C 6 Patents[479]

The number of transnational patent applications is a measure of the innovative activity of an economy. The total number of annual patent applications in the countries under consideration almost tripled in the period from 1997 to 2019. Since the mid-2000s, however, Germany's transnational patent applications have stagnated, as have those of other European economies such as the United Kingdom, Sweden and Switzerland (C 6-1). In contrast, China and South Korea in particular have shown high growth rates during this period. After Germany and Japan, China also overtook the USA for the first time in 2019 and now has the highest number of transnational patent applications.

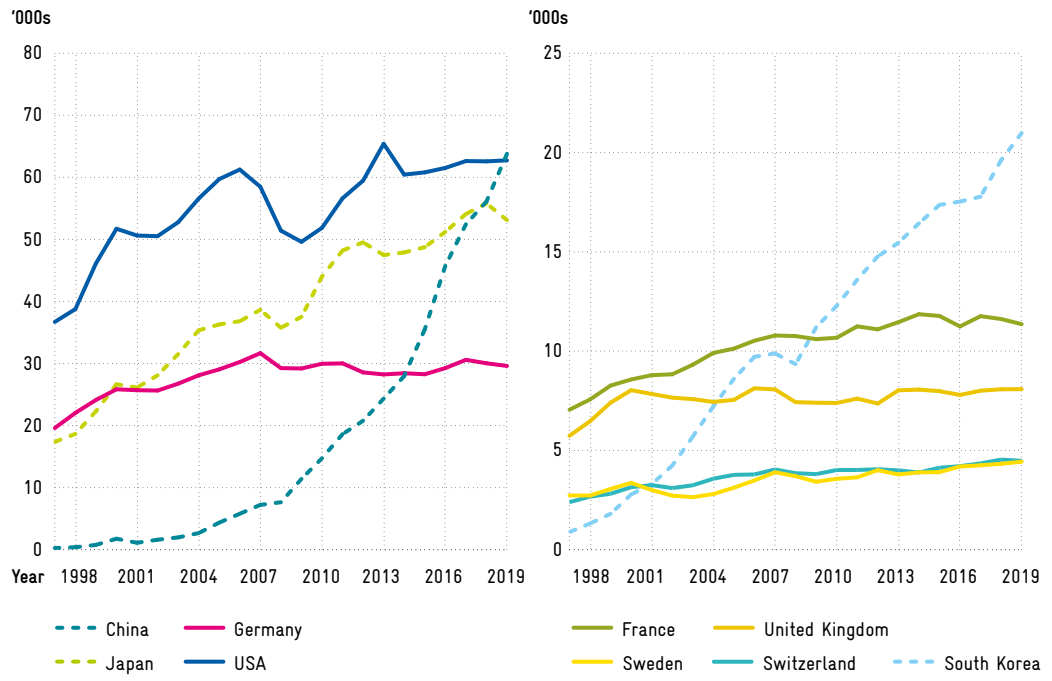
While China leads in absolute applications in 2019, it continues to lag well behind the large European and Asian industrialized nations in terms of patent intensity (patent applications per million employees) (C 6-2). Here, Switzerland, Sweden and Japan are at the top, followed by South Korea, Finland and Germany. The leading economies have patent intensities that are higher than China's by a factor of around 10. However, in the development of patent intensity in the years 2009 to 2019, China recorded by far the highest dynamics of all countries considered.

Further conclusions about a country's technological performance can be drawn from patent activities in R&D-intensive technologies. This area includes industry sectors that invest more than 3 percent of their turnover in R&D (R&D intensity). R&D-intensive technology comprises the areas of high-value technology (R&D intensity between 3 and 9 percent) and cutting-edge technology (R&D intensity higher than 9 percent).

An international comparison reveals Germany's clear and stable specialization in high-value technology (C 6-3), which can be explained by Germany's traditional strengths in the automotive industry, mechanical engineering and the chemical industry. Germany records the highest value of the comparison group here.

In contrast, China, Sweden and the USA specialize in cutting-edge technology (C 6-4), an area in which Germany, like Japan, underperforms. These specializations reflect the technological orientation of the economies under consideration and are subject to only minor fluctuations during the observation period.

Fig. C6-1 Number of transnational patent applications in selected countries 1997–2019



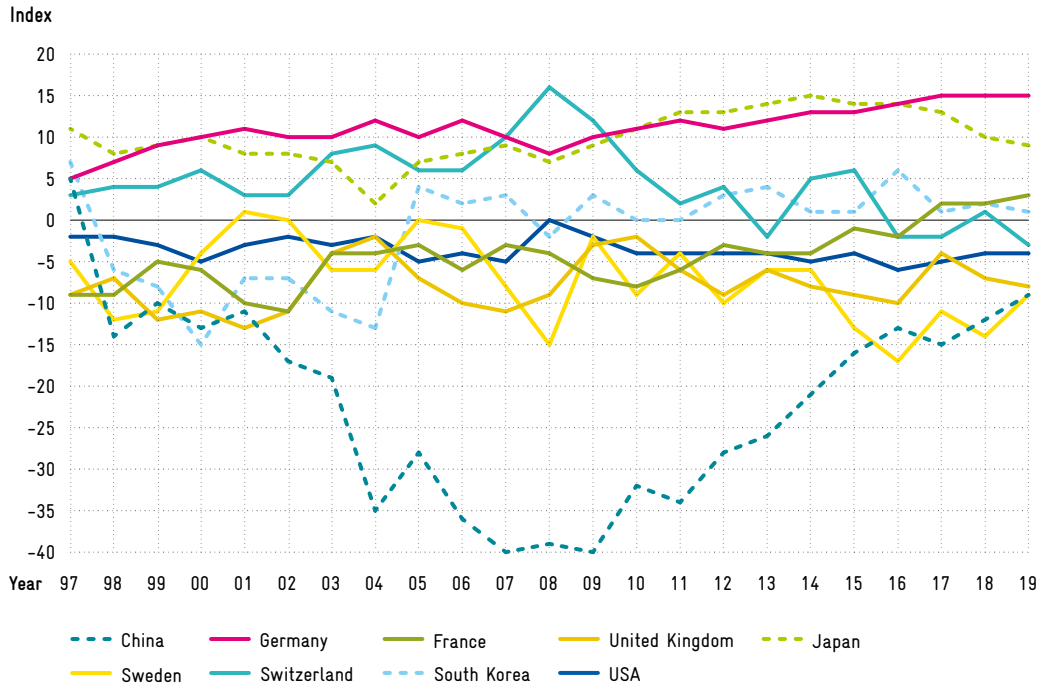
Transnational patent applications comprise applications in patent families with at least one application to the World Intellectual Property Organization (WIPO) via the Patent Cooperation Treaty (PCT) or one application to the European Patent Office (EPO).
Source: EPO (PATSTAT). Calculations by Fraunhofer ISI in Neuhäusler and Rothengatter (2022).

Tab. C6-2 Number, intensity and growth rates of transnational patent applications in the field of R&D-intensive technology in selected countries in 2019

	Number*	Intensity*	Intensity in R&D-intensive technology	Growth (2009=100)*	Growth in R&D-intensive technology (2009=100)
Total	306,087			152	152
China	63,805	83	59	560	527
Germany	29,608	698	402	101	104
EU-28	79,331	348	197	110	111
Finland	1,893	738	419	103	100
France	11,356	418	247	107	108
United Kingdom	8,085	247	141	109	106
Italy	6,028	258	125	109	107
Japan	53,115	790	456	142	127
Canada	3,624	190	119	102	100
Netherlands	5,004	557	286	127	123
Sweden	4,428	863	593	129	133
Switzerland	4,471	950	472	118	104
South Korea	20,983	774	484	187	175
USA	62,748	398	263	126	128

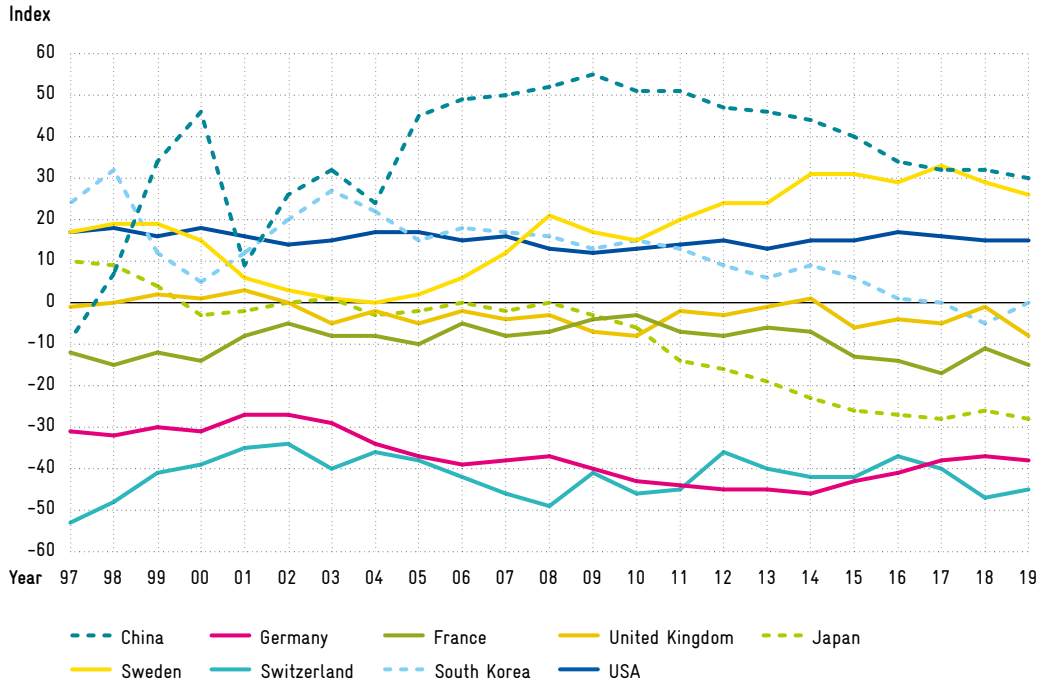
The R&D-intensive technology sector comprises industries that invest more than 3 percent of their turnover in research and development. Intensity is calculated as the number of patents per million gainfully employed persons.
* Figures refer to all industries.
Source: EPO (PATSTAT), OECD (MSTI), World Bank. Calculations by Fraunhofer ISI in Neuhäusler and Rothengatter (2022).

Fig. C6-3 Specialization index in selected countries in the field of high-value technology 1997–2019



The specialization index is calculated based on all transnational patent applications worldwide. Positive or negative values indicate whether the surveyed country's level of activity in a given field is disproportionately high or low compared to the global average.
Source: EPO (PATSTAT). Calculations by Fraunhofer ISI in Neuhäusler and Rothengatter (2022).

Fig. C6-4 Specialization index in selected countries in the field of cutting-edge technology 1997–2019



The specialization index is calculated based on all transnational patent applications worldwide. Positive or negative values indicate whether the surveyed country's level of activity in a given field is disproportionately high or low compared to the global average.
Source: EPO (PATSTAT). Calculations by Fraunhofer ISI in Neuhäusler and Rothengatter (2022).