The weakness shown by the euro area car industry from summer 2018 has continued in the year to date as a result of a combination of various factors. On the supply side, the entry into force of the new WLTP emissions regulations in the European Union (EU) in September 2018 caused some disruption to the manufacturing process due to the need to comply with the new legal requirements.[1] Also, the demand for motor vehicles made in the EU has been affected both by cyclical factors (such as the downturn in car purchases in some of the main emerging economies) and by more persistent influences (including particularly the uncertainties surrounding the dominant technology in the future and the possibility of further regulatory changes).

The car industry is extremely important in the euro area economies. This is particularly so in Germany, where it represents approximately 5.5% of total value added, a percentage which drops in Spain to 1.8% (although this is still twice the euro area average).[2] Furthermore, a high proportion of the industry's production of both final and intermediate goods is exported, making it highly dependent on foreign demand. Specifically, car industry exports represent, in gross terms, 17.7% of total sales of goods to the rest of the world in Germany, 12.1% in Spain and 4.3% in the euro area as a whole.

This box examines the propagation of a shock in car manufacturing in each of the four largest euro area economies to other industries of the country concerned and to the car industry and other industries of the other euro area countries. In this respect, it should be noted that the car industry participates extensively in global value chains and that its production is thus highly fragmented.[3] The involvement of other industries and countries, depending on their specialisation, in the various phases of car manufacturing allows the comparative advantages of each of those actors to be harnessed. This has positive effects such as the reduction of costs and the transfer of knowledge, technology and innovation. The downside is that, because of the tight links between industries and countries, the propagation of shocks is faster and more complex to analyse.

Chart 1 illustrates the structure of the value chain in the manufacture of final goods in the car industry for each of the four main euro area economies. In Germany, nearly 70% of the value added of this industry is generated domestically, while the other 30% is generated abroad, mainly in other EU countries (such as France, Italy and certain eastern European economies). In Spain, the weight of domestic value added is considerably lower, standing at 48%, while the other 52% is generated mainly in Germany, France, Italy and other EU countries. In this situation it can be expected that a shock to production in Germany and Spain of a certain size affects most strongly the domestic economy in the case of Germany and other countries in the case of Spain. In Italy, the weight of domestic value added is similar to that in Germany, while France is in an intermediate position.

Given these interlinkages, it is important to quantify the impact of a shock to the demand for cars produced in one country on the

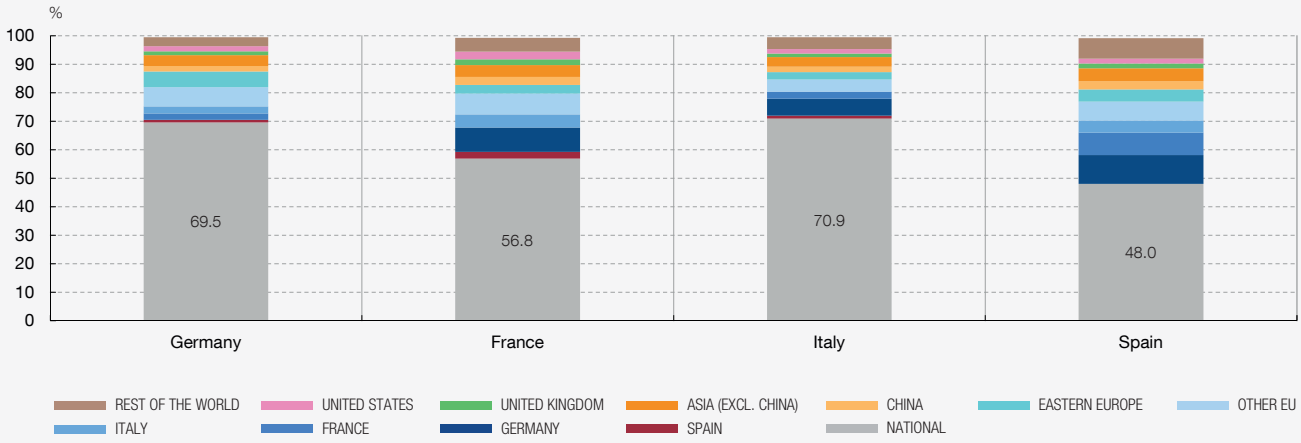
1 See Box "Impact of the new emissions regulation on the automobile market", Economic Bulletin, 4/2018, Banco de España.

2 Data taken from "Trade in Value Added (TiVA)" published by the OECD with information available to 2015.

3 See Prades E. and P. Villanueva (2017) "Spain in the global value chains" Analytical Article, Banco de España.

**Chart 1**
**BREAKDOWN OF VALUE ADDED BY SOURCE FOR THE MANUFACTURE OF ONE UNIT OF OUTPUT**

Value added contained in each country's car production, according to its source. In the case of the German car industry, approximately 70% of the value added contained is domestic, while the remaining percentage mainly comes from other EU economies and eastern European countries. In the case of Spain, the car industry is much more dependent on foreign value added, from Germany, France and Italy.




SOURCES: Banco de España calculations and WIOD 2016.

various industries of that and other countries which provide the inputs needed for car production.[4] Using the information in the world input-output database (WIOD),[5] the panels of Chart 2 illustrate the impact of a 10% fall in the demand for final goods in the car industry of each of the four economies considered. In the

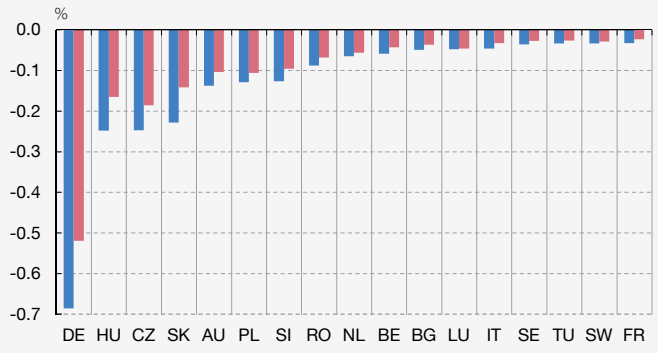
4 The exercise analyses the impact derived from a fall in vehicle production due to a fall in demand, which has an impact on all car industry suppliers. But it does not take into account the propagation to the industry's client industries (see Acemoglu et al (2016), "Networks and the macroeconomy: an empirical exploration". For an application to the Spanish economy, see Izquierdo, Moral-Benito and Prades (2019) "Propagation of sector specific shocks in Spain and other countries", forthcoming, Banco de España.

5 Specifically, the WIOD contains information, by country and sector, for the period 2000-2014. For more details on the construction of this global database, see Timmer et al. (2013) "Fragmentation, Income and Jobs. An analysis of European Competitiveness" and Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R. and de Vries, G. J. (2015), "An Illustrated User Guide to the World Input–Output Database: the Case of Global Automotive Production", Review of International Economics., 23: 575–605.

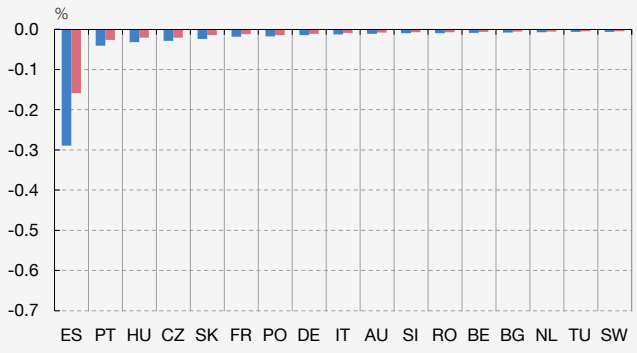
Chart 2
CAR INDUSTRY SPILLOVER EFFECTS IN THE EURO AREA (a)

A 10% decline in the demand for finished vehicles in each of the economies translates into an equivalent reduction in production. Given the integration of the car industry value chain, a decline in car production in each of the economies will have a knock-on effect on the industry itself (direct effect) and on other sectors and countries that provide the inputs needed for car manufacture (indirect effect). Germany and Spain are the countries that would suffer the greatest impact on their own gross output and value added, and would have the biggest knock-on effects on other economies, in particular in eastern Europe.

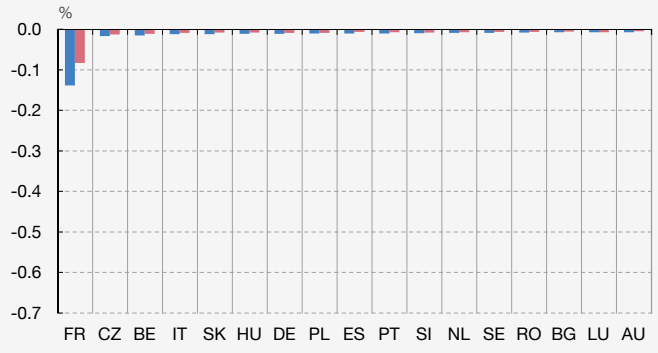
1 IMPACT ON ACTIVITY ARISING FROM A DECLINE IN OUTPUT IN THE GERMAN CAR INDUSTRY



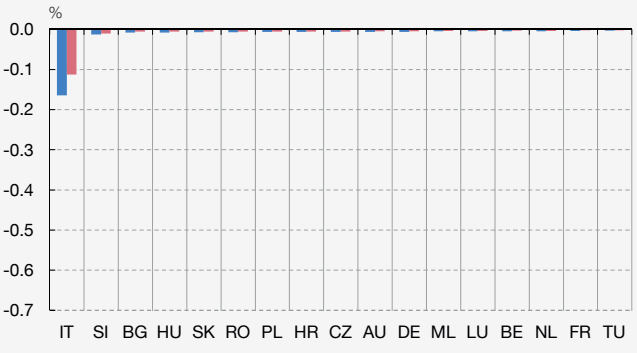

2 IMPACT ON ACTIVITY ARISING FROM A DECLINE IN OUTPUT IN THE SPANISH CAR INDUSTRY




3 IMPACT ON ACTIVITY ARISING FROM A DECLINE IN OUTPUT IN THE FRENCH CAR INDUSTRY




4 IMPACT ON ACTIVITY ARISING FROM A DECLINE IN OUTPUT IN THE ITALIAN CAR INDUSTRY




ON GROSS OUTPUT ON VALUE ADDED

SOURCES: Banco de España calculations and WIOD 2016.

a Note that the relevant impact is on gross value added and not on gross output. The difference between these two variables reflects the need for inputs from other countries.

case of Germany, that shock would have an impact of –0.5 pp on its aggregate value added. By economic sector, the most strongly affected, apart from that of manufacture of motor vehicles itself, would be some manufacturing industries such as *"manufacture of metals"* and *"manufacture of plastics"* and, within the services sector, which suffers one-third of the downturn in activity in Germany, there are notable falls in *"wholesale and retail trade; repair of motor vehicles and motorcycles"* and *"business process outsourcing"*. Furthermore, some eastern European economies (Hungary, the Czech Republic and Slovakia) would be directly prejudiced by this negative shock in Germany, with a decrease in their value added of around –0.15 pp. The impact on the Spanish economy would be very low, since the German car industry uses little input from Spain. In the case of the production of cars manufactured in Spain, a fall of 10% in their demand would give rise to a small impact on domestic value added, of around –0.15 pp, since the imports used in their manufacture are larger and the weight of the sector in Spain is lower than in Germany. Regarding the spillover effect on other economies, most notable is the estimated impact on Portugal and other eastern European economies such as Hungary and the Czech Republic.[6]

In addition to the considerable fragmentation in the production of the cars manufactured in a country, a second aspect of the interdependence between economies arises from the fact that a high proportion of the output of this industry is produced for export. Consideration of the bilateral exports of the finished good may distort the analysis, since the value added may reach its final destination in the form of a finished product or an intermediate input incorporated into the productive process in a third country that reaches its final destination indirectly.[7] To address these measurement problems, Chart 3 presents a breakdown by final destination of the value added generated in the four European economies analysed. Compared to other industries, the car industry is one of the most export orientated. Specifically, the percentage of value added that satisfied foreign final demand in 2015 ranged from 71.4% in Spain to 60.1% in Italy. Moreover, there is a certain degree of heterogeneity in geographical specialisation. The value added generated in Germany has as its main destination economies outside the EU, such as the United States, China and other Asian economies, while within the EU, the weight of the United Kingdom is notable. In the case of Spain, the main destination of the value added is the euro area economies and the United Kingdom, and to a lesser extent Asian economies and North America.

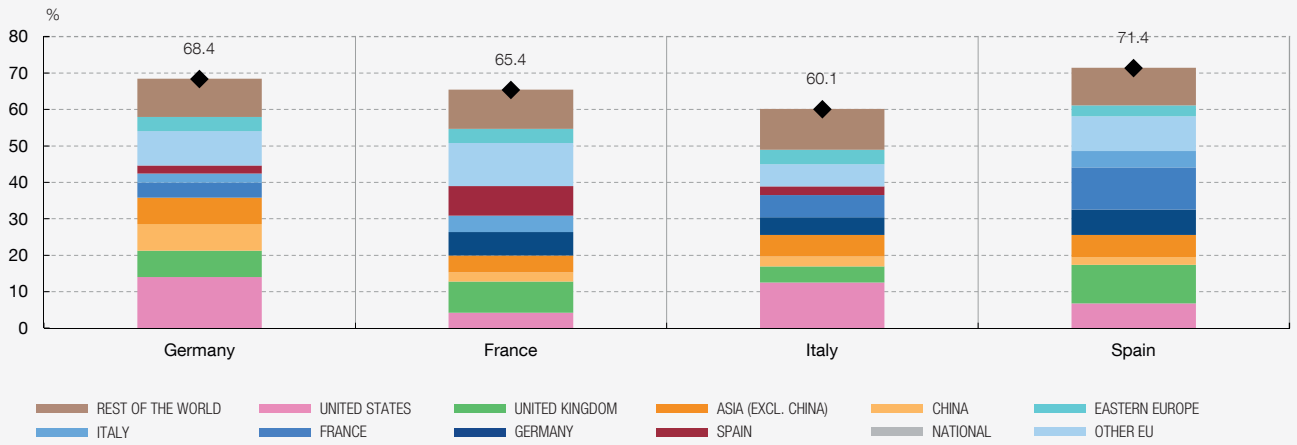
In the light of the information presented, it comes as no surprise that the recent shocks suffered by the car industry have particularly affected Germany, given the industry's significant weight in the economy's total value added, the comparatively high proportion of domestic value added employed in car production and the large

6 In the specific case of Portugal, for example, the most strongly affected sectors would be *"manufacture of motor vehicles"* itself, and *"manufacture of plastic products"* and *"manufacture of metals"*).

7 See Johnson and Noguera (2012) "Accounting for intermediates: Production sharing and trade in value added" Journal of International Economics 86(2).

Chart 3
BREAKDOWN OF DOMESTIC VALUE ADDED GENERATED IN THE CAR INDUSTRY BY FINAL DESTINATION WHERE IT IS ABSORBED

A high percentage of the value added generated in the car industries in Germany, France, Italy and Spain has a foreign economy as its final destination. Value added can arrive at its final destination directly as an export of the final product or as an intermediate product which will be directly absorbed in the importing economy; or indirectly as an intermediate good if it has been used for the manufacture of a good or service that has been re-exported from a third country. In Germany the weight of the US, UK and Asian markets is notable, whereas Spain has the euro area and UK economies as its main destinations.




SOURCES: Banco de España calculations and TiVA 2018.

weight of China in the final destinations for its output. These shocks, in turn, appear to have been passed through strongly to eastern European economies closely linked to German car production. In future, the industry faces further challenges arising from changing consumer preferences (e.g., there appears to be an increasing preference for car sharing as opposed to ownership) and growing environmental restrictions (which are already affecting each producing country differently according to, among other factors, the weight of diesel cars in total production). The information presented also suggests that materialisation of currently identified global risks would affect the various car-producing countries asymmetrically. In particular, while the imposition of tariffs on European car imports in the United States would disproportionately affect Germany and Italy, the Spanish economy might be especially harmed by the effects of a disorderly Brexit or, generally, by negative shocks to the demand for cars in EU countries.