C 7 Scientific publications

A large proportion of new technologies and services is based on developments and results from science. The performance of a country's research and science system, as measured by scientific publications, is of particular importance for future technological developments and the resulting economic gains. Bibliometric indicators and metrics are regularly used as yardsticks for evaluating scientific achievements and can therefore help estimate the performance of a research and science system in both quantitative and qualitative terms.

The bibliometric database Web of Science (WoS) covers worldwide publications in scientific journals as well as citations of these publications. The research affiliation of scientists referenced in the database makes it possible to assign individual publications to a specific country. Fractional counting is employed in cases where several co-authors from different countries contribute to a publication. The indicators used to assess the performance of a research and science system are its share of publications worldwide in 2005 and 2015 (quantitative indicator) and qualitative indicators (obtained via citations) based on the international alignment (IA), the scientific regard (SR), and the excellence rate of publications for the years 2005 and 2013 respectively.

Looking only at the number of publications, individual countries' shares of all WoS publications changed considerably between 2005 and 2015 (C 7-1).[459] China in particular more than doubled its share of publications from 6.6 to 16.1 percent. The shares of South Korea, Brazil and India also increased during this period. By contrast, lower shares were recorded in particular by the established science systems of the USA, Western Europe, Israel and Japan. Germany's share fell from 6.0 to 4.5 percent. Despite the massive increase in publications from China, some countries in Europe still succeeded in keeping their share stable over time, or even to increase it slightly. These countries include Denmark, Poland and Spain, among others.

Looking at the qualitative indicators, the following picture emerges. In 2013, scientists above all in Switzerland, the Netherlands and the USA succeeded in placing their publications primarily in scientific journals with an international audience (IA, C 7-2). According to this quality indicator, Germany was on a comparable level with the UK, Sweden and Israel in 2013, having successfully caught up with these countries since 2005, albeit without quite reaching the top group. By contrast, since 2005 scientists from the USA seem to have lost ground in terms of both the quantity (see above) and the quality in a relative comparison. Most of the BRICS countries – with the exception of Brazil – succeeded in improving their position in the index over time; however, they are still well below the average.

The scientific regard (SR) of publications shows that in 2013 publications from Switzerland, the USA, Denmark, and also China were cited particularly frequently in scientific journals by international comparison – more frequently than publications from the UK or Germany (C 7-3). Germany has worsened slightly since 2005. Almost all the BRICS countries have improved, and this shows itself in an overall convergence over time.

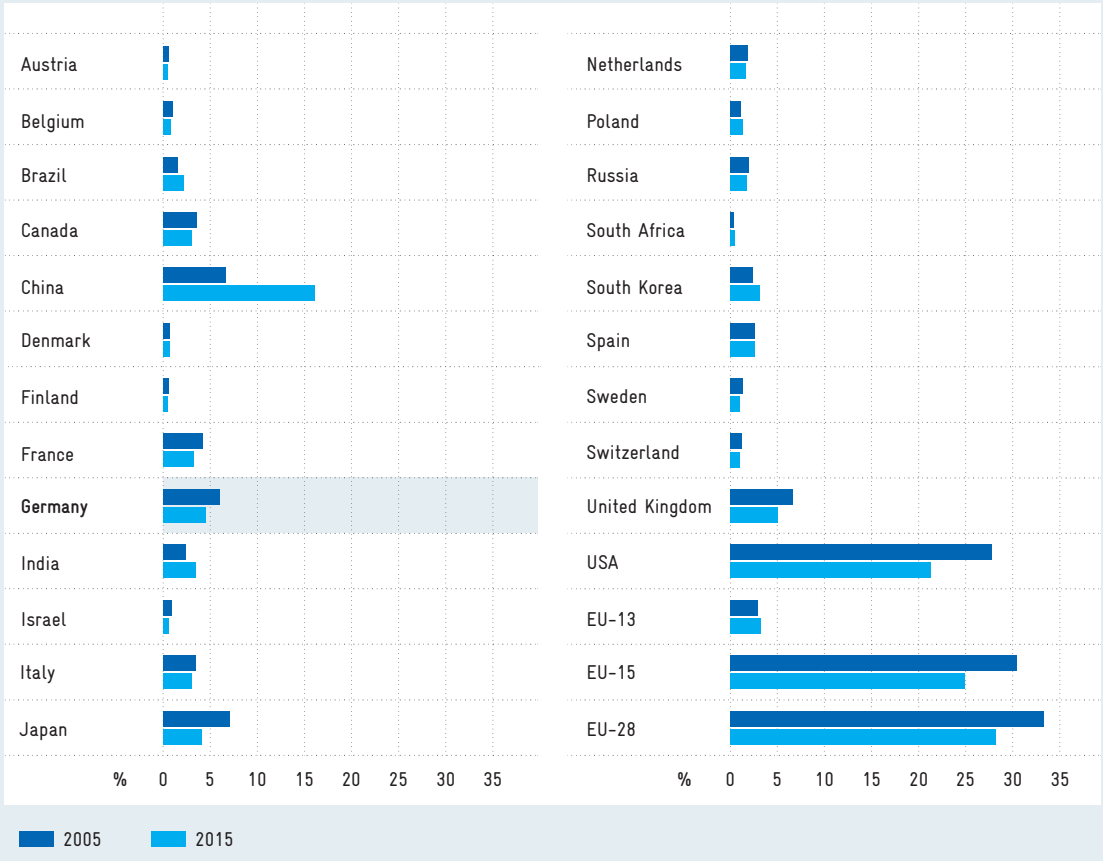
Another important quality indicator is the so-called excellence rate (no illustration) – i.e. the weighted share of a country's specialised publications among the top 10 percent of the most cited publications worldwide. This rate indicates a slight improvement in Germany's position over time.[460] One remarkable aspect is a rapid increase in the number of excellent Chinese publications. China has thus continuously increased not only the number but also the quality of its publications and has caught up with Western levels.

Fig. C 7-1

Download data

Percentages of all publications in the Web of Science from selected countries and regions, 2005 and 2015

The analysis concentrates on countries' shares, rather than on absolute figures, to compensate for changes caused mainly by the ongoing expansion of data collection.



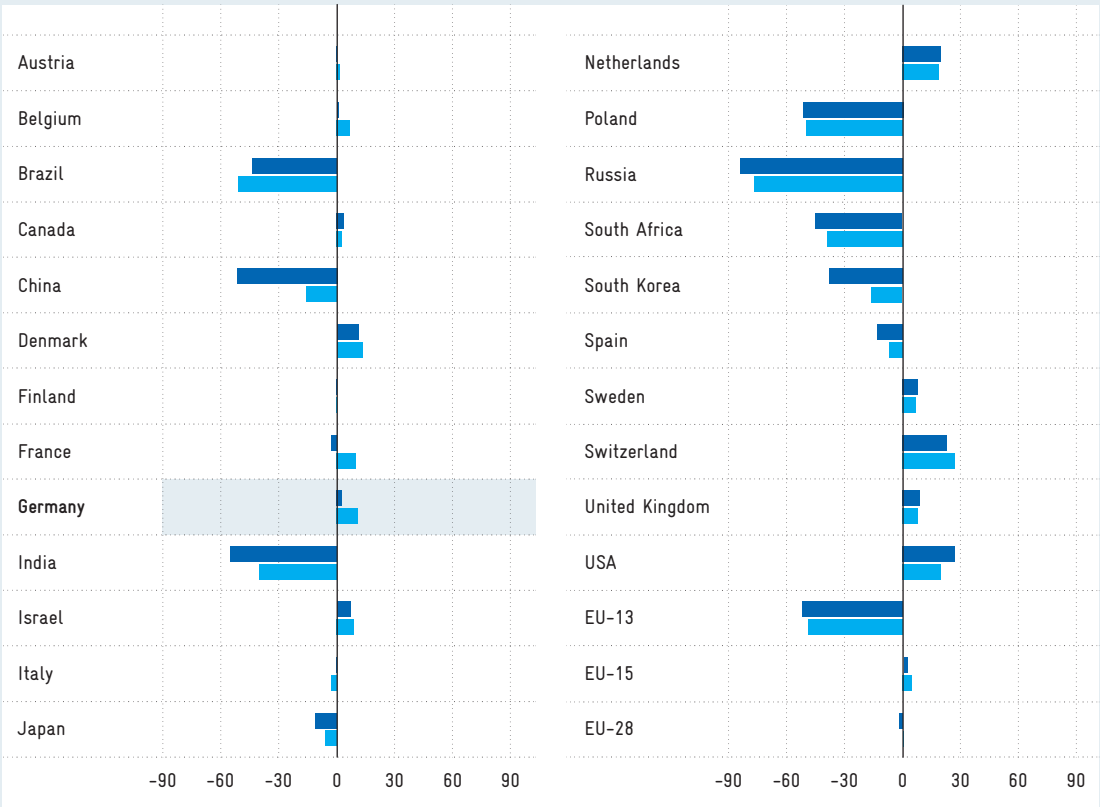
Source: Web of Science. Research and calculations by Fraunhofer ISI in Frietsch et al. (2017a). Fractional counting.

Fig. C 7-2

Download data

International alignment (IA) of publications in the Web of Science from selected countries and regions, 2005 and 2013 (index values)

The IA index indicates whether a country's authors publish in internationally more highly recognised or less highly recognised journals relative to the world average. Positive or negative values indicate an above-average or below-average IA.



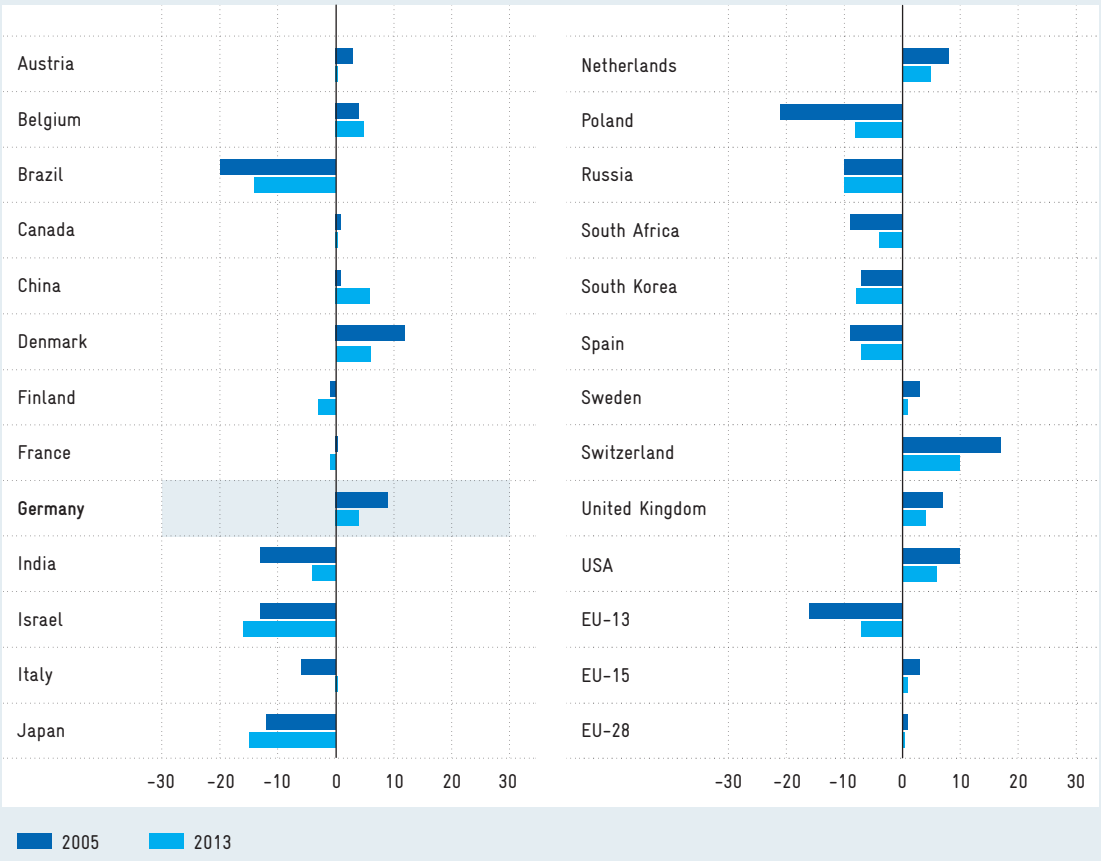
Source: Web of Science. Research and calculations by Fraunhofer ISI in Frietsch et al. (2017a). Fractional counting.

Fig. C 7-3

Download data

Scientific regard (SR) of publications in the Web of Science from selected countries and regions, 2005 and 2013 (index values)

The SR index indicates whether a country's articles are cited on average more or less frequently than other articles in the journals in which they appear. Positive or negative values indicate an above-average or below-average scientific regard. The index is calculated without self-citations.



Source: Web of Science. Research and calculations by Fraunhofer ISI in Frietsch et al. (2017a). Fractional counting.