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**Article**

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# German Manufacturing Withstands the Rise of Emerging Economies

by Martin Gornig and Alexander Schiersch

Between 2000 and 2009, China became the second largest industrialized nation, while manufacturing industries in other emerging and many Eastern European countries also experienced very strong growth. However, Germany was largely able to maintain its share of global industrial output. In 2009, as in 2000, Germany's value added share represented around 6.5 percent. This shows that Germany as an industrial location had benefited from the 50-percent increase in global industry far more than the USA, Japan, and other Western European industrialized nations.

The decisive factor here was that, despite the onset of the financial and economic crisis in 2008, German research-intensive industry was able to develop a leading position among the established economies. Sectors which particularly profited from this development include the manufacture of road vehicles, machinery, electrical machinery, and chemicals.

Emerging countries and particularly the BRIC nations (Brazil, Russia, India, and China) are always the first to come to mind when the discussion turns to the global economy or markets of the future. Alongside the potential arising from the strong economic growth and integration of these countries into the global economy, the resulting increase in competition is also highlighted, as is the danger that domestic value added will migrate to those very future markets.

In this year's report to the German government, the Expert Commission on Research and Innovation (EFI) focused on China's development and its impact on Germany.<sup>1</sup> DIW Berlin regularly conducts studies on the current state and outlook of Germany's technological capacity which act as a basis for the EFI report. The current article will outline the key findings of this report.<sup>2</sup>

## Global Industrial Production Sees Significant Growth

Discussions on the risks and opportunities resulting from the dynamic development process in the BRIC countries focus in particular on the manufacturing industry. First, it should be noted that, despite the upheaval of the financial and economic crisis, overall industrial production has experienced significant growth in the last decade. Between 2000 and 2009, the manufacturing industry's global nominal gross value added—calculated in current US dollars—grew by more than

<sup>1</sup> Expert Commission on Research and Innovation (EFI), Jahresgutachten zu Forschung, Innovation und technologischer Leistungsfähigkeit Deutschlands 2012. 2012, [www.e-fi.de/gutachten.html](http://www.e-fi.de/gutachten.html).

<sup>2</sup> H. Belitz, M. Gornig, F. Mölders, and A. Schiersch, „FuE-intensive Industrien und wissensintensive Dienstleistungen im internationalen Wettbewerb,“ Studien zum deutschen Innovationssystem, no. 12, (Berlin: Expert Commission on Research and Innovation, 2012).

50 percent.<sup>3</sup> Real value added increased by more than 20 percent. The »cake« to be portioned out thus increases in size with the integration and growth of emerging economies. At the same time, however, this will also cause a shift in the balance of power.

The most striking trend here is the increased significance of the Chinese manufacturing industry, with a real value added that more than doubled between 2000 and 2009. Nominal growth up until 2009 was even over 200 percent. As a result of this above average growth, Chinese manufacturing also experienced a dramatic increase in its share of global value added during the period analyzed. In 2000, China accounted for approximately eight percent of industrial value added. By the end of the decade, however, already almost a fifth of global industrial value added originated in China (see figure).

The other BRIC countries have also experienced above average growth rates, both nominal and real. However, in comparison with China, development there is more modest. Despite very dynamic growth, in 2009 India and Brazil only accounted for 2.4 and 2.1 percent of global industrial value added, respectively. Russia's contribution was even as low as 1.7 percent.

The majority of the more established industrialized nations have experienced developments in contrast with China's ascent (see figure). The loss in shares observed in Japan and the US were particularly significant. Whereas in 2000 the US and Japan accounted for around a quarter and almost a fifth of global nominal industrial value added, respectively, by 2009 these values had fallen to just under 20 percent (US) and approximately ten percent (Japan). Nonetheless, the US's value added (both real and nominal) still increased slightly whereas Japan experienced a drop in both real and nominal value added.

Developments in the European Union varied widely. Eastern European countries that acceded to the EU in 2004 such as Poland, Hungary, or the Czech Republic realized a significant increase in their industrial value added shares. Between 2000 and 2009, on average, these accession countries (EU-10) almost doubled their share of global industrial production. Nonetheless, the overall contribution of these countries in 2009 was still under two percent.

<sup>3</sup> The most recent available data on sectoral value added is for the years up to and including 2009. At the time of going to print, more recent sectoral data had not yet been published. Our analysis of industrial sector shares is, therefore, also limited to the period from 2000 to 2009.

Figure

**Global Share of Value Added of Manufacturing Industry by Country**

In percent



Source: United Nations Statistic Division (UNSD 2012), calculations by DIW Berlin

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**Strong growth of China's share.**

Some Western European countries (EU-14), on the other hand, experienced a drop in their global industrial value added shares.<sup>4</sup> This includes large traditional industrialized nations such as France and the UK in particular. However, in comparison with the US and Japan, the drop in shares experienced by these countries was insignificant.

The same also applies to Germany. Despite China's ascent to second largest industrialized nation and the dynamic growth experienced by other emerging economies and many Eastern European countries, Germany's share of global industrial production barely changed.

<sup>4</sup> This includes the countries of the old EU-15 excluding Germany.

Table

**Value Added Shares in Research-Intensive Industries and Rates of Change**

Shares in percent and rates of change in percentage points

| Economic sector according to ISIC Rev. 3 <sup>1</sup>                                  | Germany                               |   | USA                                   |   | Japan                                 |   | EU-14                                 |   | EU-10                                 |   |
|--|---------------------------------------|---|---------------------------------------|---|---------------------------------------|---|---------------------------------------|---|---------------------------------------|---|
|  | Value added shares in 2009 in percent | Change from 2000 to 2009 in percentage points | Value added shares in 2009 in percent | Change from 2000 to 2009 in percentage points | Value added shares in 2009 in percent | Change from 2000 to 2009 in percentage points | Value added shares in 2009 in percent | Change from 2000 to 2009 in percentage points | Value added shares in 2009 in percent | Change from 2000 to 2009 in percentage points |
| Chemicals and chemical products 24ex2423   | 12.2                                  | 1.6   | 41.6                                  | 2.3   | 14.6                                  | -7.5  | 28.6                                  | 2.7   | 2.9                                   | 0.8   |
| Pharmaceuticals 2423   | 10.0                                  | 3.7   | 46.7                                  | 3.0   | 10.7                                  | -8.4  | 29.7                                  | 0.6   | 3.0                                   | 1.1   |
| Machinery and equipment n.e.c. 29  | 19.5                                  | 4.3   | 27.3                                  | -4.0  | 17.8                                  | -8.0  | 30.4                                  | 4.9   | 5.0                                   | 2.8   |
| Office, accounting and computing machinery 30  | 6.2                                   | 1.1   | 43.5                                  | -2.0  | 31.0                                  | -3.1  | 16.2                                  | 2.4   | 3.0                                   | 1.7   |
| Electrical machinery and apparatus 31  | 18.8                                  | 2.1   | 24.7                                  | -5.6  | 19.7                                  | -8.1  | 27.8                                  | 5.8   | 9.1                                   | 5.9   |
| Radio, television and communication equipment and apparatus 32                         | 5.7                                   | 2.0   | 40.9                                  | -5.5  | 31.2                                  | -2.0  | 18.4                                  | 2.8   | 3.7                                   | 2.8   |
| Medical, precision and optical instruments, watches and clocks 33                      | 12.7                                  | -0.1  | 46.0                                  | 6.7   | 10.5                                  | -10.2   | 27.4                                  | 2.1   | 3.4                                   | 1.5   |
| Motor vehicles, trailers and semi-trailers 34  | 21.6                                  | 7.7   | 24.4                                  | -12.6   | 30.5                                  | 2.0   | 17.9                                  | -1.0  | 5.6                                   | 3.9   |
| Aircraft and spacecraft 353  | 8.9                                   | 2.4   | 63.6                                  | -2.6  | 4.1                                   | 0.4   | 22.5                                  | -0.4  | 0.8                                   | 0.3   |
| Railway and tramway locomotives and rolling stock; transport equipment n.e.c. 352. 359 | 10.5                                  | 2.3   | 31.1                                  | -12.1   | 9.8                                   | -3.7  | 42.2                                  | 10.6  | 6.4                                   | 2.8   |

<sup>1</sup> Statistical classification of economic sectors according to the International Standard Industrial Classification of All Economic Activities (ISIC) Revision 3

Sources: EUKLEMS database (2012), OECD STAN (2012), Eurostat (2012), calculations and estimates by DIW Berlin.

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The 2009 share of 6.4 percent was only marginally lower than in 2000 (6.7 percent), demonstrating that Germany as an industrial location profited more or less proportionally from global industrial growth.

In the interim, German industry even managed to noticeably expand its slice of the growing »cake.« Thus, in 2007, German industrial production accounted for an almost eight percent share. However, this increase in shares dropped away again due to the onset of the financial and economic crisis in 2008. However, the positive development observed in German industrial production in 2010 and 2011 gives reason to believe that this downturn was only temporary and German indus-

try is currently experiencing renewed growth in its value added shares.<sup>5</sup>

### Research-Intensive Industries Produce Good Results

Why, however, is German industry more successful than that of many other established economies? A key factor in the long-term structural competitive strength of German manufacturing is its significant concentration on research-intensive industries such as the manufacture of electrical machinery, machinery, chemicals, or vehic-

<sup>5</sup> D. Lucke, »German Industry—a Tower of Strength?« DIW Economic Bulletin, no. 1 (2012): 15–23.

le construction.<sup>6</sup> The following section focuses on the position of Germany and its competitors in the individual R&D-intensive sectors.<sup>7</sup>

Germany accounts for a significant proportion of the value added contributed by research-intensive industries originating in industrialized countries (see table). Approximately a fifth of value added from the manufacture of machinery originates in Germany. Omitting the EU as an aggregate and conducting a country-by-country analysis demonstrates that Germany has the second largest machinery manufacturing industry of all industrialized countries. It also shows that the German motor vehicle and electrical machinery manufacturing industries occupy prominent positions. In both of these branches, almost 20 percent of value added is created by German industry. This places German motor vehicle manufacturing only marginally behind the American competition (22 percent) and electrical machinery manufacturing at almost level pegging with Japan (20 percent). It is fair to say that Germany also contributes a significant share of value added in most of the remaining sectors. This particularly applies to the manufacture of medical, precision, and optical instruments (13 percent), and aircraft and spacecraft (nine percent) in which Germany accounts for a greater share than Japan or any of its European competitors. Also with its manufacture of chemicals and pharmaceuticals, and the manufacture of other transport equipment, Germany is positioned in the top group with a share of around twelve and ten percent, respectively. However, the contributions made by German manufacture of office, accounting and computing machinery, and of radio, television and communications equipment are insignificant in an international comparison.

**6** Research-intensive industries are defined as sectors in which the proportion of internal R&D expenditure accounts for over 2.5 percent of turnover. According to the 2006 NIW/Fraunhofer ISI list, the manufacture of chemicals (WZ (economic sector) 24ex2423), pharmaceuticals (WZ 2423), machinery (WZ 29), office, accounting, and computing machinery (WZ 30), electrical machinery (31), radio, television, and communication equipment (WZ 32), medical, precision, and optical instruments (WZ 33), motor vehicles, trailers and semi-trailers (WZ 34), railway and tramway locomotives and rolling stock; transport equipment (WZ 352, 359), aircraft and spacecraft (WZ 353) are all counted as research-intensive industries. For a more detailed description, see H. Legler and R. Frietsch, *Neuabgrenzung der Wissenswirtschaft – forschungsintensive Industrien und wissensintensive Dienstleistungen*. (2007), NIW/ISI list 2006, Studien zum deutschen Innovationssystem, no. 22, (Berlin: Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung), 2007). On the specialization of German industry, see H. Belitz, M. Gornig, and A. Schiersch, „Forschungsintensive Industrie gut aufgestellt,“ *Wochenbericht des DIW Berlin*, no. 17 (2011): 5–10.

**7** The BRIC countries are omitted here due to insufficient available data. This is unproblematic for two reasons. First, China is the only country that plays a significant role. Second, the positions of the other countries in relation to one another do not change with the omission of China.

## Strong Growth in the Manufacture of Motor Vehicles

Moreover, if development over previous years is analyzed, it becomes evident that between 2000 and 2009 Germany recorded almost continuously high share increases in the R&D-intensive sectors. The gain in the manufacture of motor vehicles of almost eight percentage points was particularly striking. This represented an increase in Germany's share of more than 50 percent since 2000 which was larger than in any of the other comparable countries and regions with the exception of the EU-10. Similarly marked increases, albeit at a lower level, can be observed in the manufacture of pharmaceuticals (3.7 percentage points) and of radio, television and communications equipment (two percentage points). Furthermore, industries manufacturing aircraft and spacecraft, with 2.4 percentage points (share growth of 37 percent), and machinery, with 4.3 percentage points (share growth of 28 percent), also experienced significant increases. Share increases were also observed in the remaining sectors. Only in the manufacture of medical, precision, and optical instruments did the value added share remain constant. Overall, it is fair to say that Germany's research-intensive industries occupy a strong position which has been consolidated over the last decade.

The US continues to maintain its dominant position in many research-intensive sectors. Thus, in 2009, American manufacturing of medical, precision and optical instruments, chemicals and pharmaceuticals, as well as of office, accounting and computing machinery and radio, television and communications equipment produced more than 40 percent of the sectoral value added.<sup>8</sup> In the manufacture of aircraft and spacecraft, the American industry's value added share is as high as over 60 percent (see table).<sup>9</sup> However, although the US continues to play an important role in many branches of industry, it still had to accept losses in shares in virtually all sectors with the sole exceptions of the chemical and phar-

**8** However, what has to be borne in mind here is that the US is a comparatively large economic area which should, therefore, also be contributing a significantly larger share of sectoral value added. According to OECD data, in 2009 GDP in US dollar purchasing power parities was approximately three billion US dollars in Germany, around four billion in Japan, approximately 12.6 billion in the EU-26 (excluding Germany), and around 14 billion US dollars in the US. <http://stats.oecd.org/Index.aspx>.

**9** However, the significant dominance of this sector must be considered in the context of high American military expenditure that is reflected in a correspondingly high value added share.

maceutical industries and the manufacture of medical, precision, and optical instruments.<sup>10</sup>

Japan finds itself in a rather different situation than the US. On the one hand, current value added shares indicate that Japan occupies a strong position in many research-intensive industries. This is particularly true for the manufacture of office, accounting and computing machinery, radio, television and communications equipment, and motor vehicles. In these sectors, Japan accounts for a third of the value added produced by industrialized countries. Japan even dominates the production of motor vehicles. Also in the remaining sectors, with the exception of the manufacture of aircraft and spacecraft, based on a country-by-country analysis, Japan occupies a strong position. In this respect, in the R&D-intensive industries, Japan's position in 2009 is similar to Germany's. However, where they differ significantly is in the dynamics. While German industries recorded increases in their shares between 2000 and 2009, almost all Japanese sectors experienced losses during the same period. Only the manufacture of motor vehicles (two percentage points) was able to increase its value added share. The losses in shares that had already been observed at the global level (see figure) are, therefore, also evident in the research-intensive industries.

Looking at the development dynamic in the EU-14,<sup>11</sup> it is evident that almost all research-intensive sectors experienced an increase in their value added shares. This particularly applies to the manufacture of other vehicles with a share gain of almost eleven percentage points or a 33-percent share increase since the starting year, 2000. However, the manufacture of machinery and electrical machinery have also recorded significant gains of 5.8 and 4.9 percentage points, respectively. Overall, the EU-14 make a significant contribution to value added in all research-intensive sectors. However, a disaggregated analysis indicates that the individual country shares are generally significantly lower than Germany's.

Similarly positive developments have been observed among the Central and Eastern European EU-10. These countries are continuing to catch up and, commencing from a low level, have, in part, managed to more than double their respective sectoral value added shares. This applies to the manufacture of machinery and motor ve-

hicles as well as electrical machinery and medical, precision, and optical instruments (WZ (economic sector) 30 to WZ 33, see table). However, in most sectors, these increases have not yet led to the EU-10 being able to lay claim to larger value added shares, with the exception of the manufacture of electrical machinery, motor vehicles, and machinery. This is evidence that the EU-10 countries are following the German specialization route without causing Germany to experience a drop in its own value added shares.

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<sup>10</sup> The strong increase in the manufacture of medical, precision, and optical instruments is a result of the financial and economic crisis. Up until 2007, the US had to accept sector share losses in this industry, too. Only the comparatively stronger decline in value added in Europe in 2008 and 2009 led to the share gains depicted.

<sup>11</sup> This refers to the old EU-15 excluding Germany.



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