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Understanding EU-China economic exposure

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FRANK VANDERMEEREN

EUROPEAN COMMISSION

Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
Directorate A – Strategy & Economic Analysis
Unit A1 – Chief Economist Unit

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Contact: Frank Vandermeeren

E-mail: Frank.VANDERMEEREN@ec.europa.eu

*European Commission
B-1049 Brussels*

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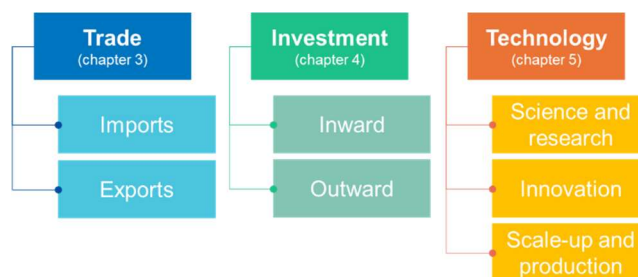
1. Introduction

The EU is operating an increasingly complex geopolitical environment. It has been confronting a sequence of shocks, including the COVID-19 pandemic and the Russian aggression against Ukraine. Geopolitical tensions are on the rise, with global actors – notably China and the US – deploying aggressive strategies to secure investments and technology leadership. Trade disruptions are increasingly likely and the risk of weaponization by third countries of the EU’s strategic dependencies results in economic security concerns.¹

In this context, the EU aims to de-risk – not de-couple – from China. On 30 March 2023, the Commission President put forward a vision on how the EU should navigate this complex reality, in particular when it comes to its relationship with China: de-risk, not de-couple.² The 2023 State of the Union³ later reiterated this, highlighting that “*there are topics, where we can and have to cooperate*” but also “*why it is so important for Europe to step up on economic security*”.

De-risking requires understanding exposure. Having set the course of action, it is important to understand “where” and “how” to implement a de-risking strategy. Recent initiatives focusing on net-zero industries⁴ and critical raw materials⁵ already provide a partial answer. Still, a careful approach to de-risking requires a good understanding of the areas where and forms in which the EU is exposed economically to China. This economic brief aims to provide a contribution to this.⁶ The purpose is not to be exhaustive, but rather highlight different angles of the EU’s exposure to China based on analytical evidence. Finally, exposure does not necessarily require policy action. Whether and how to de-risk is not the focus of this economic brief.

Figure 1 – Channels of economic exposure assessed in this economic brief



Source: Author’s elaborations

The EU’s exposure to China takes different forms. Much of the debate on EU exposure to China focuses on imports of strategic products. This is understandable, as these have been at the origin of recent disruptions. Still, there are other forms of exposure. While potentially less prone to immediate supply chain problems, their possible adverse effects can be equally important in the medium to long term. This economic brief looks at three channels of exposure, each with their own set of underlying drivers: trade, investment and technology. It will show the complexity of assessing exposure, including since part of it may be indirect.

¹ See for example T. Gomart and S. Jean (2023): “Impossible Decoupling, Improbable Cooperation: Economic Interdependencies in the Face of Power Rivalries”, IFRI

² Speech by President von der Leyen on EU-China relations to the Mercator Institute for China Studies and the European Policy Centre (30 March 2023)

³ 2023 State of the Union Address by President von der Leyen (13 September 2023)

⁴ COM(2023)161, SWD(2023)68

⁵ COM(2023)160, SWD(2023)160, SWD(2023)161, SWD(2023)162, SEC(2023)360

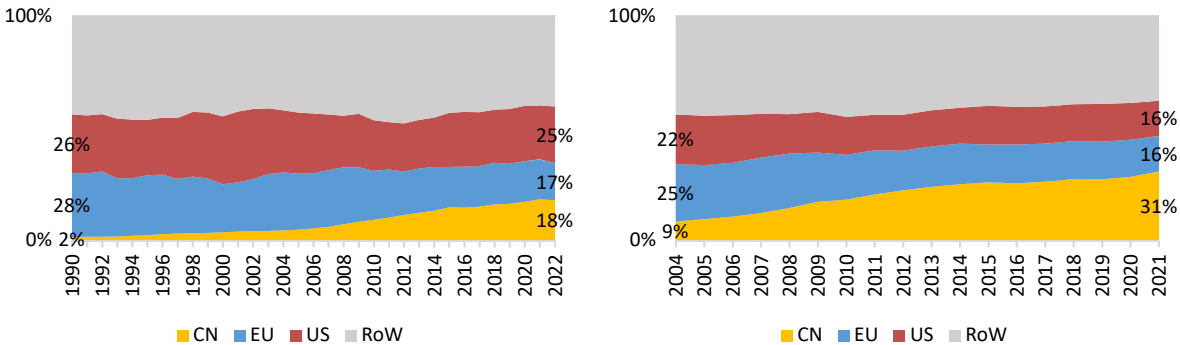
⁶ Complementing e.g. European Commission Joint Research Centre (2022): “Status and Foresight of EU-China Trade, Investment, and Technological Race”

Before assessing these different types of exposure, chapter 2 provides a few general observations.

2. EU-China economic relations: the « big picture »

China is today a larger economy than the EU and a global leader in manufacturing. An important part of the EU's increased exposure to China is the logical result of China's explosive economic growth over the past two decades. The total size of the Chinese economy (18% of global GDP) is larger than the EU (17%), although still behind the US (25%). The total value added produced by the Chinese manufacturing sector (a 31% global share) is about equal to that of the US and EU combined.

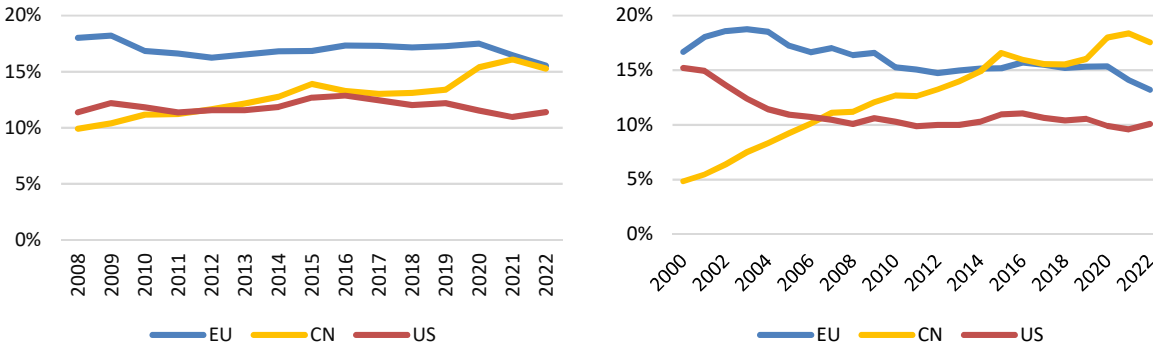
Figure 2 – Share of GDP (left, 1990-2022); share of manufacturing value added (right, 2004-2021)



Source: Author's elaborations based on World Bank
 Note: GDP and value added in current prices

China has gradually become “the world’s factory”. Parallel to its economic growth, China has rapidly become the leading global goods exporter (from 5% of global exports in 2000 to 18% in 2022). At the same time, the EU is still the world’s number one global exporter (as of 2022) thanks to stronger services exports. This prominent position in international trade (about equal to China, but significantly ahead of the US) continues as a strongpoint for the EU in an increasingly competitive and complex geopolitical environment.

Figure 3 – Share of world trade: total (left – 2008-2022); goods (right – 2000-2022)



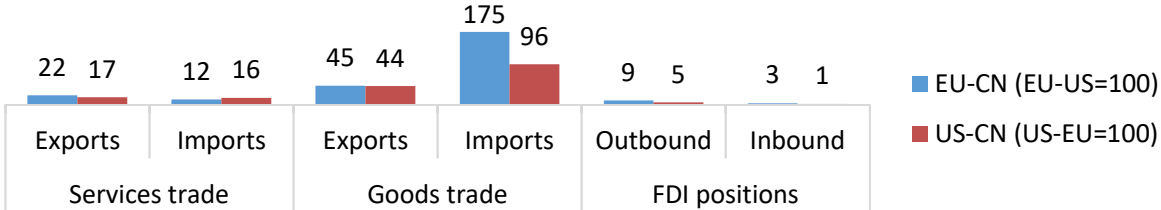
Source: Author's elaborations based on WTO

At the same time, Chinese economic growth is under pressure. China’s key role in today’s global economy makes that a possibly structural deceleration of its domestic economy would have important implications for the EU and the rest the world. The Chinese economy is facing important long-term issues such as declining productivity growth, rising public and private debt and an ageing population. On top of that, recent challenges include

falling exports, a deep real-estate crisis, high youth unemployment, low infrastructure investment and possible scarring effects from the COVID-19 pandemic.⁷ China's growth has slowed and may fall further. While once considered a near certainty, it now seems that China may not surpass the US in terms of GDP anytime soon.

Despite increased exposure to China, the US remains the EU's most important economic partner. At an aggregate level, the US is still the EU's main economic partner as of today (Figure 4).⁸ Only for imports of goods, China stands out as more important for the EU in relative terms than the US. In other dimensions (goods exports, services imports and exports as well as inward and outward FDI), the EU-US relation is significantly more intense. A similar picture exists from the perspective of the US, with the EU as a more important economic partner across all dimensions considered.

Figure 4 – Relative importance of trade and FDI of EU/US with CN (2022, US/EU indexed at 100)

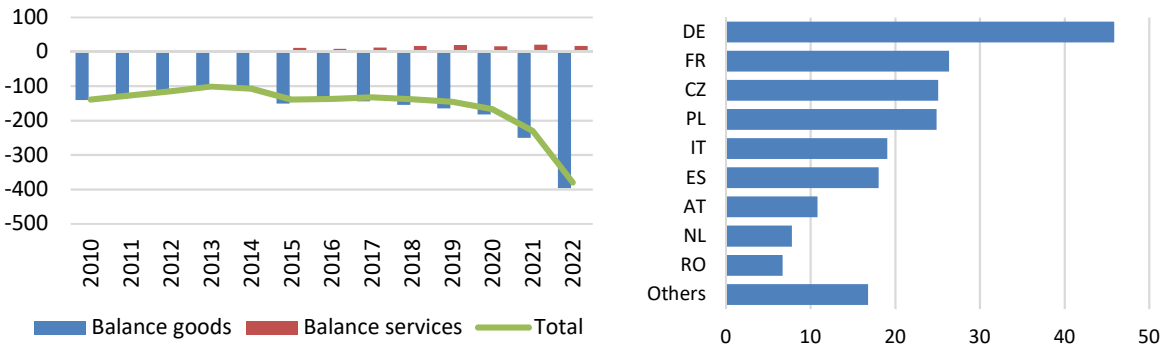


Source: Author's elaborations based on Eurostat and US Bureau of Economic Analysis
 Note: Shows the importance of the EU (US) relation with China relative to that with the US (EU). EU FDI data is for 2021.

3. Trade

The EU's trade deficit with China has increased to an all-time high in 2022. While relatively steady over the last decade, the EU's trade balance with China has significantly deteriorated since the start of the COVID-19 pandemic (amounting to a deficit of almost 400 billion EUR in 2022). It results from a quickly increasing deficit in the area of goods, with the EU's trade surplus in the area of services being only marginal in comparison.

Figure 5 – EU-China trade balance in services and goods (left: billion EUR) and trade deficit per Member State (right: goods; billion EUR, 2021)



Source: GROW A1 based on Eurostat COMEXT (left) and Figaro (right)
 Note: Figaro data accounts for re-exports (important e.g. for the Netherlands, where the "Rotterdam effect" is substantial)

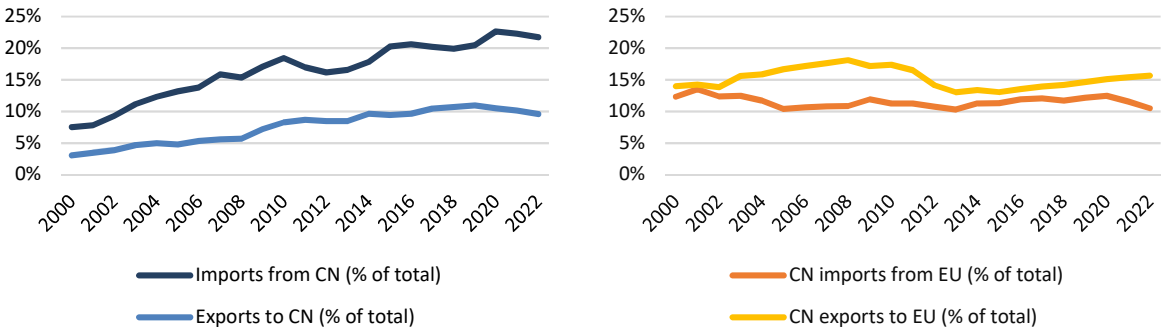
This massive trade deficit with China in goods has also been the main driver behind the record-low total extra-EU trade in goods balance in 2022 (around 430 billion EUR deficit). The worsening EU-China trade balance over the last 3 years has been particularly important for Germany, which traditionally exhibited a relatively moderate trade deficit with China but

⁷ See for example also Alicia García-Herrero (2023): "Can Chinese growth defy gravity?", Bruegel
⁸ See also M. J. Zenglein (2020): "Mapping and recalibrating Europe's economic interdependence with China", Merics

now has the highest deficit of all Member States. In this context, the EU has recently raised concerns publicly regarding a growing imbalance in its relationship with China.⁹

The EU’s direct trade exposure to China has grown over the past two decades, while Chinese exposure to the EU is stable. The EU’s direct import and export exposure to China has about tripled since 2000 (from 8% to 22% and 3% to 10%, respectively). China on the other hand kept its exposure to the EU stable over the last twenty years, both as an export market and as a source of imports.

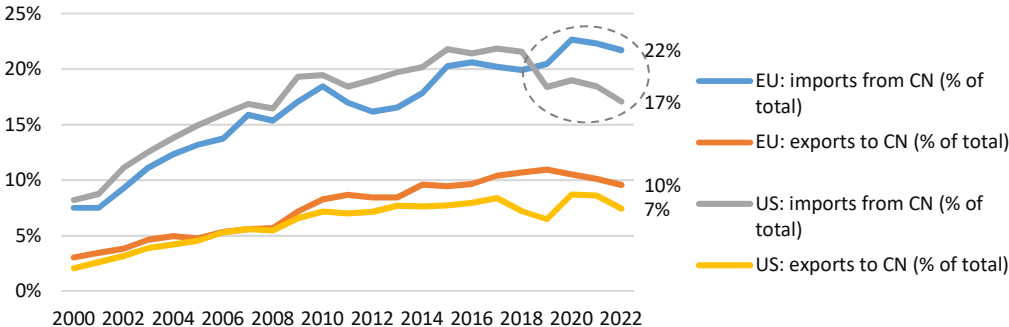
Figure 6 – EU direct trade exposure to China (left; goods, 2000-2022), CN direct trade exposure to EU (right; goods, 2000-2022)



Source: Author’s elaborations based on COMTRADE

In contrast with the EU, the US has already significantly reduced its direct trade exposure to Chinese imports. The EU is today more exposed to China than the US, for both imports and exports (Figure 7). The US has been decreasing its direct import exposure to China over the last five years, since the introduction of extensive tariffs on Chinese imports by President Trump.¹⁰ China’s share of US goods imports declined from 22% in 2018 to 17% in 2022.¹¹ Japan – another country actively managing its dependence on China¹² – may be on a similar trajectory, having reduced its import exposure on China from 26% in 2016 to 21% in 2022.

Figure 7 – EU and US direct trade exposure to China (goods, 2000-2022)



Source: Author’s elaborations based on COMTRADE

Still, things may not be that straightforward. One caveat regarding these trends is that diversification in direct trade may not translate fully in reduced exposure, as China may still be an important supplier in the upstream part of the value chain. It is interesting to see, for

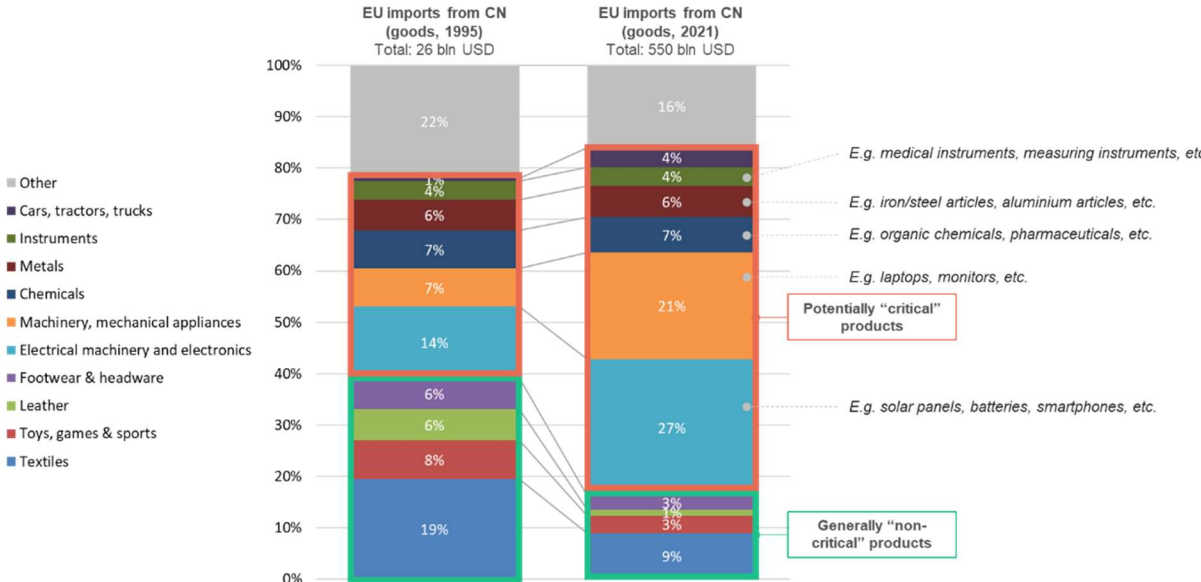
⁹ Statements by Executive Vice-President Dombrovskis following the 10th EU China High-Level Economic and Trade Dialogue (25 September 2023) and President von der Leyen at the 24th EU-China Summit (7 December 2023)
¹⁰ And later continued under President Biden. C. P. Bown (2022): “Four years into the trade war, are the US and China decoupling?”, Peterson Institute for International Economics
¹¹ See e.g. also DHL Global Connectedness Index (2023): “Globalization resilient even as US-China decoupling advances”; Goldman Sachs (2023): “US-China: More decoupling ahead?”
¹² A. Adachi, K. Shigenoi (2022): “Japan’s Chinese lesson – diversifying only production is not enough”, Merics

example, that in parallel to US diversification towards Mexico and Vietnam there has been a deepening in economic ties between these two countries and China.¹³ China indeed aims to reduce its own exposure, through diversifying or “friendshoring” its export markets. The EU’s de-risking strategy may therefore need to consider exposure across the value chain, looking beyond direct trade.

3.1 Imports

The EU’s increased import exposure to China originates in two broad drivers: quantity and quality. In terms of quantity, over the past two decades EU imports from China increased almost three times faster than imports from the rest of the world. In parallel, the composition of these imports has become decidedly more “strategic” (Figure 8). In 1995, textiles, shoes, toys, furniture and leather articles represented about 40% of EU imports from China. Today, imports from China have shifted towards product groups of a more critical nature, from electronics to pharmaceutical ingredients.

Figure 8 – EU imports from China composition (goods, 1995-2021)

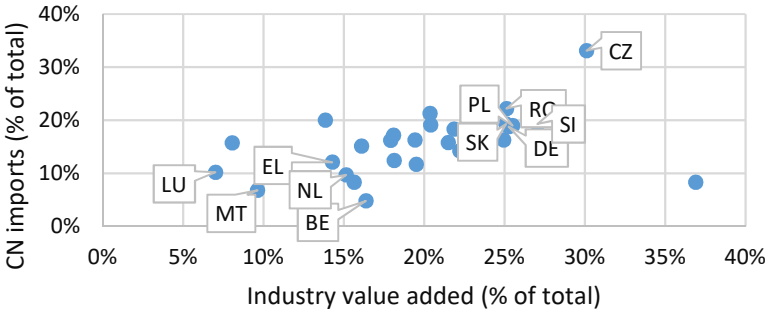


Source: Author’s elaborations based on Observatory of Economic Complexity

Member States with more industry-oriented economies typically exhibit higher exposure to Chinese imports. This is the case for Member States such as the Czech Republic’s (33% of total Czech extra-EU imports originate in China), Romania, Poland, Slovenia, Slovakia and Germany, underlining the important role of China as source of inputs for EU industry. Member States more oriented towards services (e.g. Belgium, Netherlands, Greece) are generally less exposed to China in terms of direct imports. Generally, the relatively strong reliance of certain large Member States on Chinese imports also highlights the importance of the EU as an export destination for Chinese companies. This may become even more relevant, as certain parts of Chinese production find it increasingly difficult (or even impossible) to access certain markets such as the US or Japan.

¹³ A. Kratz, C. Boullenois (2023): “Irrational Expectations: Long-Term Challenges of Diversification Away from China”, Rhodium Group

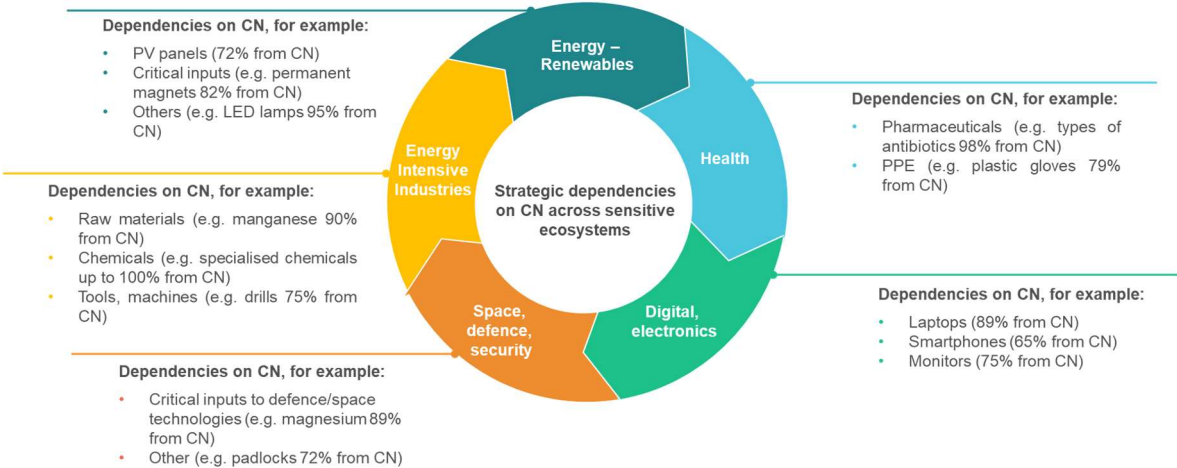
Figure 9 – Industry value added (% of total) versus relative importance of Chinese goods imports (as % of extra-EU goods imports)



Source: Author’s elaborations based on Eurostat (Figaro database and national accounts); data is 2015-2020 averages
 Note: Figaro data accounts for re-exports (important e.g. for the Netherlands, where the “Rotterdam effect” is substantial)

China is the main source of the EU’s strategic product dependencies. A recently updated bottom-up analysis identified 204 products in sensitive industrial ecosystems for which the EU can be considered dependent on third countries.¹⁴ China is by far the main origin of these dependencies: it is the main source for approximately one third of the 204 identified products (64 goods) and represents more than half of the total import value of these products.

Figure 10 – Examples of EU strategic dependencies on China across sensitive ecosystems

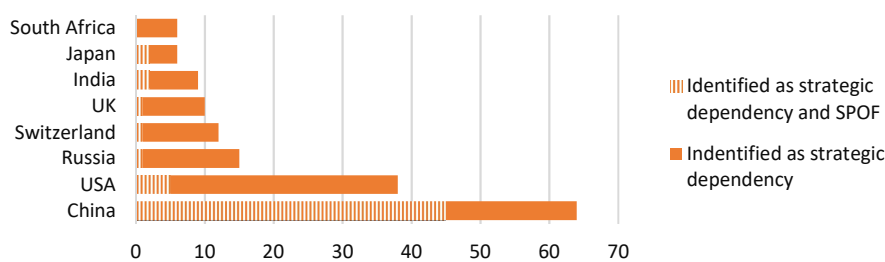


Source: Author’s elaborations based on R. Arjona, W. Connell, C. Herghelegiu (2023): “An enhanced methodology to monitor the EU’s strategic dependencies and vulnerabilities”, Single Market Economy Papers

The EU’s strategic dependencies on China exist across different sensitive industrial ecosystems. Only looking at a few examples (Figure 10) allows understanding the wide variety of the EU’s strategic dependencies on China. They range from solar panels (renewables ecosystem) to different types of pharmaceuticals (health), laptops (electronics), critical inputs for space technologies (defence, space and security) and critical raw materials and chemicals (energy intensive industries). For some specific products, the EU’s import concentration on China is at very high levels of 90% and more (e.g. certain pharmaceuticals, chemicals, raw materials). Together, the wide scope in the nature and type of dependencies (“where to start?”) and deep levels of reliance on China in specific cases (“how to diversify?”) underline the complexity of de-risking import dependencies from China.

¹⁴ R. Arjona, W. Connell, C. Herghelegiu (2023): “An enhanced methodology to monitor the EU’s strategic dependencies and vulnerabilities”, Single Market Economy Papers

Figure 11 – Identified strategic dependencies and single points of failure (SPOFs)



Source: R. Arjona, W. Connell, C. Herghelegiu (2023): “An enhanced methodology to monitor the EU’s strategic dependencies and vulnerabilities”, Single Market Economy Papers

The majority of the EU’s strategic dependencies on China present particularly high risks as global single points of failure (“SPOFS”). SPOFS are dependencies that in addition exhibit (1) an exporter being central to a large number of countries in a trade network and (2) world exports being highly concentrated. They add an additional layer of risk and vulnerability. Contrary to the EU’s dependencies with other third countries, the large majority of the EU’s dependencies on China are indeed also SPOFs (Figure 11). Examples include magnesium, permanent magnets, certain antibiotics and hormones, PV cells, laptops and smartphones.

Figure 12 – Exposure to China through international supply chains (trade in value added)

		Exposure to China’s inputs through international supply chains																											
		EU27	PT	HR	LV	LT	RO	BE	CY	IT	BG	LU	SE	AT	DK	EL	FR	IE	ES	MT	DE	FI	HU	NL	SI	SK	PL	EE	CZ
DTOTAL	TOTAL	2.0	1.3	1.5	1.5	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.8	1.9	1.9	1.9	1.9	2.0	2.1	2.2	2.2	2.2	2.2	2.4	2.4	3.2	3.3	3.4	
D05T39	Total industry (mining, manufactures and utilities)	1.1	3.4	3.1	3.5	3.3	3.4	4.6	4.4	4.3	3.9	5.6	4.8	4.7	5.2	5.0	6.0	4.6	5.5	4.9	5.1	5.3	4.9	6.7	5.5	5.0	6.5	7.2	7.0
D45T98	Total services	1.1																											
D1NFO	Information industries	4.0																											
D01T02	Agriculture, hunting, forestry	5.0																											
D03	Fishing and aquaculture	6.5																											
D05T06	Mining and quarrying, energy producing products	3.0																											
D07T08	Mining and quarrying, non-energy producing products	6.0																											
D09	Mining support service activities	2.1																											
D10T12	Food products, beverages and tobacco	2.0																											
D13T15	Textiles, wearing apparel, leather and related products	19.6																											
D16	Wood and products of wood and cork	3.9																											
D17T18	Paper products and printing	3.9																											
D19	Coke and refined petroleum products	5.5																											
D20	Chemical and chemical products	9.3																											
D21	Pharmaceuticals, medicinal chemical and botanical products	2.0																											
D22	Rubber and plastics products	5.5																											
D23	Other non-metallic mineral products	6.4																											
D24	Basic metals	14.1																											
D25	Fabricated metal products	4.8																											
D26	Computer, electronic and optical products	16.9																											
D27	Electrical equipment	10.3																											
D28	Machinery and equipment n.e.c	4.3																											
D29	Motor vehicles, trailers and semi-trailers	1.6																											
D30	Other transport equipment	3.0																											
D31T33	Manufacturing nec; repair, installation of machinery & equipment	4.2																											
D35	Electricity, gas, steam and air conditioning supply	2.5																											
D36T39	Water supply; sewerage, waste mgmt, remediation activities	1.0																											
D41T43	Construction	0.0																											
D45T47	Wholesale and retail trade; repair of motor vehicles	2.4																											
D49	Land transport and transport via pipelines	3.9																											
D50	Water transport	5.8																											
D51	Air transport	3.7																											
D52	Warehousing and support activities for transportation	2.2																											
D53	Postal and courier activities	2.2																											
D55T56	Accommodation and food service activities	0.8																											
D58T60	Publishing, audiovisual and broadcasting activities	1.1																											
D61	Telecommunications	0.8																											
D62T63	Computer programming, consultancy, information services	2.4																											
D64T66	Financial and insurance activities	2.5																											
D68	Real estate activities	0.3																											
D69T75	Professional, scientific and technical activities	0.8																											
D77T82	Administrative and support services activities	1.5																											

Source: GROW A1 based on OECD TiVA (2018 data)

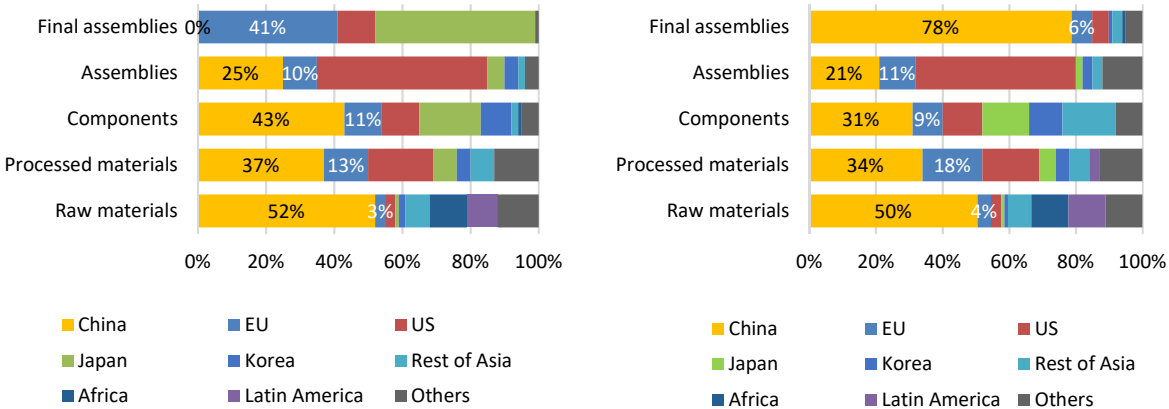
Note: Shows the contribution of Chinese inputs as a source of value added in EU production, per sector and Member State.

An increasing amount of value added produced in the EU originates in Chinese inputs. Now taking the value chain perspective (i.e. looking beyond direct imports)¹⁵, data on trade in value added confirms the important role of China as a source of value added embedded in EU production (Figure 12). Exposure to Chinese inputs across international supply chains is particularly strong for EU industries such as basic metals, chemicals, electronics and electrical equipment and in industry-oriented Member States. Generally, in services the relevance of Chinese inputs is low (with the exception of water transport services where China is an important producer, for example of tanker ships).

¹⁵ On the importance of analysing exposure across the value chain, see for example R. Baldwin, R. Freeman, A. Theodorakopoulos (2023): “Hidden Exposure: Measuring US Supply Chain Reliance”

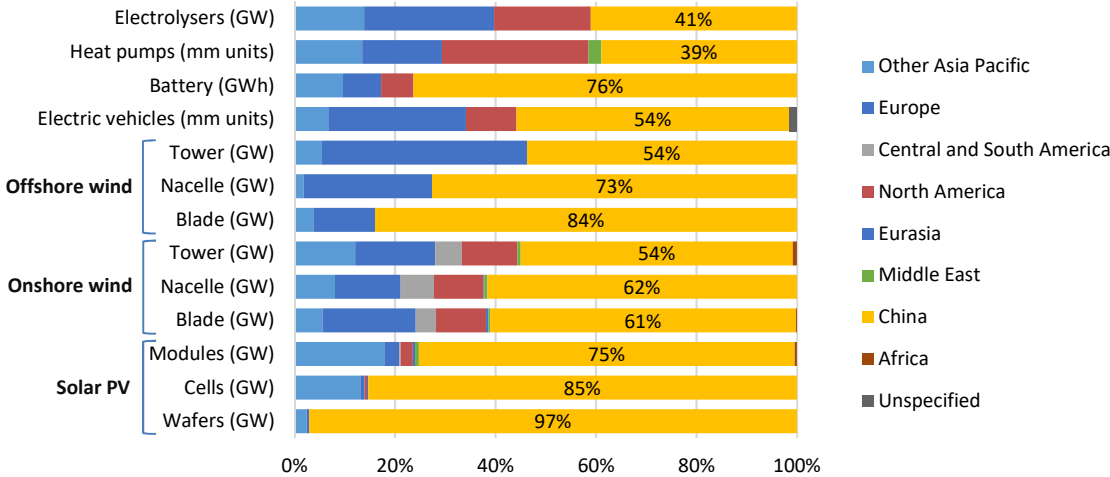
The EU’s value chain exposure to China in critical technologies ranges from partial to full-scale (Figure 13). The 2023 Commission Recommendation on critical technology areas for the EU’s economic security¹⁶ identifies 10 such areas for further risk assessment. For an important number of these critical technologies China has a dominant position when it comes to global manufacturing, resulting in exposure for the EU. For some technologies, the EU’s exposure to Chinese dominance lies mostly in the upstream part of the value chain as regards raw and processed materials (e.g. robotics). For others, the EU is confronted with China dominating global production across the value chain, from raw materials to components and assemblies (e.g. drones). Addressing only one part of the value chain (e.g. by boosting domestic production) may not effectively reduce supply chain risk in case exposure exist also in other parts.

Figure 13 – Global production shares in robotics (left); drones (right)



Source: Author’s elaborations based on European Commission – JRC (2023): “Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study”

Figure 14 – Clean energy manufacturing capacity by location (% , 2021)



Source: Author’s elaborations based on IEA, Bruegel

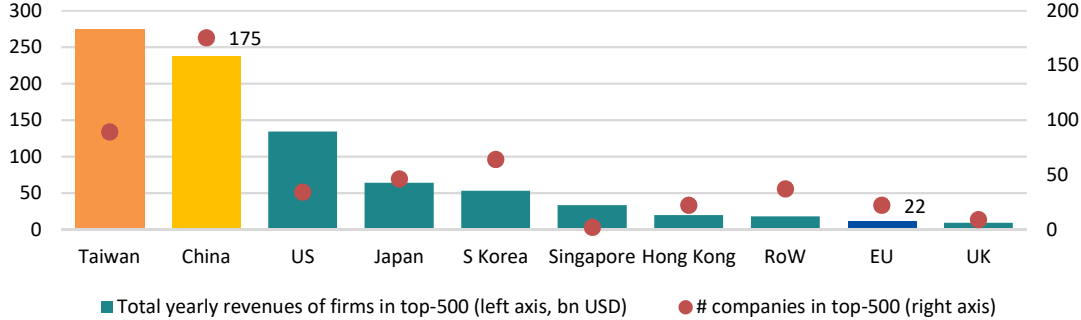
China’s dominant position in manufacturing is particularly apparent in the area of clean tech (Figure 14). For electrolysers (renewable hydrogen) and heat pumps, China has about 40% of global manufacturing capacity. In the area of EVs, China holds more than 75% for batteries and over 50% in EV production itself. Also in the area of wind, still considered an EU strength, Chinese dominance is becoming increasingly apparent with capacity going up

¹⁶ C(2023)6689

to almost 85% for the production of blades used in offshore wind turbines. Finally, Chinese leadership is perhaps still the clearest in the area of solar PV, where China for example holds more than 95% of global wafer production capacity.

Also when it comes to digital and electronics, China is generally in a stronger position than the EU in terms of global market presence and production. For example, China has almost double the number of players active in the field of AI compared to the EU and is also not that far behind the US.¹⁷ Another example is the production of technologies related to electronic equipment and parts (e.g. biometric products, advanced electronic equipment, electronics components, 3D printers), which is very heavily concentrated in China and Taiwan (Figure 15). Together, both countries capture about 60% of total revenues of the largest 500 public companies in the sector, compared to merely 1% for the EU. The dominant position of China also exposes the EU to unfavourable developments in other areas going beyond supply chain issues, such as for example when it comes to international standard setting.¹⁸

Figure 15 – Top-500 (revenues) public companies in the area of “electronic equipment and parts” per country of headquarters

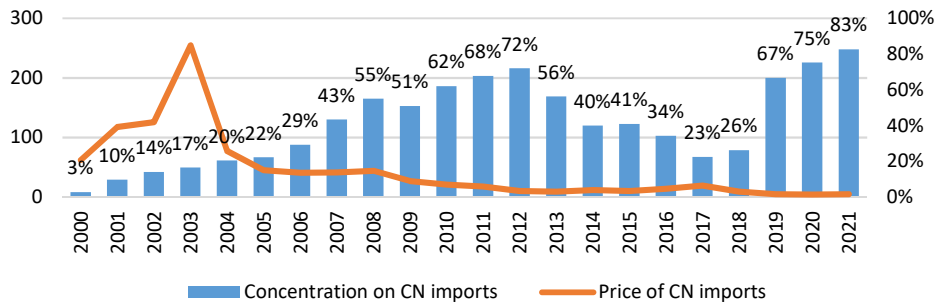


Source: Author’s elaborations based on Refinitiv
 Note: “Electronic equipment and parts” includes e.g. biometric products, advanced electronic equipment, display screens, electronic components and 3D printers

Exposure to China for specific strategic products¹⁹ can develop quickly. While the EU’s overall exposure to China as a source of imports grew gradually over the last two decades, in specific cases this happened much more abruptly. For example, while the EU was in a strong position in solar PV before 2007, the sector experienced a collapse often attributed to poor choices in industrial policy. Chinese imports replaced European production, with quickly increasing concentration levels. Anti-dumping and anti-subsidy measures imposed by the EU over the period 2013-2018²⁰ only temporarily reduced imports (with little impact on EU production) and concentration levels quickly rebounded afterwards. Today, the EU is exposed to highly concentrated solar PV imports imported at very low prices.

¹⁷ Source: European Commission, Joint Research Centre: “AI Watch Index 2021”. China: 11,362 players; EU 5,933; US: 13,770 (period considered: 2009-2020)
¹⁸ For example, S. Klotz (2023): “Who drives the international standardisation of telecommunication and digitalisation? Introducing a new data set” illustrates that particularly Chinese actors – Huawei, ZTE, China Mobile, China Unicom and China Telecom – have been driving several standardisation processes of the International Telecommunication Union
¹⁹ The notion of “strategic products” has been developed in SWD(2021)352, section 1.1
²⁰ European Commission Press Release (2/12/13): “EU imposes definitive measures on Chinese solar panels, confirms undertaking with Chinese solar panel exporters”

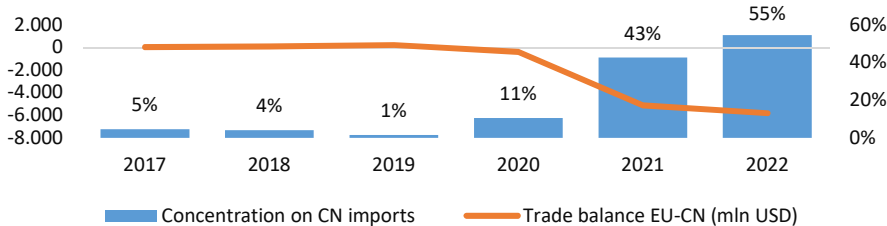
Figure 16 – Solar PV: EU concentration on CN imports (right axis); price of CN imports (left axis)



Source: Author's elaborations based on UN Comtrade
 Note: Data for HS (2017) Code 854140

Electric vehicles (EVs) is another example, where the EU is currently seeing a massive influx in imports of cheap products from China. Over the course of only two years, concentration levels jumped up and the EU's trade balance with China in EVs quickly deteriorated. Together, both examples provide a cautionary tale for traditionally strong EU industries such as wind²¹ and automotive.

Figure 17 – EVs: EU concentration on CN imports (right axis); EU-CN trade balance (left axis)

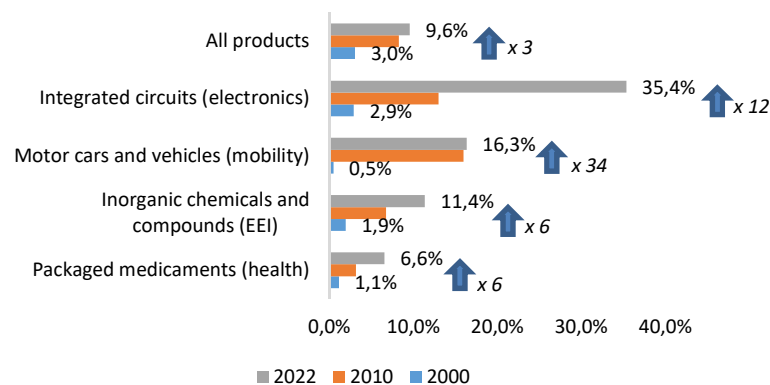


Source: Author's elaborations based on Comtrade
 Note: Data concerns HS (2017) Code 870380

3.2 Exports

The EU's exposure to China as an export market has grown, particularly in some important sectors. Overall, the importance of China as an export market is today three times higher than two decades ago (from 3% to 10% of extra-EU goods exports).

Figure 18 – EU direct exports to China (% of total extra-EU exports; 2000, 2010, 2022)



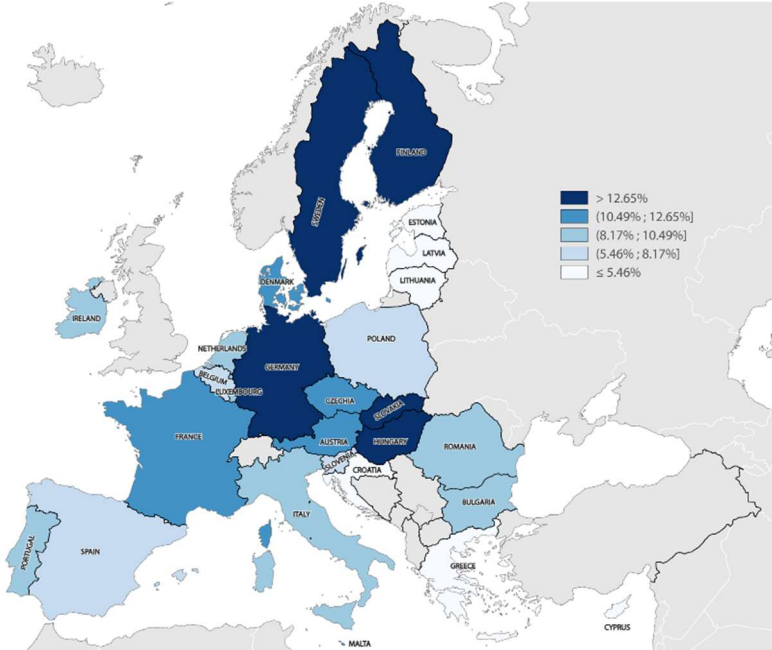
Source: Author's elaborations based on Comtrade

²¹ In this context, see European Commission (2023): "European Wind Power Action Plan", COM(2023)669

For a number of important sectors exposure has grown even much more strongly. Today, more than 35% of extra-EU exports of electronic integrated circuits (representing about 5% of total EU exports) is directed to China – 12 times more than in 2000. By way of example, 36% of total revenues of the Dutch semiconductor manufacturer NXP – one of the largest semiconductor manufacturers in the EU – originate in China. Other sectors where China has grown exponentially as an export market for the EU include the automotive sector (e.g. Volkswagen: 18% of revenues from China), the chemicals industry (e.g. BASF: 14% of revenues from China) and pharma (e.g. Sanofi: 7% of revenues from China).²²

Direct export exposure to China differs significantly across Member States. Member States with higher exposure include Slovakia (22% of extra-EU exports to China), Germany (17%)²³ and Hungary (14%). At the other side of the spectrum, Cyprus (2%), Croatia (3%) and Lithuania (3%) have the lowest levels of direct export exposure.

Figure 19 – Share of China in extra-EU exports (2015-2020 average)

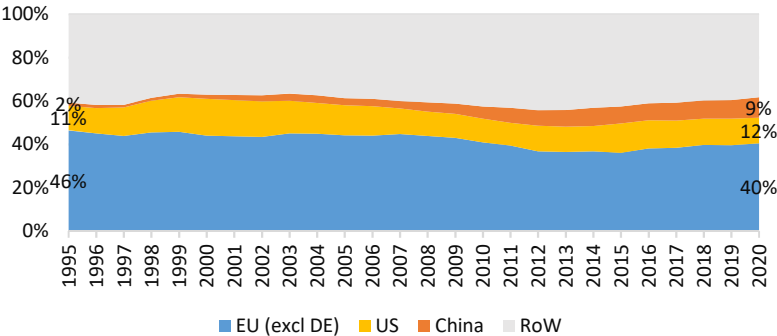


Source: Chief Economist Team (DG Internal Market, Industry, Entrepreneurship and SMEs) based on Eurostat (Figaro) data

Member States also face increasing export exposure on China through international value chains. Similarly as for imports, it is important to look beyond direct export links in order to understand exposure. By way of example, looking at the relative importance of demand in third countries in absorbing value added produced by German industry (i.e. covering both direct and indirect exports through global value chains - Figure 20), China is on the rise and almost at the same level of importance as the US. In addition, EU countries less exposed to China through direct exports typically exhibit higher exposure when indirect exports through international value chains are taken into account.²⁴ For example, Member States such as Belgium, the Netherlands or Estonia are service providers to countries (such as Germany) with strong goods exports to China. Consequently, export exposure of these Member States to China is significantly higher when taking into account also their indirect exposure through global value chains (Figure 21).

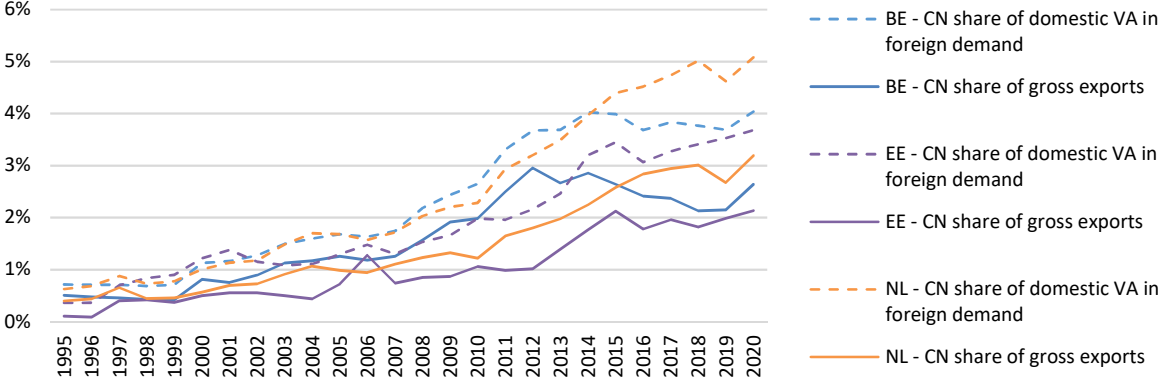
²² Firm data based on companies' annual reports (2022, except VW: 2021)
²³ For example, China is today a more important export market for the German car industry than the US or the UK
²⁴ See also M. Šebeňa, T. Chan, M. Šimalčík (2023): "The China factor: Economic exposures and security implications in an interdependent world", CEIAS

Figure 20 – German domestic value added in foreign final demand (% of total, 1995-2020)



Source: Author's elaborations based on OECD TiVa (2022 edition)

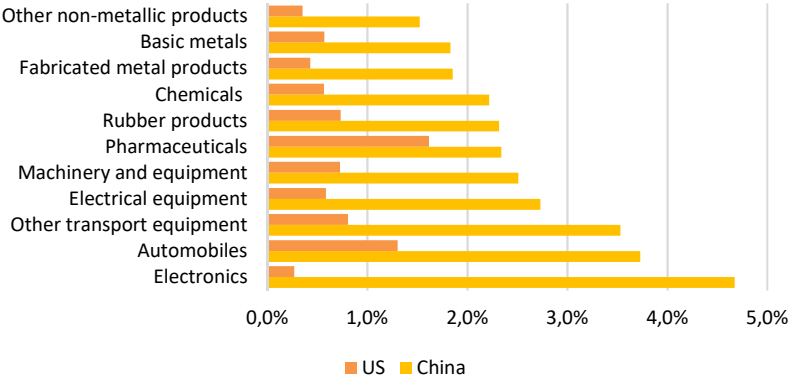
Figure 21 – China as a share of gross exports (direct export exposure) versus China as a share of foreign demand to absorb domestic value added (value chain exposure): BE, EE, NL



Source: Author's elaborations based on OECD TiVa (2022 edition)

Supply chain weaponisation may affect also EU exports. Recent Chinese supply chain measures and restrictions have been mostly related to the EU's imports from China (e.g. Chinese export restriction on gallium, germanium, synthetic graphite). Nevertheless, such weaponisation of supply chains may affect also the export side, as was seen for example in the coercive measures introduced by China against Lithuania in 2021.²⁵

Figure 22 – EU inputs used by US and China in various manufacturing sectors (EU value added embedded in final demand, 2020)



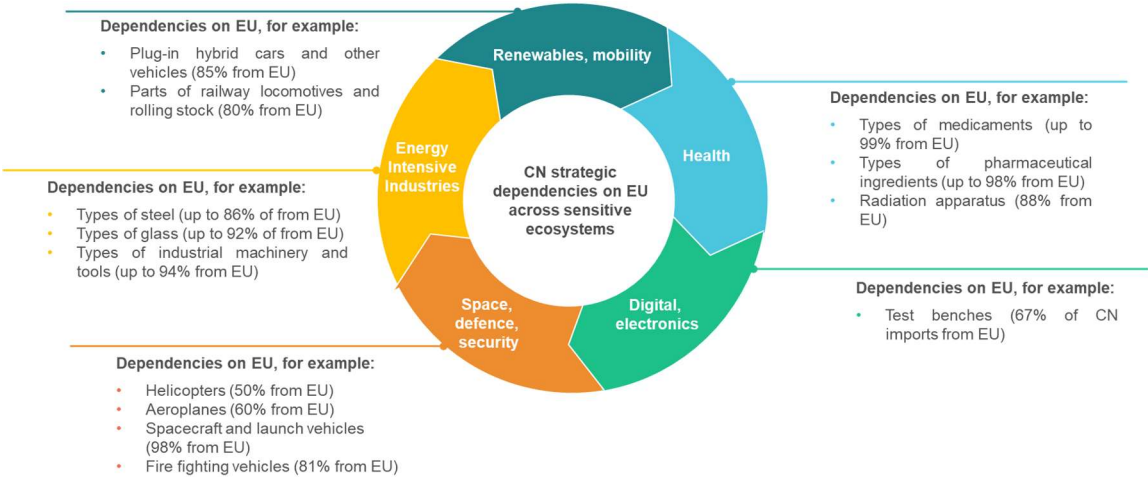
Source: GROW Chief Economist Team based on based on FIGARO Input-Output tables

²⁵ Center for Strategic and International Studies (2022): "China's economic coercion: lessons from Lithuania"

At the same time, in parallel to the increasing importance of EU exports to China there is also Chinese reliance on the EU. In fact, EU inputs are relatively more important for the Chinese than for the US manufacturing sector. Figure 22 illustrates this, showing the EU's value added embedded in the final demand of manufacturing products in both China and the US. While the contribution of EU inputs in both countries remains below 5%, a notable distinction emerges with China exhibiting a more substantial reliance on EU inputs than the US. For instance, while the final demand for Chinese electronics embeds 4.5% of EU inputs this is less than 0.5% for the US.

In addition, across different sensitive industrial ecosystems, China is dependent on the EU for access to certain strategic products (“reverse dependencies”). These reverse dependencies range from products such as for example railway locomotive parts (renewables and mobility, 80% of Chinese imports from EU), types of industrial machinery (energy intensive industries, up to 94% from EU), spacecraft and launch vehicles (space, defence, security, 98% from EU) and types of medicaments (health, up to 99% from EU).

Figure 23 – Examples of Chinese dependencies on the EU across sensitive ecosystems



Source: Author’s elaborations based on R. Arjona, W. Connell, C. Herghelegiu (2023): “An enhanced methodology to monitor the EU’s strategic dependencies and vulnerabilities”, Single Market Economy Papers

4. Foreign Direct Investment

Foreign direct investment, both inward and outward, is a source of growth and innovation for the EU but in certain cases may also be a source of risk and exposure. Inward investments create potential risks, notably when they concern strategic acquisitions that may negatively affect essential interests of the EU or Member States (e.g. takeovers of EU companies holding critical technologies, particularly by state-owned enterprises). Outward FDI may also create exposure for the EU (e.g. unwanted technology transfers) and activities of EU companies in third countries being subject to geopolitical tensions and changing business conditions beyond their control.

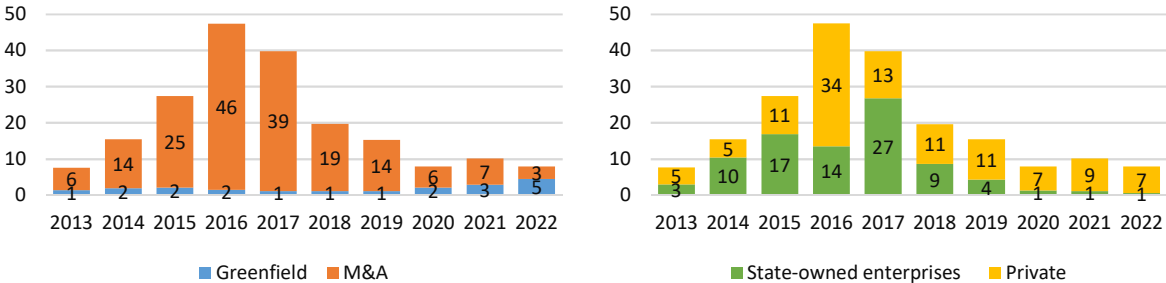
4.1 FDI by China into the EU

Recent trends regarding Chinese investment flows into the EU may point to decreasing risks. On the one hand, there has been a sharp decline in Chinese investment in the EU.²⁶ In addition, investments have shifted towards greenfield, a distinct change from

²⁶ Very similar to the evolutions seen in the US. See T. Hanemann, A. Meyer, D. Goh (2023): “Vanishing Act: The Shrinking Footprint of Chinese Companies in the US”, Rhodium

the previously strong focus by China on M&A of EU companies. Finally, the role of Chinese state-owned enterprises as a source of Chinese FDI in the EU has also been gradually declining. These elements all point to potentially decreasing risks. Stricter screening of incoming FDI by Member States and the EU may play at least a partial role in this. At the same time, there are a number of important caveats.

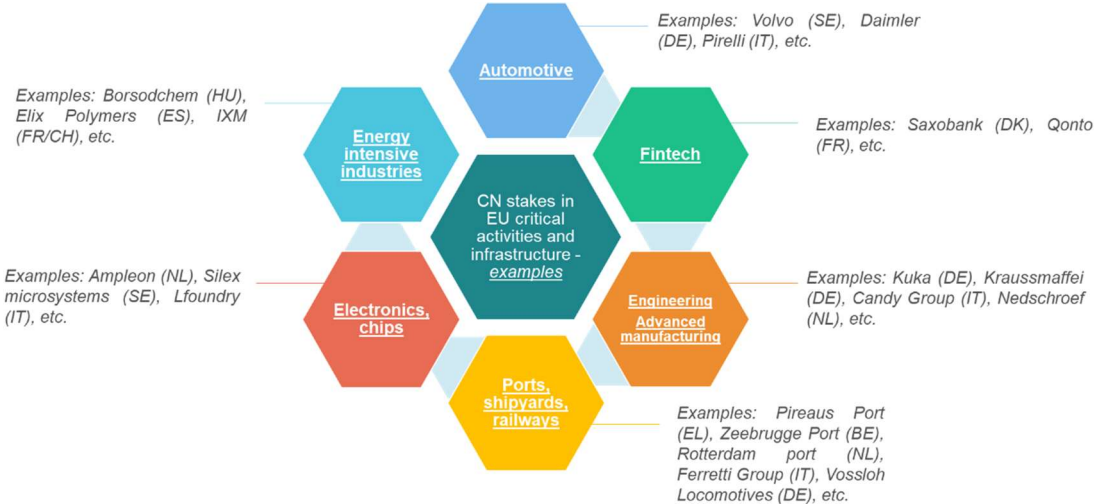
Figure 24 – Chinese FDI in the EU (2013-2022, billion EUR)



Source: Rhodium Group²⁷

A first important caveat is that China still holds assets in several critical EU activities and infrastructure. While currently there is a declining trend in the level of Chinese FDI, China still holds stakes (full or partial ownership) in critical activities and infrastructure across the EU. These range across different areas including automotive (e.g. Volvo, SE), fintech (e.g. Saxobank, DK), advanced manufacturing (e.g. Kuka, DE), ports and shipyards (e.g., Pireaus, EL), transport (e.g. Ferretti Group, IT), electronics (e.g. Ampleon, NL) and energy intensive industries (e.g. Elix Polymers, ES).

Figure 25 – Chinese stakes in critical EU infrastructure and activities: examples



Source: Author's elaborations

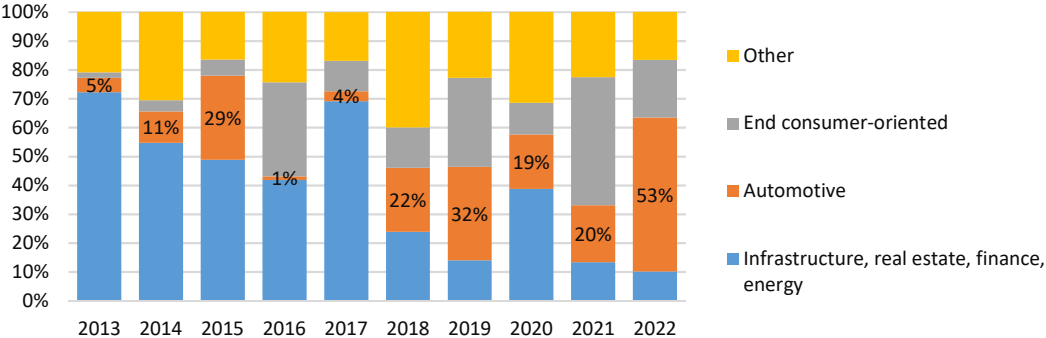
In addition, China even recently acquired stakes in EU companies active in potentially sensitive areas. Examples include the takeover of German medical equipment maker Phenox in 2022 (by Wallaby Medical)²⁸, the acquisition of part of the Portuguese infrastructure group Mota-Engil in 2021 (by China Communications Construction Company)²⁹, acquisition of a portfolio of windfarms from the Spanish renewable energy company EDPR in 2021 (by China Three Gorges)³⁰ and the acquisition of the French

²⁷ A. Kratz, M. Zenglein, G. Sebastian, M. Witzke: "Chinese FDI in Europe: 2022 Update", Rhodium
²⁸ <https://www.fyb.de/en/wallaby-medical-acquires-german-market-leader-for-neurovascular-products-phenox/>
²⁹ <https://www.mota-engil.com/en/investors/corporate-profile/>
³⁰ <https://www.edpr.com/en/news/2021/11/15/edpr-signs-asset-rotation-deal-a-181-mw-operating-wind-portfolio-spain>

electronic manufacturing services provider Asteelflash in 2020 (by Universal Scientific Industrial).³¹

Second, currently, Chinese FDI in the EU is strongly geared towards greenfield investments in the mobility ecosystem. More specifically, the EU (notably Germany and Hungary, but also Spain, Portugal, France, Sweden, Poland) is the primary target of China's battery and EV makers' global expansion. Recently announced Chinese investments in the EU include large battery plants by Chinese global battery leaders such as CATL or Svolt but also more upstream production facilities of battery components and materials such as cathodes, separator films and precursor cathode active materials. Chinese FDI of EV manufacturing itself has so far been limited (e.g. Chinese owned Volvo will build a 100% EV factory in Slovakia), but may pick up in the future.

Figure 26 – Chinese investments in the EU by sector (2013-2022)



Source: Rhodium

Such greenfield investments may not be entirely without risks.³² While generally considered to involve fewer risks than M&A, greenfield investments may have both positive but also potentially negative effects for the EU. Possible positive effects of greenfield investment include job creation, economic spill-overs on local economies and even positive effects on diffusion of innovation and technological capacities. In addition, such investments – although foreign owned – will help the EU in reaching its manufacturing targets of net-zero technologies by 2030.³³ At the same time, possible negative effects of these investments may include a further dependence on Chinese firms (even if locally present) for access to these critical products and technologies. In addition, potential Chinese subsidies to these firms may distort the Single Market's level-playing field. Finally, Chinese export restrictions on relevant products and materials (e.g. on synthetic graphite) may also restrict the EU's position, leaving it with no other option than to rely on Chinese investments in the EU for access these products. In short, the merits of such greenfield investments versus the potential increase in exposure may merit a case-by-case assessment.

Finally, the EU's exposure to Chinese FDI may also be indirect. During the last decade, China has become a major investor in third countries including through the Belt and Road Initiative. Since 2018, China has been stepping up its investments of projects in EV-related minerals in third countries such as the Democratic Republic of the Congo (cobalt), Indonesia (nickel) and Chile (lithium). These investments may further increase the EU's reliance on Chinese firms when it comes to accessing critical raw materials for EV and battery production, including those for which China has limited deposits available domestically. In

³¹ <https://www.clearwaterinternational.com/assets/pdfs/EMS-Newsletter-2020.pdf>
³² See also A. Gehringer (2023): "China's strategic foreign direct investment in Europe", Flossbach von Storch Research Institute
³³ COM(2023)161

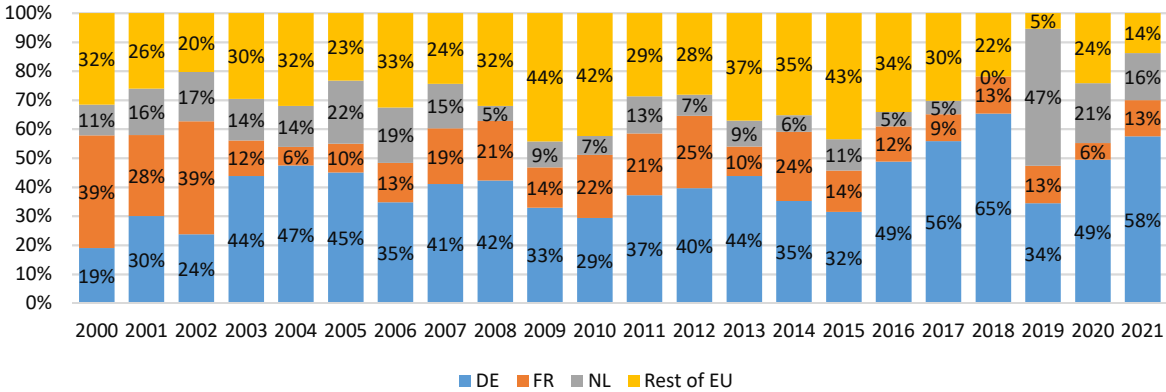
addition also beyond raw materials, Chinese battery groups are investing in third countries (e.g. Morocco) to serve EU and US markets from there.³⁴

4.2 FDI by the EU into China

EU FDI into China shows a different pattern than Chinese FDI into the EU. Overall, the level of EU FDI into China has been fairly steady over the last years (around 7-8 billion EUR in completed FDI annually since 2019), although the first two quarters of 2023 may show signs of a decline. In contrast with Chinese FDI into the EU, EU investments into China are exclusively done by private companies and significantly more through greenfield investment than M&A (for example, since 2016 announced EU greenfield investments into China are more than double in size than announced EU investments through M&A).

There is a clear trend of increasing concentration when it comes to EU FDI in China.³⁵ First, there is strong concentration at the level of Member States: Germany, France and the Netherlands in 2021 captured 86% of EU FDI into China, with Germany capturing 58%.

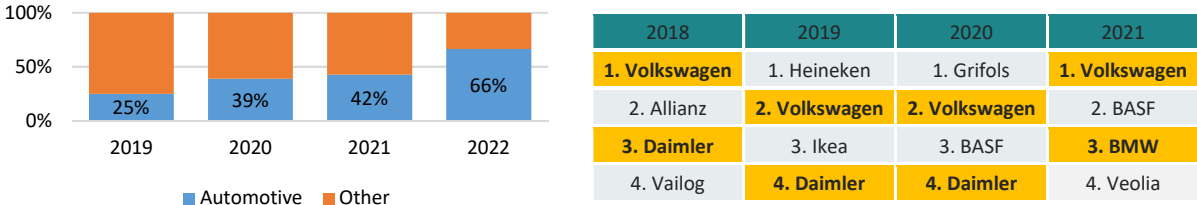
Figure 27 – EU investments in China by Member State (2000-2021)



Source: Author’s elaborations based on Rhodium

Second, concentration is also increasing at a sectoral level: over the last years, the automotive sector has increasingly become the main target of EU FDI into China. Large EU automotive producers are further expanding their investments in China, notably because they attach increasing importance to connecting to China’s innovation ecosystem in view of their strong technological advances (e.g. in electric or autonomous vehicles).³⁶

Figure 28 – EU investments in China by sector (left); top EU investors (right)



Source: Author’s elaborations based on Rhodium

At the same time, small EU companies increasingly see risks of investing in China, for a combination of reasons including China’s economic slowdown, a challenging and

³⁴ See for example Financial Times (27/9/23): “Chinese battery groups invest in Morocco to serve western markets”
³⁵ A. Kratz, N. Barkin, L. Dudle (2022): “The Chosen Few: A Fresh Look at European FDI in China”, Rhodium
³⁶ G. Sebastian (2022): “The bumpy road ahead in China for Germany’s carmakers”, Merics

unpredictable local business environment and increasing geopolitical tensions.³⁷ Overall, this ongoing concentration of investment in China in a small number of large firms could be interpreted as reducing risks for the EU given that these firms may be better equipped to manage risks and complexities compared to smaller players.

At the same time, an important part of EU FDI in China may relate to possibly sensitive activities, creating exposure to unwanted technology transfers. Concerns of critical technology transfers may be relevant, as part of the ongoing investments by EU firms in China can relate to such critical technologies. By way of example, a few recent investments by EU firms relate to autonomous driving and robotics (e.g. Volkswagen Joint Venture with China's Horizon Robotics, 2022³⁸), semiconductors (e.g. Merck to open a semiconductor base in China, 2022³⁹) and renewable energy (e.g. a joint venture in offshore wind between Électricité de France and China Investment Cooperation, 2019⁴⁰). The Commission announced its intention to evaluate a potential outbound investment screening initiative, which the US has already introduced recently.⁴¹

5. Technology

The EU's exposure to China is becoming increasingly technological. China wants to win the global race for leadership in key technologies, which it sees as of critical importance for its development and security.⁴² To do so, China employs a whole-of-nation approach to address tech gaps and support the innovation chain from research to commercialisation with the aim of achieving self-reliance. It already reported to overtaking the rest of the world in certain critical technologies.⁴³ This rise of China as a technological powerhouse has important implications for the rest of the world including the EU, extending its risk of exposure to China from imports of basic products towards science, technology and innovation. Such exposure may bring about different risks, including the emergence of new dependencies, but also a lack of technological progress in areas that matter more for the EU than for China (e.g. achieving a lower reliance on critical raw materials through new technologies).⁴⁴

Technological sovereignty is typically defined as a combination of different elements, from research to industrial leadership. While there is no single definition, assessing the EU's position of technological sovereignty (or dependence) vis-à-vis China should consider several elements, including (1) the presence of a knowledge base (science, research); (2) the ability to translate science and R&D into market solutions (innovation); and (3) achieving a position of market leadership (scale-up).⁴⁵ Overall, each critical technology merits a separate analysis for these different dimensions⁴⁶ and it is clear that the EU has both strengths and weaknesses across individual areas. The intention of this chapter is not to go into specific technologies, but rather highlight a number of broad trends.

³⁷ Roland Berger for the European Union Chamber of Commerce in China: "European business in China – Business Confidence Survey 2023", 2023

³⁸ <https://europe.autonews.com/automakers/vw-invests-self-driving-tech-chinas-horizon>

³⁹ <https://www.reuters.com/technology/merck-says-it-plans-open-semiconductor-base-china-2022-05-31/>

⁴⁰ <https://www.reuters.com/article/us-edf-china-idUSKBN2390R0>

⁴¹ JOIN/2023/20 final

⁴² J. Groenewegen-Lau, M. Laha (2023): "Controlling the Innovation Chain: China's Strategy to Become a Science and Technology Superpower", Merics for Institute on Global Conflict and Cooperation

⁴³ I. Clay, R. Atkinson (2023): "Wake Up, America: China Is Overtaking the United States in Innovation Capacity"

⁴⁴ Lack of interoperability between tech systems is another risk, potentially reducing EU-China commercial exchanges

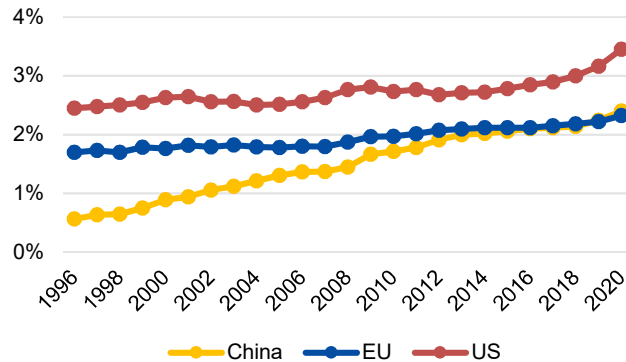
⁴⁵ EPRS (2021): "Key enabling technologies for Europe's technological sovereignty"

⁴⁶ As was done e.g. in SWD(2022)41

5.1 Research and science

China has caught up with the EU in R&D expenditure. While Chinese R&D intensity more than doubled since 2000, EU R&D intensity grew much slower. As a result, China caught up with the EU while the US keeps a consistent lead.

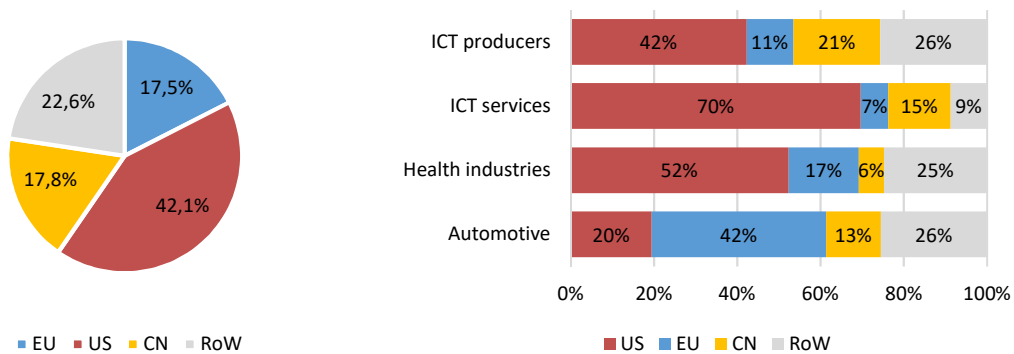
Figure 29 – Total R&D expenditure EU, China, US as % of GDP (1996-2020)



Source: Author's elaborations based on World Bank

Furthermore, China's business R&D expenditure is more concentrated in sectors with high technology-intensity. Besides the overall trend in total levels of R&D expenditure, it is important to consider the composition of R&D. In the EU, less than half of business R&D expenditure takes place in high R&D-intensity sectors. About one third is concentrated in the automotive sector (a medium-high R&D-intensity sector) with the EU capturing more than 40% of global R&D in automotive (Figure 30), driven by major EU R&D investors such as Volkswagen. Comparatively, the US and China gear significantly more R&D expenditure towards high-tech areas, notably ICT services and production. As a result, the US holds a clear global leadership of business R&D investment in ICT with also China (driven by major Chinese R&D investors such as Huawei) being significantly ahead of the EU.

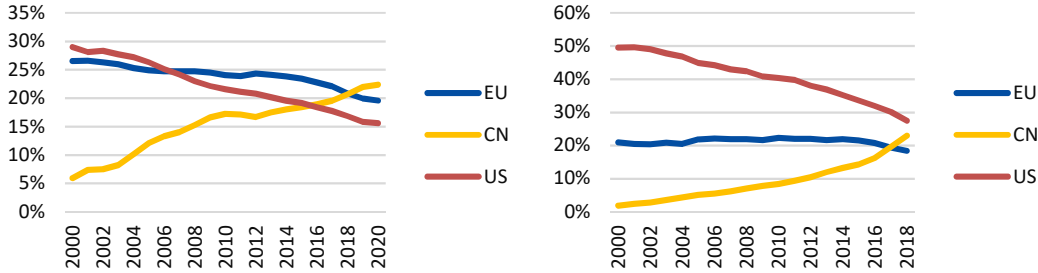
Figure 30 – Share of global business R&D (2022): total (left); in key R&D areas (right)



Source: Author's elaborations based on 2023 R&D scoreboard

In addition, China has overtaken the EU in scientific output as well as scientific excellence. China is a global leader in scientific publications overall and is today also ahead of the EU when it comes to the most cited publications, used as a proxy for quality of research (Figure 31).

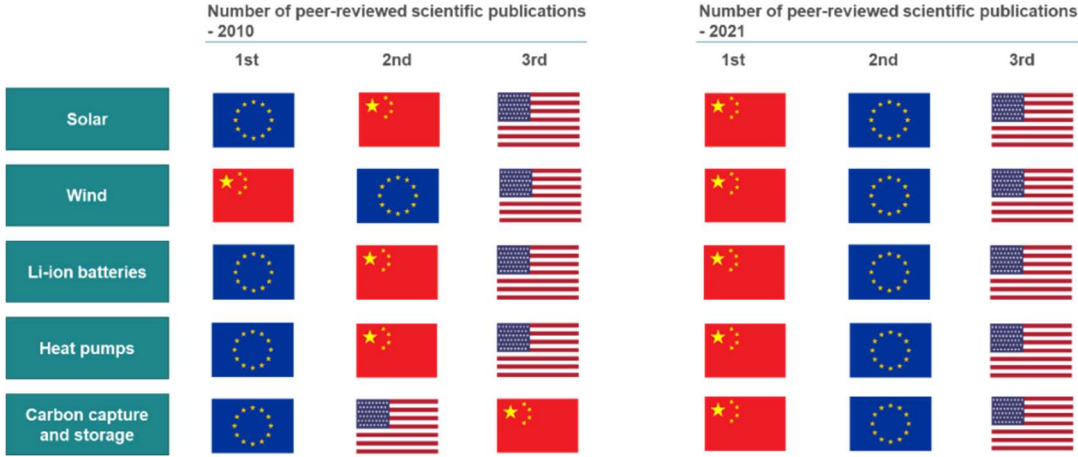
Figure 31 – Share of all scientific publications (left, 2000-2020) and 1% most-cited scientific publications (right, 2000-2018)



Source: Author’s elaborations based on 2022 Science, Research and Innovation Performance of the EU (SRIP) report

By way of example, China now leads scientific performance in climate and clean energy technologies. Across the board, China holds 25% of all scientific research on climate and environment (EU: 20%, US: 11%) and 16% of the 10% most cited research (EU: 14%, US: 15%).⁴⁷ For specific clean energy technologies, China’s rise in scientific performance is clear when comparing it to the EU and US over the past 10 years (Figure 32).

Figure 32 – Scientific performance in climate & clean energy technologies: EU, China, US



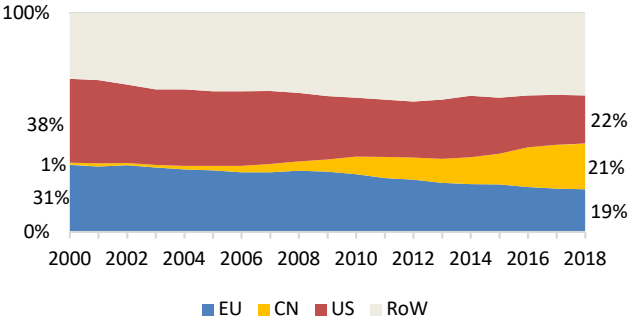
Source: Author’s elaborations based on SWD(2021)307 (solar, heat pumps); Clean Energy Technology Observatory (wind, Li-ion batteries, CCS)
 Note: Solar PV data for 2020 (not 2021), CCS data for 2011 (not 2010)

5.2 Innovation

China has overtaken the EU in terms of total international patent applications, a proxy for innovation performance. Patents are a commonly used indicator for measuring innovation performance, despite several drawbacks and challenges that come with the use and interpretation of patent statistics.⁴⁸ China’s growth in international patent applications has been impressive, having overtaken the EU since 2017 and closing in on the US. Also in terms of patent applications relative to GDP (expressed in purchasing power parities), China has surpassed the EU thanks to a massive increase over the last 10 years compared to a decline in the EU.⁴⁹

⁴⁷ 2020 and 2018 data
⁴⁸ For a description of benefits and challenges in the use of patent data, see for example Trinomics (2021): “Patents as a measure of innovation performance: Selection and assessment of patent indicators”, report for the European Commission
⁴⁹ Patent applications filed under the PCT per billion GDP (PPS €) – EU: 4,0 in 2008 and 3,5 in 2018; China: 0,9 in 2008 and 3,6 in 2018. Source: 2022 SRIP

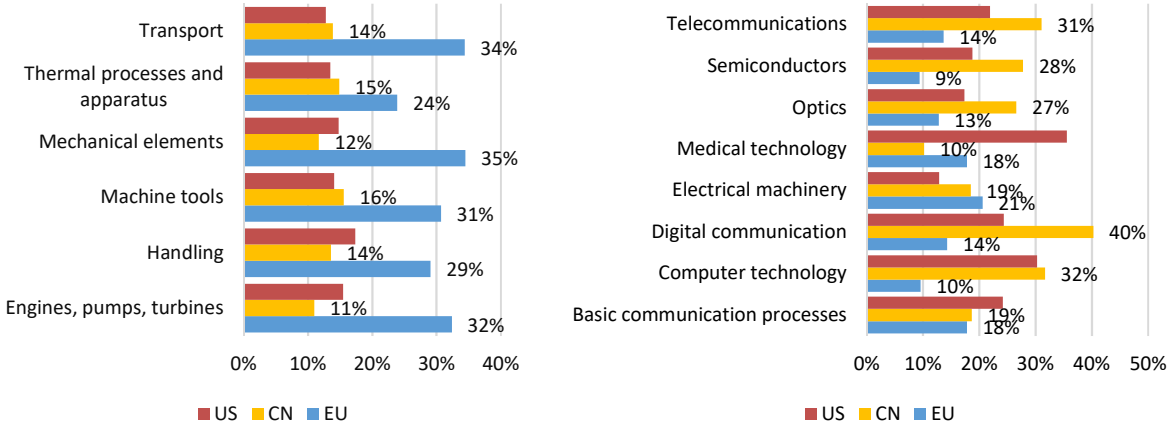
Figure 33 – World share (%) of patent applications filed under the Patent Cooperation Treaty (PCT)



Source: Author’s elaborations based on 2022 Science, Research and Innovation Performance of the EU (SRIP) report

EU innovation strengths compared to China lie in areas such as advanced manufacturing and certain clean energy technologies. EU industry is a global innovation leader when it comes to mechanical engineering and advanced manufacturing (Figure 34, left), with the US and China significantly behind. Also in clean energy⁵⁰, the EU is a global leader in international patents applications in areas such as wind⁵¹ but lags behind China and others in areas such as solar PV⁵².

Figure 34 – World share (%) of patent applications filed under the PCT (2018): mechanical engineering (left); electronics and electrical engineering (right)



Source: 2022 Science, Research and Innovation Performance of the EU (SRIP) report

EU innovation weaknesses compared to China lie particularly in the area of digital and electronics. Figure 34 (right) highlights the weak innovation performance of the EU compared to China and the US in critical transversal technologies such as telecommunications, digital communications and computer technologies. Also in the area of semiconductors, where the EU is often highlighted as hosting global leaders in research and technology organisations, overall innovation output appears low compared to China and the US.

⁵⁰ See also European Commission (2023): “European Climate Neutral Industry Competitiveness Scoreboard – Annual Report 2022”

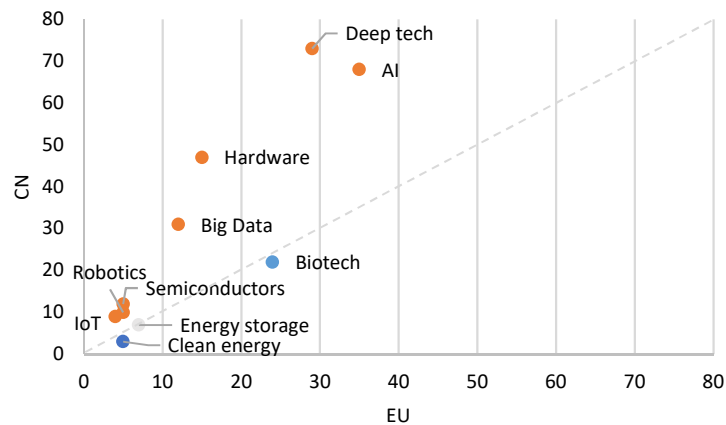
⁵¹ Clean Energy Technology Observatory (2023): “Wind Energy in the European Union: status report on technology development, trends, value chains and market”

⁵² Clean Energy Technology Observatory (2023): “Photovoltaics in the European Union: status report on technology development, trends, value chains and market”

5.3 Scale-up

The EU has a scale-up gap, also compared to China. While there are signs that the EU landscape for start-ups has improved, the scale-up gap with the US is still very large. Also when comparing to China, the EU appears less able to translate cutting-edge research and innovation into fast-growing scale-ups. At the start of 2023, only 249 unicorns were based in the EU compared to 1,444 in the US and 330 in China.⁵³ Comparing across different technologies (Figure 35), the EU only outperformed China in terms of number of unicorns since 2010 in the areas of clean energy and biotech. In the area of digital and electronics, China is significantly ahead notably as regards AI and deep tech.

Figure 35 – Number of new unicorns per technology EU and China (cumulative, since 2010)



Source: Author's elaborations based on Dealroom

⁵³ European Commission (2023): "2023 Report on the state of the Digital Decade"

6. Conclusions

Recent developments highlight the importance of having a good grip and understanding of economic exposure towards China, as a basis for implementing the EU's de-risking approach. In the course of 2023, China introduced export controls on products and inputs that are of a strategic nature for the EU such as critical raw materials (gallium, germanium, graphite), but also for example in relation to rare earth processing technologies⁵⁴ and drones⁵⁵. Chinese restrictions on gallium and germanium appear in part to be reactions to restrictions introduced by the Netherlands on exports of lithography machines, in alignment with the US and Japan.⁵⁶ There are risks that the ongoing trade war between China and the US may further escalate, which will have important implications also for the EU (e.g. export controls may hinder the development of alternative supply chains or local substitutes to clean tech products imported from China).⁵⁷

The three dimensions of economic exposure highlighted by this economic brief (trade, investment and technology) are interlinked and should be assessed collectively. Gaps in research and innovation may ultimately lead to import dependencies of future technologies and related products. Inward and outward FDI may significantly alter trade flows and affect technological capacities through (wanted or unwanted) technology transfers. Assessing these dimensions of exposure should be targeted, focusing on strategic products and critical technologies in sensitive ecosystems.

Evidence shown in this economic brief underlines that de-risking from China is a complex task. A number of important reasons for this complexity are:

1. The EU's exposure to China is diverse (from raw materials to drones), often covering large parts of the value chain and deep (up to 90% and more of EU imports). China's global dominance in critical areas such as solar and electronics results in limited options for trade diversification. Establishing domestic production is a valid avenue to reduce exposure, but may take time and require resources (notably skilled workers), infrastructure and investments⁵⁸. Contrary to the US, the EU's total trade exposure to China has continued to grow over the past five years;
2. Exposure and risks can also be indirect. This economic brief highlighted that exposure to China can exist beyond immediate (or direct) economic interlinkages. China's trade or investments with the EU's trading partners can notably create "second round" exposure (with China e.g. as a source of imports or owner of infrastructure in these third countries). This adds additional complexity for companies and policy makers when it comes to de-risking, particularly as China seeks to establish stronger ties with these economic partners of the EU;
3. China is not only a source of inputs but also an important market for the EU. Several large European companies have important economic interests in China, as an export market or investment location. This is likely an important consideration in a de-risking strategy, including when it comes to factoring in possible reactions (which may be particularly relevant when it comes to for example the application of possible trade defence measures);
4. China is increasingly becoming a world leader in science and innovation, for several critical technologies outlined in the 2023 Commission Recommendation on critical

⁵⁴ <https://www.ft.com/content/5b031db7-23dd-43d3-afe1-cef14817296f>

⁵⁵ <https://www.reuters.com/world/china-curbs-exports-drone-related-equipment-amid-us-tech-tensions-2023-07-31/>

⁵⁶ M. J. Zenglein, J. Gunter (2023): "The party knows best - Aligning economic actors with China's strategic goal", Merics

⁵⁷ H. W. Maull, A. Stanzel, J. Thimm (2023): "United States and China on a Collision Course - The importance of domestic politics for the bilateral relationship", German Institute for International and Security Affairs (SWP)

⁵⁸ This economic brief highlighted that Chinese greenfield investment in certain critical areas may also play a role

technology areas for the EU's economic security. This adds an additional layer of exposure, potentially deepening risks related to the resilience of supply chains, security of critical infrastructures, weaponization of economic dependencies or economic coercion.

At the same time, there are several strengths and opportunities that the EU may build on.⁵⁹ This economic brief showed that China is also exposed to the EU, including as an important export market and a source of strategic products and critical technologies. This may prove to be an important asset for the EU, in a context of declining Chinese economic growth and possibly increasing China-US tensions. In addition, the EU has over the past years developed and expanded its toolbox of available measures⁶⁰ that it may draw on to protect its interests, address distortions and ensure a level playing field.

⁵⁹ See e.g. also D. Baverez, E. Fabry, N. Köhler-Suzuki (2023): "Rebalancing trade dependency on China: de-risking scenarios by 2035", Jacques Delors Institute

⁶⁰ Such as, for example, the Foreign Subsidies Regulation, the International Procurement Instrument and the FDI screening mechanism

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