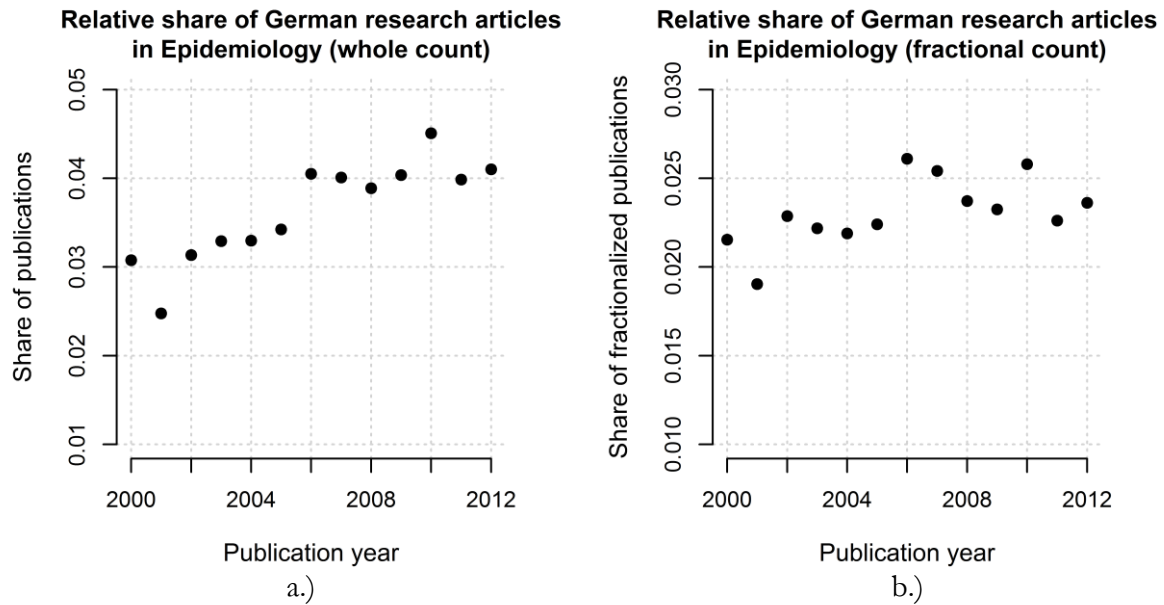


Figure 15. Relative shares of German research articles in epidemiology (2000-2012)

### 2.3.2 Publication dynamics

China has the highest average annual growth of publications among the reference countries (1.40). The United States, the United Kingdom and France have the relatively low growth rates, below 1.08. Germany has an average annual growth factor of 1.10, between France (1.07) and Switzerland (1.14).

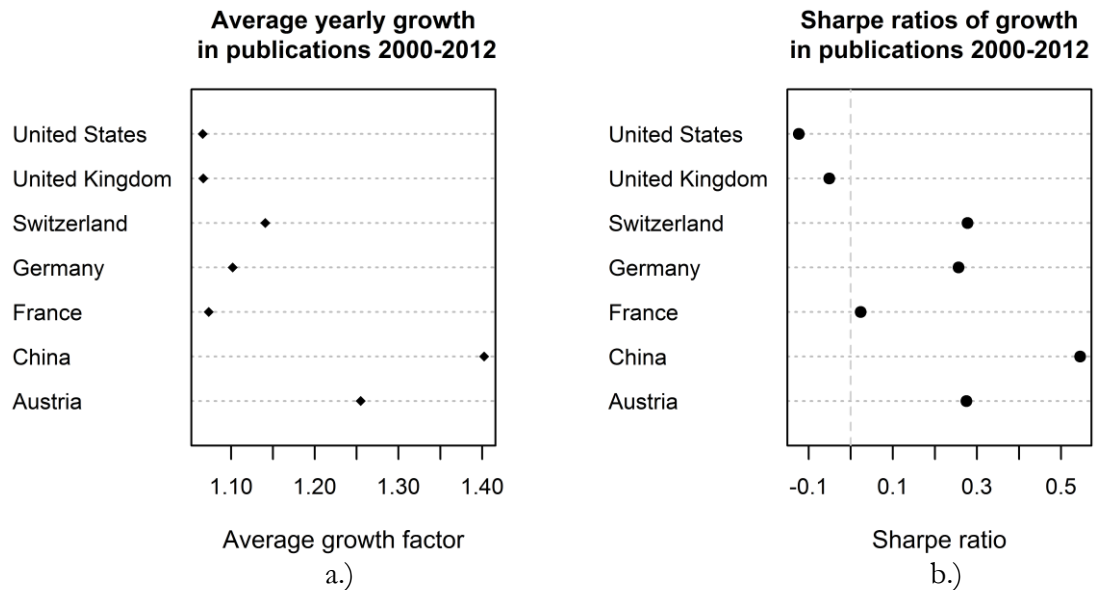


Figure 16. Average annual growth and Sharpe ratios of publications of seven countries in epidemiology (2000-2012)

The range of Sharpe ratios of all the reference countries in epidemiology is larger than in public health. Figure 16b shows that the United States and the United Kingdom have relatively low values, not being commensurate with the overall discipline growth. China again has the highest value, 0.55. Switzerland, Germany and Austria have very similar Sharpe ratios between 0.26 and 0.28.

### 2.3.3 Impact analysis

#### Absolute citations

Figure 17 shows the development of absolute citation counts of publications in epidemiology published by Germany and the six reference countries from 2000 to 2010. Annual citation counts of all reference countries increased as time elapsed, see also Table 16, Appendix 4. The United States has the citations in this field, followed by the United Kingdom.

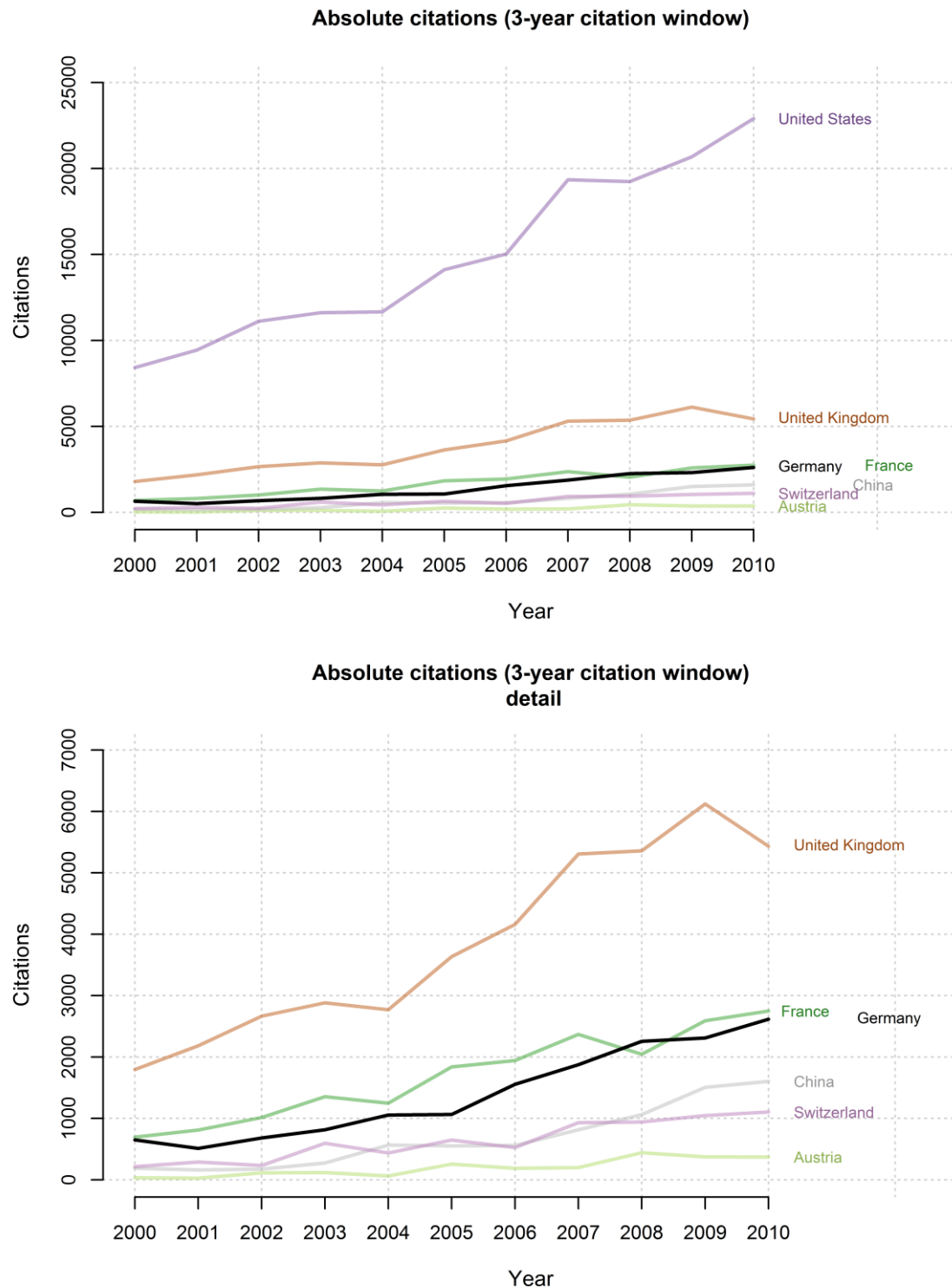


Figure 17. Absolute citations of seven countries in epidemiology (2000-2010)

### Relative share of citation numbers

Even though the United States has the most absolute citations and considerable annual growth in citations in the field, its annual relative shares of citations did not increase throughout the period and decreased after 2007. The relative shares of citations of the United Kingdom decreased after

2007 as well, from about 15% back to about 11%. German shares display a slight growth to about 5% of citation in more recent years. Germany has slightly lower shares of citation numbers in epidemiology than France. Only in 2008 Germany outscored France.

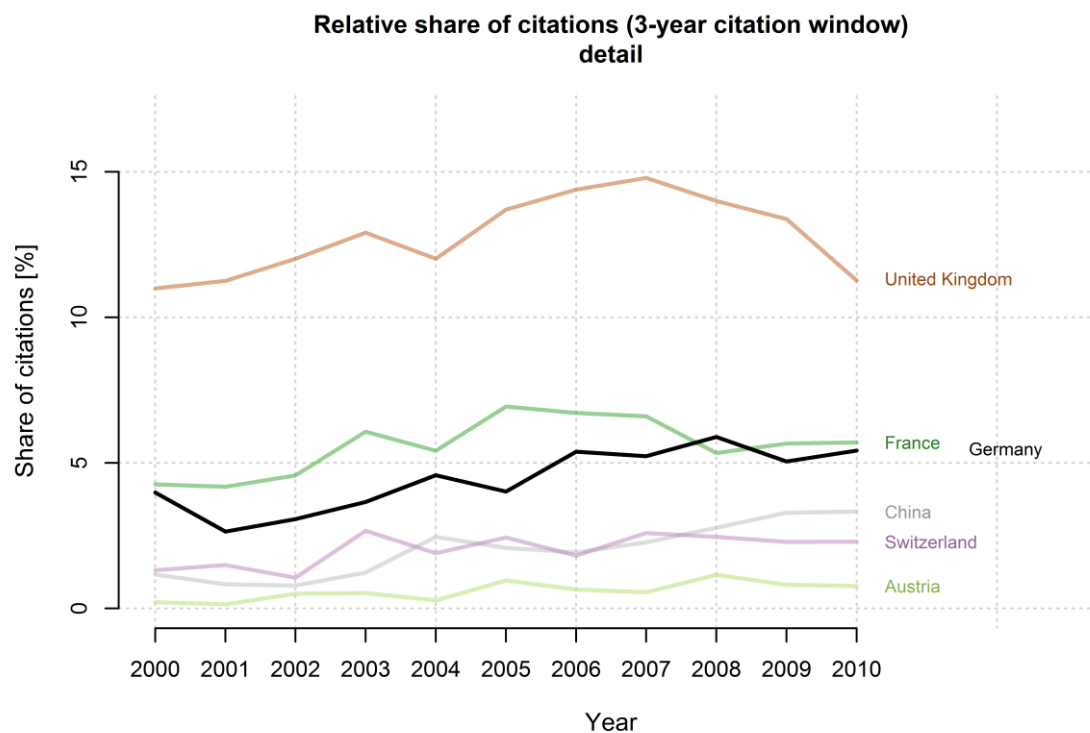
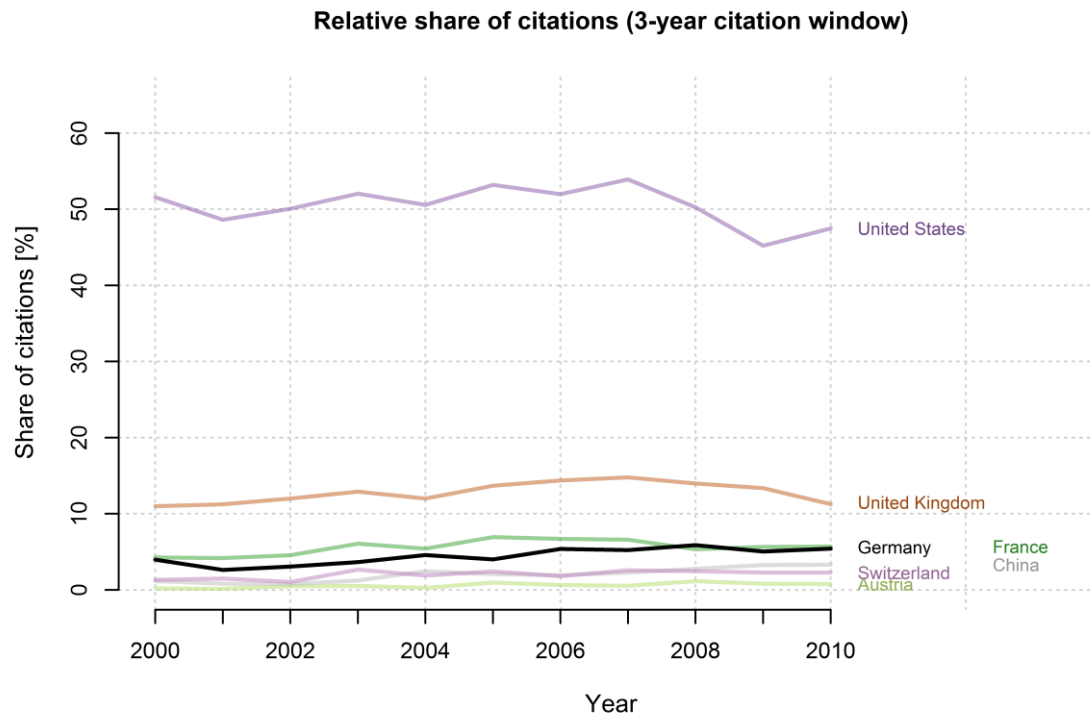


Figure 18. Relative shares of citations of seven countries in epidemiology (2000-2010)

### Citations per paper

Switzerland, Austria and Germany, the three German-speaking countries, have relatively high impact as expressed in average citation rate, cf. Table 6. France, the USA and the United

Kingdom also have above average citation rates. China has the poorest citation impact in our reference set, in contrast to its increasingly high publication numbers. All countries have increasing average citation rates as shown in Figure 19, except for China.

Table 6. Average citation rates of seven countries in epidemiology (2000-2010)

<b>Year</b>	<b>World</b>	<b>Austria</b>	<b>China</b>	<b>France</b>	<b>Germany</b>	<b>Switzerland</b>	<b>UK</b>	<b>USA</b>
2000	4.74	2.92	5.76	4.38	6.13	5.81	4.80	5.78
2001	5.17	5.60	5.03	4.72	5.51	6.28	4.99	5.98
2002	6.21	7.53	4.86	6.85	6.08	6.88	6.61	6.94
2003	6.12	6.94	5.98	6.91	6.80	9.60	6.86	7.11
2004	6.04	5.33	7.36	6.03	8.37	7.18	6.61	6.94
2005	6.40	10.63	6.90	7.80	7.50	10.11	7.31	7.36
2006	6.04	6.45	6.21	6.61	8.03	6.73	7.69	6.87
2007	6.42	6.45	2.69	8.19	8.38	9.59	8.04	7.78
2008	6.28	10.05	2.64	7.10	9.51	10.47	8.22	7.27
2009	7.18	10.11	3.31	8.78	8.99	10.68	8.65	7.76
2010	6.95	8.65	3.93	8.11	8.36	9.21	7.95	8.09

Note: All values computed with 3-year citation windows

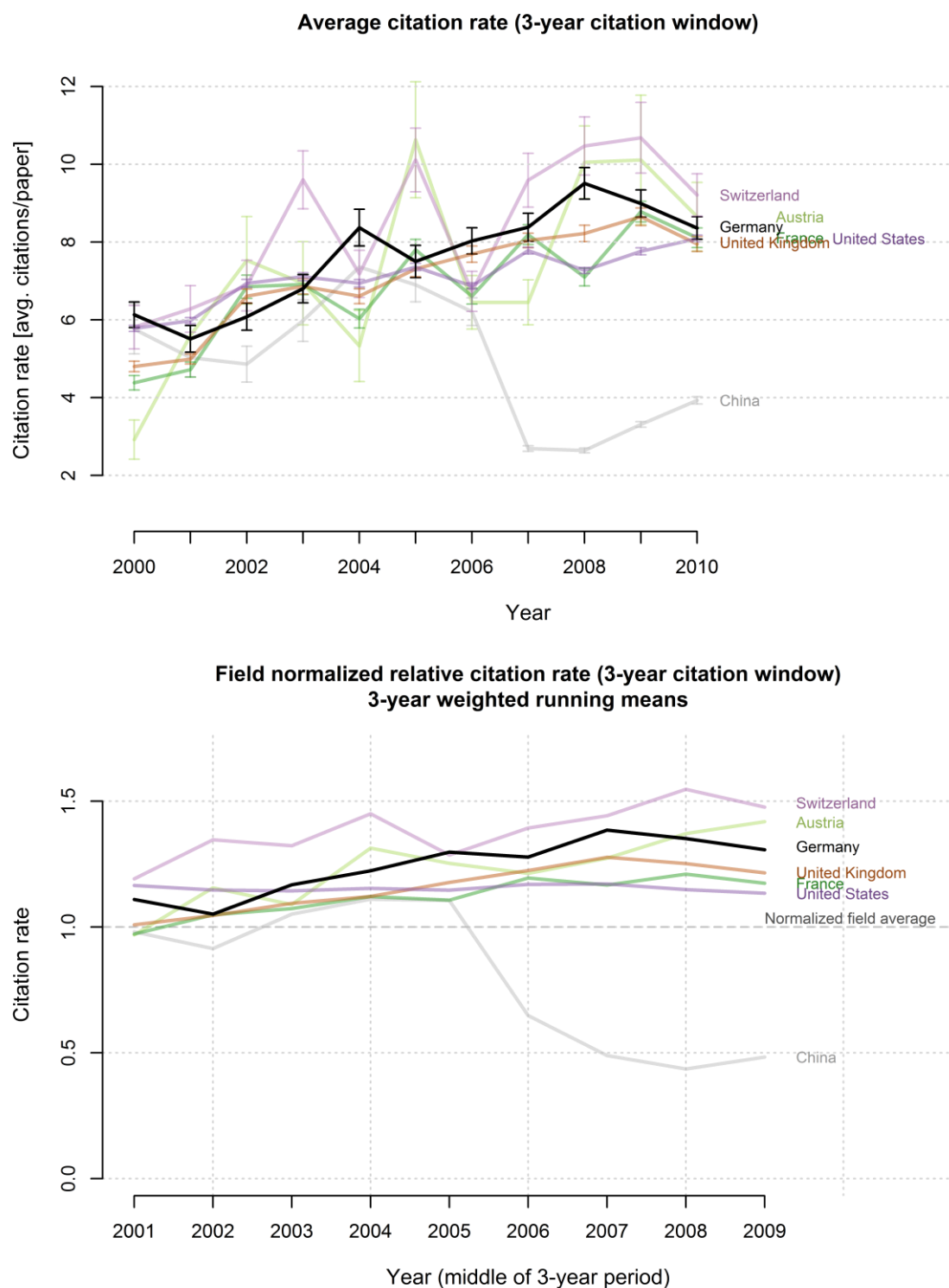


Figure 19. Average citation rates (raw and field normalized) of seven countries in epidemiology (2000-2010)

Note: Vertical bars around the means in the upper panel are approximate standard errors calculated according to Schubert & Glänzel (1983).

Regarding the field normalized relative citation rates, after 2005 China's scores are below the average of the field, this unusual deviation could not be investigated due to the constraints of this study, but it might well be attributed in part to the massive spike in annual publications. The western nations with the exception of the USA display increasing relative citation rates over time. Switzerland has the highest field normalized citation rates among the seven countries, indicating a strong perception of its research articles in epidemiology. Germany scores consistently high in field normalized citation rates.

### **Share of uncited papers**

The USA, the United Kingdom, France and Germany display decreasing uncited rates across the observation period. Switzerland has the lowest average uncited rate for the entire period (4.7%), followed by Germany (7.1%) and the United Kingdom (8.1%). China has the highest average share of uncited papers, 43.2%, and its uncited rate jumped in 2007, the year when the publications increased sharply according to the above indicators. In general, Germany has good performance in uncited rate, well below the average of the field, and its share of uncited articles is decreasing slightly during the period.



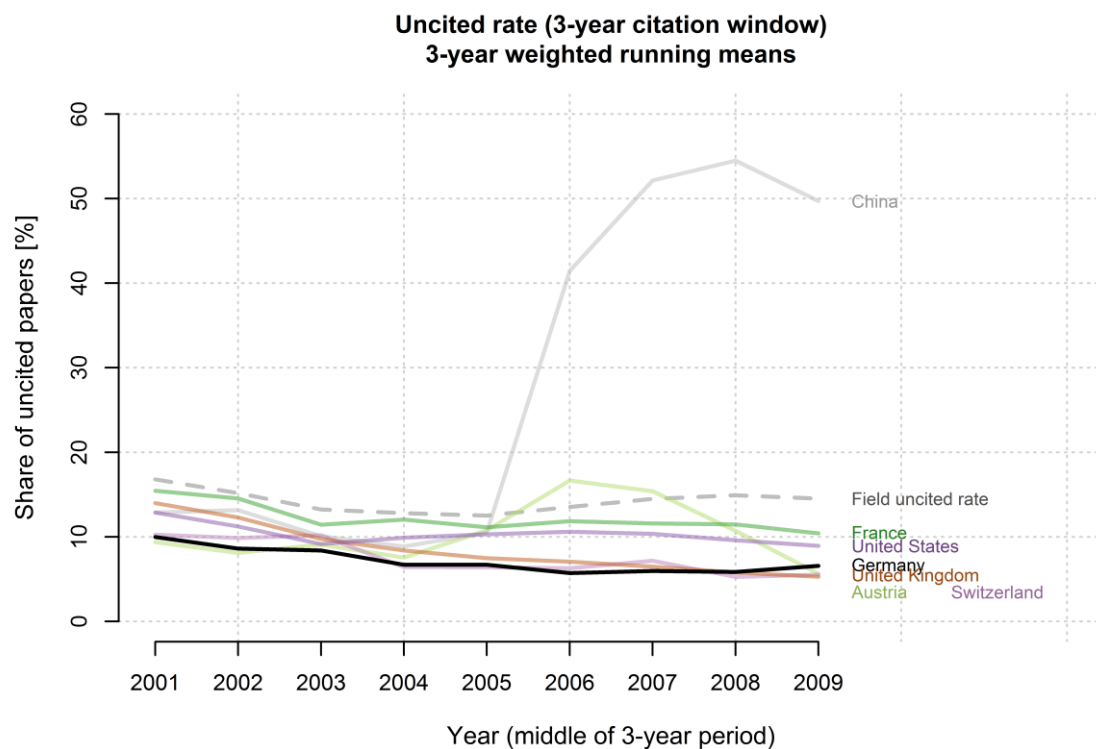
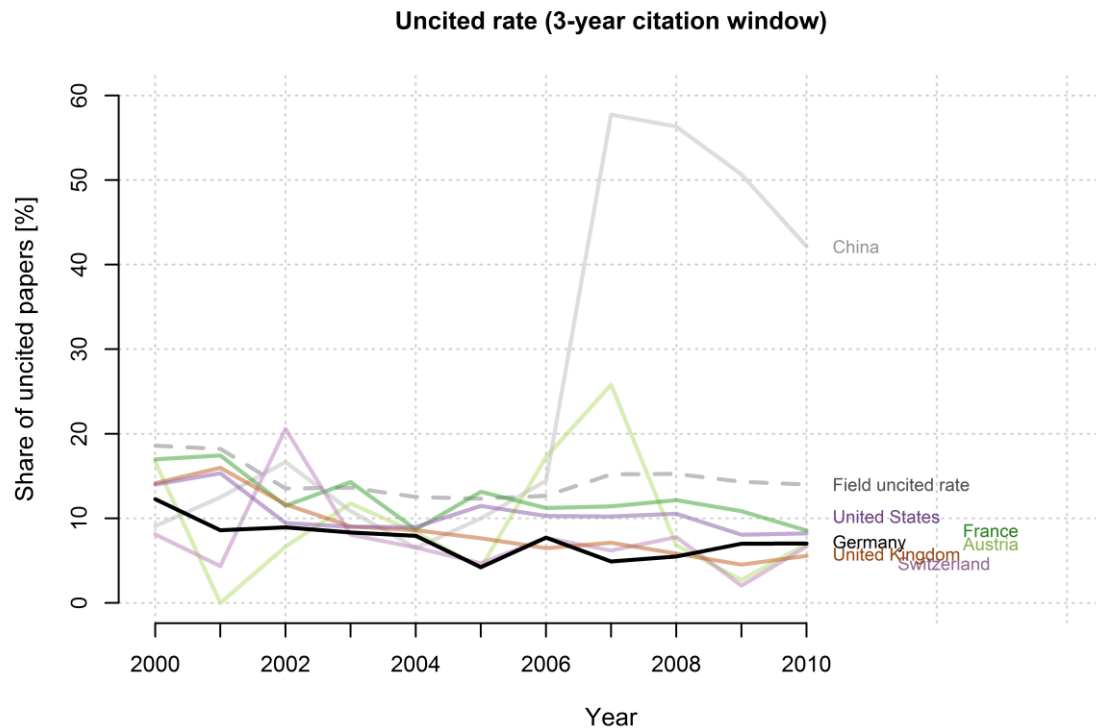


Figure 20. Shares of uncited papers of seven countries in epidemiology (2000-2010)

### 2.3.4 German institutions

The ten most productive German institutions in epidemiology are listed in Table 7. Deutsches Krebsforschungszentrum contributes the most research articles in this field, publishing 16.7% of

all German articles. Robert Koch-Institut and Ruprecht-Karls-Universität Heidelberg contribute another 10% and 8% of the whole-count German articles, respectively.

Table 7. Top 10 productive German institutions in epidemiology (2000-2012)

<b>Institution</b>	<b>Articles</b>	<b>Share of German articles</b>
Deutsches Krebsforschungszentrum (DKFZ)	322	16.74%
Robert Koch-Institut	197	10.24%
Ruprecht-Karls-Universität Heidelberg	157	8.16%
Ludwig-Maximilians-Universität München	153	7.95%
Charité - Universitätsmedizin Berlin	149	7.74%
Helmholtz Zentrum München - Deutsches Forschungszentrum für Gesundheit und Umwelt (GmbH) HMGU	119	6.19%
Albert-Ludwigs-Universität Freiburg	113	5.87%
Universität Ulm	111	5.77%
Medizinische Hochschule Hannover (MHH)	101	5.25%
DIfE - Deutsches Institut für Ernährungsforschung	97	5.04%

The ten most cited German institutions in epidemiology are shown in Table 8. Deutsches Krebsforschungszentrum received the most citations (15%), followed by Robert Koch-Institut and Charité Berlin.

Table 8. Top 10 most cited German institutions in epidemiology (2000-2010)

<b>Institution</b>	<b>Citations</b>	<b>Share of Citations of German articles</b>
Deutsches Krebsforschungszentrum (DKFZ)	2,229	14.48%
Robert Koch-Institut	1,586	10.30%
Charité - Universitätsmedizin Berlin	993	6.45%
Helmholtz Zentrum München - Deutsches Forschungszentrum für Gesundheit und Umwelt (GmbH) HMGU	950	6.17%
Ludwig-Maximilians-Universität München	909	5.90%
Albert-Ludwigs-Universität Freiburg	817	5.31%
Ruprecht-Karls-Universität Heidelberg	797	5.18%
Universität Ulm	734	4.77%
DIfE - Deutsches Institut für Ernährungsforschung	672	4.37%
Medizinische Hochschule Hannover (MHH)	573	3.72%

### 3 References

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## 4 Appendix

### 4.1 Journal list of the discipline *Public Health*

TITLE	ISSN
African Journal of AIDS Research	16085906
AIDS and Behavior	10907165
AIDS and Public Policy Journal	08873852
AIDS care	09540121
AIDS education and prevention : official publication of the International Society for AIDS Education	08999546
American journal of community psychology	00910562
American journal of health behavior	10873244
American journal of health promotion : AJHP	08901171
American Journal of Men's Health	15579883
American journal of preventive medicine	07493797
American journal of public health	00900036
Annals of behavioral medicine : a publication of the Society of Behavioral Medicine	08836612
Annual review of public health	01637525
Annual review of sex research	10532528
Anthropology and Medicine	13648470
Archives of Public Health	07787367
Asia-Pacific journal of public health / Asia-Pacific Academic Consortium for Public Health	10105395
Australia and New Zealand Health Policy	17438462
Australian and New Zealand journal of public health	13260200
Australian journal of primary health	14487527
Behavioral Medicine	08964289
BMC family practice [electronic resource]	14712296
BMC International Health and Human Rights	1472698X
BMC public health [electronic resource]	14712458
Cadernos de saúde pública / Ministério da Saúde, Fundação Oswaldo Cruz, Escola Nacional de Saúde Pública	0102311X
Canadian Journal of Human Sexuality	11884517
Canadian journal of public health Revue canadienne de santé publique	00084263
Chronic diseases in Canada	02288699
Chronic illness	17423953
Communication and Medicine	16121783
Contemporary clinical trials	15517144
Critical public health	09581596
Culture, health & sexuality	13691058

Drugs and Society	87568233
Education for General Practice	13678523
Education for primary care : an official publication of the Association of Course Organisers, National Association of GP Tutors, World Organisation of Family Doctors	14739879
Ethnicity and Disease	1049510X
Ethnicity and Health	13557858
European journal of public health	11011262
Evaluation and the Health Professions	01632787
Family and Community Health	01606379
Family planning perspectives	00147354
Family practice	02632136
Genitourinary medicine	02664348
Global Public Health	17441692
Health and human rights	10790969
Health and Place	13538292
Health care for women international	07399332
Health communication	10410236
Health Education	09654283
Health education & behavior : the official publication of the Society for Public Health Education	10901981
Health Education Journal	00178969
Health education research	02681153
Health expectations : an international journal of public participation in health care and health policy	13696513
Health promotion international	09574824
Health promotion journal of Australia : official journal of Australian Association of Health Promotion Professionals	10361073
Health psychology : official journal of the Division of Health Psychology, American Psychological Association	02786133
Health, Risk and Society	13698575
Health (United Kingdom)	13634593
Hispanic Healthcare International	15404153
Huisarts en Wetenschap	00187070
Injury prevention : journal of the International Society for Child and Adolescent Injury Prevention	13538047
International journal for equity in health	14759276
International Journal of Adolescent Medicine and Health	03340139
International journal of behavioral medicine	10705503
International journal of circumpolar health	12399736
International journal of health geographics	1476072X
International Journal of Health Promotion and Education	14635240
International journal of health services : planning, administration, evaluation	00207314

International Journal of Men's Health	15326306
International journal of public health	16618556
International journal of STD & AIDS	09564624
International Journal of Transgenderism	15532739
International quarterly of community health education	0272684X
Journal of cancer education : the official journal of the American Association for Cancer Education	08858195
Journal of community health	00945145
Journal of Gay and Lesbian Psychotherapy	08917140
Journal of Gay and Lesbian Social Services	10538720
Journal of health and social behavior	00221465
Journal of health care for the poor and underserved	10492089
Journal of health communication	10810730
Journal of health education / Association for the Advancement of Health Education	10556699
Journal of health psychology	13591053
Journal of HIV/AIDS and Social Services	15381501
Journal of HIV/AIDS Prevention and Education for Adolescents and Children	1069837X
Journal of HIV/AIDS Prevention in Children and Youth	15538346
Journal of Immigrant and Minority Health	15571912
Journal of Immigrant and Refugee Services	15362949
Journal of immigrant health	10964045
Journal of lesbian studies	10894160
Journal of medical screening	09691413
Journal of physical activity & health	15433080
Journal of prevention & intervention in the community	10852352
Journal of psychology & human sexuality	08907064
Journal of public health management and practice : JPHMP	10784659
Journal of public health medicine	09574832
Journal of public health (Oxford, England)	17413842
Journal of public health policy	01975897
Journal of Sex Education and Therapy	01614576
Journal of the Gay and Lesbian Medical Association	10907173
Journal of the National Medical Association	00279684
Journal of The Royal Society for the Promotion of Health	14664240
Journal of urban health : bulletin of the New York Academy of Medicine	10993460
Journal of women's health & gender-based medicine	15246094
Journal of women's health (2002)	15409996
Maternal and child health journal	10927875
Medical anthropology	01459740

Medical anthropology quarterly	07455194
Nicotine and Tobacco Research	14622203
Patient education and counseling	07383991
Perspectives on sexual and reproductive health	15386341
Preventive medicine	00917435
Psicologia em Estudo	14137372
Psicologia: Reflexao e Critica	01027972
Psychology, health & medicine	13548506
Public health	00333506
Public Health Medicine	14651505
Public health reports (Washington, DC : 1974)	00333549
Qualitative Research in Psychology	14780887
Quality in primary care	14791072
Reproductive health matters	09688080
Research in the sociology of health care	02754959
Revista Brasileira de Saude Materno Infantil	15193829
Revista Cubana de Salud Publica	08643466
Revista de salud pública (Bogotá, Colombia)	01240064
Revista de saúde pública	00348910
Revista española de salud pública	11355727
Revista panamericana de salud pública = Pan American journal of public health	10204989
Salud pública de México	00363634
Santé publique (Vandoeuvre-lès-Nancy, France)	09953914
Scandinavian journal of primary health care	02813432
Scandinavian journal of public health	14034948
Scandinavian journal of public health Supplement	14034956
Scandinavian journal of social medicine	03008037
Sciences Sociales et Sante	02940337
Sex Education	14681811
Sexual health	14485028
Sexuality and Culture	10955143
Sexually transmitted diseases	01485717
Sexually transmitted infections	13684973
Social science & medicine (1982)	02779536
Sociology of health & illness	01419889
Sozial- und Präventivmedizin	03038408
The British journal of general practice : the journal of the Royal College of General Practitioners	09601643
The international journal of behavioral nutrition and physical activity	14795868



The Journal of adolescent health : official publication of the Society for Adolescent Medicine	1054139X
The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association	0890765X
The Journal of school health	00224391
The Journal of the Association of Nurses in AIDS Care : JANAC	10553290
Tobacco control	09644563
Venereology	10321012
Women and Health	03630242
Women's health issues : official publication of the Jacobs Institute of Women's Health	10493867
World Health Organization Regional Publications - European Series	03782255
World Health Organization technical report series	05123054
Zeitschrift für Gesundheitswissenschaften = Journal of public health	09431853

## 4.2 Tables of the discipline *Public Health*

Table 9. Whole counts of articles of the ten most productive countries in public health (2000-2012)

Year	World	USA	UK	Canada	Australia	Brazil	Nether-lands	Sweden	Spain	Germany	France
2000	4,842	2,061	726	265	252	149	183	114	65	59	57
2001	5,097	2,117	722	268	198	81	127	156	80	44	64
2002	5,186	2,215	746	294	225	177	170	109	72	55	67
2003	4,982	2,021	716	305	274	147	159	148	81	64	67
2004	5,214	2,113	757	308	279	151	201	130	70	87	92
2005	6,099	2,591	905	399	314	169	247	179	67	83	79
2006	7,886	3,460	1,195	559	472	551	341	218	106	103	101
2007	8,425	3,627	1,223	578	532	660	345	204	132	141	133
2008	9,084	3,943	1,335	627	612	681	362	213	142	153	142
2009	9,569	4,268	1,261	734	660	688	383	261	215	161	153
2010	10,163	4,613	1,250	747	736	654	400	238	234	192	176
2011	10,960	5,018	1,417	809	862	673	489	273	231	207	197
2012	10,577	4,911	1,410	830	786	562	519	273	214	255	180
Total	98,084	42,958	13,663	6,723	6,202	5,343	3,926	2,516	1,709	1,604	1,508

Table 10. Fractional counts of articles of the ten most productive countries in public health (2000-2012)

<b>Year</b>	<b>World</b>	<b>USA</b>	<b>UK</b>	<b>Canada</b>	<b>Australia</b>	<b>Brazil</b>	<b>Netherland</b>	<b>Sweden</b>	<b>Spain</b>	<b>Germany</b>	<b>France</b>
2000	4,842	1,961.19	677.16	237.58	233.05	137.40	165.52	101.72	53.77	47.10	50.13
2001	5,097	2,023.83	671.47	242.89	180.07	74.99	108.24	136.43	68.26	31.53	52.35
2002	5,186	2,090.84	672.08	260.47	197.40	163.50	151.45	94.55	60.92	39.93	56.22
2003	4,982	1,869.13	627.12	268.89	242.19	136.34	134.65	125.93	64.94	52.65	52.24
2004	5,214	1,927.70	662.62	263.01	246.81	141.61	167.74	110.35	58.52	69.98	70.62
2005	6,099	2,373.38	773.75	334.66	270.95	160.37	218.86	151.86	55.68	67.59	62.12
2006	7,886	3,107.14	1,005.50	426.38	388.64	521.36	283.68	176.20	77.21	76.57	71.84
2007	8,425	3,181.64	1,007.21	451.35	426.11	610.56	281.07	159.71	91.22	100.12	97.15
2008	9,084	3,351.30	1,066.99	489.15	491.97	638.04	280.99	158.65	88.04	108.79	101.63
2009	9,569	3,768.88	986.36	574.18	530.17	651.38	298.75	183.84	168.21	110.34	106.83
2010	10,163	4,067.58	968.44	581.88	590.14	611.23	305.93	167.53	183.82	129.42	131.13
2011	10,960	4,428.72	1,097.82	618.77	674.57	618.42	363.06	184.24	171.14	146.23	136.97
2012	10,577	4,321.88	1,074.39	628.93	625.74	510.76	387.8	179.83	156.96	170.18	115.39
<b>Total</b>	<b>98,084</b>	<b>38,473.21</b>	<b>11,290.91</b>	<b>5,378.14</b>	<b>5,097.81</b>	<b>4,975.96</b>	<b>3,147.74</b>	<b>1,930.84</b>	<b>1,298.69</b>	<b>1,150.43</b>	<b>1,104.62</b>

Table 11. Ratios of fractional to whole publication counts for the ten most productive countries in public health (2000-2012)

	<b>Australia</b>	<b>Brazil</b>	<b>Canada</b>	<b>France</b>	<b>Germany</b>	<b>Netherlands</b>	<b>Spain</b>	<b>Sweden</b>	<b>UK</b>	<b>USA</b>
Total fractional publications	5097.81	4975.96	5378.14	1104.62	1150.43	3147.74	1298.69	1930.84	11290.91	38473.21
Total whole publications	6202	5343	6723	1508	1604	3926	1709	2516	13663	42958
Ratio fractional:whole	0.82	0.93	0.80	0.73	0.72	0.80	0.76	0.77	0.83	0.90

Table 12. Absolute citations of seven countries in public health (2000-2010)

<b>Year</b>	<b>World</b>	<b>Austria</b>	<b>China</b>	<b>France</b>	<b>Germany</b>	<b>Switzerland</b>	<b>UK</b>	<b>USA</b>
2000	12,294	13	61	121	165	82	1,902	7,334
2001	14,208	16	27	143	174	142	2,229	8,124
2002	15,597	11	80	213	207	174	2,335	8,823
2003	17,103	6	87	156	207	238	2,928	9,235
2004	18,615	22	149	398	437	202	3,034	10,262
2005	21,753	43	196	222	319	270	3,603	11,286
2006	28,794	65	431	299	525	685	4,978	15,367
2007	33,555	35	425	397	777	534	5,234	18,410
2008	35,579	113	458	572	922	620	5,605	18,670
2009	39,555	119	697	650	895	669	6,116	20,265
2010	40,804	195	779	672	979	669	5,626	21,850
Total	277,857	638	3,390	3,843	5,607	4,285	43,590	149,626

Note: All values are computed from 3-year citation windows

### 4.3 Journal list of the discipline *Epidemiology*

TITLE	ISSN
Alzheimer's and Dementia	15525260
American Journal of Epidemiology	00029262
American Journal of Infection Control	01966553
American Journal of Preventive Medicine	07493797
Annals of Epidemiology	10472797
Asian Journal of Epidemiology	19921462
Asian Pacific journal of cancer prevention : APJCP	15137368
BMC medical research methodology	14712288
Cancer Epidemiology	18777821
Cancer Epidemiology Biomarkers and Prevention	10559965
Chronic diseases and injuries in Canada	19256523
Chronic Diseases in Canada	02288699
Clinical Epidemiology	11791349
Clinical Journal of the American Society of Nephrology	15559041
Clinical Microbiology Reviews	08938512
Clinical Practice and Epidemiology in Mental Health	17450179
CVD Prevention and Control	18754570
Emerging Health Threats Journal	17528550
Emerging Infectious Diseases	10806040
Emerging Microbes and Infections	22221751
Emerging Themes in Epidemiology	17427622
Epidemiologic Reviews	0193936X
Epidemiology	10443983
Epidemiology and Infection	09502688
Epidemiology and Psychiatric Sciences	20457960
Ethnicity and Disease	1049510X
European Journal of Cancer Prevention	09598278
European Journal of Cardiovascular Prevention and Rehabilitation	17418267
European Journal of Epidemiology	03932990
European Journal of Preventive Cardiology	20474873
Eurosurveillance	1025496X
Food and Environmental Virology	18670334
Genetic Epidemiology	07410395
Health and Population: Perspectives and Issues	02536803
HIV and AIDS Review	17301270
HIV/AIDS - Research and Palliative Care	11791373
Infection Control and Hospital Epidemiology	0899823X
Infectious Agents and Cancer	17509378
Influenza and other Respiratory Viruses	17502640
International Journal of Circumpolar Health	12399744
International Journal of Epidemiology	03005771
International Journal of Molecular Epidemiology and Genetics	19481756

International Journal of Tropical Medicine	18163319
Internet Journal of Epidemiology	15402614
Italian Journal of Public Health	17237815
Journal of Applied Econometrics	08837252
Journal of Applied Microbiology	13645072
Journal of Applied Toxicology	0260437X
Journal of Cancer Epidemiology	16878558
Journal of Clinical Epidemiology	08954356
Journal of Clinical Pharmacology and Pharmacoepidemiology	1916694X
Journal of Community Genetics	1868310X
Journal of Epidemiology	09175040
Journal of Epidemiology and Community Health	0143005X
Journal of Epidemiology and Global Health	22106006
Journal of Exposure Science and Environmental Epidemiology	15590631
Journal of Immigrant and Minority Health	15571912
Journal of Research in Health Sciences	16822765
Journal of the American Water Resources Association	1093474X
Maternal and Child Health Journal	10927875
Morbidity and Mortality Weekly Report	01492195
Neuroepidemiology	14230208
Open Epidemiology Journal	18742971
Ophthalmic Epidemiology	09286586
Paediatric and Perinatal Epidemiology	02695022
Pharmacoepidemiology and Drug Safety	10538569
Population Health Metrics	14787954
Preventive Medicine	00917435
Revue d'épidémiologie et de santé publique	03987620
Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare	15592332
Social Psychiatry and Psychiatric Epidemiology	09337954
Statistical Methods in Medical Research	09622802
Statistics in Medicine	02776715
Tobacco Control	09644563
Tumor	10007431
Zoonoses and Public Health	18631959

#### 4.4 Tables of the discipline *Epidemiology*

Table 13. Whole counts of articles of the ten most productive countries and all countries in epidemiology (2000-2012)

Year	World	USA	UK	Canada	China	France	Australia	Nether-lands	Germany	Italy	Japan
2000	3,446	1,458	374	176	33	159	104	135	106	136	162
2001	3,754	1,578	438	177	32	172	110	140	93	119	136
2002	3,573	1,600	403	173	36	148	132	149	112	117	127
2003	3,646	1,633	420	200	46	196	155	127	120	118	131
2004	3,820	1,681	419	222	77	207	157	176	126	144	146
2005	4,147	1,919	497	250	80	236	181	201	142	160	172
2006	4,790	2,188	541	325	90	294	232	219	194	183	155
2007	5,587	2,486	660	347	303	289	250	257	224	204	166
2008	6,094	2,646	652	397	403	288	268	261	237	230	198
2009	6,368	2,664	708	413	454	295	282	278	257	224	223
2010	6,941	2,833	683	465	408	339	339	299	313	264	221
2011	7,325	3,104	768	471	570	360	334	300	292	295	229
2012	7,680	3,099	778	485	855	344	362	338	315	270	232
Total	67,171	28,889	7,341	4,101	3,387	3,327	2,906	2,880	2,531	2,464	2,298

Table 14. Fractional counts of articles of the ten most productive countries in epidemiology (2000-2012)

Year	World	USA	UK	Canada	China	France	Australia	Nether-lands	Japan	Italy	Germany
2000	3,446	1,330.04	286.14	138.79	15.76	130.91	79.62	105.36	140.36	100.13	74.24
2001	3,754	1,430.04	346.25	140.52	10.08	136.20	88.28	113.53	122.57	95.57	71.47
2002	3,573	1,444.96	314.41	144.49	15.11	105.72	101.29	118.35	113.84	89.88	81.71
2003	3,646	1,422.10	306.81	147.38	20.14	142.63	122.83	90.80	114.49	87.67	80.87
2004	3,820	1,451.02	310.14	168.50	40.83	145.73	116.10	137.19	121.18	113.25	83.61
2005	4,147	1,657.49	347.80	179.50	42.8	155.53	138.48	147.76	150.84	104.91	92.95
2006	4,790	1,895.81	368.55	218.26	50.91	197.76	163.06	152.32	130.54	123.77	125.00
2007	5,587	2,169.62	445.93	238.12	253.21	194.20	177.32	176.70	138.39	134.09	142.01
2008	6,094	2,216.03	410.57	276.85	337.74	199.29	177.69	175.12	154.86	158.93	144.53
2009	6,368	2,234.18	457.01	276.88	380.25	186.23	195.66	186.70	180.36	149.37	148.07
2010	6,941	2,370.68	429.51	315.26	339.28	212.64	217.73	191.92	193.39	177.08	179.11
2011	7,325	2,643.59	498.99	316.90	485.43	235.96	223.11	183.78	185.55	207.08	165.66
2012	7,680	2,630.27	479.64	326.99	764.1	216.51	249.25	201.64	173.76	179.27	181.43
Total	67,171	24,895.83	5,001.75	2,888.44	2,755.64	2,259.31	2,050.42	1,981.17	1,920.13	1,721.00	1,570.66



Table 15. Ratio of fractional to whole publications in epidemiology (2000-2012)

	<b>USA</b>	<b>UK</b>	<b>Canada</b>	<b>China</b>	<b>France</b>	<b>Australia</b>	<b>Netherlands</b>	<b>Japan</b>	<b>Italy</b>	<b>Germany</b>
Total fractional publications	24895.83	5001.75	2888.44	2755.64	2259.31	2050.42	1981.17	1920.13	1721.00	1570.66
Total whole publications	28889	7341	4101	3387	3327	2906	2880	2531	2464	2298
Ratio fractional:whole	0.86	0.68	0.70	0.81	0.68	0.71	0.69	0.76	0.70	0.68

Table 16. Absolute citations of seven countries in epidemiology (2000-2010)

<b>Year</b>	<b>World</b>	<b>Austria</b>	<b>China</b>	<b>France</b>	<b>Germany</b>	<b>Switzerland</b>	<b>UK</b>	<b>USA</b>
2000	16,330	35	190	696	650	215	1,795	8,422
2001	19,410	28	161	811	512	289	2,184	9,435
2002	22,188	113	175	1,014	681	234	2,665	11,111
2003	22,323	118	275	1,355	816	595	2,882	11,617
2004	23,058	64	567	1,249	1,055	438	2,770	11,663
2005	26,535	255	552	1,840	1,065	647	3,635	14,117
2006	28,913	187	559	1,942	1,557	525	4,159	15,031
2007	35,881	200	816	2,368	1,876	930	5,307	19,344
2008	38,291	442	1,062	2,046	2,255	942	5,359	19,241
2009	45,753	374	1,505	2,591	2,311	1,047	6,121	20,683
2010	48,240	372	1,604	2,750	2,616	1,105	5,433	22,907
Total	326,922	2,188	7,466	18,662	15,394	6,967	42,310	163,571

Note: All values calculated with 3-year citation windows