Policy Brief #2019/01

Thieß Petersen, Thomas Rausch and Andreas Sachs

Globalization of the German Automotive Industry: Where Does Added Value Occur?

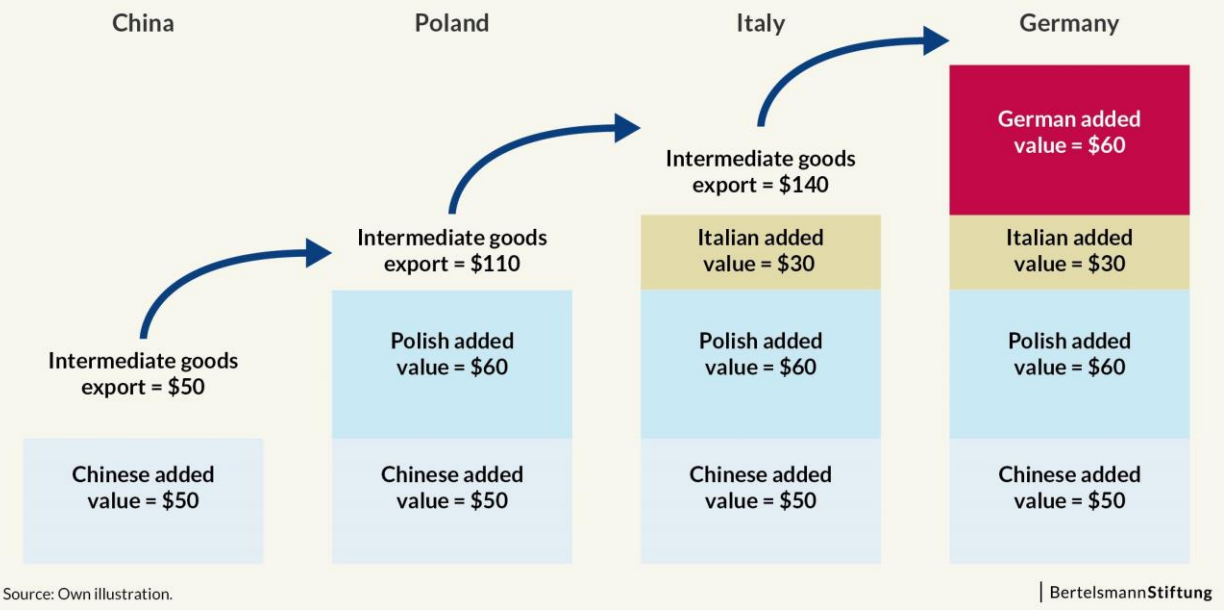
A central aspect of globalization is that companies not only sell their products all over the world, but the production of goods and services is divided into different stages of added value at home and abroad. While direct (bilateral) supplier relations can be understood reasonably well, the direct and indirect added value contributions of domestic and foreign suppliers often remain hidden. Using the German automotive industry as an example, we want to show the extent to which other countries contribute directly and indirectly to added value in this industry's production.

Intermediate Goods versus Added Value

In order to measure the foreign contribution to Germany's production, it is common practice to consider the intermediate goods that Germany purchases from the rest of the world. However, this does not correctly capture the added value contributions of the country from which intermediate goods are purchased. If, for example, Germany's automotive industry purchases car parts such as an aluminum rim with a value of USD 140 from Italy and then reprocesses them, this import of intermediate goods often also includes economic performances (added value) from other countries, for example aluminum that has been mined in China and reprocessed in Poland. The share of Italian added value in the car produced in Germany is then lower than the value of the rim imported from Italy (see Figure 1).

Figure 1 shows that the consideration of imports of intermediate goods does not correctly reflect the actual (indirect and direct) added value contributions of the suppliers. If only intermediate goods purchased from Italy are taken into account, the contributions made by China and Poland to the production of a German car are not taken into account, while Italy's contribution is overestimated. Imports of intermediate goods

Figure 1: **Schematic representation of an added value chain**



Source: Own illustration. | BertelsmannStiftung

overvalue the direct supplier country's contribution to the added value of the German automotive industry and underestimate the contributions of all indirect suppliers. In order to correctly reflect the actual added value contributions of all countries, the upstream suppliers and their added value performances must also be captured. This can be done with so-called input-output tables, which show the entire global economy (see Box 1).

Intermediate and Added Value Imports of the German Automotive Industry

In 2014 the German automotive industry produced goods worth around USD 445 billion. Products sold in Germany or abroad accounted for around USD 270 billion (hereinafter referred to as "final demand"). The remaining 175 billion in goods were intermediate goods that German automobile companies also sold at home and abroad.

As described in Box 1, the added value contributions from Germany and abroad can be calculated for the final demand of the automotive industry. An analysis of the added value contributions of all the countries considered initially provides information on the share of German added value in the goods produced for final demand in the automotive sector in Germany: At around 70 percent, the largest share of this added value is generated in Germany (see Figure 2).

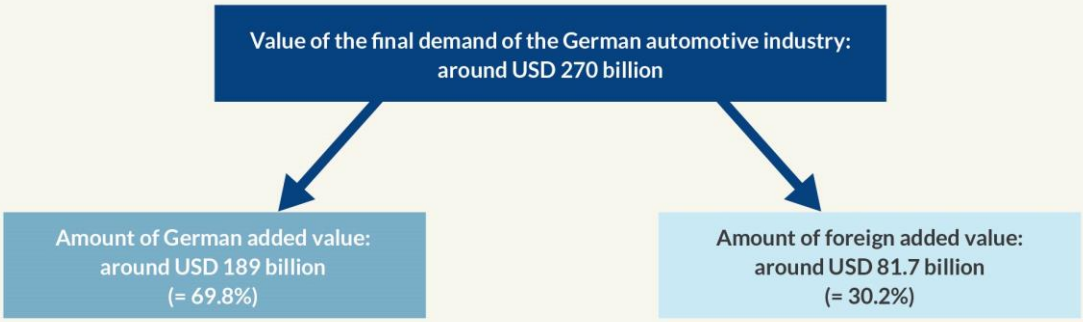
With regard to the significance of foreign countries for the added value of the German automotive industry, a comparison with imports of intermediate goods shows that there are sometimes substantial differences in the significance of individual countries as suppliers of intermediate goods and services and as suppliers of added value. This concerns both the ranking of the

Box 1: Calculation of added value contributions
Added value contributions are calculated by using various calculation steps on the basis of global input-output tables, the so-called "World Input-Output Tables" (WIOT). They are provided in the "World Input-Output Database" (WIOD). The methodological details can be found in Los, Timmer and Vries (2015) and the Bertelsmann Stiftung (2018). The results of these calculations are the added value contributions of individual sectors and countries to final demand, in this case the final demand of the German automotive industry. The calculations are carried out for 56 sectors in 43 countries and the rest of the world. The currently available WIOD data are from 2014.

countries and their actual contribution to added value (see Figure 3).

countries analyzed here in the case of Hungary at 0.3.

Figure 2: **German and foreign added value contributions to the German automotive industry (final demand) in 2014**



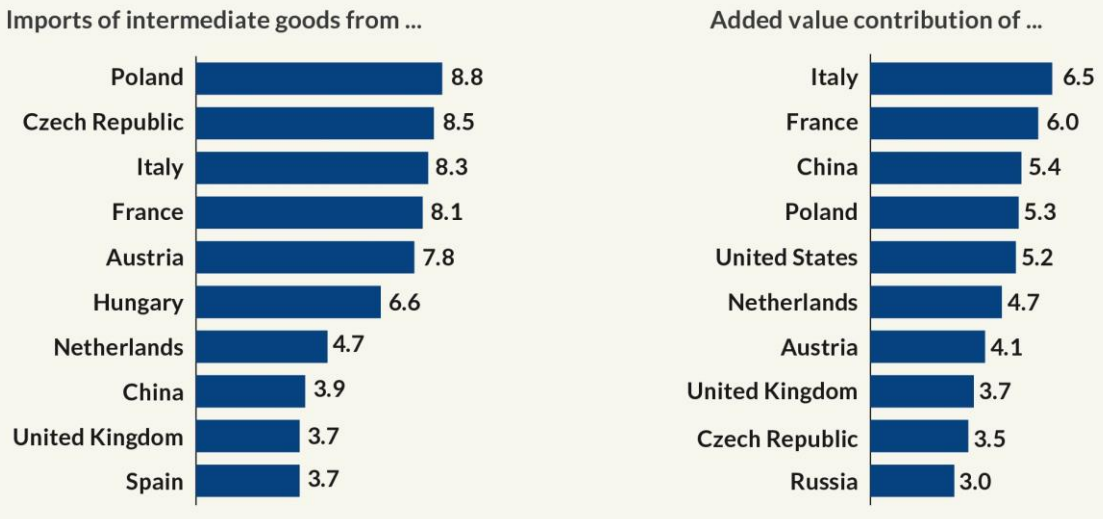
Source: Prognos 2018. | BertelsmannStiftung

Hungary, for example, is the sixth-largest supplier of intermediate goods for the final demand of the German automotive industry. It purchases imports of intermediate goods from Hungary at an amount of around USD 6.6 billion. But Hungary's added value contribution of only USD 1.9 billion means that it occupies only 16th place in the ranking of the most important added value suppliers. This difference is due to the fact that Hungary purchases many intermediate goods from other countries and then reprocesses them with a relatively low added value of its own. The ratio of a country's own added value in the German automotive industry to exports of intermediate goods for this industry is the lowest of all the

The situation is quite different for countries such as the US, China and Russia: The added value contribution of these countries relative to the manufactured and sold goods in the German automotive industry is greater than the value of the intermediate goods that these countries supply to the German automotive industry (see Figure 4). This means that countries such as the US, China and Russia provide intermediate goods that are not exported directly to Germany, but imported from other countries, reprocessed there and then exported to Germany.

In the case of Hungary mentioned above, the added value contribution is considerably lower

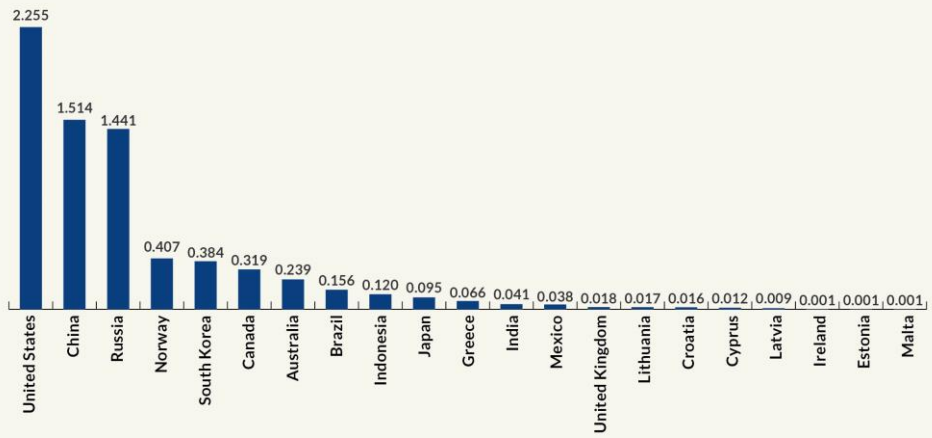
Figure 3: **Intermediate deliveries and added value contributions to the German automotive industry (final demand) in 2014, in each case the top 10 countries,**
in USD billion



Source: Prognos 2018. | BertelsmannStiftung

than the value of the intermediate goods exported to Germany for the automotive industry. The absolute difference is greater only in the Czech Republic (see Figure 5).

Figure 4: **Countries whose added value contributions are greater than the deliveries of intermediate goods for the German automotive industry (final demand) in 2014, difference between added value contribution and intermediate goods value**
in USD billion

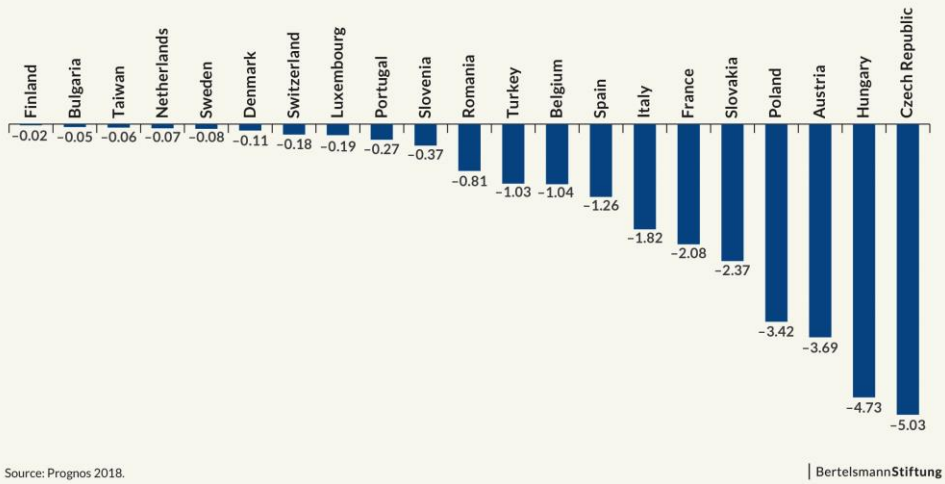


Source: Prognos 2018. | BertelsmannStiftung

Simulation of US Market Being Closed to German Cars

On the basis of the individual added value shares, it is then also possible to estimate how great the economic damage will be for individual countries if production falls in one country. This is illustrated by the example of a complete closure of the American market to products from the German automotive industry. Although such a radical development is unlikely, even in the case of 25 percent import duties on German cars in the US, this shock illustrates the added value at stake in the individual countries.

Figure 5: **Countries whose added value contributions are lower than the deliveries of intermediate goods for the German automotive industry (final demand) in 2014, difference between added value contribution and intermediate goods value**
in USD billion



Source: Prognos 2018. | BertelsmannStiftung

As mentioned above, German automakers sold products worth around US 270 billion worldwide in 2014. Almost 28 percent of these sales were generated in Germany. The breakdown of other sales is shown in Table 1.

Should there be a complete collapse in German automobile exports to the US, automotive industry production in Germany would fall by around USD 31.5 billion or 11.6 percent of final demand. The added value in the other countries would also decline in line with the added value contributions. The reduction in economic added value – i.e. production – in Germany and abroad is shown in Table 2.

Since around 70 percent of the added value of production destined for final demand takes place in Germany itself, Germany would suffer most from the loss of exports to the US. However, the production losses in European countries such as Poland, China, France and Italy would be between USD 600 and 750 million, which also means noticeable economic losses.

In the US, too, added value would decline by around USD 600 million due to the lower demand of German automobile companies for intermediate goods from abroad. This means that the US would have to accept the sixth-largest loss in added value of all countries in the world. A look at the US's pure exports of intermediate goods to the German automotive industry underestimates this economic damage:

- In 2014 US exports of intermediate goods to the German automotive industry amounted to around USD 2.9 billion. This means that the US did not make it into the top ten suppliers of intermediate goods (see Fig. 3, left).
- If the 11.6 percent decline in German automobile production is applied to these exports of intermediate goods, US exports to Germany will fall by around USD 336 million.
- However, the actual losses in added value in the US would be much higher at around USD 600 million.

TABLE 1: **Final demand for products of the German automotive industry in 2014**

Country	Value of final demand	Share of total final demand
Germany	USD 75.6 billion	27.9%
United States	USD 31.5 billion	11.6%
China	USD 19.4 billion	7.2%
United Kingdom	USD 19.2 billion	7.1%
France	USD 14.0 billion	5.2%
Russia	USD 8.5 billion	3.1%
Spain	USD 7.6 billion	2.8%
Switzerland	USD 5.8 billion	2.1%
Japan	USD 5.6 billion	2.1%
Italy	USD 5.5 billion	2.0%
Netherlands	USD 5.1 billion	1.9%
South Korea	USD 5.0 billion	1.9%
Sweden	USD 4.8 billion	1.8%
Austria	USD 4.2 billion	1.5%
Turkey	USD 3.9 billion	1.4%
Canada	USD 3.9 billion	1.4%
Poland	USD 3.7 billion	1.4%
Belgium	USD 3.1 billion	1.1%
Norway	USD 2.8 billion	1.0%
Rest of the world	USD 41.5 billion	15.3%
Total	**USD 270.6 billion**	**100.0%**

Source: Prognos 2018. | BertelsmannStiftung

TABLE 2: **The ten countries with the greatest losses in added value due to a complete disappearance of final demand for products of the German automotive industry in the US (final demand) in 2014**

Country	Loss of added value
Germany	USD 21.93 billion
Italy	USD 0.75 billion
France	USD 0.69 billion
China	USD 0.63 billion
Poland	USD 0.62 billion
United States	USD 0.60 billion
Netherlands	USD 0.54 billion
Austria	USD 0.48 billion
United Kingdom	USD 0.43 billion
Czech Republic	USD 0.40 billion
Rest of the world	USD 4.37 billion

Source: Prognos 2018. | BertelsmannStiftung

Conclusions

Four central conclusions can be drawn from the fundamental considerations and simulated example:

First: The importance of foreign countries for the economic added value in Germany cannot be sufficiently considered by solely looking at imports of intermediate goods. What is needed rather is a calculation of the actual added value contained in the worldwide deliveries of intermediate goods. Example of German automotive industry: A mere look at imports of intermediate goods overestimates the importance of intermediate goods from the Czech Republic, Hungary and Austria for added value in Germany. At the same time, it massively underestimates the role of the United States, the People's Republic of China and Russia. In relative terms, the former are more transit countries for added value, while the latter are more countries in which added value originates.

Second: The same logic can be applied to the appropriate significance of a sales market for the German economy or a German industry, which cannot be derived solely from German exports of intermediate goods abroad. Rather, added value exports must also be taken into account here in order to better determine the significance of the market. Example of German automotive industry: If additional trade barriers lead to less demand for German cars or car parts from the United States, an additional look at the added value share first shows that these trade barriers are likely to lead to a significant drop in sales at German automakers and manufacturers because their added value accounts for a significant share of exports to the United States.

Third: The assessment of the critical dependence of an industry or an entire economy on another economy – understood as vulnerability in the event of a total or partial disappearance of supply – results from the joint consideration of trade in goods and services intended for final demand, trade in intermediate goods and trade in added value. The disappearance of imports of goods and services intended for final demand can have a significant impact on wages and prices, among other things. The disappearance of imports of intermediate goods would show up in the loss of government revenue from import customs; the disappearance of imports of intermediate goods and added value would show up in the loss of private sector sales and the resulting loss of government tax revenue. Example of German automotive industry: If Germany can no longer import car parts from China, the corresponding customs revenue will be lost. At the same time, if the car parts cannot be substituted, sales will fall or employment figures at German companies that depend on these car parts will drop – as will the tax revenue or wages to be paid on this basis. These losses would be especially high at companies where a particularly large amount of German added value depends on the availability of Chinese car parts.

Fourth: The added value perspective makes it clear that the increasingly fragmented and complex international division of labor places ever higher demands on its political management. Not only the classical bilateral relations of large intermediate trading partners are important. In addition, bilateral relations with large indirect added value trading partners and governance along the entire added value chain or at central interfaces of the chain are also crucial. Example of German automotive industry: It is not enough to concentrate on good trade relations with Germany's direct European neighbors from which many intermediate goods are imported directly. Economic relations with major added value suppliers such as the United States, Russia and China are also crucial. At the same time, Germany must advocate international rules for managing the entire automotive added value chain and prevent the escalation of bilateral disputes between countries that produce many car parts for Germany or allow transit for them.

Bibliography

- Bertelsmann Stiftung (Ed.) (2019). “Wertschöpfungsnetzwerke am Beispiel der deutschen Automobilindustrie.” GED Study. Gütersloh.
- Bosker, Maarten / Westbrock, Bastian (2019): The Network Origins of the Gains from Trade. https://voxeu.org/article/network-origins-gains-trade
- Gereffi, Gary / Humphrey, John / Sturgeon, Timothy J. (2018): The Governance of Global Value Chains, in: Gereffi, Gary (Ed.) 2018: “Global Value Chains and Development. Redefining the Contours of 21st Century Capitalism. Cambridge University Press. Cambridge. 108 – 134.
- Los, Bart, Marcel Timmer and Gaaitzen de Vries (2015). “How global are global value chains? A new approach to measure international fragmentation.” Journal of Regional Science (55). 66 – 92.
- WIOD (2018). World Input-Output Database. http://www.wiod.org/home

Responsible for Content according to German Media Law

Bertelsmann Stiftung
Carl-Bertelsmann-Straße 256
D-33311 Gütersloh

Armando García Schmidt
Telephone: +49 5241 81-81543
armando.garciaschmidt@
bertelsmann-stiftung.de

Dr. Thieß Petersen
Telephone: +49 5241 81-81218
thiess.petersen@bertelsmann-stiftung.de

Eric Thode
Telephone: +49 5241 81-81581
eric.thode@bertelsmann-stiftung.de

Cover photo: © roibu – stock.adobe.com

Author | Contact

Dr. Thieß Petersen
Program Megatrends
Bertelsmann Stiftung
thiess.petersen@bertelsmann-stiftung.de
Telephone: +49 5241 81 81218

Thomas Rausch
Program Megatrends
Bertelsmann Stiftung
thomas.rausch@bertelsmann-stiftung.de
Telephone: +49 5241 81 81330

Dr. Andreas Sachs
Prognos AG
andreas.sachs@prognos.com
Telephone: +49 89 9541586 702

ISSN: 2191-2467