Directorate for Science, Technology and Industry www.oecd.org/sti

OECD Science, Technology and Industry Scoreboard 2013

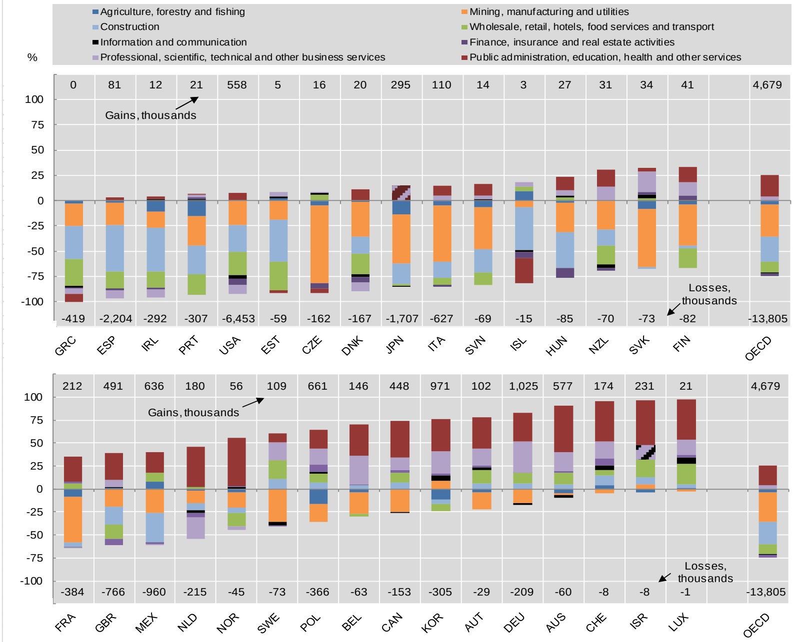
UNITED STATES HIGHLIGHTS

- The United States (US) economy quickly recovered from the crisis, but lost over 6 million jobs between 2008 and 2011, two-thirds of the total jobs loss across the OECD during that period. Young firms of 5 years old or less made a large contribution to new job creation.
- The downturn has affected US business R&D, which has not recovered since 2008. R&D spending in the EU28 has been more robust, while China's business R&D nearly doubled.
- The US remains the world's larger's spender on R&D, accounts for a large share of scientific publications, and for over one third of scientific publications cited in patents. The US still enjoys three distinct advantages: world class universities, a scale that is unmatched, being the central node in the global network of science, technology and innovation.
- The US remains the main beneficiary of mobility of researchers and the nine largest bilateral flows of researchers all involve the US. US researchers that have stayed affiliated with US universities are the most productive "stayers" at the global level.

The United States (US) has been at the forefront of the crisis in terms of employment, losing over 6 million jobs between 2008 and 2011, almost 4% of employment and two-thirds of the total number of jobs lost across the OECD during this period (Figure 1). Manufacturing, construction and trade sectors were the hardest hit, but information industries – ICT manufacturing, publishing or telecommunication services – suffered too, with the only exception of IT services.

Figure 1. Where people lost their jobs, 2008-11

Relative contribution to change in total employment by major sectors of economic activity



StatLink : http://dx.doi.org/10.1787/888932889440

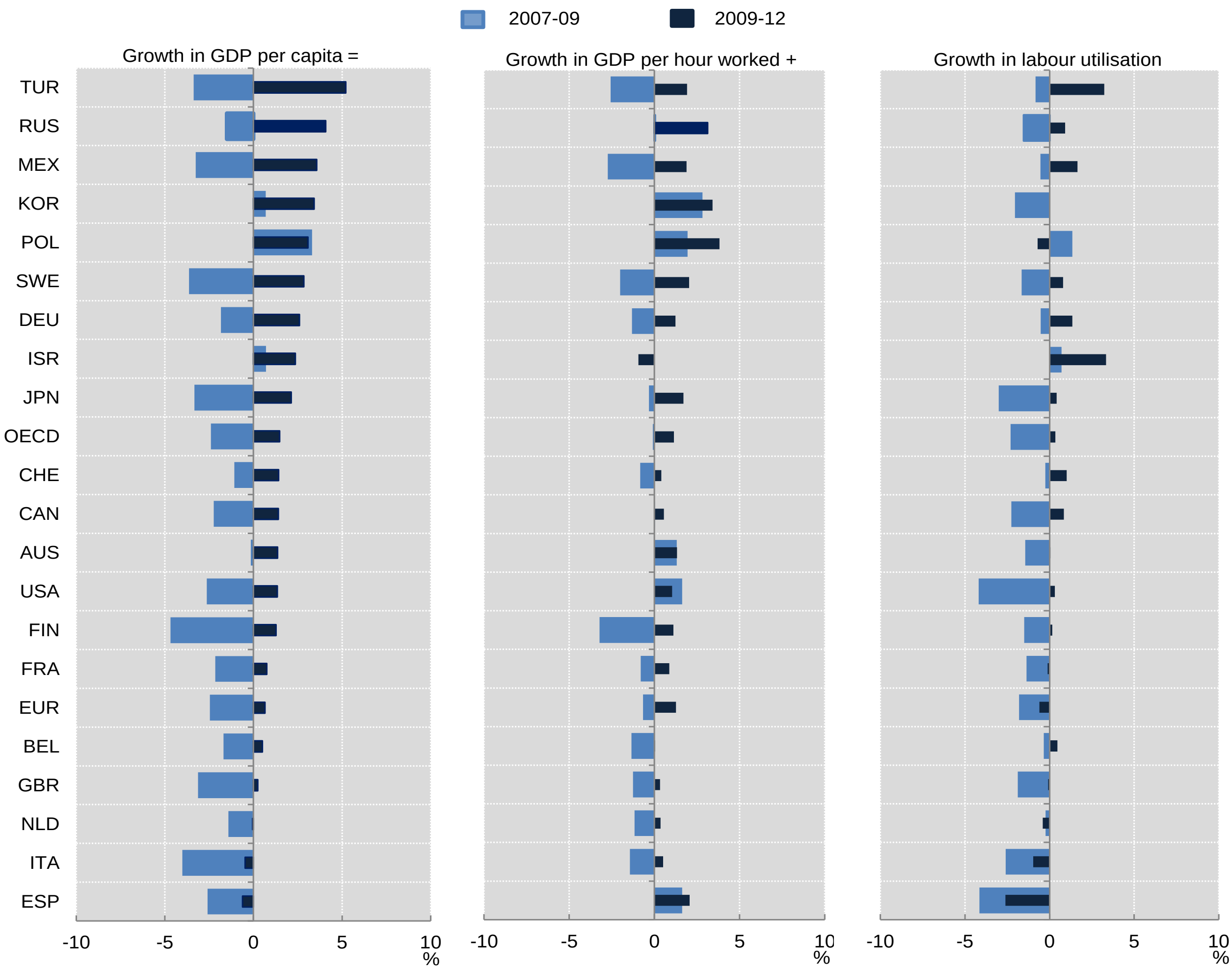
Source: OECD, Structural Analysis (STAN) Database, May 2013; OECD National Accounts (SNA) Database and national statistical institutes, June 2013.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities or third party. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Last updated: October 2013

While growth has recovered, in per capita terms it still lags behind a number of countries as well as the OECD average, mainly being held back by a lack of labour utilisation, not productivity (Figure 2).

Figure 2. Decomposition of Growth in GDP per Capita, 2007-09 and 2009-12



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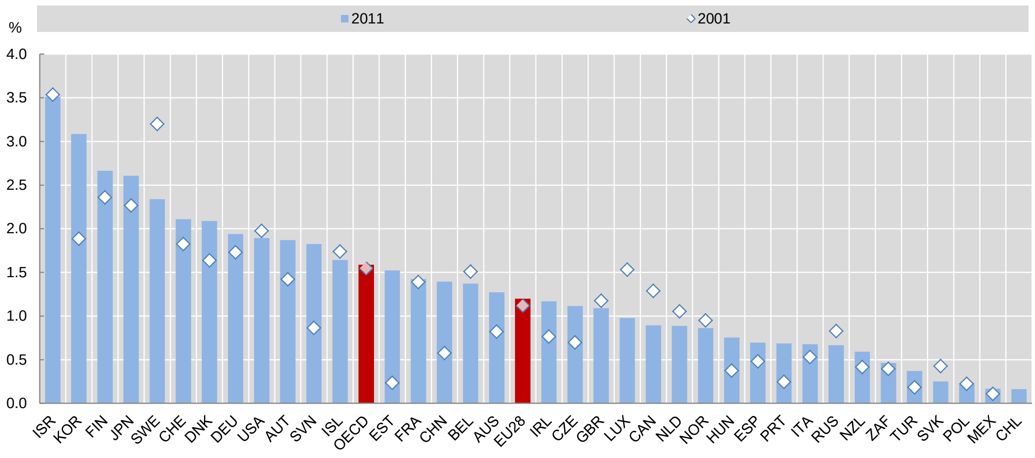
Source: OECD, Productivity Database, www.oecd.org/std/productivity-stats, August 2013. StatLink contains more data. See chapter notes.

The downturn has also affected overall US investments in R&D which still have not recovered since 2008, mainly due to lagging investment in business R&D (Figure 3). Somewhat surprisingly, the EU28 performance has been more robust, principally due to growth in Germany's business R&D, which has more than offset reductions in other countries. The crisis also had little effect on China, where R&D expenditure nearly doubled in real terms over a five year period, principally due to the business sector.

The dynamism of the US economy partly reflects its strong entrepreneurial activity. As in many other countries, the United States owes a large share of its job growth from 2001-2011 to young firms (five years or younger). Over the countries for which data are available, firms of 5 years old or less accounted for only about 20% of non-financial business sector employment over the past decade, but generated nearly half of all new jobs. These figures are similar in the non-financial services sector (Figure 4) and the manufacturing sector. Moreover, during the crisis, most of the jobs destroyed were the result of old businesses downsizing while net job growth in young firms remained positive.

Figure 3. Business enterprise expenditure on R&D, 2001 and 2011

As a percentage of GDP

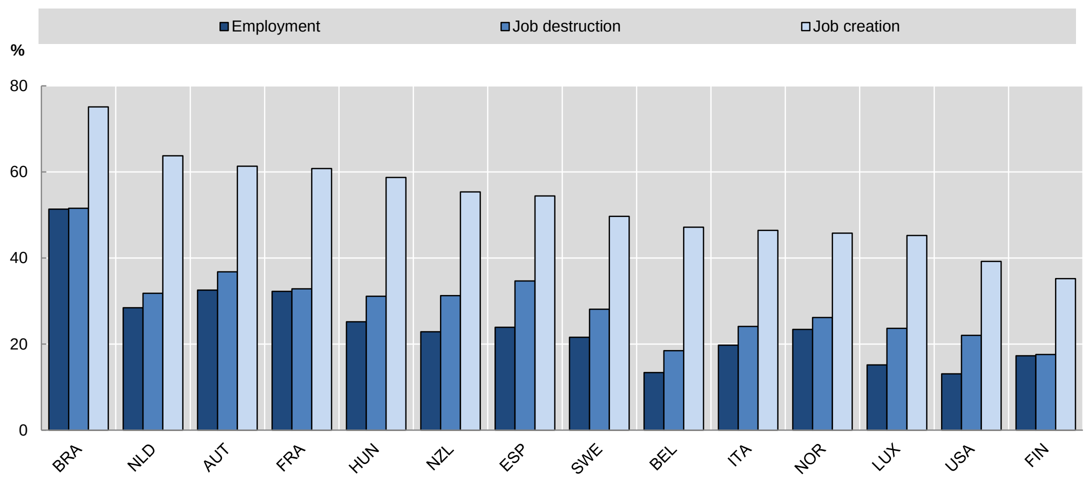


StatLink http://dx.doi.org/10.1787/888932891055

Source: OECD, Main Science and Technology Indicators Database, www.oecd.org/sti/msti.htm*,* June 2013.

Figure 4. Employment, job creation and job destruction in young firms, non-financial services, 2001- 2011

Percentage shares



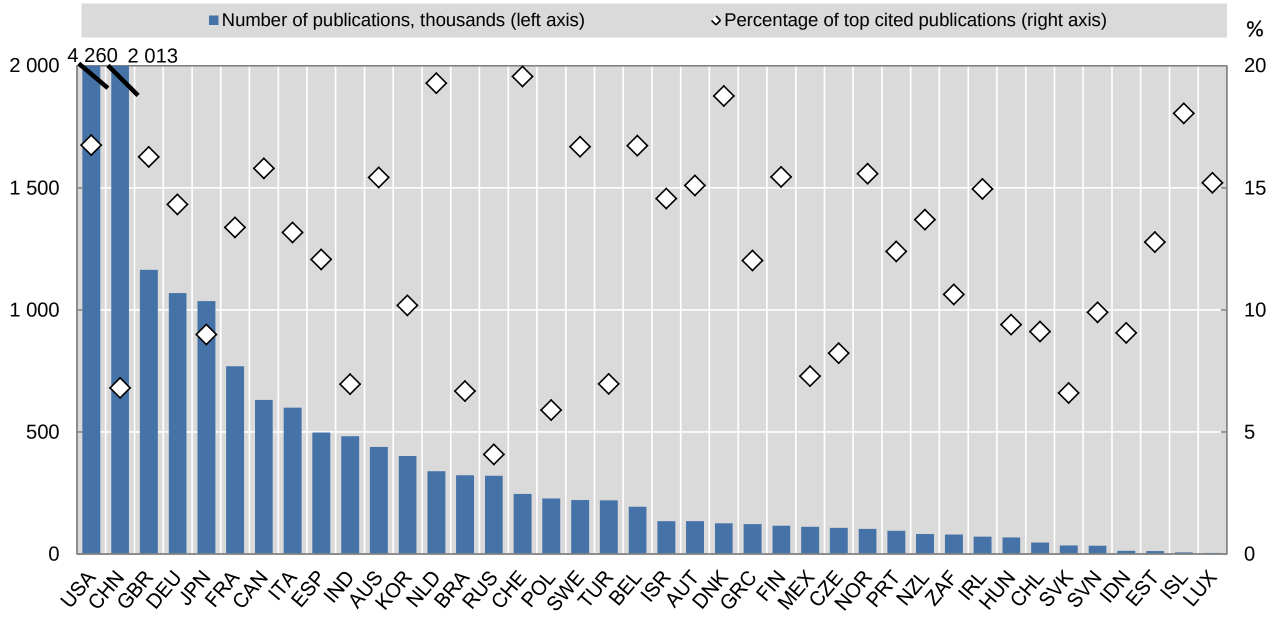
StatLink http://dx.doi.org/10.1787/888932892955

Source: OECD calculations based on the OECD DYNEMP data collection, July 2013.

Offsetting the cyclical weakness of the economy are a number of structural qualities to the US science, technology and innovation system that attest to its continuing global strength, although the gap with other countries is beginning to narrow. Specifically the United States still enjoys three distinct advantages: 1) top-ranked science and world class universities; 2) a scale that is unmatched and 3) being the central node in the growing global network of STI. These provide a strong basis for 21st Century innovation and growth. However, given the dynamic nature of the economy, these assets require investment and nurturing which is difficult in the current economic and budgetary environment.

The United States led the production of scientific publications – a key output indicator of the science system - over 2003-11 with more than 4 million publications, double that of the second placed country, China (Figure 5). When these publications are "quality adjusted" by citations, China's ranking falls and the United Kingdom and Germany move into the number 2 and 3 positions worldwide. The US strength is also reflected in patenting activity in cutting edge sectors, many of which depend on close interaction with fundamental science as reflected in references to the scientific literature. Scientific authors affiliated to US-based institutions account for more than a third of all scientific documents cited in patents in the areas of biotechnology, health, nanotechnology, ICT and environment – far above other highly-ranked countries like Japan, Germany and the UK that account for less than ten percent each.

Figure 5. The quantity and quality of scientific production, 2003-11



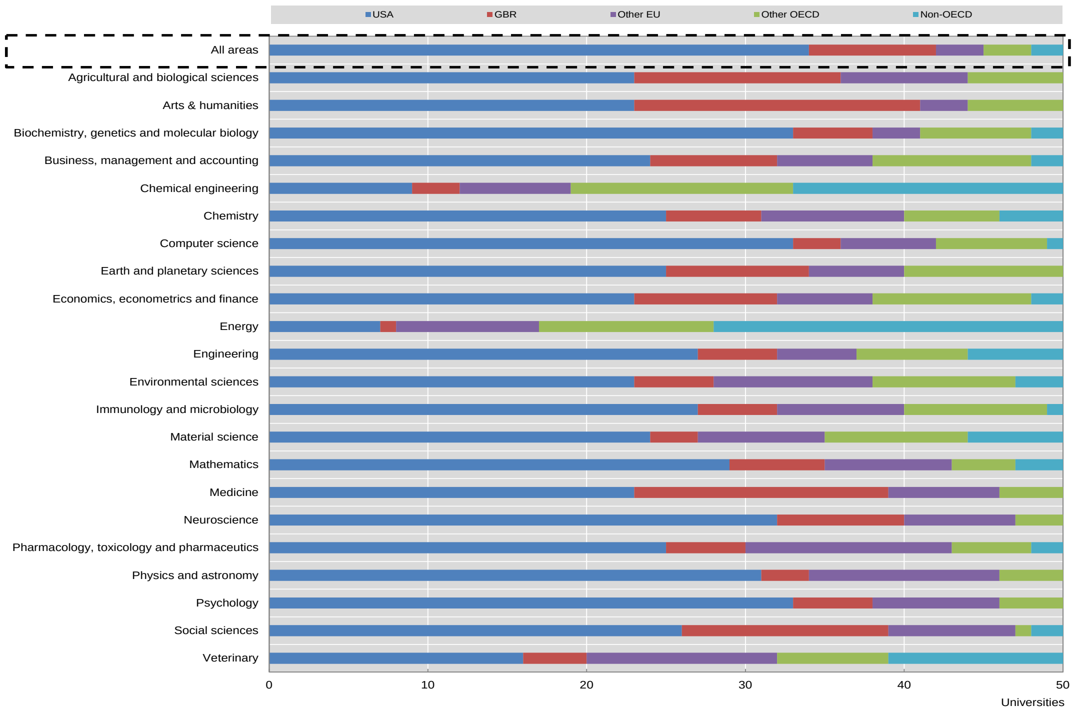
StatLink http://dx.doi.org/10.1787/888932891568

Source: OECD and SCImago Research Group (CSIC), Compendium of Bibliometric Science Indicators 2014, based on Scopus Custom Data, Elsevier, May 2013. See chapter notes.

Much of this scientific excellence emanates from US universities. On the basis of the impact of scholarly publications, the United States has 34 of the top-50 universities worldwide (Figure 6). US-based universities are most likely to excel in biochemistry, computer science, neuroscience and psychology. Outside of the United States, all but two of the other top-ranked universities are in Europe, with the United Kingdom leading.

Figure 6. University hotspots, geographical distribution of highest impact institutions, 2007-11

Location of top 50 universities by main subject areas



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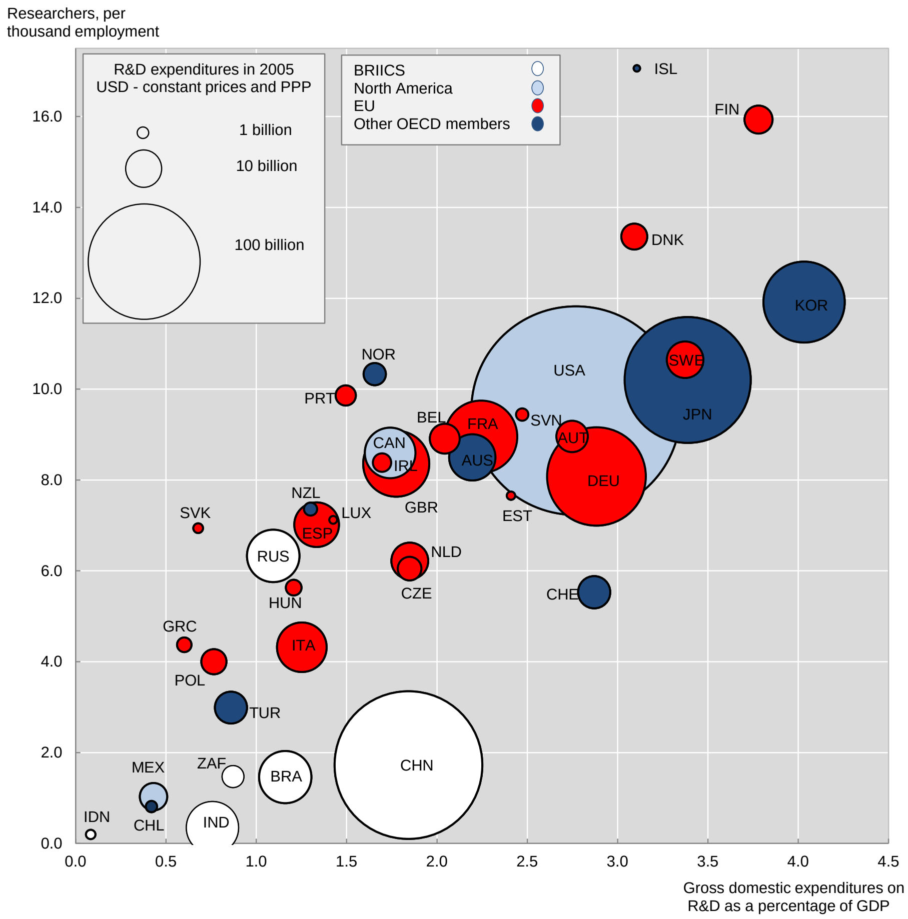
Source: OECD and SCImago Research Group (CSIC), Compendium of Bibliometric Science Indicators 2014, based on Scopus Custom Data, Elsevier, May 2013. StatLink contains more data. See chapter notes.

This strong system is backed by a very positive public attitude towards science and technology where about 90 per cent of US respondents either agreed or strongly agreed with the statement that "Science and technology are making our lives healthier, easier and more comfortable." While this public perception was similar in China, Korea and Japan, it was significantly higher than what was found in Europe, especially Germany where less than two-thirds agreed or strongly agreed with the statement.

A key factor that contributes to this excellence in science and research is the scale of the US STI system, which is the largest in the world (Figure 7.) With R&D expenditures in 2011 of nearly USD 415 billion, the United States spends about twice the amount of R&D performed in China, which is now the second largest performer, ahead of Japan, Germany and Korea. When adjusted for the size of GDP, Korea has the highest ratio of R&D expenditures to GDP.

Figure 7. R&D in OECD and key partner countries, 2011



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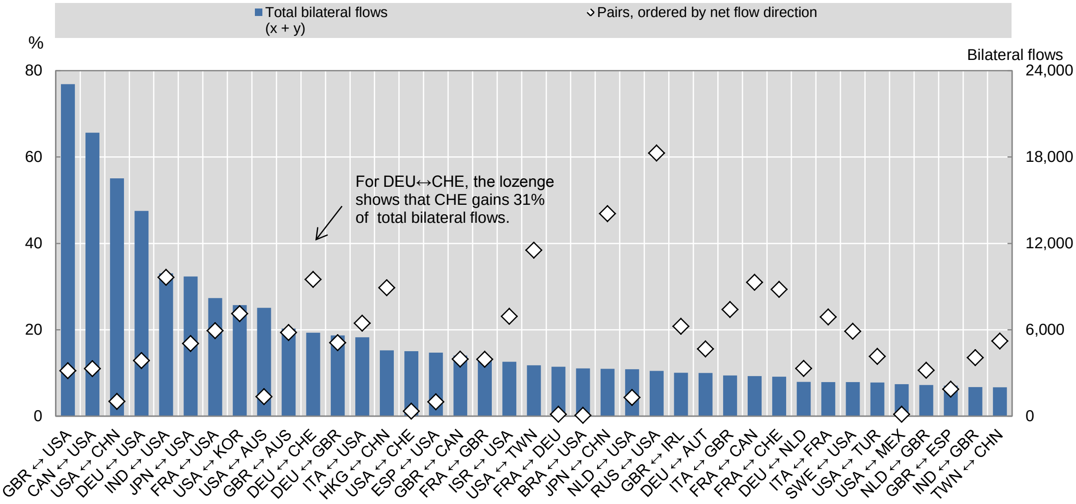
Source: OECD, Main Science and Technology Indicators Database, www.oecd.org/sti/msti.htm, Brazil's Ministry of Science, Technology and Innovation and UNESCO Institute for Statistics, June 2013. See chapter notes.

Its large scale implies that the United States can generate high-impact research domestically. The impact of scientists that have been affiliated with a US institution over the entire period 1996-2011, is about 50% higher than the world average for such "stayers". These US stayers have a higher impact than returning researchers and new inflows in most other countries. Returnees and new inflows tend to publish in journals with higher quality than researchers that have not engaged in international mobility. In the United States, only about a quarter of the publications involved international collaboration, which again reflects the large scale of its science and innovation system. Germany and France have lower impact research than the United States – although 30% and 25% above the world average – and rely much more on international collaboration (40% and 45% of publications). This underscores the need for Europe to achieve scale through the realisation of a European Research Area.

Its large scale combined with excellence has made the United States a key node in the global STI network. A new indicator that tracks changes in the affiliation of scientists who publish in scholarly journals reveals their movement while citations to these publications provide an indication of the quality of the various researchers. This analysis shows that the top-nine international bilateral flows of researchers coming into and leaving an economy involve exchanges with the United States (Figure 8). The United States is a net beneficiary of these flows in all but a handful countries including Australia, China, Korea and Switzerland. Even though the median impact of researchers who stay in the United States is already the highest in the world, the impact of those scientists whose affiliation shifts to the US, both as returnees and new inflows, tends to be even higher – boosting the impact. This is a trend found to be true in nearly all economies, underscoring the importance of international mobility of the highly skilled.

Figure 8. International flows of scientific authors, 1996-2011

Largest bilateral flows, by first and last affiliation



StatLink http://dx.doi.org/10.1787/888932891511

Source: OECD calculations based on Scopus Custom Data, Elsevier, version 5.2012, May 2013. See chapter notes.

While the US still enjoys a pre-eminent position in the global STI system, new players are emerging. In 2010, China surpassed the United States to become the world's leading manufacturer. Over the past five years, Chinese R&D expenditure has nearly doubled in real terms and China is now the second largest performer of R&D in the world (Figure 7). It produces more doctoral degrees in science and engineering than the United States. The United States, along with Chinese Taipei, Hong Kong and Japan, is now a net source of researchers as measured by researchers who change affiliations from the United States to China (Figure 8). While the quality of its science as measured by highly cited publications may lag, China has begun to integrate itself into the global STI system and engages in collaboration which is highly correlated with improved quality. In 2011, China had 74 000 internationally collaborative publications, compared with only 9 000 in 1998; 22 000 of these 2011 co-authored documents were with US-based institutions.

The rise of China and other emerging economies as contributors to the global science commons is to be welcomed. As China invests in its institutions, expands its funding and becomes a more active participant in the global STI network, some of the inherent advantages the United States has enjoyed for decades may be reduced and a new node for STI will begin to form. This creates challenges for the US system, especially given its dependence on highly-skilled talent from abroad. To maintain its position, the United States needs to continue to invest and let its system evolve to encompass new developments ranging from sophisticated IT applications to greater recognition of the importance of non-technological innovation.

Note: The information included in this note is based on the October 2013 release of the OECD Science, Technology and Industry Scoreboard. The data can be accessed from www.oecd.org/sti/scoreboard.htm.

For more information

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