

EU Strategic Dependencies: A Long View

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Summary

We analyze how trade dependencies have evolved over time to better understand how they relate to vulnerabilities.

We focus on the EU-27 and apply the bottom-up approach laid out by the European Commission (EC) using trade data from 1996 to 2019.

The number of dependent products has shown no clear pattern since the mid-1990s, nor has their sectoral composition. The geography of dependencies has, however, evolved towards dependencies concentrated on Chinese suppliers, but this shift had already occurred in 2010.

The products identified as dependent exhibit significant churning over time: one out of five dependent products in 2018 was not identified as such one year later in 2019 and close to half of dependent products in 2014 were not identified as such five years later.



The Covid-19 pandemic and resulting congestion of global supply chains have reignited a focus on dependencies arising from trade openness. In the wake of the pandemic, both the European Commission and the US government have conducted reviews of their supply chains to identify strategic dependencies, *i.e.* products for which they depend on foreign suppliers in strategic ecosystems. The war in Ukraine and weaponization of gas exports by Russia have further contributed to shift the focus from gains from trade openness to vulnerabilities arising from trade specialization. They have also changed the conception of vulnerabilities arising from dependencies, from exogenous risks of disruption due to pandemics or natural disasters to the risk of dependencies being weaponized by foreign governments in trade disputes and coercion.

In this policy brief, we take a step back from current dependencies and look at their evolution over time. The definition, measurement and scope of the risks associated with trade links are still widely debated, and constitute an

area of ongoing work. Here, we focus on the EU-27 and apply the bottom-up approach laid out by the European Commission (EC) to identify 137 products in the most sensitive ecosystems in 2018 (EC, 2021).¹ Such dependent goods are just a first step in the mapping of strategic vulnerabilities. In that respect, in order to assess their consequences, it is useful to understand how dependencies developed and whether they are a stable pattern of the world trading system. Taking a long view at trade relationships also helps understanding of the specificities of the current global environment.

The EC (2021) assesses dependent products from the importer point of view, taking into account the concentration of imports, their importance in demand and their substitutability. Such an approach is broadly similar to other proposed identification criteria; the main criteria used however focus on the importer side and disregards concentration on the export side. Using those criteria, we ask whether strategic dependencies are a new phenomenon or whether the global environment and perception of underlying risks have changed. No clear pattern emerges in that respect since the mid-1990s in terms of the number of dependent products. The geography of dependencies, however, has evolved towards dependencies concentrated on Chinese suppliers, which suggests that, while dependencies are a structural feature of the trading system, the perception of the risks associated with it has changed. Interestingly, the shift towards dependencies from Chinese suppliers dates back to the early 2010s but started

to be perceived as a source of vulnerabilities almost a decade later.

Another important dimension to be considered when mapping dependencies into vulnerabilities is the lasting nature of product-level dependencies. For trade dependencies to generate strategic vulnerabilities, they need to be long-lasting and structural. The fact that dependent products vary from one year to the next means that their sourcing is volatile, which reduces the risk of supply disruptions because of a single country or firm. The products identified as dependent exhibit significant churning over time: one out of five dependent products in 2018 was not identified as such one year later in 2019 and close to half of dependent products in 2014 were not identified as such five years later. Such variability over short horizons calls into question the vulnerabilities associated with dependent products identified through specific criteria.

The geography of dependencies has evolved towards dependencies concentrated on Chinese suppliers

such dependent goods are just a first step in the mapping of strategic vulnerabilities

1. The bottom-up approach of the European Commission

The European Commission's methodology, presented in the 'Strategic dependencies and capacities' report (EC, 2021), combines three criteria measuring different dimensions of dependencies (Table 1): 1) concentration of extra-EU imports, 2) the importance of demand and 3) the substitutability with EU production. The first criterion is computed for each imported product as a Herfindahl-Hirschman Index (HHI) measuring the concentration of European imports over all trading partners. The HHI is the sum of squared market shares of European imports from country *i*, over all trading partners. In this case, a product is defined as concentrated when the HHI of the corresponding imports is larger than 0.4. The second criterion is the share of extra-European imports over total European imports. The corresponding threshold is set to 0.5, identifying products in high demand. The third criterion is the ratio of extra-European imports over total European exports; the product is considered as not substitutable when the ratio is larger than 1.

Considering, for example, the year 2019 (first year of the report) and over 4,726 products, the first criterion alone identifies 1,374 products, the second 1,564, and the third 773. Combining all three criteria, 353 products are defined as dependent. It is worth noting that not all three criteria are similarly binding: in particular, when the third criterion applies, the second one always does. Hence, only criteria 1 and 3 define dependent products.

The EC then restricts the identified products to those pertaining to sensitive ecosystems, including aerospace and

(1) Before the EC report, Bonneau and Nakaa (2020) and Jaravel and Méjean (2021) proposed classifications of dependent products based on alternative criteria. See section 1.

Table 1 – Classification criteria for dependent products

	European Commission (2021)	Bonneau and Nakaa (2020)	Jaravel and Méjean (2021)	CESifo: Baur and Flach (2022)
Criteria 1	Concentration of imports: HHI > 0.4	Source of imports: Extra-EU imports > 50%	Source of imports: a majority of extra-EU imports	Relevance of the goods for domestic production: 3 most used intermediate goods in the 5 most important sectors of the economy
Criteria 2	Importance in demand: ratio extra-EU imports / total EU imports > 0.5	Concentration of imports HHI > 0.5	Concentration of imports: HHI > 0.5	Concentration of imports: HHI > 0.33
Criteria 3	Substitutability by EU production: ratio extra-EU imports / total EU exports > 1	Diversification potential: centrality risk > 2.5 (Y. Korniyeko, M. Pinat and B. Dew, 2017)	Granularity of demand: one French firm represents at least 90% of imports	Substitutability by domestic production: ratio imports/exports > 1
Additional criterium	Restricted to sensitive ecosystems (not defined) Diversification potential 1: HHI of exports > 0.4 Diversification potential 2: price difference between extra- EU imports and total EU exports > 30%			

Sources: EC (2021), Bonneau and Nakaa (2020), Jaravel and Méjean (2021) and Baur and Flach (2022).

defense, electronics, energy-intensive industries, renewable energy, health, and digital industries. Since we do not have the definition of these ecosystems, we focus on the products identified by the first three criteria without restricting them to sensitive ecosystems. The EC also considers two additional criteria to assess the diversification potential of dependent products through an HHI of exports by products, and a price differential between extra-EU imports and total EU exports.² Those are not used to identify dependent products in the EC (2021) methodology but to qualify dependent products identified, so we disregard them in the following.

Alternative criteria have been proposed to identify dependent products, in particular by the French Treasury (Bonneau and Nakaa, 2020), the French Council of Economics (Jaravel and Méjean, 2021), and CESifo (Baur and Flach, 2022). All four studies have in common the level of concentration of imports (Table 1). The first three studies also consider the level of extra-EU imports. The substitutability of imports by domestic production is adopted by both the EC and CESifo studies (criteria 3), while both French studies build on a proxy for supply concentration. Jaravel and Méjean (2021) proxy the concentration of suppliers (*i.e.* exporters), at the firm level, by the number of French firms importing the products. Indeed, the economic literature has shown that a firm generally imports from only a few foreign exporting firms; hence, if the imports rely on only one French firm, they also rely on a few foreign suppliers, increasing the risk of supply

disruption. Bonneau and Nakaa (2020) consider a centrality risk measure, which proxies the potential for diversification across exporting countries. In both cases, the idea is to capture the level of production concentration of the product considered. This is also the goal of one of the additional criteria the EC is using, by computing the HHI of world exports to capture the diversification potential.

Baur and Flach (2022) introduce another criterion to take into account the relevance of the good for domestic production, which would put the focus on intermediate goods rather than downstream goods aimed at final consumption. To that end, they consider the five largest sectors in Germany (machinery, cars, metals, chemicals and electronics) and identify the three most important inputs of the final

goods produced in each sector, using input-output tables.

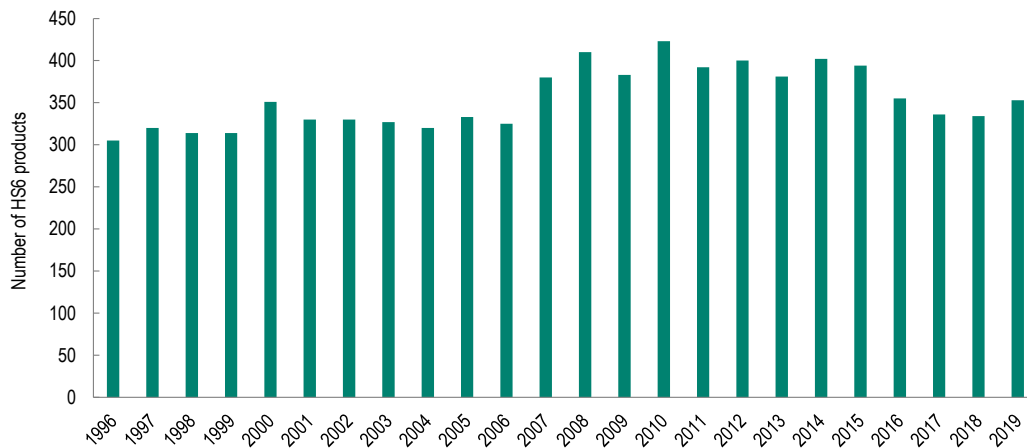
Overall, these studies build on similar criteria to identify products for which domestic imports are concentrated on a small number of suppliers. Additional criteria regarding the importance of imports in domestic production, their substitutability with domestic production or the concentration of exports are specific to studies presented in Table 1. In particular, the EC does not consider the concentration of exports in its main criteria.

In the following section, we use detailed product-level trade data from the BACI database in HS-1996 nomenclature (Gaulier and Zignago, 2010) and apply all three criteria used by the EC for every year over the period 1996–2019.³

(2) Similar indicators of diversification potential can be found in Bonneau and Nakaa (2020) and Baur and Flach (2022).

(3) We drop hydrocarbon trade flows whose geography is difficult to measure using trade data (Bellora et al., 2022).

Figure 1 – Number of dependent products



Source: Authors' computation from CEPII, BACI database.

2. Dependent products over time

The number of dependent products varies over time, from 300 at its lowest level to 420 products at its highest, but no specific trend emerges: the number of dependent products increases over the period 2007–2015, but comes back to the level reached in the 1990s from 2016 on (Figure 1).

the number of dependent products varies over time but no specific trend emerges

Such stability in the extent of dependencies raises the question of potential changes in their composition, and therefore the risk associated with specific dependencies. We therefore focus on two dimensions along which dependencies may have changed over time: sectors and country of origin.

We first split the product identified by broad sectors of activity, distinguishing seven sectors likely related to the strategic ecosystems mentioned by the EC: agrifood, chemicals, health, steel, defense and aerospace, transport and electronics.⁴ In 2019 the seven sectors yield 134 products, close to the 137 products identified in EC (2021), distributed as follows: 4 in agrifood, 77 in chemicals, 11 in health, 17 in steel, 2 in defense and aerospace, 1 in transport and 22 in electronics. This distribution is quite stable over time but for the share of chemical products increasing slightly and that of electronics decreasing (Figure 2). Other dependent products concentrate over the manufacturing sector (e.g. yarn fabrics) or animal products (mainly meat and fish).

Focusing on specific products that are at the top of the current policy agenda, semi-conductors enter the list of dependent

products in 2002 and remain on it until 2019.⁵ Rare metals are also a constant feature of dependent products; several are included in the list since 1996, in particular borates, scandium and cobalt.⁶ The specific case of solar panels is worth mentioning: this product⁷ is identified as dependent between 2010 and 2012 and then in 2019 only. Interestingly, in December 2013, the European Union imposed a provisional anti-dumping tariff on solar panels imported from China. The temporary trade protection was lifted in September 2018, after which solar panels return to the list of dependent products. This underlines that trade protection has an impact on strategic dependencies, by reducing the level of imports of a particular product, but also by artificially hiding a dependence.

The pervasiveness of the status of specific products that feature high on the policy agenda on strategic dependencies currently, draws to attention the monitoring of such dependencies and/or the evolution of perception of risks associated with such dependencies.⁸ One aspect of these risks relates to the geographic origin of imports.

The map of EU dependencies, based on the top country of origin for each dependent product, shows

the map of EU dependencies shows a clear shift in the origin toward China

a clear shift in the origin toward China (Figure 3). While it was already in the top three origins in 1996, China was the main exporter of only 50 dependent products in 1996 (i.e. 1/6 of total EU dependent products). Since 2010 it has been the

(4) We use the CEPII-Chelem industry classification. The health industry includes pharmaceuticals and medical equipment, including active components upstream in the production chain as defined in Cotterlaz *et al.* (2022). Note that we use the 1996 HS nomenclature throughout our time period in order to have a stable number of products. Some “new” product categories may not be adequately captured.

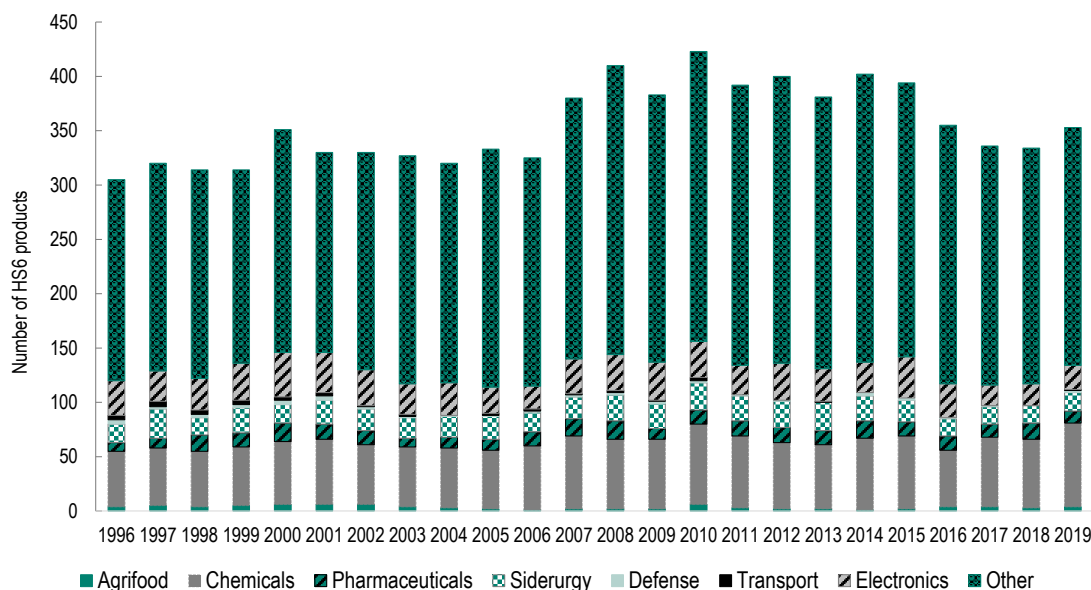
(5) We assimilate semi-conductors to products in the HS4-digit sectors 8542 (electronic integrated circuits) and 8541 (diodes, transistors and similar semi-conductor devices).

(6) Other metals that also appear as dependent during our time period are: magnesium, niobium, germanium, borates, scandium, strontium, cobalt, platinum, palladium, natural graphite and lithium.

(7) HS code 854140.

(8) The European Commission has published a [list](#) of critical raw materials since 2011.

Figure 2 – Dependent products by sector



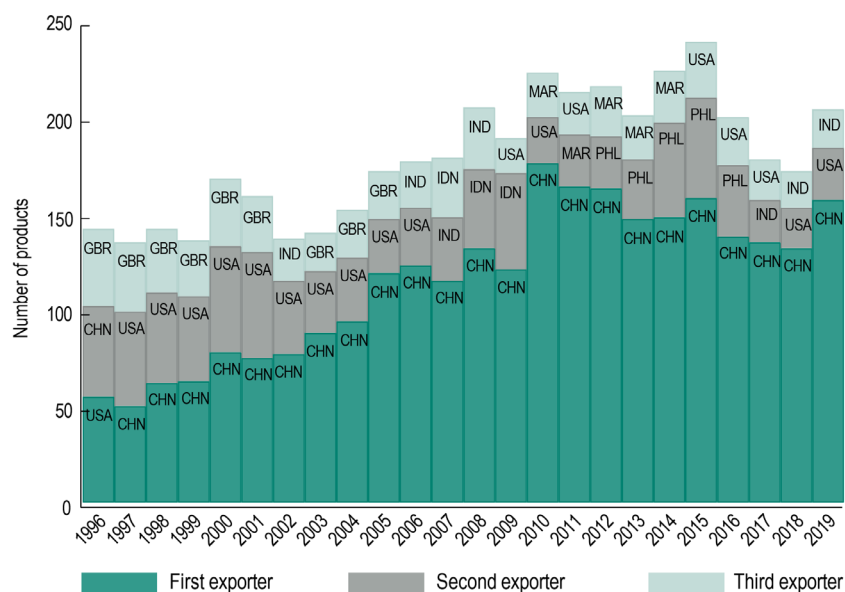
Source: Authors' computation from CEPII, BACI database.

main source of around 150 dependent products (almost half of dependent products). For comparison, the share of China in EU imports was 7.3% in 2010 and 8.8% in 2020. In 2019, 50 dependent products were sourced primarily from the USA and only 30 from India.⁹ The total share of the top three origin countries increased, as they supplied 150 of the dependent products in 1996 and supply more than 200 today, mainly due to the increasing share of Chinese products. Overall, we document limited changes in the number of dependent products – if anything a decrease over the last decade – and sectoral composition for the EU over the period 1996–2019. However, the bilateral dimension of dependencies has changed, as illustrated by the concentration in the origin of imports of dependent products on China. This reflects the increasing share of China in world trade, especially for highly concentrated products. Considering the top 10% most concentrated products in world exports, China appears in the first five exporters for 249 of them in 1996 but 527 in 2019. This calls into question the potential for supplier diversification given the concentration of production and exports in China for such a large number of products.

(9) Other countries like Morocco and Philippines also appear in the top three in the mid-2010s; the dependent products concerned are mainly agricultural products and textile, and electronics in the case of Philippines.

Figure 3 – Main exporters of dependent products

Origins of dependent products



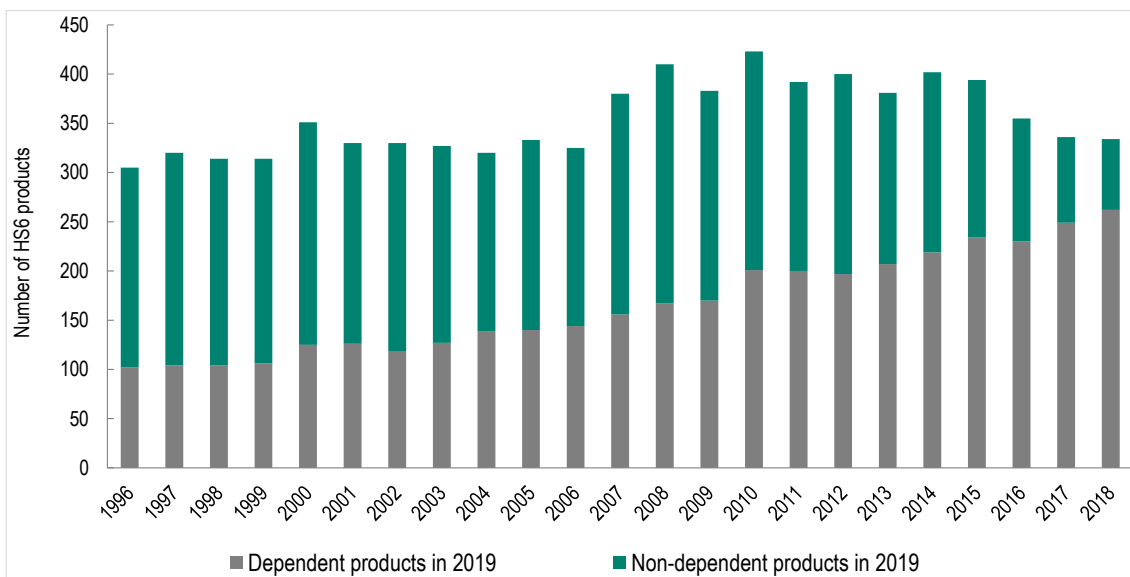
Notes: For each dependent product, we keep the main supplier to the EU and aggregate over all dependent products. USA = United States, CHN = China, GBR = United Kingdom, IDN = Indonesia, MAR = Morocco, PHL = Philippines, IND = India.

Reading note: In 1996, the EU had 55 dependent products for which the first supplier country was the United States, 47 China and 40 the United Kingdom.

Source: Authors' computation from CEPII, BACI database.

Moreover, the trading regime has changed radically over the past three decades, affecting the comparison of trade dependencies over time. In particular, during the hyper-globalization period of the 1990s and 2000s, the emergence of global value chains increased the overall reliance of national economies on foreign production, both as a source

Figure 4 – Churning of dependent products



Source: Authors' computation from CEPII, BACI database.

of intermediate and final goods. For the EU-27, trade openness increased from 22% of GDP in 1996 to 34% in 2012. The 2010s, however, were characterized by a plateau of globalization so that, in 2019, EU trade openness still stood at 34%.¹⁰ Such a dimension of dependency is not picked up by any criterion used to identify dependent products in Table 1. However, it further underlines that, while the landscape of dependencies has changed from 1996 to 2012, most of the characteristics of dependencies in 2019 were already in place after the global financial crisis, including the concentration of imports of dependent products from China.

Such stable patterns of dependency draw attention to the delayed policy response throughout the 2010s – and all the more since geopolitical risks and challenges to the world trading system were already intensifying compared to the pre-global financial crisis period. Caldara and Iacoviello (2022) document already larger average geopolitical risks over the 2010s compared to the late 2000s, outside major armed conflicts in 2001 and 2014. The rule-based international trading system was also already under stress, notably through the US blocking of the renewal of judges of the appeals body of the WTO dispute settlement mechanism, starting with the Obama administration. Such challenges to the international trading system and the protectionist turn have obviously increased following the election of Donald Trump, but they were already evident before that. The Chinese export embargo on rare earth to Japan was also an early weaponization of trade ties

most of the characteristics of dependencies in 2019 were already in place after the global financial crisis

during the period. Major natural disasters – e.g. flooding in Thailand and the Fukushima catastrophe in Japan in 2011 – also paralyzed specific regions and industries such as the electronics and automotive industry, with consequences down the supply chain worldwide.

3. The (in)stability of dependent products

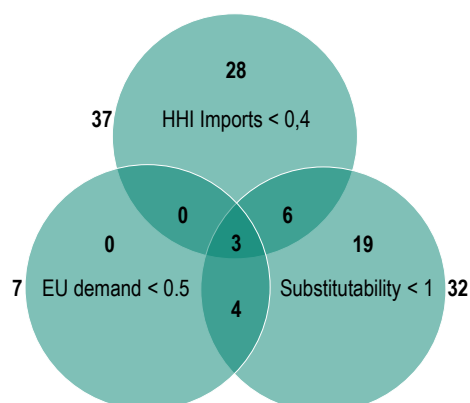
The relative stability in the total number of dependent products, highlighted in the previous section, hides a significant churning of specific dependent products over time over the last two decades. Taking 2019 as a reference year, Figure 4 shows whether the products identified as dependent in 2019 (represented by grey bars) were dependent in the years before. Over the period 1996–2019 dependent products vary significantly: 22% of dependent products in 2018 were not tagged as dependent just one year later in 2019. At a longer horizon, 46% of products identified as dependent in 2014 were not dependent five years later. Such churning resonates with the overall short median duration of export spells at the firm (Berthou and Vicard, 2015) and country level (Besedes and Prusa, 2006). In addition, this churning could be explained by market concentration changes.

Such large year-on-year churning of dependent products calls into question the definition and interpretation of dependencies. Vulnerabilities related to dependencies on foreign production are by nature a medium or long-term issue, which is relevant to the extent that there is no alternative or substitute in the

(10) Mean of exports and imports of goods excluding intra-EU trade, divided by GDP, <http://visualdata.cepii.fr/RegionProfiles/fr/?region=Europe&tab=patterns>.

Figure 5 – Binding criteria in 2018 vs 2019

Number of dependent products in 2018 but not in 2019 (based on the 2019 indices)



Source: Authors' computation from CEPII, BACI database.

domestic market or abroad. In this context, year-to-year changes in dependent products calls into question the potential vulnerabilities associated with such import dependencies.

The volatility in dependent products based on a year-on-year

22% of dependent products in 2018 were not tagged as dependent just one year later in 2019, 46% of products identified as dependent in 2014 were not dependent five years later

definition may be too large to back policy changes. One could think of applying the same criteria on a rolling window to obtain medium-run trends that would be better suited to support European policies.

Going further, we focus on the dependent products identified in 2018, and explore which criteria explain why some of them no longer qualify as dependent products in 2019 (60 products out of 334). Figure 5 presents the distribution of these 2018 dependent products according

to whether they failed to meet one, two or all three of the criteria in 2019. Among these products, we find that, for almost two thirds of them, the import concentration index has fallen back below the threshold (37 products), more than half have a substitution criterion lower than unity in 2019 (32 products), and seven had a switch in the EU demand criterion but systematically combined with another criterion not binding

anymore (all three together or the substitutability criterion). This further underlines that the identification of dependent products rests primarily on two criteria – concentration of imports and substitutability with EU production – and that the variability of dependent products is not related to a single criterion.

Conclusion

Applying the criteria used by the European Commission to identify dependent products back to 1996, this policy brief shows that trade dependencies are not a new phenomenon, nor is their sectoral composition. What has changed is the geography of EU dependencies, with increased sourcing from China. Such patterns underline that it is not the underlying structure of dependencies that has changed but the perceived risks associated with them because of the concentration of imports of dependent products from a source country, China, that is now considered less aligned geopolitically to the EU, and/or increasing risks of supply-chain disruption due to pandemics or natural disasters. The shift in the source of dependent products, however, occurred a decade ago, which reminds us that the renewed focus of the EU on its strategic vulnerabilities results from a shift in the perception of the consequences of trade relationships rather than the build-up of new dependencies. It underlines the need to focus on identifying risks associated with specific products, related to the concentration of production worldwide, its location and the products involved in its value chains.

Furthermore, the variability, even with short horizons, of the list of products identified as dependent should be considered when mapping dependencies to vulnerabilities, which by definition are long-term issues addressed by structural policies. In particular, import concentration features year-to-year variability – a pattern that should be taken into account when thinking about the identification of vulnerabilities.

trade dependencies are not a new phenomenon, nor is their sectoral composition. What has changed is the geography of EU dependencies

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Policy Brief



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ISSN 2270-258X

June 2023

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