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The impact of the coronavirus: A supply-chain analysis

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- The outbreak of the novel coronavirus is adding new uncertainty to the outlook for the world economy. In our previous notes we have assessed the impact of the coronavirus on the rest of world focusing particularly on lower demand and confidence spillover effects.
- In this note we try to assess the impact of a China shock through the lens of the supply chain. That is, we look at the inputs needed for production in the different sectors of different countries. We construct a dependency indicator, i.e. how much a country depends on China for the supply of particular imported inputs. The more a country depends on China, the more difficult it may be for the country to switch to a different supplier country if there is any production disruption in China.
- We find evidence that the euro area is less directly exposed to a China supply-chain shock than the other major countries such as US, Canada, Japan, and all the major Asian countries (*i.e.* India, South Korea, Indonesia, Malaysia, Vietnam).
- Although, *prima facie* this might sound encouraging for the outlook of the euro area, other aspects need to be taken into account. First of all, a total shut down of some Chinese production lines may have an oversized effect if firms are unable to substitute away from a particular Chinese input in their production process. Secondly, the second-round effect could be particularly painful for the euro area should the rest of the world be hard-hit by a China shock in the first place. In other words, China has become such an important player in the global production supply chain that a shock to Chinese production has the potential to have a multiplied effect on the rest of the world through direct and indirect channels.

Introduction

In our previous note[1] we tried to estimate the impact of the novel coronavirus (COVID-19) on Europe, focusing to the traditional channels of lower demand for European exports and negative confidence spillover effects. In that analysis we only briefly touched on the supply-chain issues that a disruption in Chinese production could cause for Europe and the rest of the world.

In this note we take our analysis a step further into the supply chain links by assessing the degree to which countries are exposed to China from a production point of view.

We find that from a production point of view, euro-area countries are somewhat less directly dependent on China for intermediate inputs than other major economies in the rest of the world. This might imply that production in the euro area is less exposed to a Chinese shock. However, although the direct impact on production could be limited, the second round effects coming from lower output elsewhere in the world could be more damaging. In other words, China seems highly integrated into world production and a sudden stop could cause non-negligible disruptions to the world economy.

An input-output table approach

The aim of this note is to assess from the supply chain production angle which countries are most exposed/dependent on China. To this purpose we use the input-output table from the OECD[2] . The table combines data from 69 economies for 36 sectors allowing us to identify the quantities of inputs produced by different sectors in different countries that are needed to produce the final output of a particular sector in a particular country. By aggregating across sectors within a particular country, we can measure a country's total production and how much the country relies on foreign inputs to produce its own output. The appendix at the end of the note provides more details on the data coverage.

First step: determine in which industries China has a comparative advantage

We proceed in two steps. First of all, we assess in which sectors China has a comparative advantage with respect to the rest of the world. These are the sectors where the dependence on Chinese imports in the supply chain are likely to be more pronounced. To identify these sectors we use the Revealed Comparative Advantage Indicator (RCAI).[3] In particular, a country has a "revealed" comparative advantage in product "*p*" when the export share of product "*p*" in their total exports is higher than the corresponding share of product "*p*" in total world exports (i.e. product "*p*" makes up a larger share of a country's exports than the world average).

Starting from this index we build an indicator ranging from -1 to +1 (the so called Revealed Symmetric Comparative Advantages indicator or RSCA). A value of +1 means that country "*c*" is the world's only exporter of product "*p*", while a value of -1 means that country c does not export it at all. A value of 0 means that a country's export share is identical to the world trade share of product "*p*".

1 "Estimating the impact of coronavirus on Europe" DB Focus Europe on 6 February 2019
2 For more see "OECD Inter-Country Input-Output (ICIO) Tables" available here
3 For more on this point see " Who's in your export market? The Changing patter of the competition in the world trade" OECD Economic Department working paper No 1526, December 2018.

We computed the RSCA for each sector in China and we focus our analysis on those sectors in which China has an RSCA>0, *i.e.* China exports relatively more than average in this sector, or more precisely, the share of that product in China's export basket is higher than the share of the product in world exports. Given the comparative advantages of China in these sectors, it is natural to assume a greater dependence of the rest of the world on China for these products.

Figure 1 reports those sectors where China has an RSCA>0 and the China's export shares of intermediate inputs (the ratio of Chinese exports of a particular input product "*p*" divided by the world input exports of the product "*p*").

Figure 1:Sectors in which China as revealed comparative advantages

Sectors	RSCA>0	Chinese export share of intermediate inputs(%)*
Textiles, wearing apparel, leather and related products	0.538	47.2
Computer, electronic and optical products	0.485	40.9
Electrical equipment	0.477	40.0
Other non-metallic mineral products	0.445	36.8
Other manufacturing; repair and installation of machinery and equipment	0.341	28.8
Fabricated metal products	0.268	24.5
Rubber and plastic products	0.235	22.9
Wood and products of wood and cork	0.232	22.7
Basic metals	0.224	22.3
Machinery and equipment, nec	0.191	20.8

Source :Deutsche Bank, OECD
** Ratio of Chinese intermediate exports of a particular input over the world exports of that input*
RSCA means Revealed Symmetric Comparative Advantages indicator (for details please see the main text).

Second step: country dependence

We then assess how dependent production in euro-area countries and other major countries in the global economy are to the import of these particular Chinese intermediate inputs. To answer this question we look at the share of a country's imported intermediate inputs that come from China for each of the input types listed in Figure 1.

This provides a dependency indicator for Chinese imports in the production of goods and services in another country. The idea is that the higher the value of this indicator, the more dependent the country is on imports from China. For a particular input "*p*", an indicator =1 (or 100%) would imply that the all of a country's imports of that particular input come from China. In other words, the country would be totally dependent on China for its imports of that particular input. The closer the indicator is to 0 (or 0%) the smaller the country's share of imports of input "*p*" that come from China. In this case, the country is less dependent (less directly exposed) to China for the production on this input factor "*p*".

An indicator close to 1 or to 0 is relatively easy to interpret. However, it is more problematic to interpret intermediate value between 0 and 1. For this purpose, we compare the results against the benchmark of China's export share of intermediate inputs in total world exports for each intermediate input. [4] This benchmark reflects the relevance of China in the supply of a particular intermediate input worldwide. An indicator above (below) the benchmark implies that for the particular input, a country is more (less) dependent on China than the global average dependency. We also construct an aggregate dependency measure for each country by averaging the distance between the indicator and benchmark for each sector.

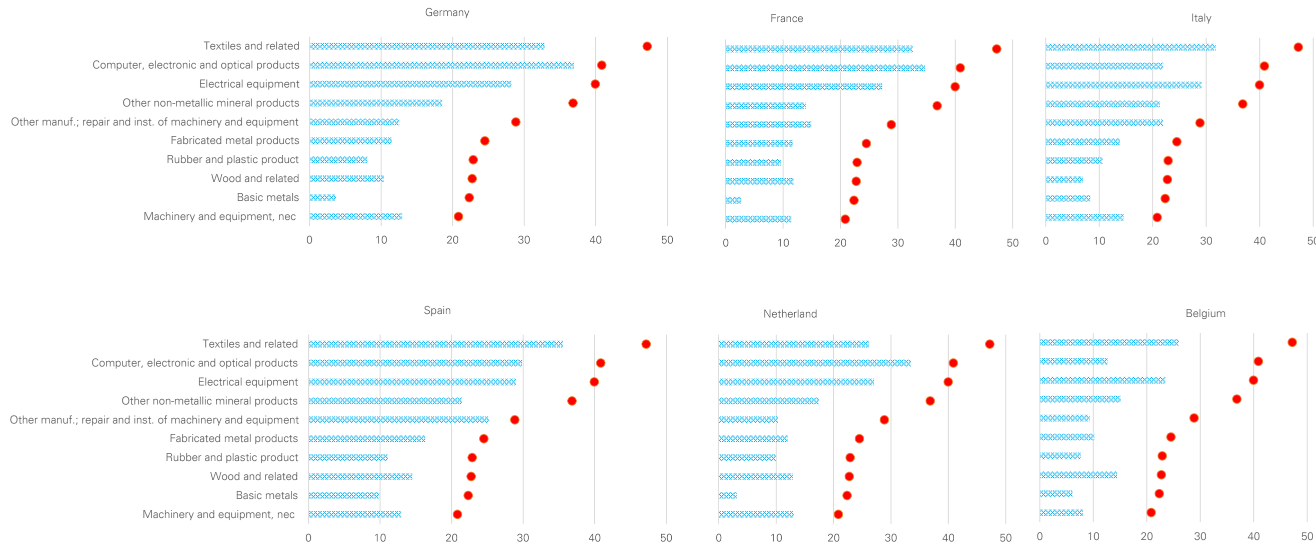
Results

Figure 2 and Figure 3 below show the results. Our main takeaways are the following:

- The euro-area countries have, in general, a dependence indicator below the benchmark. This suggests that euro-area countries have below-average direct dependence on Chinese imports of intermediate inputs (Figure 2).
- Germany seems more exposed to the import of electronic components than other euro-area countries. Chinese accounts for 37% of total German imports of this input, while the average for the rest of the euro area is 26%. Yet, on average Germany does not show any abnormal degree of exposure which makes it largely different from the rest of the euro area.
- The situation is significantly different for the other major global players in the world economy. The USA, Japan, Canada and all the major Asian countries have the majority of their dependence indicators above the benchmarks showing that they have a higher direct exposure to China supply chain (Figure 3).
- Figure 4 shows the results from a different angle. For the countries analysed in Figure 2 and Figure 3 it maps the distance between the benchmark and the dependence indicator as defined above and the input imported from China over the total input imported. Figure 4 shows that the euro area economies have a lower percentage of imported input from China and are below the benchmark regarding the dependence indicator.
- On average, the euro area has a dependence indicator smaller than the other regions and in general imports less intermediate inputs from China. This analysis confirms our preliminary thoughts on the effect the coronavirus (COVID-19) may have on the global economy with the euro area less directly affected than other major countries[5] .

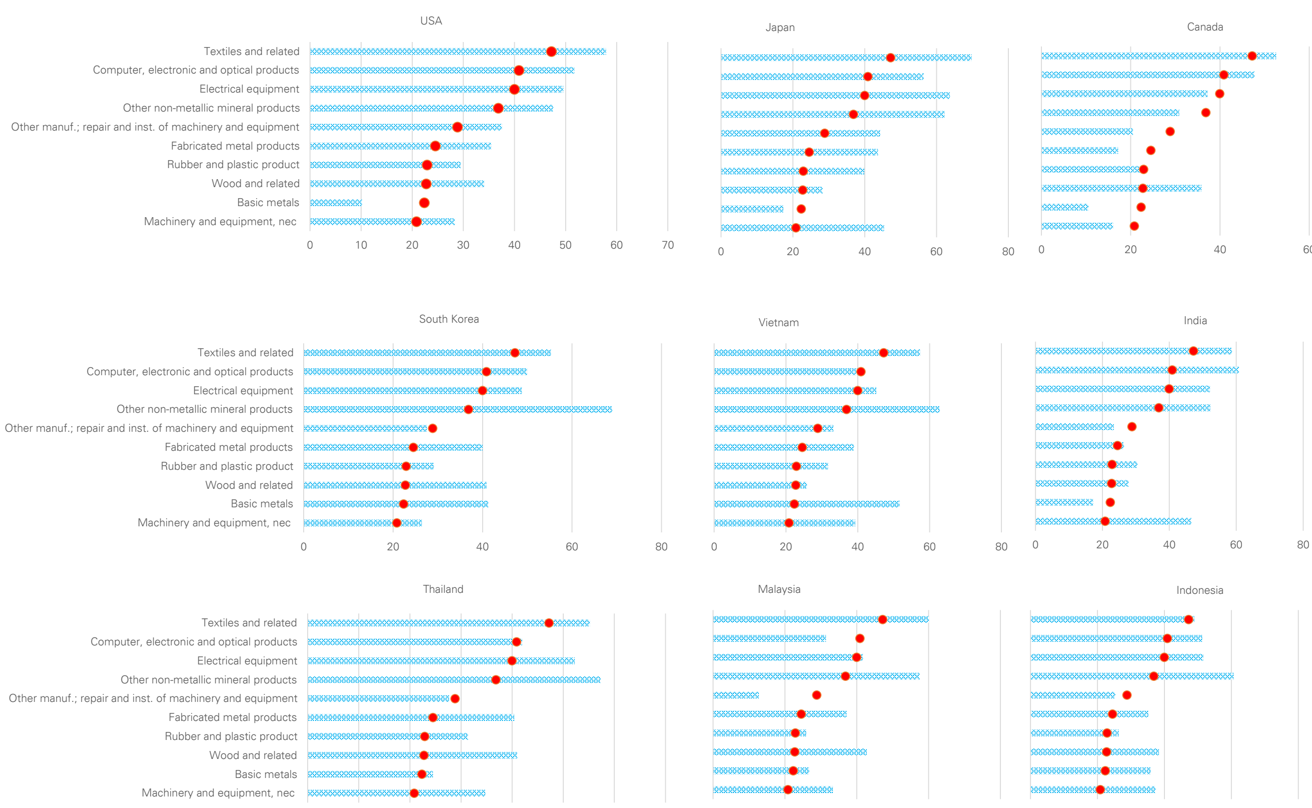
4 One alternative is the average of the indicator among several countries. This indicator, however, is broadly similar to the benchmark we identified above.
5 See "Impact of the novel coronavirus on global GDP growth", DB Special Report, 6 February 2020"

Figure 2: Euro area dependence: Chinese intermediate imports over total sector imports (%)



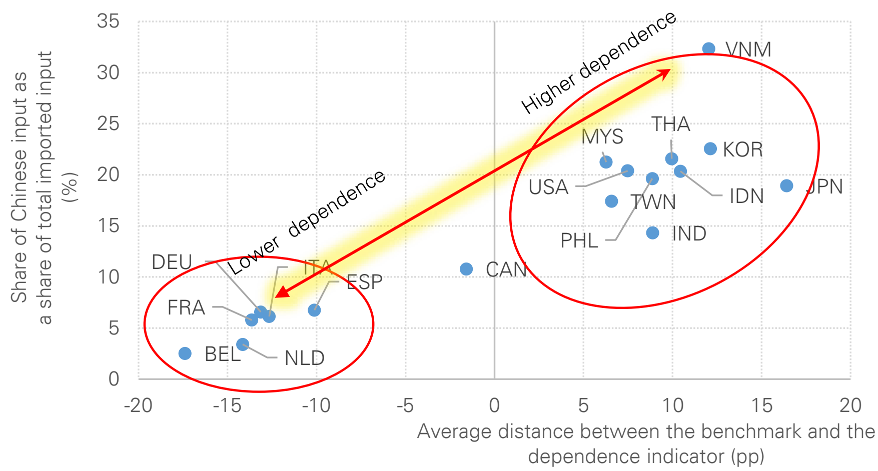
Source : Deutsche Bank, OECD
Blue bars indicate share of Chinese imports for each sector. Orange dots indicate the benchmark ie China export share (China exports of that particular product as % of world exports of that particular product).

Figure 3: Other countries dependence: Chinese intermediate imports over total sector imports (%)



Source : Deutsche Bank, OECD
Blue bars indicate share of Chinese imports for each sector. Orange dots indicate the benchmark ie China export share (China exports of that particular product as % of world exports of that particular product)

Figure 4: Country exposure (dependency) to China



Source :Deutsche Bank, OECD
The Benchmark is the China export share in those particular sector where China as a revealed comparative advantages (for more see the above).
The dependence indicator is the ratio of imports from China for a particular products on the total imports of that product (for more see above)

To sum up, our analysis show that the euro area seems less directly exposed to disruptions in the supply of intermediate inputs from China than other countries. Although encouraging, this does not represent a sufficient buffer for the euro area against supply problems in China.

- First of all, our analysis does not take into account non-linearity in the production process. In other words, it does not capture consequences from a stop in production for particular product. It might indicate that given the dependance is smaller, Europe could find it somewhat easier substitute a Chinese product with another. B there is no guarantee this will be the case.
- Secondly, while our results indicates that the direct impact from supply issues in China could be smaller for the euro area than for other regions in the world, the euro area could be hard-hit by second round effects. With their higher direct exposure to China, production in other major economies could slow down as a result of disruptions in the supply chain. This not only could cause a shortage in demand for euro-area exports, but it could also impact on the euro-area's import of intermediate inputs from these other countries (second round effects). In other words, China has become a relevant player in the world supply chain and production/demand problems in China are spread worldwide through direct and indirect channels.

Related research notes on the coronavirus impact

- "Impact of the novel coronavirus on global GDP growth" DB Special Report, 6 February 2020
- "Outlook update: Coronavirus and Boeing cloud H1 growth visibility" DB US Economic Perspectives, 5 February 2020
- "Impact of coronavirus on Japanese economy: provisional estimate" DB Japan Economic Perspectives, 5 February 2020
- "Beyond Wuhan", DB Asia Macro Insight 5 February 2020
- "Estimating the impact of coronavirus on Europe", DB Focus Europe 6 February 2020

Appendix: some details of the input-output table

The input-output table from the OECD mixes data from 69 economies for 36 sectors. The table below reports the sectors/products included. For more details please go here.

Figure 5: Sector included into the input output table from the OECD

.	Sector
1	Agriculture, forestry and fishing
2	Mining and extraction of energy producing products
3	Mining and quarrying of non-energy producing products
4	Mining support service activities
5	Food products, beverages and tobacco
6	Textiles, wearing apparel, leather and related products
7	Wood and products of wood and cork
8	Paper products and printing
9	Coke and refined petroleum products
10	Chemicals and pharmaceutical products
11	Rubber and plastic products
12	Other non-metallic mineral products
13	Basic metals
14	Fabricated metal products
15	Computer, electronic and optical products
16	Electrical equipment
17	Machinery and equipment, nec
18	Motor vehicles, trailers and semi-trailers
19	Other transport equipment
20	Other manufacturing; repair and installation of machinery and equipment
21	Electricity, gas, water supply, sewerage, waste and remediation services
22	Construction
23	Wholesale and retail trade; repair of motor vehicles
24	Transportation and storage
25	Accommodation and food services
26	Publishing, audiovisual and broadcasting activities
27	Telecommunications
28	IT and other information services
29	Financial and insurance activities
30	Real estate activities
31	Other business sector services
32	Public admin. and defence; compulsory social security
33	Education
34	Human health and social work
35	Arts, entertainment, recreation and other service activities
36	Private households with employed persons

Source :Deutsche Bank, OECD

Appendix 1

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