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DG GROW's SUPPLY CHAIN ANALYTICS HUB

SINGLE MARKET ECONOMICS BRIEFS

Economics Brief n°18

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DG GROW's Supply Chain Analytics Hub

Single Market Economics Briefs

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DG GROW's SUPPLY CHAIN ANALYTICS HUB[1]

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The EU gains resilience from being open and integrated in global value chains, but there are also associated risks likely to affect specific products and inputs that are particularly critical for the EU's society and economy.

It is crucial to enhance preparedness against all types of disruptions that could potentially impact supply chains through appropriate monitoring systems. This is the motivation behind **DG GROW's "Supply Chain Analytics Hub"**, which addresses both structural dynamics and real-time developments across supply chains. Examples of work undertaken under the Hub are presented below.

1. Monitoring and Anticipating Strategic Dependencies and Vulnerabilities

- Anticipating and monitoring the EU's strategic dependencies is essential because dependent products bear relatively higher risks in the event of supply chain disruptions.

- In 2021, as part of its Industry Policy Update, the European Commission developed a bottom-up methodology to assess EU product dependencies across sensitive industrial ecosystems (i.e. health, energy intensive industries, renewable energy, digital/electronics).[2] Recently, it was updated to reflect the latest data.[3]

- To identify foreign dependencies in sensitive industrial ecosystems, more than 5,000 products imported by the EU were reviewed. A product is considered as foreign dependent if it suffers from excessive concentration on foreign sources, significant scarcity within the EU and low possibilities for domestic substitution.

- On this basis, the latest update identifies 204 products where the EU faces foreign dependencies, which represent around 9.2% of the total extra-EU import value. China accounts for more than half of this value, followed by the US and Vietnam with 9% and 7%, respectively. In the number of dependent products, China is the first source for 64 of them, followed by the US with 38 and Russia with 15 (see Figure 1).

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(1) This brief was prepared for, and discussed by, the Working Party on Competitiveness and Growth (High Level) on 9 September 2025.

(2) See SWD(2021) 352 final.

(3) See Arjona et al. (2023): "An enhanced methodology to monitor the EU's strategic dependencies and vulnerabilities", European Commission, Single Market Economics Papers 14.

- Some examples include permanent magnets, nickel, rare earth metals, among others, which are all raw materials used for various green technologies, as well as more processed goods such as photovoltaic cells. In the health area, dependencies are identified in heterocyclic compounds, alkaloids, and medical devices (e.g. orthopaedic appliances), as well as COVID-related goods (e.g. surgical gloves). Digital dependencies include devices like laptops, smartphones, and monitors.

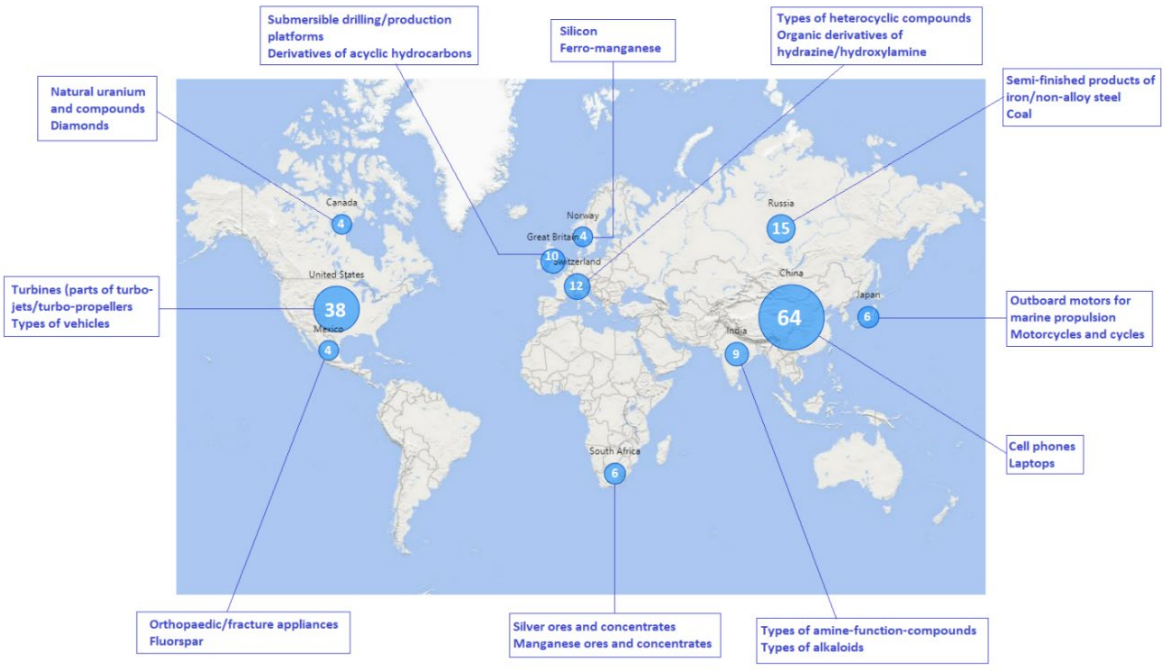
- Moreover, a subset of the 204 foreign dependent products is identified as being particularly vulnerable or subject to Single Points of Failure (SPOFs). This implies that the global production of these goods is concentrated in a few countries and the countries concentrating the global production are central to many other countries in a trade network. Of the 204 EU-dependent products, nearly 20% fall in the highest-risk category for SPOF, while only 6% are low risk. High-risk items include antibiotics, vitamins, medical devices, COVID-19 goods, laptops, mobile phones and LED lights.

- This methodology has been adopted and/ or tailored by various Member States to suit their national contexts. Countries such as Belgium,([4]) Finland,([5]) the Netherlands,([6]) Poland,([7]) Portugal,([8]) and Spain([9]) have conducted analyses of foreign dependencies using this approach. Countries such as Denmark have undertaken complementary approaches. The European Central Bank (ECB) also implemented this methodology.([10])

- The methodology is also applied to assess reverse dependencies with the EU's trading partners, highlighting not only where the EU depends on third countries but also where those countries rely on the EU. Furthermore, it enables the analysis of shared dependencies, whether broadly across third countries or in relation to specific partners.

(4) See Buysse et al. (2025): "De-risking European trade with China: Implications for Belgium", NBB Economic Review, No 7.
(5) See ETLA's report by Ali-Yrkkö et al. (2025). "How is Finland Responding to the Shifts in the Geopolitical Landscape?/Geopolitiikka muuttaa toimintaympäristöä. Mitä tekee Suomi?".
(6) See CBS report by Lemmers et al. (2023): "The supply chains of five industries": https://www.cbs.nl/-/media/_pdf/2023/42/zeggenschap_en_producten_in_toeleveringsketens.pdf and https://www.cbs.nl/-/media/_pdf/2023/42/aanvullende_informatie_producten.pdf.
(7) See Ambroziak et al. (2022), "The decade of economic resilience. From offshoring to partial friendshoring", Polish Economic Institute, Warsaw.
(8) See Almodovar et al (2025): "European Framework for Strategic Dependencies: insights from Portugal between 2019 and 2024", GEE Papers 189, Gabinete de Estratégia e Estudos, Ministério da Economia, revised Feb 2025.
(9) See Spain's National Office of Foresight and Strategy (2023): "Resilient EU 2030", NIPO: 089-23-024-6.
(10) See ECB (2023): "The EU's Open Strategic Autonomy from a central banking perspective - Challenges to the monetary policy landscape from a changing geopolitical environment", Occasional Paper Series 311, European Central Bank.

Figure 1: Mapping the origins of 204 dependent products, including examples



Source: Authors' computations based on the database - Trade-Figaro-Eurostat.

2. Measuring External Vulnerability through the EXVI

- The External Vulnerability Index (EXVI) is a composite indicator designed to assess external vulnerability across products, sectors, supply chains and the overall economy. It quantifies the economy's vulnerability to external shocks with scores ranging from 0 (low vulnerability) to 1 (high vulnerability).

- The index is built on two pillars: the first focuses on risks from foreign dependencies, examining the concentration of trade flows and reliance on foreign markets, while the second addresses risks from a weak global market position, evaluating competitive strengths and weaknesses through price differences and relative comparative advantages.([11])

- Based on the latest available data (2023), Table 1 shows that the EU is more exposed to external trade vulnerabilities than China, but less so than the United States.

- A closer examination of critical areas such as semiconductors, net-zero technologies and raw materials reveals that the EU is most vulnerable in raw materials. Moreover, the EU is more vulnerable than China in all three areas, and than the United States only in the semiconductor supply chain.

- Figure 2 shows that over time, the EU's vulnerabilities have been broadly stable across all areas, with the highest decrease observed in raw materials.

(11) See Connell and Ho (2025): "EXternal Vulnerability Index (EXVI)", European Commission, Single Market Economic Briefs 14.

- The EXVI has been adopted as a KPI in the Annual Single Market and Competitiveness Report, as well as for the Clean Industrial Deal.([12]) It has also been used by Member States([13]) and the private sector.([14])

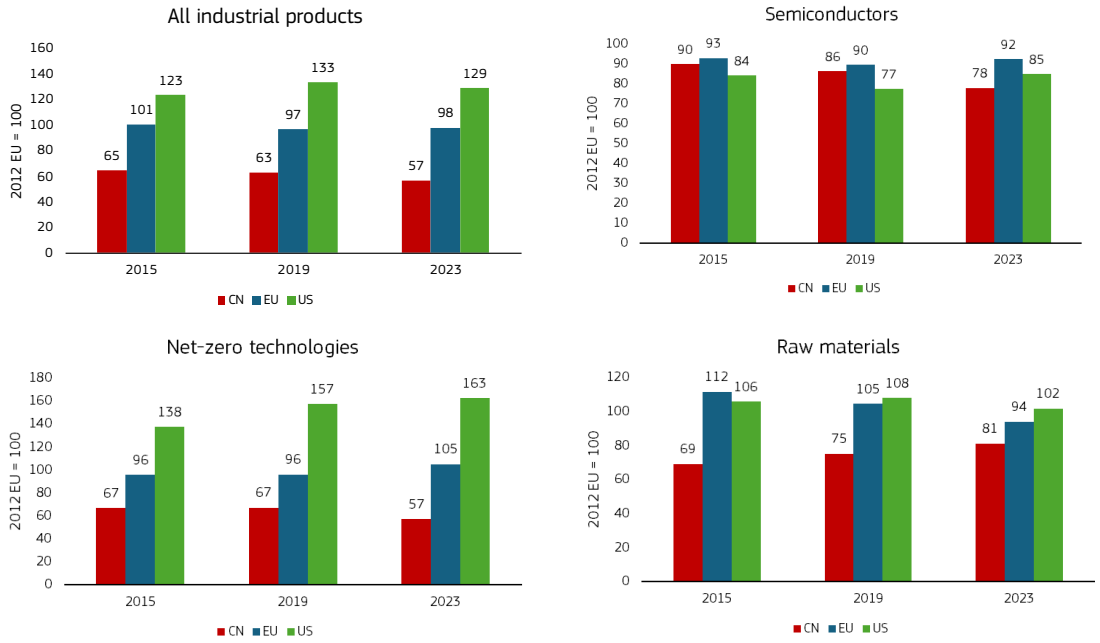
- The EXVI index is receiving positive uptake by Member States and stakeholders([15]).

Table 1: External Vulnerability Index (EXVI) of the EU, USA, and China across strategic supply chains

	Semiconductors	Net-zero technologies	Raw materials	All industrial products
EU	0.22	0.18	0.28	0.22
USA	0.20	0.28	0.31	0.29
China	0.18	0.10	0.24	0.13

Note: EXVI scores: 0 = low vulnerability; 1 = high vulnerability.
Source: DG GROW CET based on the BACI database (2023).

Figure 2: EXVI of the EU, USA and China over time across strategic supply chains



Source: DG GROW CET based on the BACI database (2023).

(12) See COM(2025) 85 final.
(13) See the example of Poland: The Polish economy and critical dependencies on imports - Trade.gov.pl.
(14) It is used as a KPI in the Monitoring Framework of the Antwerp Declaration.
(15) For example, it was recently adapted and used by The Economist's Intelligence Unit (EIU) for its Archimedean Trade Index: EU edition | Events | EIU.

3. Evaluating Supply Chain Distress through the SCAN Method

- Monitoring the ever-evolving situation of supply chain distress is crucial, to identify and assess possible critical disruptions as soon as first signs appear.

- While monitoring foreign dependencies can ex ante indicate areas where supply chain disruptions are likely to materialise, a solid early warning monitoring system to identify signs of distress in supply chains is also necessary.

- For this purpose, an indicator-based system has been built using very high-frequency information from customs data, which allows for a dynamic monitoring and captures early signals of distress in EU's supply chains.

- The "SCAN" (Supply Chain Alert Notification) system uses quasi-real time movements in import quantities and prices to signal possible mismatches between supply and demand - to identify pressures and possible signs of bottlenecks.([16])

- Two criteria are considered to identify the early signs of distress. The first scenario occurs when prices increase and the supply decreases, suggesting that there is a bottleneck in the supply chain that prevents the supply to adjust causing high price increases. The second scenario occurs when prices increase and, although the supply adjusts upwards, it does not adjust proportionately. This again results in inflationary pressures.

- "SCAN" also integrates the information provided through monitoring foreign dependencies to understand whether signs of distress are observed for product ex ante identified as being more prone to risks.

- This monitoring tool has been so far applied to raw materials necessary for the predominant designs of various green technologies (e.g. solar panels, batteries for electric vehicles, fuel cells, wind turbines).

- It has been used as part of the Chips Act (pillar III) to monitor components throughout its supply chain.([17]) The underlying methodology also informed other monitoring tools within the European Commission, such as the Import Surveillance Task Force, which monitors trade diversion risks amid increasing restrictive measures imposed by the EU's trading partners on each other.([18])

- As an illustration, Figures 3 and 4 below examine the prevalent raw materials used for the production of offshore and onshore wind turbines, respectively. It appears that there are no significant ongoing demand pressures on raw materials.

(16) See Amaral et al. (2022): "'SCAN' (Supply Chain Alert Notification) monitoring system", European Commission, Single Market Economics Papers 3.
(17) See Bonnet and Ciani (2023): "Applying the SCAN methodology to the Semiconductor Supply Chain", European Commission, JRC133736.
(18) See Monitoring Trade Diversion for more details.

Figure 3: Average of May/Apr/Mar 2025 is compared to the same period in 2024, 2023 and 2022 (offshore wind turbines)

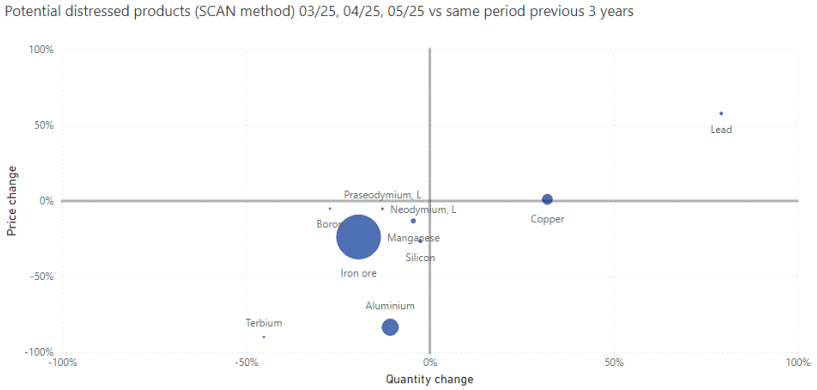
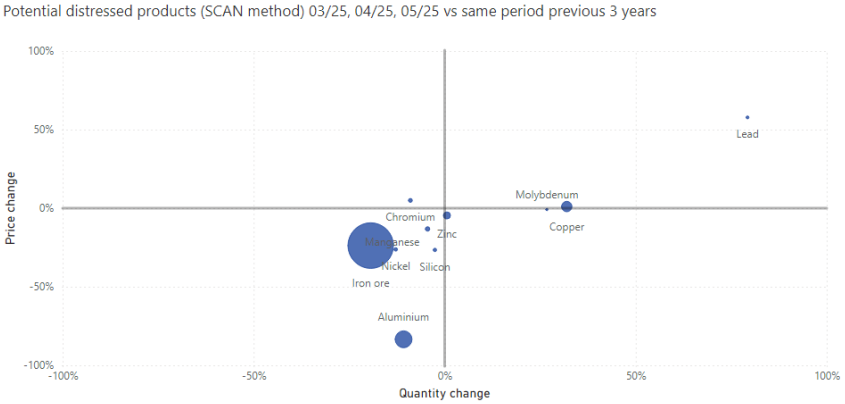


Figure 4: Average of May/Apr/Mar 2025 is compared to the same period in 2024, 2023 and 2022 (onshore wind turbines)



Source: GROW Chief Economist Team based on the European Commission's customs surveillance database. Two cases are distinguished: (1) raw materials displayed in quadrant II experience an increase in import price combined with a decrease in quantities imported, (2) raw materials displayed in quadrant I and above the 45-degree line experience a more important increase in import price compared to the increase in import quantities. The intensity of distress of a raw material can be measured by the distance to the "north-west" corner of quadrant II, where the closer the product is to this upper corner, the higher its potential distress. The size of the bubble represents the total quantity imported in the selected year (i.e. 2025).

4. Joint GROW-EIB Survey on Supply Chain Distress

- The Supply Chain Survey is a joint annual initiative between the European Investment Bank (EIB) and DG GROW. First launched in 2023 and repeated in 2024, it covers approximately 850 importers and exporters across the EU. The survey will continue to be conducted on a yearly basis.

- The survey aims to provide detailed insights into how EU firms manage their supply chains, including sourcing strategies, trade partner diversification, exposure to disruptions and adjustment measures. It captures firm-level data on obstacles to trade and expectations about future exports, offering a targeted view of how companies adapt to supply chain tensions within and beyond the EU.

- The latest wave of the survey shows that trade-related disruptions remained significant in 2024, though less severe than in 2023, with firms in basic manufacturing and construction less affected (Figures 5 and 6).

- Reported trade obstacles dropped notably between 2023 and 2024: access to raw materials declined from 33% to 17%, semiconductors from 18% to 9% and logistics disruptions from 33% to 19%.

- Intra-EU trade helped cushion firms from global tensions, as extra-EU importers faced more issues with logistics (22% vs. 14%), raw materials (18% vs. 15%) and semiconductors (10% vs. 7%).

- Firms dependent on essential inputs from China were more likely to report difficulties in accessing raw materials (20% vs. 12%) and semiconductors (19% vs. 11%) than firms importing essential inputs from other third countries.

- Several key aspects have emerged regarding firms' adjustment strategies. Digital tracking of inputs remained a key strategy in 2024, with around 25% of firms investing in such tools.

- Almost 75% of firms that adjusted their supply chains in 2024 had already done so in 2023, indicating that the strategy takes time to implement.

- Extra-EU importers were more likely to diversify trade partners than intra-EU firms (21% vs. 13%), with even higher rates among those importing from the US (29%) and China (33%).

- Among firms that diversify, 36% source only within the EU, while 46% combine EU and non-EU suppliers.

Figure 5: Major trade-related obstacles for EU importers (% of firms)

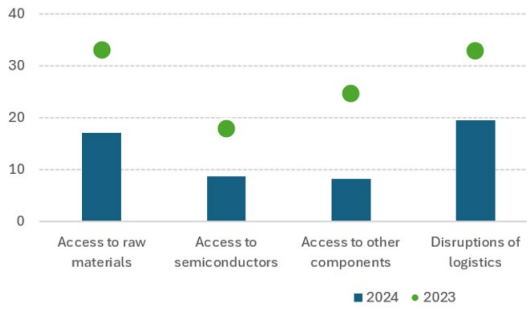
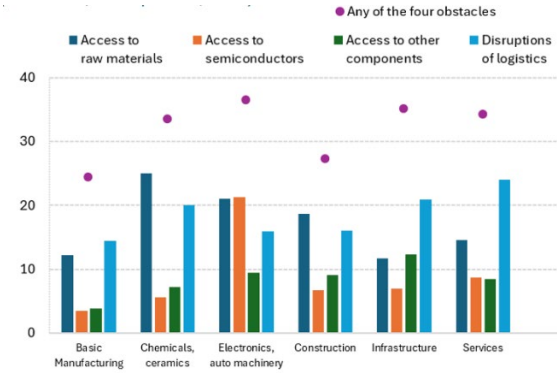


Figure 6: Supply chain tensions for EU importers, by sector (% of firms)



Source: GROW-EIB supply chain survey, "Shockwaves from turbulent times: how EU businesses recalibrate supply chains" (2025).

5. Supply Chain Tectonics: Monitoring the Reallocation of EU Supply Chains

- For decades, global supply chains enhanced EU efficiency through open markets and value chain integration. Considering recent crises and geopolitical risks, the EU is now recalibrating its trade and industrial strategies toward greater resilience, economic security and reduced strategic dependencies.

- This analysis explores the EU's evolving import sourcing strategy amid rising geopolitical tensions, with a focus on supply chain reorganisation, import diversification and price dynamics.([19]) Besides providing a general analysis, particular attention is given to critical sectors such as raw materials, semiconductors, net-zero technologies, as well as foreign-dependent products and single points of failure.

- To this end, countries are grouped into four categories based on trade agreements and geographical proximity: EU27, neighbouring agreement partners, non-neighbouring agreement partners and non-agreement partners (Figure 7).([20])

- Following the 2021 update of the EU's industrial and trade strategies, a shift in import sourcing is observed, with a reallocation towards EU27 and agreement partners. Between 2021 and 2023, the market share of non-agreement partners declined by 1.8 percentage points, while EU27 and agreement partners saw corresponding gains (Figure 8).

- However, this aggregate trend may mask product-level variations, particularly in high-value goods, an issue further examined through regression analysis controlling for product-specific characteristics. This analysis shows a clear reallocation of EU imports away from non-agreement partners towards the EU, indicating early signs of reshoring. This trend holds for sensitive supply chains, except for single points of failure.

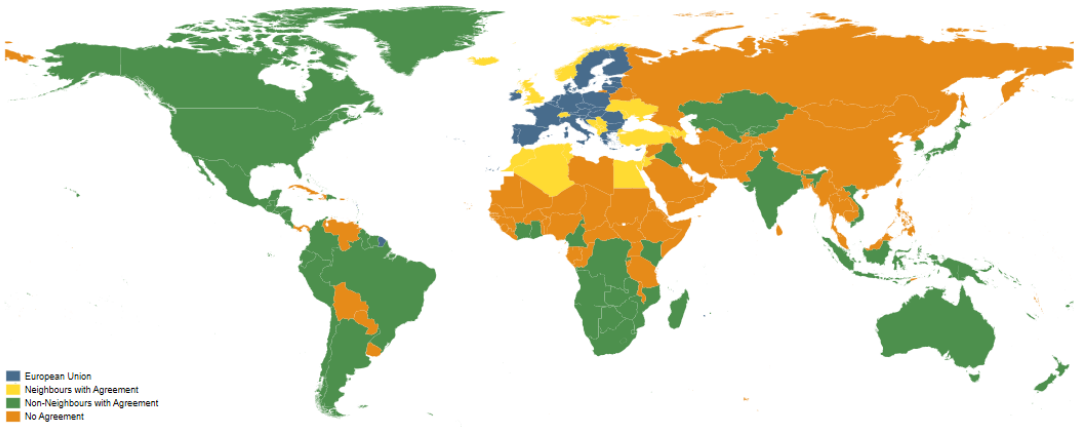
- Partner-shoring appears through increased sourcing from both nearby and distant agreement partners. In sensitive supply chains, nearshoring is seen for semiconductors, while far partner-shoring is evident for dependent goods and raw materials.

- The shift away from non-agreement partners leads to greater overall import diversification but also increased concentration among agreement partners, likely reflecting capacity constraints during the adjustment phase. Reallocation is also associated with rising unit prices, particularly from EU27 and distant agreement partners, indicating that enhancing resilience may entail short-term cost increases, though firms' adaptations could help ease these pressures over time.

(19) See Arjona et al. (2024): "Supply Chain Tectonics: Empirics on how the EU is plotting its path through global trade fragmentation", European Commission, Single Market Economics Papers 28.

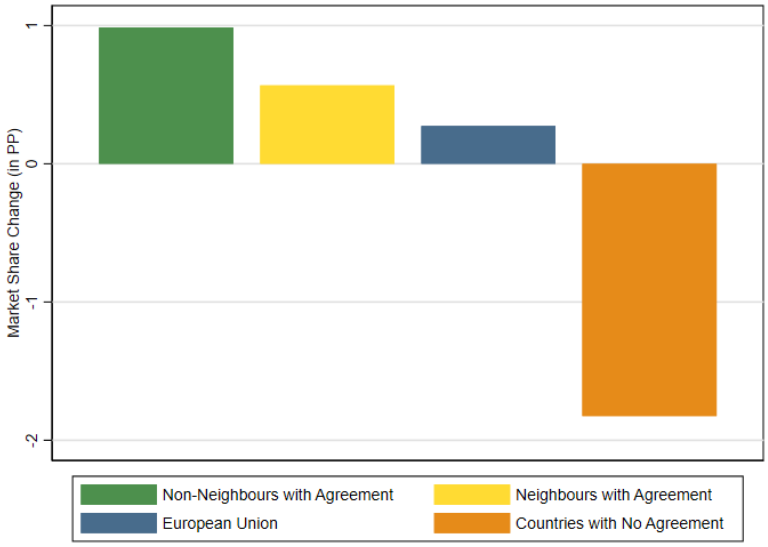
(20) This classification relies on the EU's various trade cooperation agreements. It includes countries with established or provisionally applied trade agreements and those that have recently signed Raw Material Partnerships or the 2022 Joint Statement on Cooperation on Global Supply Chains. In addition to the UK and EFTA countries, EU neighbours are identified using information on the European Neighbourhood Policy and Enlargement framework.

Figure 7: Distribution of countries in trading groups



Source: Arjona et al. (2024).

Figure 8: Changes in EU import market shares across trading groups for all products from 2021 to 2023



Source: Arjona et al. (2024) based on Eurostat-Comext.
Note: The graph shows the changes in market shares held by various trading groups in EU imports from 2021 to 2023 excluding energy-related products, measured in percentage points (pp).

6. Supply Chain Stress Testing

A. Stress testing value chains: A pilot case on wind power

- A novel approach to measure supply chain distress, specifically through stress-testing of supply chains, has also been proposed and is being extended.([21]) This is a "proof of concept" that focuses on the EU wind turbine manufacturing sector, and which uses the FactSet supply chain relationships database to simulate the impact of an external shock on supply chain dynamics. The paper chose to model

(21) See B. Dumont and X.-L. Varela-Irimia (2024): "Supply chain stress tests for critical inputs: a proof-of-concepts", European Commission, Single Market Economics Papers 27.

an export ban from China on rare earth materials, a scenario that would significantly disrupt the global supply chain of wind power manufacturers.

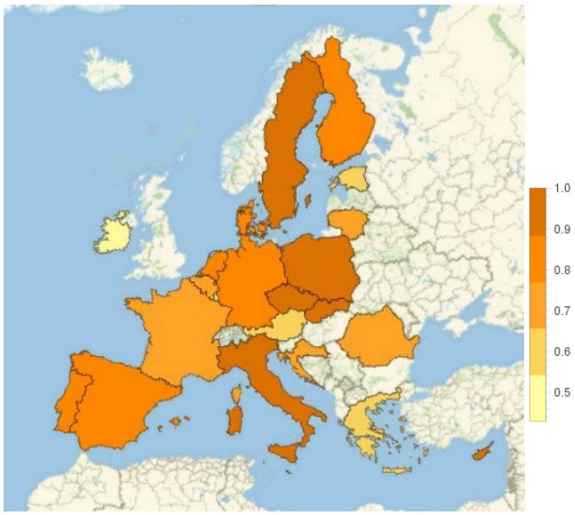
- From a conceptual perspective, the starting point is that each firm tends to focus on its optimal sourcing strategy, without necessarily considering the risks faced by its suppliers' suppliers. This creates an economic externality, where supply risk is transmitted from downstream firms, highlighting the interconnected nature of the supply chain. The study concentrates on four turbine manufacturing firms that collectively capture 90% of the EU market. To assess the resilience of these firms, the paper employs a Monte Carlo method that recursively iterates the network structure of the sector until convergence. This approach allows them to compute "resilience coefficients" for firms, which provide insights into their ability to withstand supply chain distress.

- The results displayed in Figure 9 show that the resilience of EU firms varies considerably, with those based in Ireland being the least resilient (coefficient of 0.5) while countries such as Czech Republic, Italy, Hungary, Poland and Sweden being the most resilient (resilience coefficients over 0.9). Notably, countries with substantial installed wind power capacity, such as Germany, Denmark, and Spain, occupy a middle position (resilience coefficient between 0.8 and 0.9). These results suggest that a uniform de-risking strategy may not be the most effective approach across the EU, highlighting the need for tailored policies that account for the unique characteristics of each member state.

- A closer examination of the four selected - and duly anonymised - firms reveals interesting dynamics. Figure 10 illustrates the difference between the partial and cumulative density functions of resilience coefficients computed for each firm in the Monte Carlo method. For firm C, the results show that key suppliers are affected by the shock upstream, leading to a rapid "contamination" of the firm. In contrast, firms A, B and D experience the shock after the 10th-20th iteration, indicating a delayed impact. This variation in response times underscores the complexity of supply chain interactions and the need for a nuanced understanding of these dynamics to develop effective risk mitigation strategies. By applying this stress-testing approach, policymakers and industry leaders can better anticipate and prepare for potential disruptions, enhancing the resilience of the EU wind power sector.

- This analysis is being expanded into other sectors and industries, by replicating the underpinning methodology.

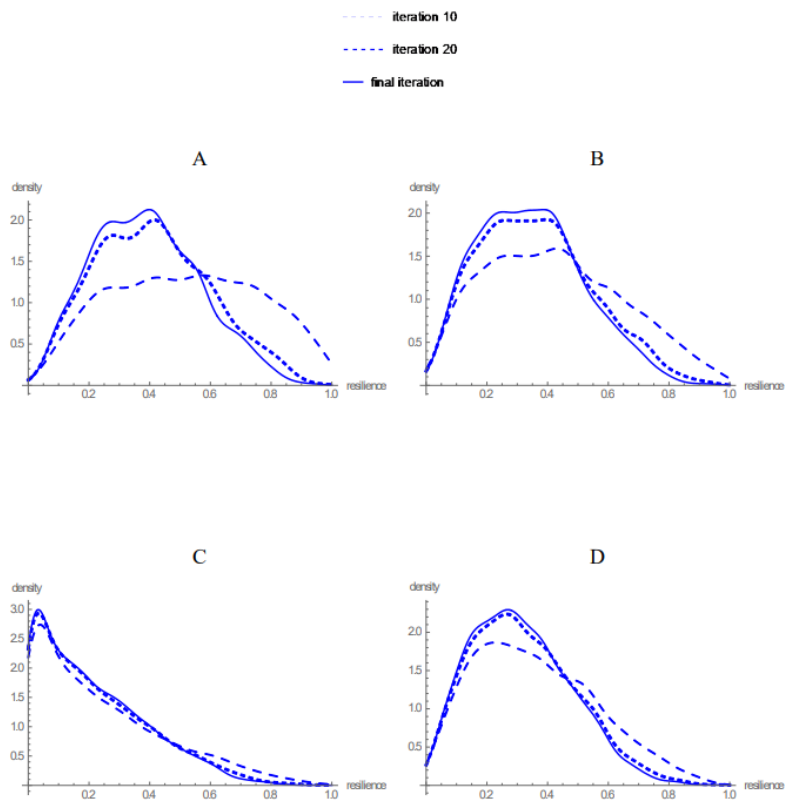
Figure 9: Changes in EU import market shares across trading groups for all products from 2021 to 2023



(those not coloured have no firms upstream the supply chain)

Source: B. Dumont and X.-L. Varela-Irimia (2024).

Figure 10: Distribution of the aggregate index of resilience at different iterations of the stress test



Source: B. Dumont and X.-L-. Varela-Irimia (2024).

B. Recreating supply chains: the joint GROW-OECD LIFT project

- The European Commission (DG GROW), in partnership with the OECD through the "LIFT" project,([22]) is proposing another novel method to recreate supply chains. This proposal involves the exploitation of highly disaggregated VAT invoicing data to study the microstructure of production networks.([23])

- This approach holds great promise, as VAT data exist in many countries and captures sales across nearly all firms, providing a wealth of information on networks and shock propagation. However, accessing this data can be challenging and institutional collaboration is necessary to overcome these limitations.

- A pilot study was conducted in 2024 using Estonian VAT data to gain insights into the Estonian supply chain universe. The Paper by Andrew Green and Louise Guillouet,([24]) merged customs and firm-to-firm VAT data to track the effects of the early Covid-19 lockdowns in China on the Estonian supply chains. The sample consisted of around 91,000 firms, with approximately 2,600 of them importing from China (Table 2). Notably, these China-importing firms were larger on average than those that did not import from China.

- The analysis revealed interesting dynamics. While prior to the shock, there were no significant differences between firms that imported from China and those that did not, this changed during the Covid period (with the maximum difference observed in April 2020), where the report finds that firms that bought from China experienced a 4% decline in sales compared to those that did not import from China, relative to November 2019. Furthermore, the sales and purchases of China-based sellers were heavily impacted by the Chinese lockdowns, as shown in Figures 11 and 12.

- The LIFT related work highlights the heterogeneous impact of shocks across firms and sectors. The findings suggest that policymakers should consider the diverse effects of supply chain disruptions on different firms and industries, rather than adopting a one-size-fits-all approach. By leveraging VAT data and conducting similar stress tests, policymakers can gain a better understanding of the complex interactions within production networks and develop more targeted and effective policies to mitigate the impact of shocks and support economic resilience.

- Further work is needed to extend these analyses to a greater number of Member States, enhancing the scope and impact of the joint GROW-OECD project: LIFT (Leveraging Inter-Firm Transactions).

(22) For more details, see LIFT: Leveraging Inter-Firm Transactions.
(23) See OECD (2025): "Transaction data for evidence-based industrial policy", OECD Science, Technology and Industry Policy Papers, No. 178, OECD Publishing, Paris.
(24) See Criscuolo et al. (2024): "Estonia's firm-level production network: Lessons for industrial policy", OECD Science, Technology and Industry Working Papers, No. 2024/13, OECD Publishing, Paris.

Table 2: China importers are larger than non-China importers in terms of some variables but similar in terms of domestic sales and domestic purchases.

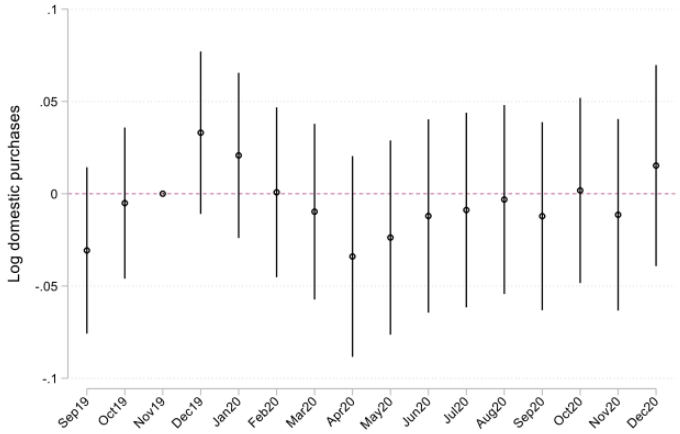
Summary statistics for all Estonian firms and the estimation sample, 2019

	Number of firms	Average in 2019							
		Employ-ment	Turnover	Domestic purchases	Imports	Share of imports in total purchases	Domestic sales	Exports	Share of exports in total sales
All Estonian firms	90,953	5	788,180	154,528	1,491,234	11%	154,528	1,324,901	10%
All importers	5,482	34	7,022,257	2,599,518	36,082,600	75%	2,762,929	27,979,170	33%
China importers	2,601	43	8,168,499	2,796,958	47,030,976	76%	2,800,389	33,245,598	35%
Non-China importers	2,881	27	5,987,416	2,421,076	26,187,726	73%	2,729,074	23,219,504	31%

Source: Green et al. (2025), "The transmission of foreign shocks to the Estonian production network", OECD Science, Technology and Industry Working Papers, No. 2025/12, OECD Publishing, Paris.

Figure 11: Dynamic impact of the early Chinese lockdowns on the domestic purchases of Estonian firms importing from China relative to other Estonian importers

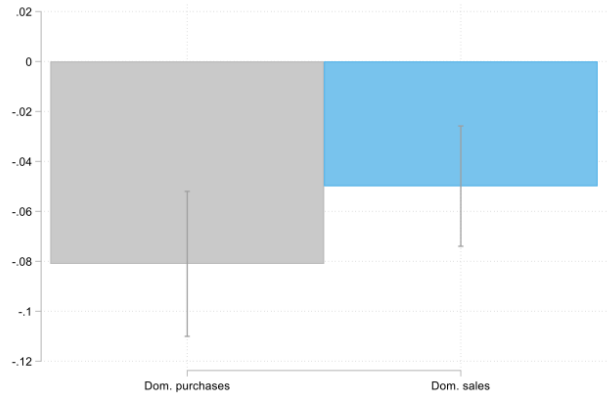
Monthly difference-in-differences coefficients and 95% confidence intervals obtained from estimating Equation 2 on domestic purchases.



Source: Green et al. (2025), "The transmission of foreign shocks to the Estonian production network", OECD Science, Technology and Industry Working Papers, No. 2025/12, OECD Publishing, Paris.

Figure 12: The domestic purchases and sales of Estonian firms buying from China importers were heavily impacted by the early Covid-19 lockdown in China.

Difference-in-differences (where the treatment is buying from a China importer and post is after February 2020) coefficients and 95% confidence intervals obtained by estimating Equation 1 on domestic purchases and sales.



Source: Green et al. (2025), "The transmission of foreign shocks to the Estonian production network", OECD Science, Technology and Industry Working Papers, No. 2025/12, OECD Publishing, Paris.

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