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Critical input disruptions – mapping out the road to EU resilience

by Dennis Essers, Laura Lebastard, Michele Mancini, Ludovic Panon and Jacopo Timini[1]

Using firm-level data for five EU Member States we study how disruptions to the supply of foreign critical inputs (FCIs) might affect value added. Our findings suggest a 50% reduction in imports of FCIs from China and China-aligned countries would lead to transitory value added losses in manufacturing of about 2-3%, with significant variation across firms, sectors, regions and countries. This has implications for the wider economy, growth and price stability.

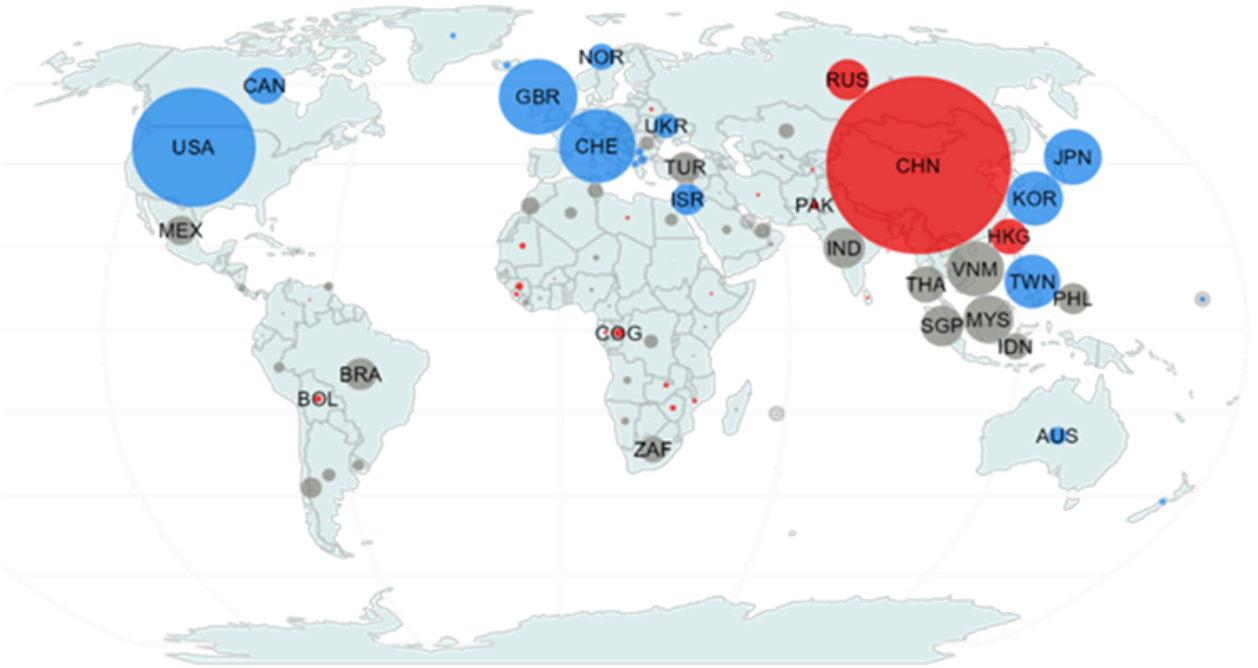
Global disruptions reveal the EU's reliance on foreign inputs

Global disruptions have highlighted the euro area's reliance on foreign input sourcing. Not only the COVID-19 pandemic and Russia's invasion of Ukraine but also, more recently, the announcement of new US tariffs and the heightened geopolitical risks stemming from tensions in the Middle East have focused attention on international supply chains. Mapping strategic vulnerabilities and quantifying the impact of disruptions to the supply of key inputs are central to building resilience.

China is the EU's top provider of FCIs. These are defined as inputs sourced mostly from outside the EU and falling into one of the following three categories: difficult to substitute,[2] high-tech products, and/or items that are vital for the green transition. This list includes microchips, turbine parts, optical equipment, and chemicals used to produce drugs and batteries for electric cars. FCIs represent 17% of extra-EU imports. The European Bank for Reconstruction and Development's "Transition Report 2023-24" highlights that China dominates the production of most critical raw materials. According to country-level trade data, in 2022 a third of FCIs imported by the EU came from China (Chart 1). For the EU, other relevant, geopolitically distant suppliers of FCIs are Russia and Hong Kong.

Chart 1

Non-EU countries' share of FCI imports to the EU and partner alignment



Source: CEPII BACI.

Notes: The size of the circles represents the relative share of each non-EU country's exports in FCIs imported into the EU. Blue circles signal US-aligned countries, red circles China-aligned countries and grey circles neutral countries. China's circle represents 30% of FCIs imported into the EU, the US circle 18%.

2-3% drop in value added if China-aligned FCIs are halved

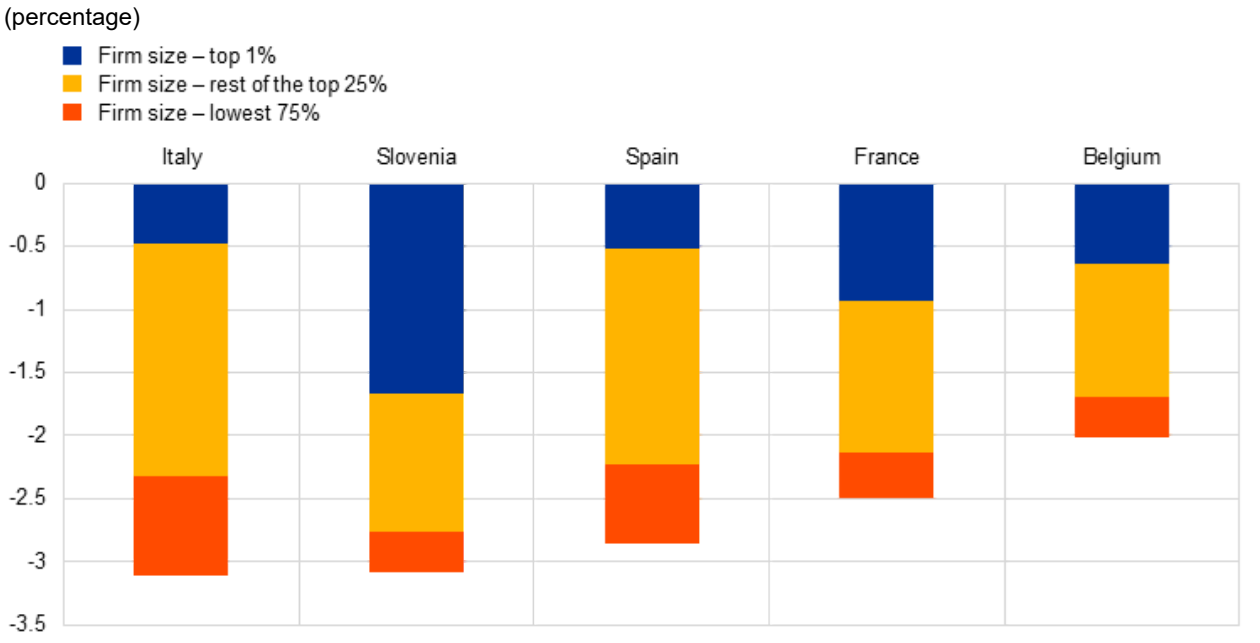
In Panon et al. (2024), we use firm-level trade and balance sheet data for five euro area countries − Belgium, Spain, France, Italy and Slovenia – to shed quantitative light on the exposure to foreign supply risks. We employ a firm-level partial equilibrium model, based on a production function approach, to assess the short-term effect on manufacturing value added of disruptions to the supply of FCIs from China and other countries with a similar geopolitical orientation ("China-aligned countries"). We base geopolitical orientation on United Nations voting patterns, the frequency of sanctions and other measures of geopolitical alignment (den Besten et al., 2023; Capital Economics, 2023). In the model, firms combine labour, capital and intermediate goods, the latter being produced using FCIs and non-FCIs.

Our baseline scenario consists of a sudden drop that halves the supply of FCIs from China-aligned countries. In line with business survey evidence (Attinasi et al., 2023; Bottone et al., 2024) and the economic literature (Barrot and Sauvagnat, 2016; Atalay, 2017; Boehm et al.,2019), we assume that firms cannot substitute these inputs in the short run. Such FCI supply disruptions would generate a drop in manufacturing value added of 2.0% for Belgium, 2.5% for France, 2.9% for Spain and 3.1% for Italy and

Slovenia in the short term (Chart 2). Large firms drive the overall change, accounting for about 75% of the value added decline in all countries. This finding confirms the message from Gabaix (2011): the behaviour of large firms explains a substantial share of aggregate fluctuations. The results for the top 1% of firms display more heterogeneity, explaining about one-sixth of the decline in Italy and Spain, a third in France and Belgium, and more than half in Slovenia.

Chart 2

Breakdown of change in manufacturing value added by size of firm



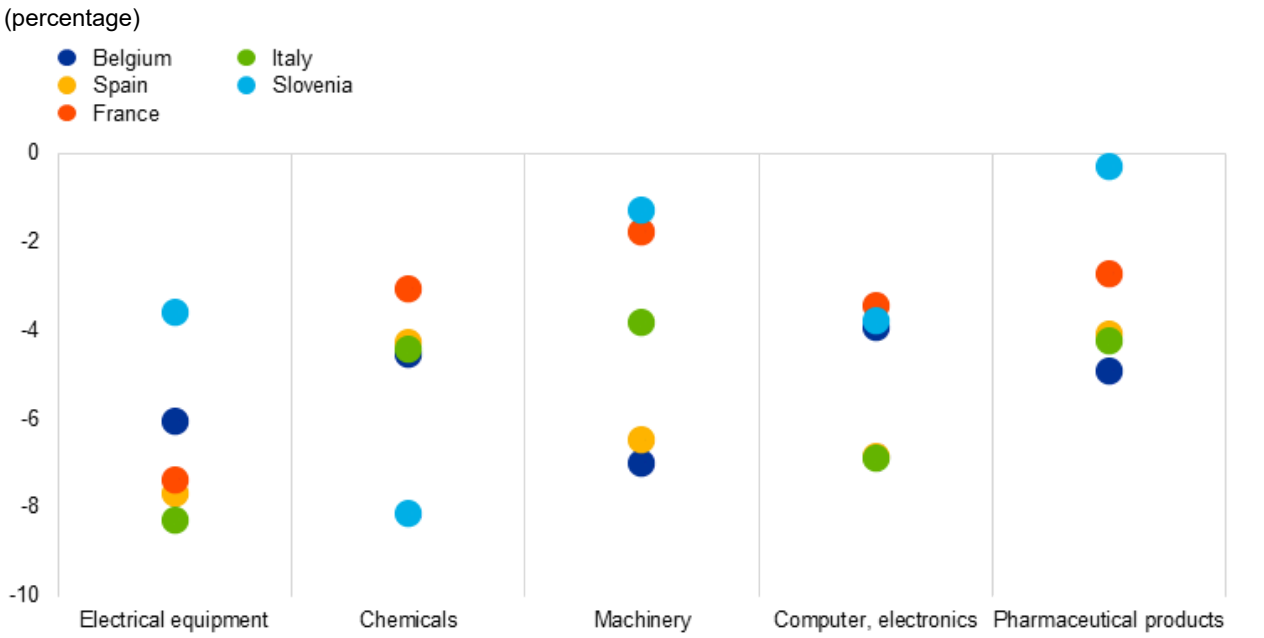
Notes: The chart reports the change in value added (as a percentage) resulting from a 50% drop in FCI supply from China-aligned countries. Percentiles are calculated using the value added of the firm (the percentile calculation only includes firms exposed to changes in access to FCIs). Only manufacturing firms are included.

The road to resilience is longer for some sectors and regions

The simulated impact varies greatly across sectors. The electrical equipment industry stands out as the most affected, with a median decline in value added across countries of about 7%, more than double the overall median of 3%. Other industries experiencing declines greater than the median include chemicals, basic metals, electronics, and machinery (Chart 3). Together, these five industries account for nearly one-third of manufacturing value added in the five countries in the sample. Some sectors show a similar decline across the five countries (e.g. electronics), while for others the results vary much more at the country level (e.g. chemicals, machinery). This reflects different sub-sector compositions and firm-specific sourcing patterns.

Chart 3

Change in value added by manufacturing sector across countries



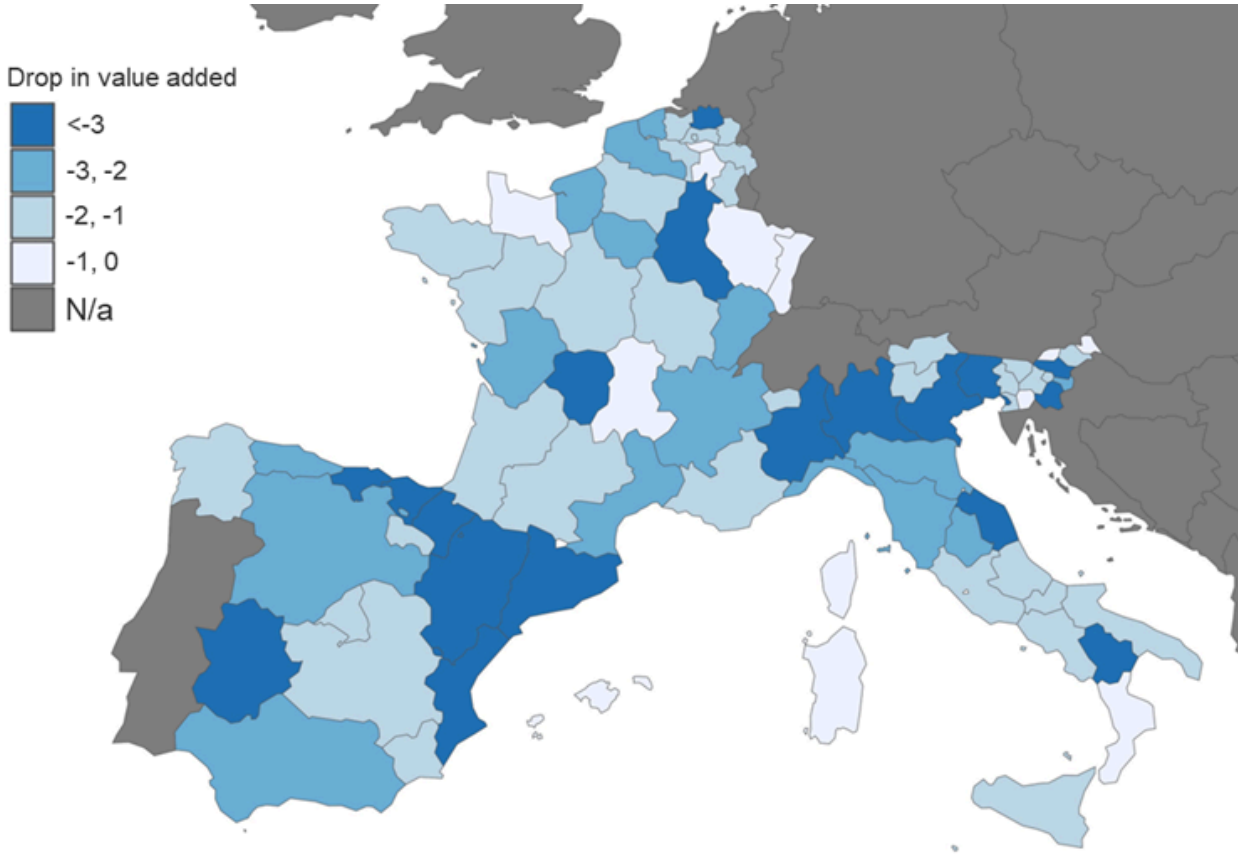
Notes: The chart reports the change in value added (as a percentage) across the most exposed manufacturing sectors for a 50% drop in FCI supply from China-aligned countries.

Regional results are also mixed (Chart 4). The large heterogeneity across regions within countries is driven by two factors: specialisation and concentration. The most affected regions are those specialised in sectors heavily reliant on FCIs imported from non-EU countries. For instance, the Italian region of Marche is relatively more specialised than other regions in the production of electrical equipment, which is an industry that relies heavily on sourcing FCIs from China-aligned countries. The concentration of top producers in some regions also contributes to this uneven impact: where large firms are reliant on FCIs the effect of a 50% drop on the value added of their region is more substantial. This is consistent with the aggregate effects shown in Chart 2.

Chart 4

Change in manufacturing value added at the regional level

(percentage)



Notes: The chart reports the percentage change in value added across regions resulting from a 50% drop in FCI supply from China-aligned countries. Only manufacturing sectors are considered.

Destination EU resilience

Identifying firms exposed to disruptions of critical inputs is key for policymakers to better prepare for forthcoming shocks with potential implications for growth and price stability. Microdata are crucial not only for mapping strategic dependencies, but also for quantifying their importance if a shock hits. A negative supply shock like the one modelled in this paper would have a temporary inflationary effect on the countries concerned; its intensity would depend on the degree of substitution of the affected goods. A deeper, more granular understanding of exposure to foreign dependencies would enhance our ability to pinpoint where and to what extent price pressures may arise, while also improving the assessment of economic and financial stability risks. At the same time, this insight is essential for designing more effective industrial policies and improving supply chain resilience. This aligns with the European Commission advocating for “strategic autonomy”, in particular increasing our use of technologies that do

not rely on materials provided by potentially unreliable trading partners. We therefore support the call of Pichler et al. (2023) for "an alliance to map global supply networks", and agree with them on the importance of collecting microdata and making them available for research purposes.[3]

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European Commission, 2023; Arjona et al., 2023.

3.

Our work is part of the effort of the European System of Central Banks (ESCB) to enhance its understanding of the ongoing geoeconomic trade fragmentation process. The 2024 ESCB Report on Geoeconomic Trade Fragmentation by Attinasi, Mancini, et al. highlights the need to look beyond aggregate trade data and improve the detailed monitoring of supply chains, including through increased cooperation among central banks and other international organisations.