

Germany: High-level and Cutting-edge Technology after the Crisis

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After the Crisis: German R&D-intensive industries in a good position

by Heike Belitz, Marius Clemens, Martin Gornig, Florian Mölders, Alexander Schiersch, and Dieter Schumacher

The strong reliance of the German economy on the industry sector has been a point of criticism for years now. Germany is too strongly focused on export, making it susceptible to crises and fluctuations in demand and exchange rates, the critics allege. A non-critical look at the numbers during the recent economic crisis seems to reaffirm these old concerns: Industrial productivity shrank significantly and exports collapsed. Taking a closer look, however, it is clear that R&D-intensive industries passed their trial by fire during the crisis. The joint strategy of companies, unions and politicians managed to keep employment figures mostly stable during the global slump in demand and thus helped these industries to be well prepared for the upswing with a broad portfolio consisting of vehicle manufacturing, machine building, and electronic, measurement and medical technology. Looking specifically at the emerging markets, these industries did better than just defend their leading positions; they expanded market shares during the crisis. This can be seen in the international comparison of the latest data on value added, productivity and bilateral trade, conducted by DIW Berlin. The results: The R&D-intensive industries in Germany have already returned to their long-run growth path and are in a favorable position for the future.

High-level and cutting-edge technologies have been the drivers behind Germany's macroeconomic performance for years now. Their growth outperformed other industries by far right into 2008. Since 2007 Germany has also been the largest gross and net exporter of R&D-intensive goods in the world.

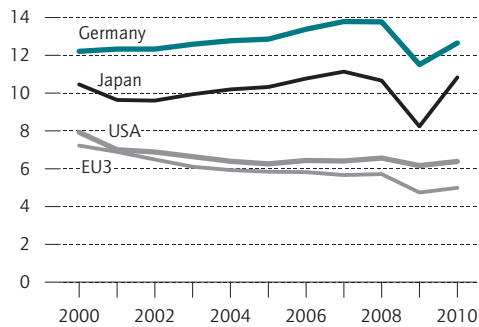
However, the crisis of confidence following the turbulences in the financial markets caused the global demand for capital goods to collapse. Production in high-tech areas like machine building, electronic engineering and vehicle manufacturing, all of which are aligned toward global capital goods, shrank dramatically. This turbulence was therefore the trigger for the most serious recession in Germany's postwar history.

Other large OECD economies faced similar crisis-related difficulties. In particular, our analysis shows that the R&D-intensive industries in Japan experienced similarly strong fluctuations as those in Germany (Figure 1). There is hardly any difference in the extent of the estimated 2009 losses and 2010 gains in the share of value added between Germany and Japan. Evidently, the other large economies in Europe are trailing behind in terms of how quickly their R&D-intensive industries are recovering. In the US, the fluctuations seem to be more moderate. The contraction and growth figures between the R&D-intensive industries and the overall economy differ only marginally. Boosted by exports, R&D-intensive industries across the world demonstrated a healthy growth as early as 2010. Therefore, the contribution of the R&D-intensive sector to total value added in Germany has risen significantly. Nevertheless, the pre-crisis level will most likely not be reached until 2010.

Germany was also able to defend the top position as exporter for R&D-intensive goods in 2009: While its main competitors, the US and Japan, reported decreases in exports by 27 and 29 percent respectively, Germany's exports "only" declined by 24 percent. As seen in both

Figure 1

Share of R&D-intensive industries in value added in select countries from 2000 to 2010
In percent



EU-3: France, the United Kingdom and Italy.

Sources: EU KLEMS Database 2010; calculations and estimates of DIW Berlin.

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The importance of R&D-intensive industries in Germany is twice as high as in the US.

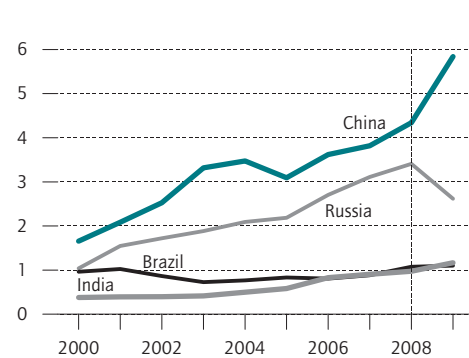
the sectoral and geographic breakdown of foreign trade, Germany's market position has improved.

The export-import ratio of most R&D-intensive industries has improved during the crisis, particularly for machine building and electronics. However, the scrapping premiums negatively affected the export-import ratios of vehicle manufacturing. At the same time, considerable shifts were witnessed within the regional structure of global trading flows during 2009. The strong growth of emerging markets, like China, became more important for the export of R&D-intensive goods (Figure 2). Even though Europe remains the main destination of German goods, the focus of R&D-intensive goods is increasingly shifting toward these emerging markets. In contrast, the US is becoming a less critical destination for Germany's R&D-intensive goods. The rising market shares in the emerging markets are very promising thanks to the potential growth and the associated demand in these economies.

Companies in the countries under review reacted quite differently to the sales crisis in 2009. Supported by labor market policies, the core staffing at German companies hardly shrank. Thus, there is plenty of evidence that labor market actors and industrial policymakers in Germany reacted appropriately to the global crash in demand and helped ensure that German industry remained competitive. However, in the future, politicians should be handed an instrument to make decision-

Figure 2

Share of R&D-intensive goods exported to the emerging economies from Germany from 2000 to 2009
In percent



Sources: UN Comtrade 2010; calculations of DIW Berlin.

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More than one tenth of the export of R&D-intensive goods goes to the four largest emerging markets.

making more objective and transparent. An international industry monitoring system should be developed to assist in distinguishing more rapidly temporary gaps in demand from long-term changes to regional conditions. This would also counter subsidies that are aimed at structural conservation.

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SIX QUESTIONS FOR ALEXANDER SCHIERSCH

"Leading position maintained"

1. Mr. Schiersch, is German high technology industry better or worse off than before the crisis? If you consider added value only, the crisis isn't quite over yet. This means that the research-driven industry sector hasn't recovered yet to where it was in the summer of 2008, when the financial crisis struck the real economy. However, we are getting there. If you look at relative proportions in the different markets, the losses were not as big as in other countries.
2. Why did the German research-driven industry do so well through the crisis? German industry has always paid attention to efficiency issues, even before the demand slump and it has always actively faced competition. Research investments were barely reduced during the crisis and industry made an effort to keep its staff and their know-how. In contrast, in the Anglo-American countries - especially the U.S. - employees were let go and expenses reduced. Germany and German firms bet that the crisis would be temporary and that industry would only be able to take advantage of the expected upward trend of the global economy if its staff and its know-how were retained and available. Thus, money was invested, in cooperation with the state and jobholders, in order to make it through the dry spell. Looking back today, it was the right strategy.
3. Which industry sectors were able to stand their grounds and which did not do so well? All sectors were affected by the crisis. The slump in added value was immense, and sometimes as big as 20 percent. However, the demand for cars was stimulated by government policy. This caused the automotive industry, which suffered great

losses as well, to be less affected by the crisis than, for example, the machine building industry, which didn't have a "car-scrap bonus".

4. What is Germany's position in international comparison? It is important how focussed on global or national markets an industry is. Germany - like Japan - has good and competitive products that are generally very successful on global markets. However, during the crisis there was a worldwide demand slump. This is why Germany and Japan were more affected by the crisis than other countries, such as the US. The US high technology sector is much bigger, but it is also much more focussed on national markets. However, even there, losses were high.
5. Which are the most important foreign markets for German high technology? The most important foreign markets are located in Europe. The US also remains a very important market. However, Germany is increasingly paying attention to so-called Emerging Markets, such as Brazil, India and China. We, as Europeans, have a natural disadvantage in transportation compared to Japan and the US, but if German products are successful there, despite the geographical challenges, it is due to the quality of our products.
6. What are the prospects – Is there going to be growth over the next few years? Currently, there are signs of growth. Although the losses have been severe, recovery is happening very quickly. If no further external problems occur and global economic growth remains steady, research-driven industries in Germany will keep benefitting.

Interviewed by Erich Wittenberg

German R&D-intensive industries: Value added and productivity have recovered considerably after the crisis

by Heike Belitz, Martin Gornig und Alexander Schiersch

No large industrialized nation is as strongly specialized in the production of R&D-intensive goods as Germany.¹ In the crisis year 2009 these export-oriented industries had to pass a crucial test. The slump in sales endangered both specialized jobs and the financing of high R&D expenditures, and thus the ability of these industries to compete technologically in the future.

The Commission of Experts for Research and Innovation (Expertenkommission Forschung und Innovation - EFI), which regularly informs the German government about the status and prospects of Germany's technological performance, requires early indications about the development of R&D-intensive industries. Detailed comparative international data regarding industrial development, such as the EU KLEMS Datenbasis and the OECD STAN data, is only available with a lag of two to three years. This is why the DIW has estimated the value added and the volume of labour input for R&D-intensive industries in Germany, the US, Japan, France and the UK for the period from 2008 to 2010 (Box 1). This extended database is used to analyze the development of production and labour productivity up to the present.²

Traditionally strong specialization of Germany on R&D-intensive industrial goods

The long-term development of structural differences and specialization patterns in the industries of different countries and regions can be measured based on their relative share on value added. This is the contribution of an industry to the nominal value added in a country, compared to the same ratio calculated using all countries in the analysis, which are here Germany, the US, Japan and the EU-25 (relative share of value added or RVA).³ When comparing Germany to other European countries, a distinction is made between the EU-14 (members of the EU before 2004 with the exception of Germany) and the EU-10 (members joining in 2004).

An international comparison clearly reveals the strength of Germany's specialization on R&D-intensive industries, especially high-level technologies, and how this specialization increased up to 2007 (Figure 1). Until the beginning of the financial and economic crises, Germany was the country most clearly specialized on R&D-intensive industries. Only Japan has a similar specialization pattern, whereas the other countries are not specialized on these sectors. Germany also has an especially broadly diversified portfolio in this regard: Seven out of ten R&D-intensive industries have positive RVAs. This is far higher than in the benchmark regions. Even in terms of cutting-edge technologies, Germany is now well above the average of all regions considered.

Japan is the only other nation also specialized in the sub-segment of cutting-edge technologies, as it is strong in office machinery, computers and communication equipment. The US is most heavily specialized in the cutting-

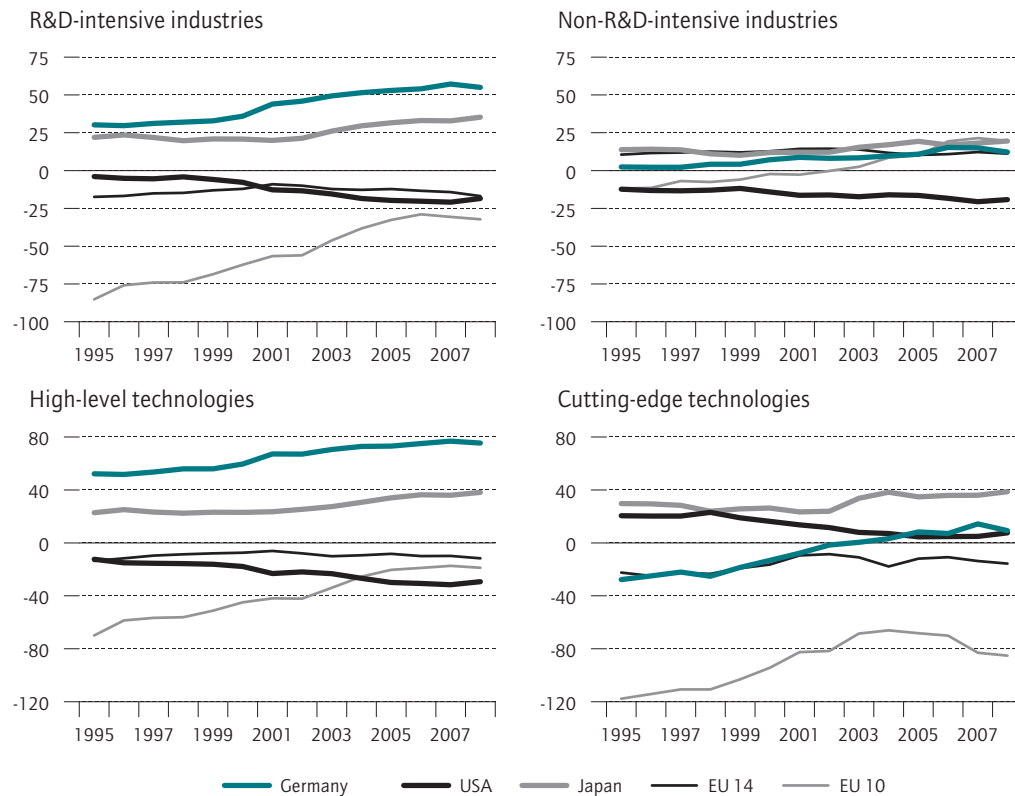
¹ Belitz, H., Clemens, M., Gornig, M., Schiersch, A., Schumacher, D.: Wirtschaftsstrukturen, Produktivität und Außenhandel im internationalen Vergleich. Studien zum deutschen Innovationssystem No. 5/2010. Pub.: Commission of Experts for Research and Innovation, Berlin, February 2010. www.e-fi.de.

² Belitz, H., Clemens, M., Gornig, M., Schiersch, A., Schumacher, D.: Wirtschaftsstrukturen, Produktivität und Außenhandel im internationalen Vergleich. Studien zum deutschen Innovationssystem No. 4/2011. Pub.: Commission of Experts for Research and Innovation, Berlin, February 2011. www.e-fi.de.

³ The RVAs are listed here in natural logarithms multiplied by 100. A value of 0 for all sectors would indicate that the shares are identical. Positive values signify the share is higher than average, while negative values mean it is lower than average. The greater the amount, the greater the (relative) difference in share. Also refer to the RCA in the box within the following article.

Figure 1

Relative shares of nominal value added by industrial groups in select countries and regions from 1995 to 2008 (RVAs)



Comments: The relative share of value added or RVA represents the contribution of an industry to the nominal value added in its country in relation to the same contributions in the group of benchmark countries comprising the US, Japan and the EU-25.

Example for reading the table: The R&D-intensive industries in Germany show the highest relative share of value added among the countries considered here. The EU-10 curve in the negative area refers to the less than average but growing contribution from R&D industries. See the Box for definitions of the industrial groups.

US 2008 estimated, Japan: 2007 and 2008 estimated.

Sources: EU KLEMS Datenbasis 11/2009; OECD STAN 2010; calculations and estimates of DIW Berlin.

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The cutting-edge technologies are now also making a better than average contribution to value added in Germany.

edge technologie of aircraft and spacecraft. The advantages it had in communication equipment in the middle of the 1990s are now lost, and those in medical and precision instruments have diminished significantly. Germany is meanwhile strongly specialized in medical and precision instruments.

Between 1995 and 2007, German companies gained market shares in nearly every segment of the R&D-intensive industries. In addition, they are very efficient at producing R&D-intensive goods.⁴ Indeed the traditionally strong specialization on R&D-intensive industries may bear risks, as proven by the strong decline in pro-

duction at the end of 2008 and in 2009. However, the long-term success of German industry has prompted the US and the UK in particular to call for policy actions to strengthen their own industrial bases again.⁵

Large production cuts during the crisis ...

In the fall of 2008 the crisis at the financial markets very quickly caused a decrease in demand around the world, which led to recessions in nearly every region. Given the uncertainty in the global markets, capital goods producers suffered the greatest losses. According to our esti-

⁴ Belitz, H., Gornig, M., Schiersch, A.: Deutsche Industrie durch forschungsintensive Güter erfolgreich. DIW Berlin Wochenbericht, 9/2010, 2-10.

⁵ See for example Ezell, S.J. and Atkinson, R.D.: The Case for a National Manufacturing Strategy, The Information Technology & Innovation Foundation, April 2011.

Box 1

Classification by sector and region, data basis

R&D-intensive industries and knowledge-intensive services

Research-intensive manufacturing industries are the producers of goods using high-level and cutting-edge technologies, defined as follows:¹

- The cutting-edge technology category includes goods for which internal R&D expenditures comprise, on an OECD average, more than 7 percent of revenues. This is the case for pharmaceuticals, office machinery and computers, communication equipment, medical and precision instruments, and aircraft and spacecraft.
- The high-level technology category includes goods for which internal R&D expenditures comprise between 2.5 and 7 percent of revenues. This includes chemicals, machinery, electrical machinery and apparatus, motor vehicles, and other transport equipment.

This distinction is based on the R&D intensity and not meant to imply that cutting-edge technology is more "advanced" or "valuable". Goods using cutting-edge technology are more frequently subject to government intervention in the form of subsidies, government contracts, and non-tariff trade barriers. Policies are created to promote them not only with technological goals in mind, but also in pursuit of national goals in areas such as defense, healthcare and the aerospace industry.

¹ Legler, H., Frietsch, R.: Neuabgrenzung der Wissenswirtschaft—forschung-intensive Industrien und wissensintensive Dienstleistungen (NIW/ISI-Listen 2006), Studien zum deutschen Innovationssystem No. 22-2007, German Federal Ministry of Education and Research, Berlin 2007.

Division of European countries into survey regions

The "EU-14" are the original EU member states with the exception of Germany: Belgium, Denmark, Finland, France, the United Kingdom, Greece, Ireland, Italy, Luxemburg, the Netherlands, Austria, Spain, Portugal and Sweden.

The "EU-10" are the countries that become members in May 2004: Estonia, Latvia, Lithuania, Malta, Poland, Slovenia, Slovakia, Czech Republic, Hungary and Cyprus. Bulgaria and Romania, which joined the EU in 2007, were not considered in the survey.

Data basis

Data compiled by the European research consortium (EU KLEMS) and the OECD (STAN) provide the data basis for an international comparison for the period from 1995 to 2007. The EU KLEMS version of March 2008 provides detailed data, grouped by sector, for every year up to 2005. The values for 2006 and 2007 for Germany, the US and the EU countries have been added, and in some cases estimated, from the more current EU KLEMS version of November 2009 and the OECD STAN data from 2010. The later EU KLEMS provided data for a more limited classification by sector.

Data was further drawn from national reported production indices, price indices, incoming orders, capacity utilization, etc. to calculate the value added and the volumes of work to the present. This data was processed using ARIMAX and naive models to project the value added and volumes of work for each sector up to the present.²

² For more details, refer to Schiersch, A., Belitz, H., Gornig, M.: Fortschreibung internationaler Wirtschaftsstrukturdaten für FuE-intensive Industrien. Studien zum deutschen Innovationssystem No. 5/2011. Commission of Experts for Research and Innovation, Berlin, February 2011. www.e-fi.de.

mates, the share of industry to total value added fell in every country. In 2010 it was still lower than in 2007, the year before the crisis (Figure 2).

Japan reported the greatest drops: 2.9 percentage points in R&D-intensive and 2.6 percentage points in non-R&D-intensive industries. In Germany, the share of R&D-intensive industries fell by 2.3 percentage points to 11.5 percent between 2007 and 2009. These strongly

export-oriented industries were hit especially hard by the slump in global demand for capital goods. In contrast, the decline in non-R&D-intensive industries turned out to be relatively minor, at 0.3 percentage points.

In 2010 Japan showed the greatest annual growth in the contribution of R&D-intensive industries to value added (2.6 percentage points). Germany came second at 1.1 percentage points.

... but only minor reduction in employment

Analyzing production trends is not enough to evaluate the repercussions of the financial and economic crisis on the German economy. Rather, it is also necessary to determine changes in employment and labour productivity. The DIW therefore estimated these time series for different countries and presents the results in this report to an international audience for the first time.

During 2009, the volume of labour in the R&D-intensive industries declined in all of the countries considered in this report (Figure 3). The UK and the US suffered the greatest declines compared to 2007, the year before the crisis. There were strong decreases in the volume of labour in Germany as well. However, these were more moderate than the production cuts would have implied. This development, however, was also different due to the fact that labour market stakeholders (companies, unions and government) took great efforts to prevent a reduction in jobs because of the crisis.

Short-time work was one tool in this respect.⁶ In August 2008, shortly before the financial crisis became an economic crisis, about 4,000 companies and 40,000 employees were supported by this instrument. This figure then skyrocketed. It finally peaked in May 2009, when 56,000 companies applied short-time work rules to more than 1.4 million employees.⁷ At the same time, the number of employees only shrank by 310,000, in the already seasonal weak period, from August 2008 to January 2009. In April 2009 the unemployment rate for the workforce force was at its zenith during the crisis at 8.6 percent, though this was still below the yearly average from 2005 to 2007. At the same time, the number of hours worked per employee fell by more than 15 percent between Q3 2008 and Q2 2009. This means that the enormous cut in production was not accompanied by an equally extreme reduction in jobs.⁸ Rather, many companies held on tight to their employees despite the lack of orders and the strong underutilization of their production capacities, to ensure that they would have the necessary firm specific human capital and capacities to quickly return to pre-crisis production levels.

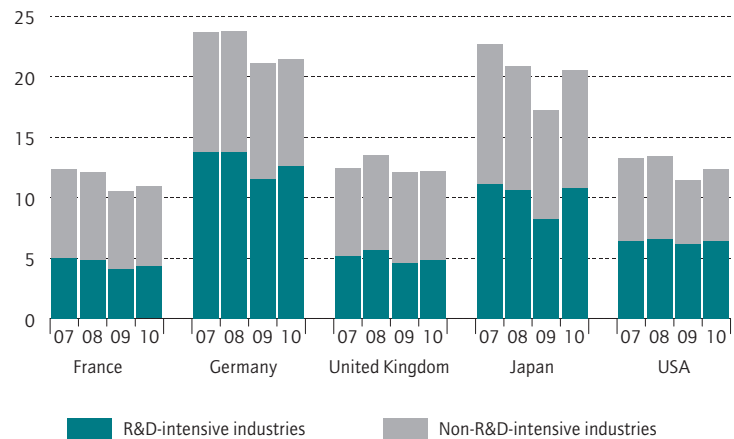
⁶ For a detailed presentation of the changes to short-time working rules as a result of the crisis, especially in terms of economic short-time allowances, refer to Mai, C. M.: Der Arbeitsmarkt im Zeichen der Finanz- und Wirtschaftskrise. *Wirtschaft und Statistik*, 3, 2010, 237-247.

⁷ The data on short-time working and the following information on employment figures and hours worked was drawn from the Genesis database run by the Federal Statistical Office (Statistisches Bundesamt), www.genesis.destatis.de

⁸ Another step used heavily to maintain employment during the financial and economic crises was the work-off of overtime account balances. Zapf, I., Brehmer, W.: Working time accounts have proven to be of value. IAB Brief Report, 22/2010.

Figure 2

Contribution of R&D-intensive and non-R&D-intensive industries to national value added from 2007 to 2010



Sources: EU KLEMS Datenbasis 11/2009; calculations and estimates of DIW Berlin.

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The R&D-intensive sectors in Germany and Japan plummeted but then recovered quickly from the crisis.

Other actions also assisted these efforts, such as additional state subsidies to companies for research, development and innovation.⁹

Only short-term decline in labour productivity

These policies of German firms during the crisis, caused a decrease in labour productivity in 2009 which had never been seen before. Every R&D-intensive industry in Germany was affected (Figure 3). Labour productivity in machinery declined particularly drastically, but this industry also reported the harshest production cuts. However, in 2010 labour productivity in the R&D-intensive industries in Germany was nearly back to the pre-crisis level. The strategy pursued during the crisis to secure jobs thus had no long-term negative impact on labour productivity as a measure of production efficiency.¹⁰

Labour productivity in the UK and the US, which traditionally follow more conservative labour market policies,

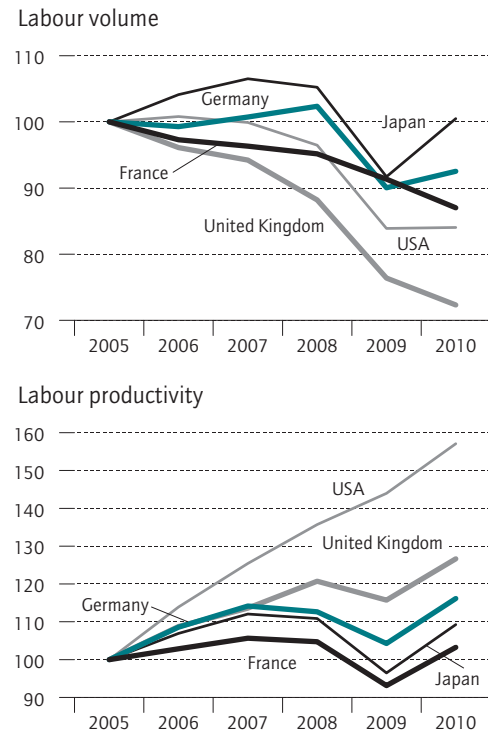
⁹ According to the Center for European Economic Research (ZEW), innovation expenditure did not shrink as much as production during the 2009 year of crisis, meaning that the intensity of innovation even increased from 2.72 to 2.74 percent. The R&D-intensive industries were especially persistent, increasing their intensity of innovation from 7.7 to 8.4 percent. Rammer C. et al. (2011): Innovationserhebung für Deutschland 2010–Mit Schwung aus der Krise. Mannheim, January 2011.

¹⁰ Based on the available data, no comment can be made on the adjustments to and efficiency of the capital input.

Figure 3

Labour volume and labour productivity in the R&D-intensive industries

Index 2005 = 100



Sources: EU KLEMS Datenbasis 11/2009; calculations and estimates of DIW Berlin.

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The labour productivity of the R&D-intensive industries is greater now than before the crisis.

showed quite different trends.¹¹ The decline in the volume of labour in the R&D-intensive sectors of both countries was so harsh that in some cases it overcompensated the decrease in value added. In the UK, labour productivity in the R&D-intensive industries diminished in 2009, but this was mainly due to the temporary productivity losses in machinery and electrical machinery. In contrast, labour productivity increased further in the other R&D-intensive industries.

This trend was even more pronounced in the US manufacturing industry. The companies in the US reacted to the crisis by reducing their workforce, often more than their production decreased. Except for machinery, this meant that labour productivity in the R&D-intensive sec-

tors also rose during 2009. Therefore, measured by labour productivity, the efficiency of the US R&D-intensive industries even improved as a result of the crisis.

The development of labour volume and labour productivity in the two Anglo-Saxon countries is characterised by the policy of "hire and fire". Nonetheless, the greater productivity in these two countries did not translate into relatively higher market shares for the R&D-intensive industries. Rather, Germany held onto its lead over the UK and the US.

Conclusions

The R&D-intensive and heavily export-oriented German manufacturing industry has passed its trial by fire during the global economic crisis and at least held onto its leading international competitive position. This success is due principally to the fact that companies were mostly able to maintain their human capital throughout the crisis because of the concerted action of company management, unions and politicians. In this regard, however, there is always a risk of preserving industry structures that will no longer be competitive in the long term.

To be able to react appropriately and flexibly to future shocks to global demand, the actors need instruments that allow them to distinguish between temporary decreases in demand and long-term structural changes. This could prevent existing competitive advantages from being recklessly jeopardized and, at the same time help reduce the subsidies needed to preserve obsolete structures. This is why we see the need for a scientifically founded, international industrial monitoring system which gives politicians early indication of upcoming structural shocks triggered by external factors.

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¹¹ For the US also Schatz, P., Spitznagel, E.: Macroeconomic dynamism of labour markets: a comparison of internal and external flexibilities in the USA and in Germany. WSI-Mitteilungen, 63 (12), 2010, 626–635.

Exports: Orientation Towards Emerging Markets

by Marius Clemens, Florian Mölders and Dieter Schumacher

Nearly 60 percent of globally traded industrial goods are R&D-intensive. Two fifths are goods with very high research intensity (cutting-edge technology), while the remaining three fifths are goods with high research intensity (high-level technology).¹ Up until the 1990s, the USA was the global market leader. However, since then, the situation has changed in favor of Germany and remained so despite the recent economic crisis.² In 2009, Germany exported R&D-intensive goods amounting to USD 670 billion. The two main competitors, the USA and Japan, exported goods worth USD 561 and 388 billion respectively. The new Central and Eastern European EU member states, which increasingly focus on the production of R&D-intensive goods, reached a value of USD 189 billion altogether. The situation on the import side is reversed: Here the US market dominates with imports worth USD 756 billion, while Germany comes second with USD 430 Billion (see Table 1).

Germany biggest technology supplier in world trade

Selling R&D-intensive goods on the world market also means selling the know-how implemented in these goods. In this sense, exports tell us to what extent technology is exported to other countries. Similarly, imports

indicate a transfer of know-how in the target country. Measured by the difference of exports and imports, and in relation to a country's population, Japan and Germany are net exporters with per capita values of USD 2929 and 1621; to a much lesser extent also the EU-14 group with USD 151 (Table 1). In contrast, the USA is the biggest net importer. In both cases this tendency has already evolved in the 1990s.

During the economic crisis, worldwide trade in R&D-intensive goods decreased from USD 6.7 trillion in 2008 to 5.3 trillion in 2009.³ The demand for high-level technology goods collapsed significantly. This did not only apply to long-lasting industrial goods, for example in the machine building and vehicle manufacturing industries, but also to second-tier industries like suppliers of vehicle parts as well as plastic and rubber producers.

Countries like Japan and Germany, which specialize in high-level technology, observed a decrease in exports of 31 and 27 percent respectively (USA: -23 percent). The export of cutting-edge technology products has most drastically decreased in the USA (-31 percent), whereas Germany and Japan saw a decline of only 11 and 19 percent respectively. Regarding imports, losses in the high-level technology sector are smallest in Germany (Germany: -23 percent, USA: -27 percent, Japan: -26 percent). For cutting-edge technology products, the decline was similar in all three countries (about 8 percent).

Implications of the crisis on export specialization

The amount of export-import flows is largely influenced by fluctuations in demand and currency exchange ra-

¹ See Box 1 in the previous article.

² Belitz, H., Clemens, M., Gornig, M., Schiersch, A., Schumacher, D. (2010): Wirtschaftsstrukturen, Produktivität und Außenhandel im internationalen Vergleich, Studien zum deutschen Innovationssystem No. 5-2010, Expertenkommission Forschung und Innovation (eds.), Berlin, February 2010.

³ Belitz, H., Clemens, M., Gornig, M., Mölders, F., Schiersch, A., Schumacher, D. (2011): Die deutsche forschungsintensive Industrie in der Finanz- und Wirtschaftskrise im internationalen Vergleich. Studien zum deutschen Innovationssystem No. 4-2011. Eds.: Expertenkommission für Forschung und Innovation, Berlin, February 2011. www.e-fi.de

Table 1

Foreign Trade indicators of selected countries and regions for R&D-intensive Goods 2008 and 2009

	Germany		USA		Japan		EU-14		EU-10	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Exports in billion USD										
R&D-intensive goods	873.5	670.1	765.4	561.2	542.6	388.3	1782.6	1433.6	290.8	188.9
Cutting-edge technology	225.7	200.4	337.8	231.8	117.4	95	617.8	560.8	88.8	57.3
High-level technology	647.9	469.7	427.6	329.4	425.3	293.3	1164.8	872.7	201.9	131.6
Imports in billion USD										
R&D-intensive goods	522	429.6	929.8	755.9	218.7	180.1	1762.4	1386.5	290.7	211.9
Cutting-edge technology	195.4	179.1	401	369.4	105.5	96.1	641.8	573.9	89.3	75.2
High-level technology	326.6	250.5	528.8	386.6	113.2	84	1120.6	812.5	201.4	136.8
Balance of trade per capita in USD										
R&D-intensive goods	4 281	2 929	-541	-641	2 537	1 621	65	151	1	-311
Cutting-edge technology	368	258	-208	-453	93	-9	-77	-42	-6	-241
High-level technology	3 913	2 670	-333	-188	2 443	1 630	142	193	7	-70
Relative share of exports in world trade (RXA)*										
R&D-intensive goods	18	17	22	17	31	26	0	1	1	-5
Cutting-edge technology	-18	-14	39	19	-23	-24	-8	-3	-19	-34
High-level technology	35	34	10	16	54	51	4	3	11	11
Relative share of imports in world trade (RMA)*										
R&D-intensive goods	4	3	2	3	-14	-15	-4	-5	-1	-3
Cutting-edge technology	1	1	14	17	9	8	-8	-7	-23	-21
High-level technology	5	4	-6	-9	-32	-36	-1	-3	10	8
Comparison of export and import share (RCA)**										
R&D-intensive goods	13	11	18	12	44	39	2	3	0	-5
Cutting-edge technology	-24	-22	20	-5	-36	-39	-3	-3	0	-20
High-level technology	30	29	16	25	87	87	4	7	1	3

1 A positive value indicates that the share of R&D-intensive goods in exports/imports of that country is higher than the corresponding share in global trade.

2 A positive value means that the share of R&D-intensive goods in exports is bigger than in imports.

Sources: UN Comtrade 2010; DIW Berlin calculations.

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tes. In order to describe the position of German R&D industries without these influences we compare export and import shares of a country with the corresponding international share. We use an indicator⁴ that illustrates comparative advantages and disadvantages of the countries of interest in their foreign trade with R&D-intensive goods and analyzes whether the crisis has changed Germany's foreign trade profile (see Box 1).⁵

If we take a look at specific countries' positions regarding R&D-intensive goods for exports (RXA) and imports (RMA), we identify the following grouping for

2009: Regarding cutting-edge technology, the USA was strongly involved on both sides of the international trade flow, surpassing its competitors. In Germany and Japan, only imports were above average. EU-14 countries' trade in cutting-edge technology is below average for both imports and exports. For high-level technology goods, Germany and the EU-10 countries are strongly involved in global trade in both imports and exports, while for Japan, the EU-14 and the USA the same pattern is reflected on the export side.

The RCA indicator combines the two above mentioned indicators to illustrate the current situation of comparative advantages. It can be used to estimate the relative scale of the financial crisis. Table 1 shows that the RCA index has developed negatively from 2008 to 2009 for Germany, the USA and Japan. The lower RCA values for Germany and Japan can be explained by a decline of exports of R&D-intensive goods. However, Germany only had to cope with a moderate decrease compared to Japan, the USA and the EU-10.

⁴ For the calculation of the indicator, foreign trade data are structured according to the four-digit International Standard Industrial Classification (ISIC Rev.3). Information on the calculation of specialization indicators can be found in Box 1.

⁵ Dividing the shares provides us with the measure introduced by Balassa (1965), which is used for quantification of specialization patterns of a given country in international trade. See Balassa (1965): Trade Liberalization and 'Revealed' Comparative Advantage. The Manchester School of Economic and Social Studies, 33, 99-123.

Box 1

Indicators Measuring Specialization in International Trade

Specialization patterns of a given country are measured on the basis of whether a country has a significantly bigger or smaller share in world trade regarding imports/exports of specific product groups—compared to its overall share in the manufacturing sector. A country's comparative advantages are calculated based on a comparison of exports and imports. In case the export/import balance of a class of goods—adjusted for the total balance—is positive, the country has a comparative advantage in this class. If it is negative, the country has a disadvantage. Indicators are calculated from relations, making them independent of the size of different classes of goods.¹

Indices reveal a specialization in exports (imports), if the share of a specific class of goods in total exports (imports) of the manufacturing sector is bigger than in world trade.²

$$RXA_{ij} = 100 \ln [(X_{ij}/\sum_i X_{ij})/(\sum_j X_{ij}/\sum_j X_{ij})]$$

and

$$RMA_{ij} = 100 \ln [(M_{ij}/\sum_i M_{ij})/(\sum_j M_{ij}/\sum_j M_{ij})]$$

Therefore, a positive value means that the economy is specialized in the (export) production of goods in a certain class of goods, while a negative value indicates that involvement in world exports is below average.

A comparison of comparative advantages for imports and exports can be achieved with the help of the RCA (Revealed Comparative Advantage) index:

¹ The analysis of comparative advantages and disadvantages based on foreign trade data (RCA: Revealed Comparative Advantage) was developed by Balassa (1965) and is often used in his mathematical formulation.

² X = exports, M = imports, i = product group index, j = country index.

$$RCA_{ij} = 100 \ln [(X_{ij}/\sum_i X_{ij})/(M_{ij}/\sum_i M_{ij})]$$

If the world import value equals the world export value, the RCA index can be calculated as the difference between RXA and RMA. RCA values characterize the pattern of comparative advantages/disadvantages of a given country in world trade, taking into account import competition on the domestic market. In this respect it is important to note to what extent a country's import structure deviates from the global trade structure.

Measuring relative geographic orientation

The Revealed Geographic Advantage Index (RGA, following the RCA index) measures geographic advantages/disadvantages of a specific country regarding its trade in certain sectors. To this end, the share of an export market in total exports of a specific sector is calculated (in our case R&D-intensive industries) and put in relation to the corresponding weight of the other OECD member states. This creates a relative index that mirrors a country's geographical orientation in correspondence to the orientation of the potential competitors, the other OECD countries. Formally, this index is calculated as follows:

$$RGA_{jk} = 100 \ln [(X_{jk}/\sum_j X_{jk})/(X_{OECDjk}/\sum_j X_{OECDjk})]$$

A positive RGA value indicates that the respective country exports more goods of sector k to country j than other OECD member states do. In case the index echoes a null value, this means e.g. that Germany and the other OECD member states have identical shares in exports to country j in sector k.

³ Definition of variables: X = exports, j = country index, k = product group index, OECD = OECD member states.

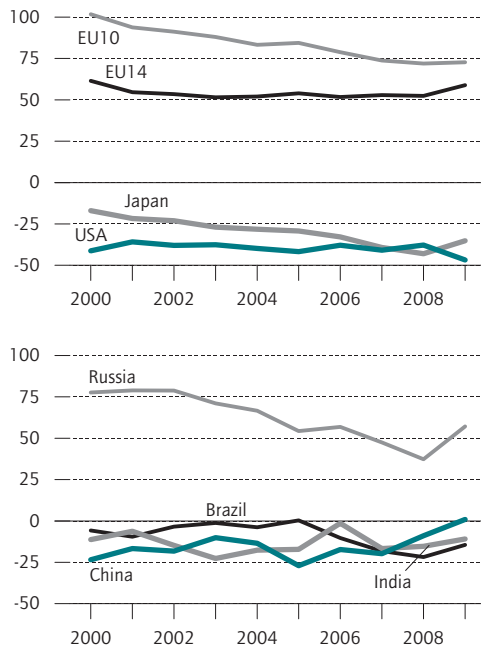
An analysis of specific industry sectors reveals a more detailed picture: RCA values show that after the crisis Germany holds comparative advantages in a number of R&D-intensive products. This is the case, not only in the traditionally export-strong industries like vehicle manufacturing and machine building, but also in many smaller product groups like medical technology, chemistry

and electrical engineering.⁶ Overall, the USA (like Germany) possesses comparative advantages in 20 out of 31 R&D-intensive classes of goods in 2009. Japan and EU-14 countries are nearly as strong with 19 and 18 classes

⁶ See also Schrooten, M., Teichmann, I. (2010): Export wieder auf Touren—Binnennachfrage muss nachziehen. Wochenbericht des DIW Berlin No. 35, 2-7.

Figure 1

Geographic orientation of German exports of R&D-intensive goods in international comparison



Sources: UN Comtrade 2010, DIW Berlin calculations.

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German exports of R&D-intensive goods to BRIC states grow faster than those of the other OECD countries.

respectively, while the EU-10 falls behind with advantages in only eight product classes.

In summary, the following can be recorded about a shift of the sectoral patterns in the year of crisis: Though absolute numbers have gone down, Germany has not experienced severe losses compared to its competitors. While medical technology, chemical industry and machine building show moderately positive or no changes at all in their relative positions the loss of comparative advantages in the high-level technology sector can be mainly attributed to the automobile industry.

Geographical diversification

The demand of the emerging countries in Asia and Latin America has reduced the market concentration of the traditional sales markets for the USA, Europe and Japan. The world economy is currently driven by these emerging countries, putting the geographical competitive position on new emerging markets into the foreground. Although the European and North American

markets still dominate as destinations for German exports of R&D-intensive goods, a regional shift can be identified. The BRIC⁷ states' share used to be below five percent in the beginning of the last decade –it has now risen to nearly eleven percent in 2009. Emerging countries are likely to play an increasing role: The share of R&D-intensive goods in total Chinese imports has increased by 12 percentage points in the past decade.

To obtain a relative index, a subsequent analysis should include the corresponding values of countries that are potential competitors in a specific market, (see Box 1). This index describes the geographical orientation of R&D-intensive industries, in relation to the orientation of other OECD countries. The Revealed Geographic Advantage Index (RGA) allows us to draw conclusions on the relative geographical orientation of exports based on observations from 2000 till 2009. Figure 1 illustrates the development of the RGA index between 2000 and 2009 for German exports in selected traditional and emerging markets.

The biggest part of Germany's foreign trade is conducted within Europe. Especially the EU-10 countries import a significant, and above average, percentage of R&D-intensive goods from Germany. Starting in 2008, the figure shows a decline in the relative concentration of R&D-intensive goods on the US market. This shift is accompanied by a reorientation of German trade towards the BRIC states; however, because of its geographical proximity, exports above-average can only be observed for Russia.

The value of the RGA index is influenced by the geographical proximity to the sales market. This allows Germany, the United Kingdom and France to gain significant geographical advantages on the European market, as it is the case for the USA on American and Japan on Asian markets (see Table 2).

Compared to other OECD countries, the USA has lost some of its presence both on traditional and emerging markets over the past years. Regarding the Chinese market, Japan holds a clear advantage because of its geographical proximity. Furthermore, a slightly negative tendency can be observed concerning the markets of industrialized economies. The BRIC states do not play a significant role for Japan with regard to the development during the financial crisis.

In UK's regional orientation, its cultural proximity to the American market is mirrored, whereas France pos-

⁷ BRIC states are Brazil, Russia, India and China.

Table 2

Relative geographical orientation of selected export countries and destination markets

RGA Index 2009, values for 2007 in brackets

Destination	Germany	USA	Japan	France	United Kingdom	China	India	Russia	Brazil
Exportländer									
Germany	0	-47 (-41)	-35 (-39)	66 (59)	46 (42)	1 (-20)	-11 (-17)	57 (47)	-14 (-18)
USA	-48 (-45)	0	56 (69)	-91 (-57)	-20 (-18)	2 (13)	-3 (41)	-108 (-103)	79 (94)
Japan	-95 (-92)	34 (46)	0	-151 (-141)	-90 (-69)	116 (109)	-19 (-28)	-76 (-2)	-42 (-58)
France	68 (58)	-64 (-70)	-68 (-62)	0	46 (48)	-64 (-38)	-33 (13)	31 (-18)	-15 (10)
United Kingdom	36 (36)	16 (2)	-27 (-38)	27 (37)	0	-78 (-95)	-18 (-34)	-9 (-17)	-30 (-50)

Sources: UN Comtrade 2010, DIW Berlin calculations.

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sesses geographical advantages in Russia. Regarding the emerging economies, both states have developed quite differently over the past years. France has increased its exports to Russia, whereas British exporters have become more present in all BRIC states, although still below OECD average.

Outlook

Following the economic crisis, German R&D-intensive exports have decreased. However, the share of R&D-intensive goods in total exports has nearly remained unchanged in Germany—in contrast to Japan and the USA. Taking into account indicators of relative specialization, we see that Germany's loss of comparative advantages regarding R&D-intensive goods was less dramatic than that of Japan or the USA. Comparative advantages of Germany's exports have not shifted, but there are signs that exporters have begun a reorientation towards emerging markets in 2007. With respect to expected future growth, a stronger focus on the Chinese, Indian, Russian and Brazilian markets is important. Their weight in the demand for R&D-intensive goods is expected to increase with their economic development, making a geographical reorientation probable. Large emerging countries like China are increasingly focusing their export specialization on R&D-intensive industries, possibly leading to an increasing demand for German technology.

Based on these findings, European foreign trade policy should focus on improving trading conditions with these fast growing and emerging economies. Free trade agreements with the EU are currently being negotiated with India as well as with a number of Latin American and East Asian states. Since the market diversification in R&D-intensive exports may guarantee a more consistent growth, and as the import of know-how can

improve the countries' capacity for innovation, barrier-free trade is in the interest of both European and emerging countries.

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Japan at the Crossroads— State Budget Remains the Achilles' Heel

by Georg Erber and Mechthild Schrooten

The natural and nuclear disaster on the 11th of March 2011 pulled Japan into a renewed recession. Projected on the annual basis, the gross domestic product nosedived by 3.5% in the first quarter of 2011.

Indeed the consequences of the earthquake, tsunami and subsequent nuclear disaster will be very noticeable for the remainder of the year with regard to economic development. However, initial signs of a rebound have begun to appear in the meantime. Extensive public spending programs are currently sustaining the demand. Prior to the earthquake, the public debt was already approximately 200% of the gross domestic product and was rising rapidly. The government must harmonize duties, responsibilities and financial conditions; otherwise its room to maneuver in times of more "extreme events" decreases. Thus the Japanese government faces a dilemma: Increasing the tax burden, which is low when compared internationally, will have a negative impact on economic development. Fiscal consolidation and debt-financed economic growth are contradictory.

The catastrophe from the 11th of March 2011 (earthquake, tsunami, nuclear disaster) hit the Japanese economy at a point when industrial production was appearing to recover. All of the monetary and fiscal stabilization measures taken were unsuccessful in establishing a permanent growth course following the international financial crisis. In the last quarter of 2010, economic performance was again declining.¹ This downward trend was exacerbated by the disaster. In the first quarter of 2011, the gross domestic product shrank by 3.5 percent.

Industrial production fell drastically as an immediate consequence of the natural disaster. Thus in March of 2011, the strongest monthly decline since 1953 was recorded at minus 15.5%. Significant bottlenecks occurred in the country's power supply as a result of the disaster in Fukushima. Entire regions were disconnected from the power grid at hourly intervals.

In addition there was the significant disruption in the supply chains, which, due to the just-in-time production, could have a particularly rapid and sustained impact on key economic sectors such as the automotive industry or semiconductor manufacturing.² Due to the focus on single Japanese manufacturers and the few locations in the earthquake zone, production had to be reduced or shut down entirely in these sectors, at least temporarily.

¹ The Japanese economy has only slowly recovered from the effects of the international financial crisis of 2008/2009. Although the gross domestic product grew by 4% in 2010, the weak domestic demand contributed to a renewed decline in the total economic output already in the 4th quarter of 2010. Also see Ferdinand Fichtner and others: Sommergrundlinien 2011. Wochenbericht des DIW Berlin No. 26+27/2011.

² A small vendor part, which measures the air supply for car engines, will apparently be a problem for the global automotive industry due to supply shortages caused by the production downtimes in Japan. The earthquake and the subsequent tsunami in mid-March have already led to cutbacks in production or plans to do so in some plants from General Motors, Toyota Motor and PSA Peugeot Citroen. Manufacturers fear supply shortages of such individual critical parts that are produced in Japan, reports the Thursday edition of "The Wall Street Journal." Klaus Brune: JAPAN / supply shortages hamper production - reduced working hours threaten. Dow Jones Newswire, Message dated 24 March 2011.

Despite the dramatic events, a positive growth rate (although slight) has already been reported in April for the industrial production. Such a rebound effect is typically following disasters.³

The positive trend was reinforced in May of 2011. However, industrial production remains about five percent below the respective comparison value from the previous year.⁴ Meanwhile, survey indicators, such as the Tankan index, are suggesting that the economic mood is brightening.

Japan: Export-driven growth ...

Japan is using a strategy similar to Germany's: The overall economic development is strongly influenced by foreign demand and therefore by exports. Domestic demand has only grown slightly in recent years. Up until the late 1980's, Japan was still the future leading economic power ahead of the United States of America.⁵ Since the collapse of its housing bubble in the early 1990's, Japan has not found its way back to its old growth dynamic.

In 2008/2009, Japan also fell into the wake of the international financial crisis. The country, such as Germany, is a major net creditor on the international capital market. Just like Germany, Japan reported had large current account surpluses for years.⁶ More is produced than is invested and consumed by the domestic economy.⁷ In 2010, the current account surplus amounted to just over three percent of the gross domestic product.

Similar to Germany, the country could first recover relatively quickly from the effects of the international financial crisis, not least due to massive fiscal programs, a continuous policy of cheap money and high overall economic dynamism of the Asian "emerging economies." However, dwindling exports in the fourth quarter of 2010 demonstrated the fragility of the growth - the gross domestic product caved immediately.

After the earthquake, the current account surplus declined and in April 2011 did not even reach one third of the previous year's comparison value. This trend continued in May. However, the balance of current accounts remained positive even during these difficult months, which is primarily due to the repatriation of Japanese foreign assets. The trade balance was in the deficit in both months. Overall, Japan's export quota, at nearly 14% in 2010, is far below that of Germany's. The Japanese import quota reached approximately 11%. The limited openness of the Japanese economy, as compared to Germany's, contributed to the fact that the consequences of the natural disaster as a whole had a negligible impact on international markets. In particular, it is evident in other economies (despite the existing tight value chains) that hardly any lasting loss of production there occurred.⁸ However, it remains to be seen whether or not the de-stocking of critical parts from Japan in individual areas presents delayed consequences. Currently Japan is the sixth largest trading partner of the EU. Last year, the EU exported goods and services to Japan amounting to nearly 44 billion euro. Germany was the leading participant with 13 billion euro. Imports amounted to 65 billion euro. While the export demand for Japan's economic development is of vital importance, Japan's importance in all international trade is likely to decline. Thus in 2010, China replaced Japan from its position as the second largest economy in the world. Currently, there is much evidence that Japan's global economic importance will continue to decline in the future.⁹

... weakening domestic demand

The demand from the private sector has been weak for years (table 1). Politico-economic impulses always only lead to a short-term stimulation. This applies both for private consumption as well as for investments. Therefore, after the economic stimulus package for handling the financial crisis expired, a renewed decline of the pri-

³ M. Shirakawa (2011): Great Eastern Japan Earthquake: Resilience of Society and Determination to Rebuild, Remarks of the Council of Foreign Relations. New York, April 2011. E. Cavallo und I. Noy (2010): The Economics of Natural Disasters: A Survey. IDB Working Paper Series, No. 124.

⁴ www.meti.go.jp/statistics/tyo/iip/result/pdf/press/h2a1005j.pdf.

⁵ Ezra Vogel: Japan as Number One: Lessons for America. iUniverse.com, 1979, San Jose, New York, Lincoln, Shanghai.

⁶ Andreas Rees, Markus Taube, Bernd Kempa and Georg Erber: USA, China, Indien: Droht ein globaler Abwertungswettbewerb? In: Ifo-Schnelldienst, 2010, Vol. 63, No. 22, 3-17.

⁷ Since the fall of 2010, the Japanese yen has depreciated by approximately two percentage points as compared to the currencies of its major trading partners (measured by the real exchange rate).

⁸ "For the time being, the earthquake disaster and the nuclear accidents in Japan are not causing supply shortages for high-tech equipment in Germany." The Bitkom inter-trade organization stated this on Wednesday in Berlin. According to the manufacturers' first reports, the direct impact of the earthquake and tsunami on the production of high-tech products was limited. "Companies are striving to bring production back up to full speed or they are relocating production capacities to other plants," said Bitkom president August-Wilhelm Scheer. www.wallstreet-online.de/nachricht/3118186-erdbeben-bitkom-keine-lieferengpaesse-bei-hightech-durch-japan-katastrophe.

⁹ Simply considering the proportion of an economy in global production falls far too short of being able to estimate their productivity and competitive position. This is especially true if a country is confronted with massive demographic changes. Since the Japanese government hardly allows immigration from abroad, the aging of the Japanese population penetrates the Japanese job market. In addition, fertility is low by OECD standards. At the same time, life expectancy is above the OECD average. Traditionally, the unemployment rate in Japan is low by OECD standards. It is currently at five percent.

vate demand was assumed. Now, the immediate consequences of the disaster continue to dampen the demand. Thus, consumer spending in March declined nationally by nearly eleven percent.¹⁰

Compared internationally, Japan has shown a propensity to consume comparatively little, which is accompanied by a high overall saving rate. Deflation (which is still to be sustainably overcome) played a role on expenditures both in private households as well as in companies.¹¹ Falling prices increase the incentive to delay the purchase of durable and more expensive goods further into the future. With deflation, the interest on borrowings (such as for credit financing of investments) is subject to an additional risk. The nominal interest rate is fixed at the time when the contract is signed, but the real interest rate may be higher if the prices fall. From the perspective of companies, the risk of investment thus increases.¹²

10 Here, the consumption of households with two or more persons was registered. Bank of Japan (2011): Consumption.

11 Related to the complete basket of goods, an inflation of zero percent is shown for the 1st quarter 2011. Not considering the price development for fresh foods, Japan has been in a new ongoing deflation since 2009. Bank of Japan (2011): Commodity and Service Prices.

12 The most recently declining investments (1st quarter 2011: -5.2 percent) in Japan can thus also be seen as connected with the fragile export development.

Table 1

Economic situation in Japan

Change from the previous year in percent

	2008	2009	2010	2011 ¹
Gross domestic product	-1.2	-6.3	4.0	-0.9
Private consumption	-0.7	-1.9	1.8	-1.1
Asset investments	-1.4	16.7	2.1	-1.3
Public investments	-8.6	10.4	-3.4	-1.4
Export	1.6	-23.9	23.9	0.7
Import	0.4	-15.3	9.8	1.9
Consumer prices	1.4	-1.4	-0.7	0.3 ²
Unemployment rate in percent	3.9	5.0	5.0	4.5 ³

¹ 1. Quarter 2011 compared with the previous quarter.

² June 2011 compared with the previous month.

³ May 2011.

Sources: Cabinet Office, Statistics Bureau, Bank of Japan.

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After recovering from the financial crisis, the economy is decreasing again due to the natural disaster.

Despite all monetary and fiscal policy endeavors in recent years, this deflation-consumption downward spiral has yet to be broken in Japan.¹³ So far, the expansionary monetary policy measures seem to mainly fall flat. A significant portion of the liquidity has been transferred abroad through “carry trades.”¹⁴

The purchase of securities by the Japanese Central Reserve Bank was facilitated as a part of the crisis management following the earthquake.¹⁵ It is positive that the banking system was apparently hardly shaken by the consequences of the earthquake. Adhering to the policy of easy money should support the financing of reconstruction in the affected coastal region. However, the expansionary impulses that may be caused by interest rate policies are largely exhausted. The prime rate has long been close to zero percent. Monetary policies can therefore only assume impulses through an ever more generous provision of liquidity. If monetary policy measures have only limited effect, then the traditional economic policy for economic stimulation must primarily rely on fiscal policy.¹⁶

Crisis management through fiscal policy

An additional fiscal program of the magnitude of 0.8% of the gross domestic product was approved immediately following the disaster from the 11th of March 2011. According to preliminary estimates by the Japanese government, the costs to overcome the disaster will amount to 208 billion euro.

It remains to be seen whether the long-lasting costs for redressing the nuclear disaster in Fukushima are already considered in a sufficient amount. The fiscal costs of reconstruction in the next several years are estimated by the International Monetary Fund (IMF) to be approximately two to four percent of the gross domestic product.¹⁷

13 Mechthild Schrooten (2001): Japan: Zinsschritt reicht nicht aus. Wochenbericht des DIW Berlin No. 8/2001.

14 Currency carry trade is a speculative strategy where a speculator borrows money in a currency with a relatively low interest rate in order to buy debt securities, which are quoted with a higher interest rate in another currency (e.g. U.S. government bonds). Profits arise from the difference in interest rates.

15 Immediately following the earthquake, the Japanese Central Reserve Bank considerably increased the framework in which securities of all types can be bought out and at the same time made available an additional line of credit in the order of one billion yen.

16 The national demand was in a supporting role, even in the current downturn (as is so often the case with a fading economy). (1st quarter 2011: + 9.2 percent). Cabinet Office (2011): Quarterly Estimates of GDP: Jan.–Mar. 2011 (The 2nd Preliminary Estimates). www.esri.cao.go.jp/jp/sna/sokuhou/kekka/gaiyou/main_1.pdf.

17 IMF (2011): Article 4 Consultations.

The Japanese government budgets have been chronically in deficit for years. Negative consequences must be expected for economic growth with a national debt of more than 90% of the gross domestic product.¹⁸ Japan has long been on the other side of this limit and continues to move further away from it. Japan's chronic growth weakness could be part of its cause. The private capital investments have turned out very low for years and public infrastructure investments cannot compensate for this in terms of economic growth. Japanese multinational companies would rather invest abroad.

In the 2011 fiscal year, nearly 48 percent of the expenditures were not financed by taxes and levies. This corresponds to a deficit ratio of approximately 10 percent. The debt increased by 17 trillion yen just in the time period immediately following the earthquake (from March to April 2011, illustration 1). At first glance, financing by way of public debt is attractive in Japan, because the central bank's interest rate policy, combined with the policy of easy money, appears to secure cost-effective financing. Actually the burdening of the state budget by the debt service has so far only slowly increased. This is due to the extremely low nominal interest rate on Japanese government bonds of approximately 1% for ten-year government bonds and 2% for maturities between 20 and 40 years.¹⁹ Therefore, a significant increase in interest rates due to a confidence crisis could dramatically change the situation in Japan. In order to prevent this, the government is attempting to convert short-term financing to longer-term financing (illustration 2). However, it could be difficult to find buyers on the market with the current low interest rate. As a result of the many years of underfunding of the state, the public debt increased to over 200% of the gross domestic product²⁰—by this is on top of all other OECD countries.

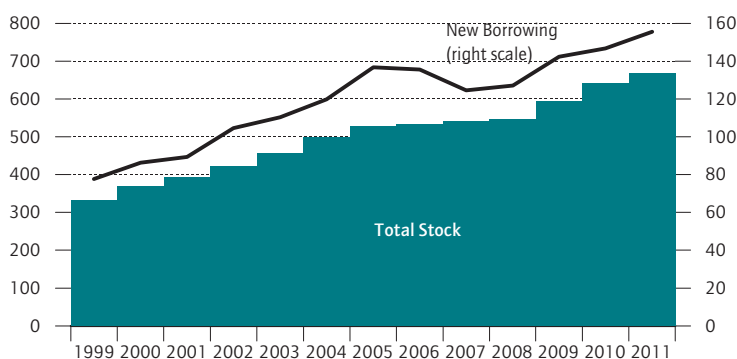
If there were an average annual interest rate of 1.5 percent for the national debt, then approximately 3 percent of the gross domestic product would have to be collected annually from the Japanese government only for interest payments.

In doing so, government expenditure is not particularly high compared to international standards. Rather, in the 2011 fiscal year, it was nearly 20 percent of the gross domestic product. The revenue from taxes and levies does

Figure 1

Japanese Government Bonds

In Trillion Yen



Source: MoF Japan, April 2011.

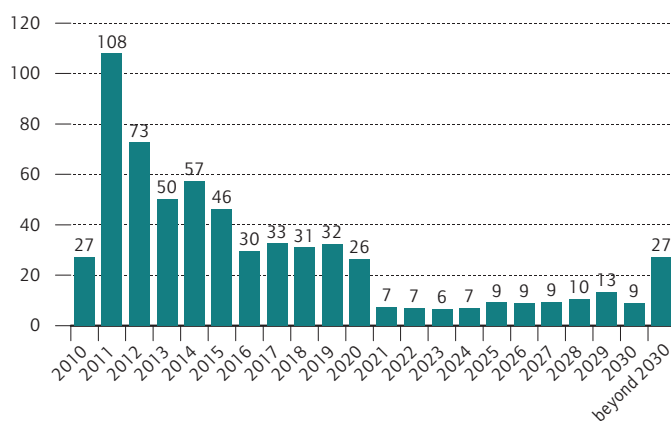
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Public debt is ever increasing while new borrowing reached alarming proportions.

Figure 2

Maturities of Japanese Government Bonds

December 2010 in Trillion Yen



Source: MoF Japan, April 2011.

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The extension of maturities would secure long-term low interest payments.

not even reach the threshold of 10 percent of the gross domestic product. Therefore if (as a part of a crisis confidence regarding the credit rating of Japanese public finances) the average interest rate were increased from 1.5 percent to 2.5 percent for the long term, it would result in doubling the revenue needed for handling the interest payments from the previously accumulated public debt. Japan would then need to consolidate public fi-

¹⁸ Carmen M. Reinhart und Kenneth E. Rogoff (2008): This Time is Different: A Panoramic View of Eight Centuries of Financial Crises. NBER-Working Paper, April 2008.

¹⁹ Ministry of Finance of Japan: Quarterly Newsletter. April 2011.

²⁰ In April 2011, debts amounted to 942.3 trillion yen (approx. eight trillion euro) and thus approx. five percent up on the comparable figure of the prior year. Compare Bank of Japan (2011): National Government Debt.

nances under adverse framework conditions similar to those currently in the European crisis countries. Drastic spending cuts would be inevitable.

The history of prior development is primarily that of low tax rates and tax revenues compared to international standards. For example, the sales tax rate is 5%. The income tax burden is also low compared to international standards. Tax relief programs were implemented here as a part of the past fiscal programs. Previously, the stabilization of the economy, social security and recurring fiscal programs have been offered to the private sector in Japan are far below the actual costs and virtually at no cost. Consequently, redistribution from the state to the private sector has taken place here for years. The legal framework conditions (e.g. for the public pension fund, but also for insurance funds) in turn oblige the private sector to hold significant amounts of government bonds. Thus, in recent years the private sector has established significant claims against the state, for which it even receives interest payments (albeit low).²¹

²¹ The companies are currently in much more debt than at the time of the economic crisis of the 1990's.

At the same time, the tax burden on the private sector is low by international standards. Foreign creditors have so far played no significant role in the credit financing of public budgets in Japan. Domestic creditors hold approximately 95 percent of the government securities (illustration 3). From the perspective of foreign investors, Japanese securities are hardly attractive, not least with a view to the low interest rates (by international standards) and the risks associated with a high public debt. In particular, the high proportion of government bonds held by domestic pension funds could become a problem due to the demographic change of a quickly aging Japanese society. Finally, always increasing payouts from the assets of pension and life insurance must be made in growing amounts. The low yields on Japanese government bonds hardly suffice in being able to service merely the corresponding claims from the current interest income. Japan is increasingly viewed more critically by international rating agencies. An example is the development of the credit rating by Fitch, one of the three major rating agencies (table 2).²² This means that Japan's country rating is only two levels (A and BBB) above the critical threshold of the junk bond rating (BB and below). However, the Japanese rating agency Japan Credit Rating Agency (JCR) continues to rate Japan with AAA.²³ It is therefore reasonable to suspect that JCR is allowing a home bias in their assessment. So far, the credit rating downgrades by international rating agencies have had no effect on the interest rate of Japanese government bonds.²⁴ In particular, the worsened rating has thus far not led to a deterioration of financial conditions for the Japanese state, but that could change for Japan as a part of the financial markets becoming very sensitive to higher public debt (such as in Italy's case recently). The ever-changing weak governments also have little hope for a rapid shift to comprehensive structural reforms.

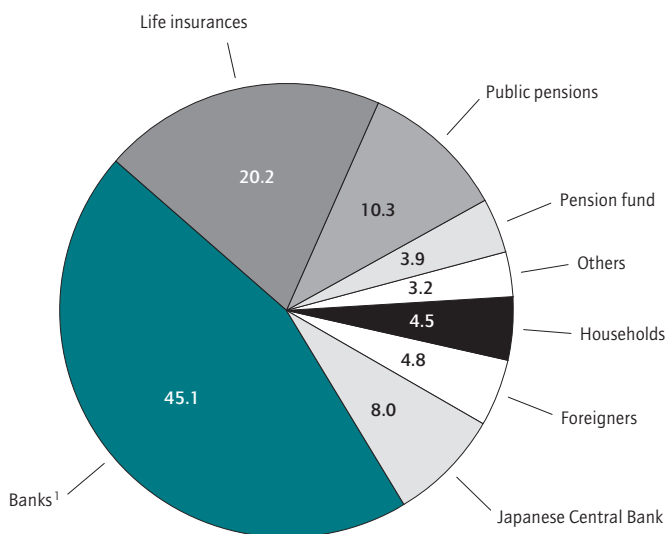
Threatening debt trap

The Japanese government has recognized²⁵ that financing significant portions of public responsibilities via loans cannot go on forever without curtailing too much the government's future ability to act in extreme situa-

Figure 3

Owner Groups of Japanese Government Bonds

Shares in percent



¹ In particular also Japan Post Bank.

Source: MoF Japan, April 2011.

95 percent of government bonds are owned by nationals.

tions. Precisely because natural disasters must always be expected in the country, the government's ability to act also serves to restore confidence and thus stabilize the expectations of the population. In fact, the government has decided to cut the primary deficit of the public budgets in half by 2015.

Tax increases are currently being discussed. Formally, increasing the sales tax rate (which is at 5%) offers a starting point.²⁶ The IMF suggests a gradual increase to 15%. With regard to the widespread reluctance in consumer spending, such a tax hike, however, could be fatal for the overall economic development in Japan. In the past, the domestic demand completely collapsed following a relatively minor sales tax increase from 3 percent to 5 percent. This led simultaneously to a political crisis. A Japanese government would only very reluctantly desire to take such a risk again.

Conclusion

The first signs of recovery after the disaster are appearing in Japan. Currently, a more pronounced economic recovery is beginning to show up due to the renewed deficit-financed government demand. However, different long-term and short-term development trends are overlaying another. The earthquake from March of 2011 and its consequences have further intensified the already prevailing structural problems. The Japanese government has faced the challenge of introducing steps for budget consolidation without jeopardizing the country's economic development nine years. So far they have been unsuccessful in finding a way out of this dilemma. Up until now, the government still benefits from favorable financing conditions to deal with the rising public debt. This could turn out to be a fatal debt trap if the situation in the financial markets change unfavorably. It is therefore now also important to strengthen the revenue aspect of the public budgets. The problem is known. If its solution of problems is postponed future costs might increase significantly accordingly.

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JEL: E62, E63, E66

Keywords: Japan growth, fiscal stability, tsunami-quake impacts, nuclear accident

Table 2

Fitch-Ratings for Japan

	In foreign currency			In national currency	
	long-term	short-term	outlook/watch	short-term	outlook/watch
27 May 2011	AA	F1+	Rating Watch negative	AA-	Rating Watch negativ
9 May 2005	AA	F1+	stable	AA-	stable
21 November 2002	AA	F1+	negative	AA-	negative
26 November 2001	AA	F1+	negative	AA	negative
2 March 2001	AA+	F1+	negative	AA+	negative
21 September 2000	AA+	F1+	stable	AA+	stable
29 June 2000	AA+	F1+	-	AA+	-
21 September 1998	AA+	F1+	-	AAA	-
1 September 1998	AAA	F1+	Rating Watch negative	AAA	Rating Watch negative
26 October 1995	AAA	F1+	-	AAA	-
10 August 1994	AAA	-	-	-	-

Comments: Negative rating actions are in bold.

Source: Fitch, version: May 2011.

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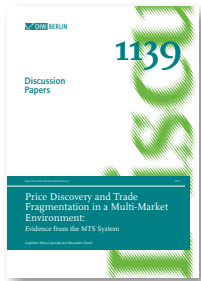
According to the Fitch rating agency, Japan's credit rating is declining steadily.

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²⁶ Given the background of the relatively low sales tax rate, the International Monetary Fund, for example, suggests a gradual increase to 15%. The IMF is also assuming a dampening effect on private consumption. Currently, the sales tax revenue is approximately 2.5% of the gross domestic product. In Germany, the sales tax revenue is 7.5% of the gross domestic product with the tax rate of 19 or 7%. In Japan's case, the tax revenue is expected to double by increasing the tax rate to 15%.

Discussion Papers Nr. 1139/2011

Guglielmo Maria Caporale, Alessandro Girardi



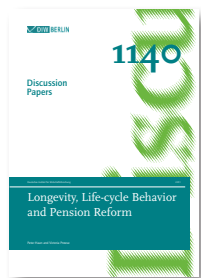
Price Discovery and Trade Fragmentation in a Multi-Market Environment: Evidence from the MTS System

This paper proposes new metrics for the process of price discovery on the main electronic trading platform for euro-denominated government securities. Analysing price data on daily transactions for 107 bonds over a period of twenty-seven months, we find a greater degree of price leadership of the dominant market when our measures (as opposed to the traditional price discovery metrics) are used. We also present unambiguous evidence that a market's contribution to price discovery is crucially affected by the level of trading activity. The implications of these empirical findings are discussed in the light of the debate about the possible restructuring of the regulatory framework for the Treasury bond market in Europe.

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Discussion Papers Nr. 1140/2011

Peter Haan, Victoria Prowse

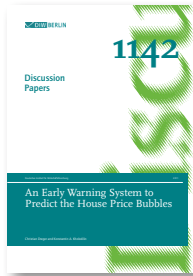


Longevity, Life-cycle Behavior and Pension Reform

How can public pension systems be reformed to ensure fiscal stability in the face of increasing life expectancy? To address this pressing open question in public finance, we estimate a life-cycle model in which the optimal employment, retirement and consumption decisions of forward-looking individuals depend, inter alia, on life expectancy and the design of the public pension system. We calculate that, in the case of Germany, the fiscal consequences of the 6.4 year increase in age 65 life expectancy anticipated to occur over the 40 years that separate the 1942 and 1982 birth cohorts can be offset by either an increase of 4.34 years in the full pensionable age or a cut of 37.7% in the per-year value of public pension benefits. Of these

two distinct policy approaches to coping with the fiscal consequences of improving longevity, increasing the full pensionable age generates the largest responses in labor supply and retirement behavior.

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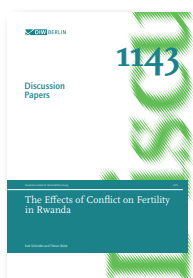
Discussion Papers Nr. 1142/2011
Christian Dreger, Konstantin A. Kholodilin

An Early Warning System to Predict the House Price Bubbles

In this paper, we construct the country-specific chronologies of the house price bubbles for 12 OECD countries over the period 1969:Q1- 2010:Q2. These chronologies are obtained using a combination of a fundamental and a filter approaches. The resulting speculative bubble chronology is the one that provides the highest concordance between these two techniques. In addition, we suggest an early warning system based on three alternative approaches: signalling approach, logit and probit models. It is shown that the latter two models allow much more accurate predictions of the house price bubbles than the signalling approach. The prediction accuracy of the logit and probit models is high enough to make them useful in forecasting the future speculative bubbles in housing market. Thus, our method can be used by the policymakers in their attempts to timely detect the house price bubbles and attenuate their devastating effects on the domestic and world economy.

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Discussion Papers Nr. 1143/2011
Kati Schindler, Tilman Brück



The Effects of Conflict on Fertility in Rwanda

The aim of this paper is to study the short and long-term fertility effects of mass violent conflict on different population sub-groups. The authors pool three nationally representative demographic and health surveys from before and after the genocide in Rwanda, identifying conflict exposure of the survivors in multiple ways. The analysis finds a robust effect of genocide on fertility, with a strong replacement effect for lost children. Having lost siblings reduces fertility only in the short term. Most interesting is the continued importance of the institution of marriage in determining fertility and in reducing fertility for the large group of widows in Rwanda.

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SOEPpapers Nr. 384/2011

Benjamin Crost



The Effect of Subsidized Employment on Happiness

While a large body of evidence suggests that unemployment and self-reported happiness are negatively correlated, it is not clear whether this reflects a causal effect of unemployment on happiness and whether subsidized employment can increase the happiness of the unemployed. To close this gap, this paper estimates the causal effect of a type of subsidized employment projects – Germany's Arbeitsbeschaffungsmaßnahmen – on self-reported happiness. Results from matching and fixed effects estimators suggest that subsidized employment has a large and statistically significant positive effect on the happiness of individuals who would otherwise have been unemployed. Detailed panel data on pre- and post-project happiness suggests that

this effect can neither be explained by self-selection of happier individuals into employment nor by the higher incomes of the employed.

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SOEPpapers Nr. 385/2011

Ruud Muffels, Bruce Headey



Capabilities and Choices: Do They Make Sense for Understanding Objective and Subjective Well-Being? An Empirical Test of Sen's Capability Framework on German and British Panel Data

In Sen's Capability Approach (CA) well-being can be defined as the freedom of choice to achieve the things in life which one has reason to value most for his or her personal life. Capabilities are in Sen's vocabulary therefore the real freedoms people have or the opportunities available to them. In this paper we examine the impact of capabilities alongside choices on subjective and objective well-being. There is a lot of theoretical work on Sen's capability framework but still a lack of empirical research in measuring and testing his capability model

especially in a dynamic perspective. The aim of the paper is to elaborate and test a 'stock-flow' model measuring capabilities and choices to explain longer-term changes in well-being using 25 years of German and 18 years of British data. Three measures of well-being are constructed: life satisfaction for subjective well-being (SWB) and relative income and employment security for objective well-being (OWB). We ran random and fixed effects GLS models. The findings strongly support Sen's capabilities framework and provide new evidence on the way capabilities and choices matter for well-being. Capabilities indicated by human capital, trust, altruism and risk taking, and family, work-leisure, lifestyle and social choices show to strongly affect the three well-being indicators but their effect sizes differ largely dependent on the type of indicator used.

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