European Commission

Unravelling the territorial weave of trade: Assessing EU's vulnerability to US trade policy shifts towards China – *Territorial Development Insights Series*

HIGHLIGHTS

→ In her political guidelines, President Von der Leyen emphasised the significance of "Clean Trade and Investment Partnerships" to enhance competitiveness and decrease reliance on other world economic regions, while reinforcing trade defence mechanisms.

→ Within this policy context, this policy brief aims to help prioritising trade policy actions by unravelling the EU vulnerabilities and dependencies at three levels: EU, national and territorial, with a high industry detail.

→ This brief is focused on the possibility of a change in US trade defence policy towards China in light of the forthcoming US elections, which may affect EU exports to the US with high Chinese value added content.

→ At EU level, China accounted in recent years for around 18-27% of the foreign value added incorporated in the EU exports to US of motor vehicles, machinery and equipment and computer and electronics.

→ At national level, Germany and France alone cumulated more than half of the total Chinese value added content in the EU exports to US whereas other smaller Eastern European countries, such as Estonia or Hungary, showed high relative dependence levels.

→ At regional level, Stuttgart and Upper Bavaria (Germany), Ile-de-France (France), North Brabant (Netherlands) and the Southern, and Eastern and Midland regions (Ireland) accounted for half of the total Chinese value added content in EU exports to US.

→ Our findings can help informing upcoming preferential trade agreements and investment partnerships to be more effective in the regions and industries that would be more impacted by US trade policy shifts towards penalising the entrance of goods and services with high Chinese value added content.

BACKGROUND AND POLICY CONTEXT

Decades of globalisation and stable geopolitics have created inter-dependencies between country blocks and raised risks of supply disruptions. Although global value chains (GVCs) have led to efficiency and cost savings, they have also increased the countries' vulnerability to foreign suppliers and markets, now more visible due to recent changes in the worldwide geopolitical situation.

Indeed, the Russian's invasion of Ukraine, the rise in energy prices, the increasing protectionism of trade policy measures in China and United States[1] (US), among other events (e.g. WTO being questioned by

[1] In reaction to the increase in vulnerabilities and to reduce dependence from foreign partners, the United States shifted to a more protectionist stance on trade in 2017 under the Trump presidency (2017-2021). The negotiations of the Transatlantic Trade and Investment Partnership (TTIP) with the European Union (EU) were put on hold since then. Only after Trump's term, in 2021, the EU reached an agreement with US to temporarily suspend tariffs on certain goods, including aircraft and agricultural products, resolving a long-standing trade dispute between the two.

US), have changed the world scene and those (formerly beneficial) dependencies have slowly become EU vulnerabilities.

In addition, trade disruptions caused by the Covid-19 pandemic, geopolitical events and global financial turmoil have also impacted international trade. Specifically, concerning the Covid-19 pandemic impacts, trade disruptions caused an abrupt deviation of international trade from its pre-pandemic trend (European Central Bank, 2024). Furthermore, more than 8 in 10 firms in the EU have reported trade disruptions in recent years (European Investment Bank, 2023).

In particular, since 2018, escalating trade tensions between the US and China have persisted, with both countries implementing aggressive trade policies that show no immediate signs of abating. The China-US trade relationship remains complex as shown by the recent US policy measures banning American companies to invest in technology[2] in China and the promulgation of the CHIPS Act[3] (2022).

As a matter of fact, the rules of the game have changed worldwide in terms of trade and therefore, third countries' (e.g. US and China) trade policies can affect the European Union's (EU) economy as never seen before. Within this new geopolitical context, the European Commission has recently given a clear response by putting trade as one of the pillars[4] of the new economic foreign policy, together with economic security and investment in partnerships (e.g. "Clean Trade and Investment Partnership"). In addition, Draghi (2024) also suggested preferential trade and investment agreements as a way to ensure supply chains in old and new markets, clean energy and clean technologies.

There is no doubt that political decisions[5] in US and/or China can have collateral effects[6] in the EU and in EU countries but it is not less important the fact that they can affect differently to regions within the EU. For this reason, this policy brief pays attention to three levels of analysis: EU, national and regional level, with a high industrial detail.

In particular, our analysis looks into the heterogeneity of the Chinese value added content in EU exports to US, at EU, national and territorial levels. This provides for the first time further insights into the EU regions (and industries) that would potentially be affected most by US trade policy measures penalising goods produced in the EU with high Chinese value added content. Understanding such vulnerabilities (and in particular their industrial and territorial dimensions) is key for the design of a solid European trade policy.

MODEL AND DATA

CARMEN[7] is a new versatile model developed by the European Commission's JRC that allows for a wide range of policy relevant impact analyses at territorial and industrial level. For this policy brief, CARMEN[8] is developed in a modular approach allowing to analyse the (domestic and foreign) value added content of bilateral exports, at three levels: EU, national and regional, with a high detailed industrial breakdown.

CARMEN's main input is the FIGARO-REG[9] (García et al., 2023) multi-regional input-output (MRIO) table, a comprehensive economic database that covers 240 EU regions (NUTS2), 48 non-EU regions (Norway and United Kingdom), and 16 main non-EU trading actors, with data for 56 industries. It is fully consistent with the Eurostat's FIGARO (inter-country) input-output tables of the year 2017 (Remond-Tiedrez and Rueda-Cantuche, 2019).

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[2] These include advanced computing chips and microelectronics, quantum technology, and artificial intelligence.

[3] This Act aims to create internal incentives to produce semi-conductors and raising trade barriers to reduce US dependence on China. The future perspective of this process is not promising and threatens to escalate.

[4] The new European Commission's political guidelines prioritise boosting the EU's competitiveness at home and investing in research capacity for maintaining the Europe's trading power and economic openness. The focus is on a guaranteed supply of raw materials, clean energy and clean tech from across the world in the framework of the "Clean Trade and Investment Partnership".

[5] As, for instance, future US policy decisions coming up after the next US Presidential elections in late autumn 2024.

[6] The EU is the largest exporter of manufactured goods and services globally, amounting to around 16% of world exports, being US and China the EU's main trading partners, mainly in machinery, transport equipment, chemicals and food products.

[7] CARMEN is the acronym for: "Computable Analysis of the Regional Multipliers of the European ecoNomy".

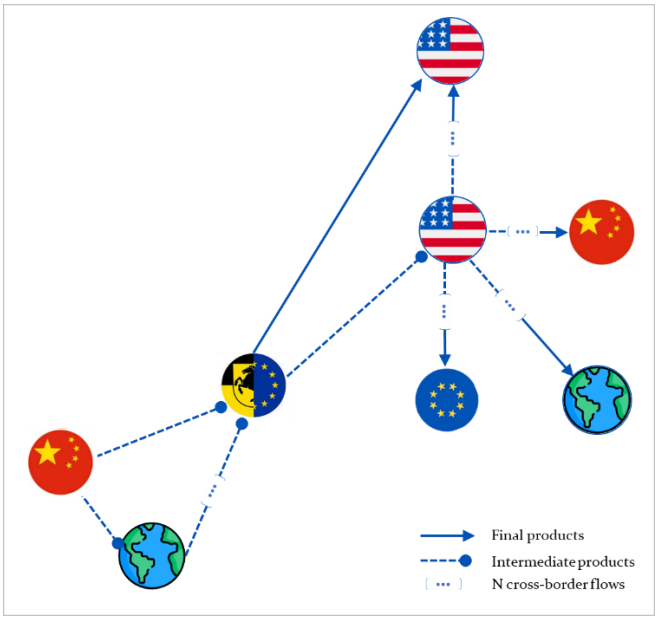
[8] Other CARMEN modules are related to the decomposition of regional value chains into intraregional and interregional effects (Rueda-Cantuche et al., 2024a) or the analysis of economic disruptions affecting the EU economy at regional level (Rueda-Cantuche et al, 2025b).

[9] These FIGARO-REG tables encompass a complete description of all bilateral trade flows between the above mentioned 288 regions, for intermediate and final uses, as well as with other non-EU countries.

CARMEN allows breaking down regional exports into domestic and foreign value added contents[10] accounting for both direct and indirect upstream linkages. The main added value of CARMEN is that it allows for a deep dive analysis of such linkages with a high level of granularity, at 56 industries, while keeping a regional perspective at 288 NUTS2 territories when analysing these impacts.

As illustrated in Figure 1, an EU region such as Stuttgart (Germany) can export goods and services to US generating the so-called domestic value added content of the Stuttgart's exports to US.

Figure 1 – Flow of Chinese value added content in the exports to US from a representative EU region (Stuttgart).



Source: Own elaboration.

In particular, Stuttgart can export goods for final use (e.g. Stuttgart's cars purchased by US residents) or exports of intermediate goods (e.g. Stuttgart's engines sold to US car manufacturers). In the latter case, these intermediate goods (e.g. engines) are used by US manufacturers to produce a car that can be purchased by either a resident in US, in any other region in the EU, in China or in the rest of the world[11].

Similarly, the cars and engines produced in Stuttgart and exported to US have used inputs (e.g. semiconductors, electrical batteries) from China and therefore, these inputs have Chinese value added content either because they were imported directly from China or from somewhere else that contained Chinese value added (see Figure 1).

Therefore, CARMEN stands out from other models because of its capacity to estimate the Chinese value added content of regional exports to US and provide very detailed results at industrial level for the EU, national and regional levels, as shown in this policy brief. As such, it enables an understanding of the potential impact[12] of specific third countries' protectionist measures (e.g. US trade policy measures to reduce dependence from China) that may have on industries in different EU regions, different EU countries and the EU as a whole. The next section presents the main results at three levels: EU, national and regional, with high detailed industry breakdown.

MAIN RESULTS

This section describes the results at EU, national and territorial levels (also by industries) to showcase the relevance of the territorial dimension and the heterogeneous economic structures of EU regions when designing EU trade policies in response to US-China commercial relationships.

Following Arto et al. (2019), we will focus on three indicators to know which regions contain more Chinese value added content in their exports to US:

- I1: Chinese value added content in each EU region's exports to US (in million Euros) – it measures dependence in absolute terms.
- I2: Share of Chinese value added content over each total EU region's exports to US – it measures dependence relative to exports.
- I3: Share of Chinese value added content over each total EU region's foreign value added content of their exports to US – it measures dependence relative to foreign suppliers (i.e. China)[13].

The three indicators should be interpreted as follows. In absolute terms (I1, in million Euros), the Chinese dependence of regions with high values may be overestimated because of the size of the country to

[10] This methodology can be found in Arto et al. (2019).

[11] This is a stylised example that can be expanded to many more production stages until reaching the production of the good for final use.

[12] We assume that there are no concurrent changes in variables such as prices, technology, or the elasticities of substitution. Therefore, the findings discussed here should be interpreted as a detailed snapshot of trade in terms of value added, rather than as an analysis of the effects of policy shocks on value added.

[13] This indicator will be used to sort the tables of results, given its relevance to explain the region's vulnerability to Chinese value added content in their exports to US.

which they belong to. Germany and France may surely report the highest values in million Euros. With such purpose, we also use I2 to complement the analysis and to know how much the share of Chinese value added content over the total regional exports to US is. However, I2 can also show high dependence on China but with wider variety of foreign suppliers. For this reason, foreign supplier diversification is measured by the third indicator I3. As a result, high values of I3 typically indicates high relevance of China as foreign supplier. For this reason, tables of results will be sorted by indicator I3 in what follows.

The total volume of regional exports can be split into domestic and foreign value added, namely value added generated in the corresponding area of interest and value added generated elsewhere, respectively. Both magnitudes are relevant for the global value chains analysis of the three different areas of interest: EU, national and territorial.

EU level

When considering the EU as a whole, the total foreign value added content in EU exports to US accounted for 57.460 million Euros in 2017, out of which 12.4% (=I3) came from China, resulting in 7.122 million Euros (=I1) and 1.7% (=I2) of total EU exports to US (see Table 1). This amount represents 13.8% of the total EU exports to US.

Table 1 – Top-ten EU industries exporting to US with highest share of value added content (sorted by I3).

Industry	I1 (Million €)	I2 (%)	I3 (%)
Textile and wearing apparel	237	4.3	29.3
Computer and electronics	825	5.0	26.7
Electrical equipment	351	3.6	25.7
Motor vehicles	1,311	3.2	20.4
Machinery and equipment	1,098	2.8	18.4
Other transport equipment	683	3.8	17.3
Repair/installation of machinery	42	1.7	16.0
Construction	20	1.4	15.0
Fabricated metal products	124	1.5	14.4
Wood and cork	17	1.1	14.2
…	…	…	…
European Union	**7,122**	**1.7**	**12.4**

Source: JRC based on CARMEN and FIGARO-REG.

Table 1 shows the top-ten EU industries exporting to US with the highest shares of Chinese value added content over their total foreign value added (sorted by I3). The Chinese value added content was above 25% (I3) in textiles and wearing apparel, computer and electronics and electrical equipment and a bit above 20% in the manufacture of motor vehicles. These industries also show high values for their shares over total exports (I2) except for Machinery and equipment, which suggests lower dependence on China, as foreign supplier, than in other industries such as electrical and equipment.

In million Euros (I1), the manufacture of machinery and equipment and the manufacture of motor vehicles accounted for one third of the total Chinese value added content of EU exports to US (2,409 million Euros), being them the industries potentially most affected in absolute terms.

National level: country-wise and industry-wise heterogeneity

This subsection provides insights into the Chinese dependence by EU country and exporting industry, thus showing the relevance of heterogeneity within the EU in evaluating strategic dependences. As shown in Table 2, Estonia and Hungary more than double the EU average, with a share of Chinese value added content in their exports to US of 27.2% and 25.9%, respectively, over their total foreign value added (I3). Poland and Czechia follow with around 20%. The same applies for Estonian and Hungarian shares of Chinese value added content in their total exports (I2), with 4.7% for Hungary and 4.5% for Estonia.

Table 2 – Top-ten EU countries exporting to US with highest share of value added content (sorted by I3)

Country	I1 (Million €)	I2 (%)	I3 (%)
Estonia	22	4.5	27.2
Hungary	182	4.7	25.9
Poland	120	1.6	20.8
Czechia	100	2.6	20.6
Germany	2,671	2.1	17.6
Slovenia	8	1.8	17.3
Slovakia	42	2.3	16.8
Austria	228	2.0	16.6
France	1,198	2.1	16.6
Italy	859	1.9	15.9
…	…	…	…
European Union	**7,122**	**1.7**	**12.4**

Source: JRC based on CARMEN and FIGARO-REG.

In million Euros (I1), Germany and France alone cumulate more than half of the total Chinese value added content in EU exports to US although the percentage of Chinese value added content in their total export is relatively limited (2.1%, in both cases).

By industry (see Table 3), the EU exports of computer and electronics to US stand out with the highest Chinese value added content in six EU Member States, namely Poland, Estonia, France, Hungary, Czechia and Finland, all of them above 34% of their total foreign value added content coming from China.

Table 3 – Top-ten industries by EU country exporting to US with highest share of value added content (sorted by I3)

Country	Industry	I1 (Million €)	I2 (%)	I3 (%)
Poland	Computer and electronics	18	9.4	41.4
Estonia	Computer and electronics	14	12.7	40.1
France	Computer and electronics	123	6.6	38.8
Hungary	Computer and electronics	71	11.7	37.6
Czechia	Computer and electronics	18	7.2	36.1
Czechia	Textile and wearing appare	2	5.8	35.9
Czechia	Paper and paper products	1	4.4	34.8
Finland	Computer and electronics	23	4.8	34.1
Poland	Textile and wearing appare	2	4.1	34.0
Estonia	Electrical equipment	2	7.3	33.3
...		...	...	...
European Union		**7,122**	**1.7**	**12.4**

Source: JRC based on CARMEN and FIGARO-REG.

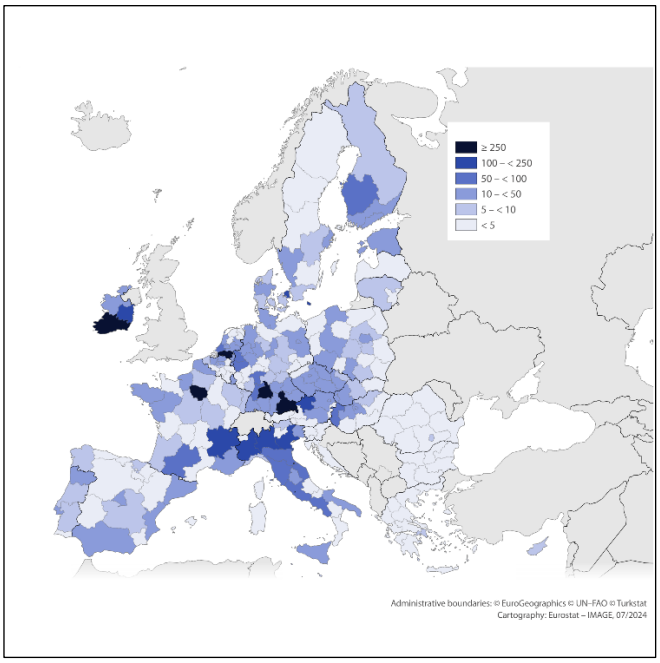
This fact reveals a high dependence of the EU computer and electronics manufacturing industry on the Chinese market independently of the size of the country or its economy structure. In this regard, computer and electronic products heavily rely on critical raw materials, with China being the global leader in producing many of them and serving as the primary global supplier for the EU in industries such as the manufacture of fabricated metals, chemicals, stone and glass, or plastic and rubber.

Territorial level: additional heterogeneity

Figure 2 displays the spatial distribution of the Chinese value added content in regional exports to US (I1), by regions. The largest values (dark blue) are associated with some German, Irish, and French regions followed by others in Italy, Netherlands, Austria and Denmark.

Two German regions (Stuttgart and Upper Bavaria) and one French region (Ile-de-France) accounted for 40% of the total Chinese value added content in EU exports to the US[14], amounting to around 2.800 million Euros. Despite its smaller size, the Southern, and Eastern and Midland Irish regions stood out with 466 million Euros of Chinese value added content in their exports to US[15], which could be explained by the relevance of digital companies in such regions of Ireland. However there are very low dependence shares in relative terms with respect to Ireland's total exports to US or the total foreign value added content of such exports.

Figure 2 – Map of Chinese value added content of EU region's exports to US (in million Euros – I1).



Source: JRC based on CARMEN and FIGARO-REG.

Other worth noting regions are North Brabant in the Netherlands, Lombardy, Veneto and Piedmont in Italy, Upper Austria in Austria, Hovedstaden in Denmark and Rhône-Alpes in France, all of which reported above 100 million Euros of Chinese value added content in their exports to US.

[14] Mercedes Benz and IBM in Stuttgart, BMW and Siemens in Upper Bavaria and Renault or Airbus in Ile-de-France are representative companies that belong to the main industrial exporters to US.

[15] Eastern and Midland stood out in computer programming, financial services and trade. Southern in manufacture of computers and machinery. Companies such as Amazon, Google, IBM, Microsoft or Oracle have their main European headquarters in Ireland.

Table 4 – Top-ten EU regions exporting to US with highest share of Chinese value added content (sorted by I3)

Region	I1 (Million €)	I2 (%)	I3 (%)
Budapest (HU)	47	4.5	31.6
Southeast (CZ)	21	3.5	27.9
Pest (HU)	22	4.9	27.4
Estonia (EE)	22	4.5	27.2
Warsaw metropolitan area (PL)	29	2.2	26.5
Western Transdanubia (HU)	71	5.9	26.5
Central Transdanubia (HU)	33	5.1	24.3
Lower Silesia (PL)	14	1.9	23.8
Piedmont (IT)	146	2.4	23.4
Lodz (PL)	6	1.5	23.0
...	...	...	...
European Union	**7,122**	**1.7**	**12.4**

Source: JRC based on CARMEN and FIGARO-REG.

Table 5 – Industries with high Chinese value added content in their exports to US, top-ten EU regions (sorted by I3)

Region - Industry	I1 (Million €)	I2 (%)	I3 (%)
Budapest (HU) - Computer and electronics	31	16.8	45.9
Southeast (CZ) - Machinery and equipment	6	4.6	31.2
Pest (HU) - Computer and electronics	17	10.9	36.4
Estonia (EE) - Computer and electronics	14	12.7	40.1
Warsaw metr. (PL) - Computer and electronics	5	13.1	50.8
Western Transdanubia (HU) - Motor vehicles	5	11.4	37.7
Ctl. Transdanubia (HU) - Computer and electronics	16	12.0	38.4
Lower Silesia (PL) - Computer and electronics	3	9.6	41.1
Piedmont (IT) - Motor vehicles	72	2.4	24.1
Lodz (PL) - Computer and electronics	2	8.1	41.2
...	...	...	...
European Union	**7,122**	**1.7**	**12.4**

Source: JRC based on CARMEN and FIGARO-REG.

Table 4 identifies the top-ten EU regions exporting to US with the highest share of Chinese value added content. There are four Hungarian regions, namely Budapest, Pest, Western Transdanubia and Central Transdanubia with shares between 31.6% and 24.3%, respectively. Besides, Estonia as a single region and Southeast in Czechia follow with shares close to 30% while other three Polish regions stood out as regions with high Chinese value added content in their exports to US, i.e. the Warsaw metropolitan area, Lower Silesia and Lodz (I2 and I3).

To better understand these results, Table 5 shows the industries with the highest Chinese value added content in their exports to US in each of the regions identified in Table 4.

As expected, the manufacturing of computer and electronics stood out as the industry with the highest Chinese value added content in its regional exports to US, as is the case for Budapest (Hungary), the Warsaw metropolitan area, Lower Silesia and Lodz (Poland), and Estonia[16] with shares of Chinese value added content above 40%. The production of this industry is typically used as input into other production processes such as the fabrication of components for motor vehicles in regions such as Stuttgart. Piedmont[17] in Italy (24%) and Western Transdanubia[18] in Hungary (37%) have a strong exporter automotive industry with high Chinese value added content in their exports of motor vehicles to US, too.

CONCLUSIONS

The manufacture of motor vehicles, machinery and equipment and computer and electronics would be the most affected industries in the EU if US commences a trade policy penalising the entrance of products with a high Chinese value added content. In particular, China accounted for around 18-27% of the foreign value added incorporated in the EU exports of those industries to the US.

In million Euros, Germany and France are the countries with the highest Chinese value added content since they alone cumulate more than half of the overall Chinese value added content in EU exports to US. However, other smaller Eastern European countries show higher dependence levels in relative terms, such as Estonia, Hungary, Poland and Czechia, for which 21-27% of the value of their exports is generated in China. At industry level, the Chinese value added content of the Polish exports of computer and electronic products to US can be as high as 41% and 40% in Estonia.

From the territorial viewpoint, six regions accumulate 50% of the Chinese value added content of EU exports to US, namely, Stuttgart (Germany), mainly in motor vehicles and machinery and equipment; Upper Bavaria (Germany), mainly in motor vehicles, computer and electronics and other transport equipment; Ile-de-France (France), mainly in other transport equipment and computer and electronics; North Brabant (Netherlands), mainly in machinery and equipment and computer and electronics; the Southern region (Ireland), mainly in computer and electronics; and the

[16] Bosch in Budapest, Elcoteq in Estonia, Samsung in Warsaw metropolitan area or Lodz in Poland are examples of industries located in these regions.

[17] Fiat, Ferrari and Iveco.

[18] Audi and Mercedes-Benz.

Eastern and Midland region (Ireland), mainly in computer programming, consultancy and related services, and financial services. In relative terms, other regions such as Budapest and Pest (Hungary), Southeast (Czechia), Estonia (as one single region) and the Warsaw metropolitan area (Poland) stood out as regions potentially most vulnerable to reductions in their exports to US.

These findings are unique in the sense that they provide for the first time a detailed snapshot of the exposure and vulnerabilities of the EU economy at three levels: EU, national and territorial, also with a detailed industry coverage, that can unravel the territorial weave of trade when third countries' trade policies (e.g. US) penalise the entrance of goods and services with high value added content of other country (e.g. China).

This policy brief can help informing upcoming preferential trade agreements, and investment partnerships to secure supply of raw materials, clean energy and clean technologies from across the world (von der Leyen, 2024; Draghi, 2024) and, at the same time, boost competitiveness and fostering investments in those regions and industries potentially most affected by third countries' protectionist trade policies. For this purpose the use of data and empirical evidence is crucial to inform upcoming trade policy making in the near future.

READ MORE

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CONTACT INFORMATION

simone.salotti@ec.europa.eu

EU Science Hub — joint-research-centre.ec.europa.eu

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