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Which countries own/control your supply chain?¹

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¹ This contribution was prepared for the conference. The views expressed are those of the authors and do not necessarily reflect the views of the European Central Bank, the Bank of Spain, the BIS, the IFC or the other central banks and institutions represented at the event.

Which countries own/control your supply chain?

External statistics after the pandemic: addressing novel analytical challenges

Madrid, 12 February 2024

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Disclaimers

- All authors are employed at Statistics Netherlands
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- The opinions expressed in this paper/presentation are those of the authors and are not necessarily in accordance with the policies of Statistics Netherlands or the Ministry of Economic Affairs and Climate Policy.

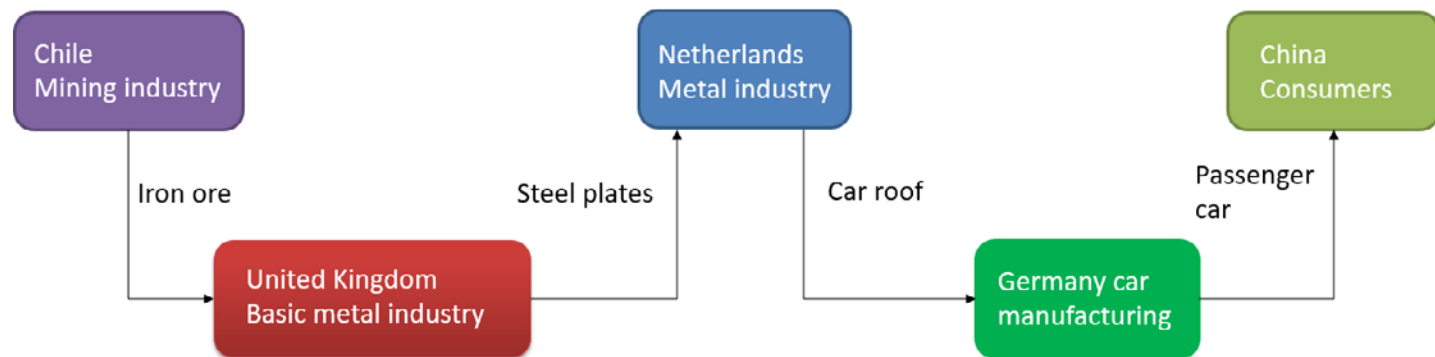
Global value chains (GVCs) create dependencies

Who is dependent on whom for supplies of energy, food, materials for the energy transition, high tech production etc.?

- At the start of the COVID-19 pandemic, there were export restrictions of pharmaceuticals and masks by several countries
- EU dependency on Russian gas became clear when supply was cut
- [EU strategic autonomy](#), a.o. related to economic resilience, foreign and security policies
- [Strategic dependencies](#), [Critical Raw Materials Act](#), [European Chips Act](#)

This presentation: who produces for you and who owns that production

Standard analysis of GVC dependencies



Production in several countries → dependencies. See, e.g., [Kuzmenko & Čechura \(2023\)](#). If something happens in an industry in a country that produces in your supply chain, you can be affected. Adaptation takes time.

Could be a natural disaster, a strike, geopolitics, and so on.

Location, location, location?

Location of production in supply chain - only this matters for dependencies?

Everyone who ever rented, knows dependency on the owner of the property!

- [UNCTAD](#) (2022): “national security concerns about foreign ownership of critical infrastructure, core technologies or other sensitive domestic assets”
- Firms might move production at home to foreign affiliates to circumvent issues with country of production ([Alfaro and Chor, 2023](#))
- [European Commission](#) proposed improved screening of foreign investment into the EU to protect against risk (24 January 2024)

Novel analytical challenges

Country of ownership of production in your supply chains matters

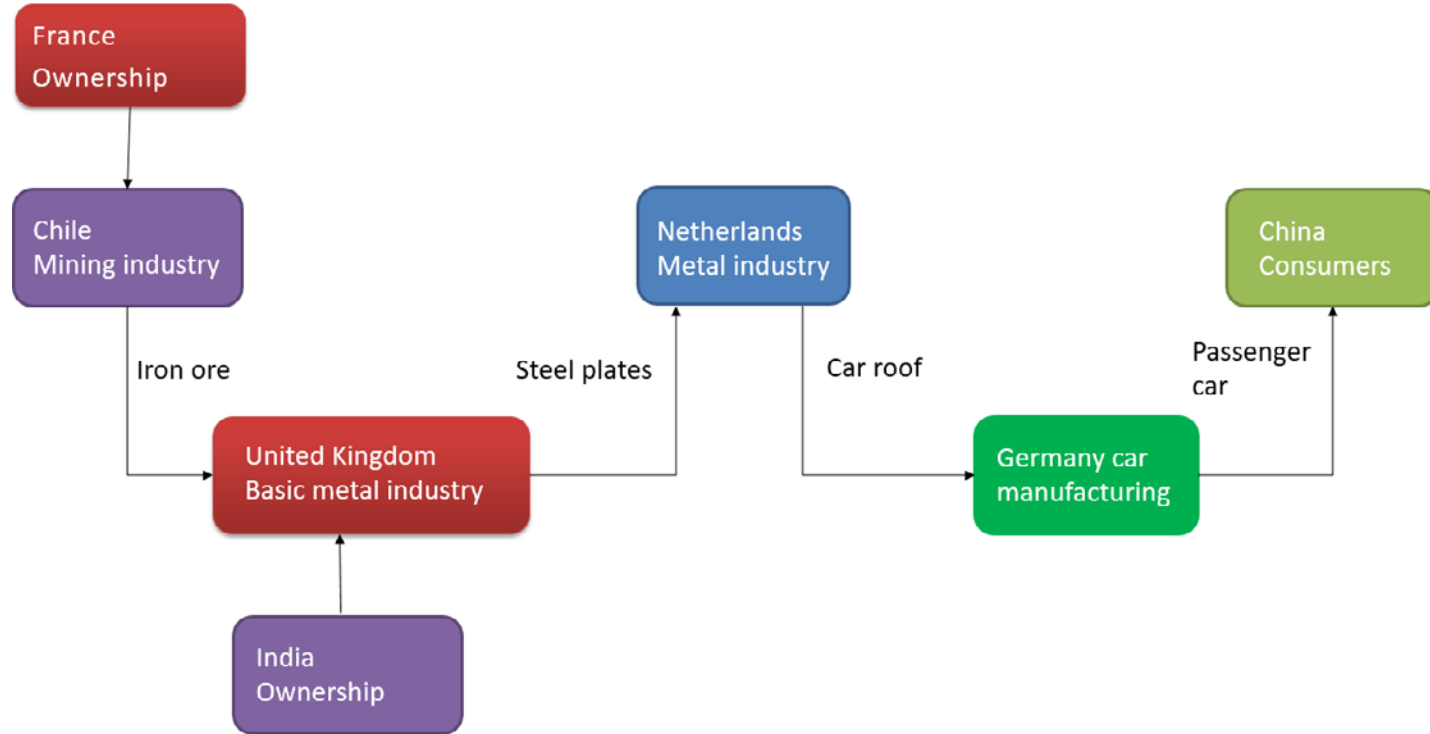
If country A owns production somewhere in the world that ultimately ends up in your supply chain, there is a dependence of country A

New information is necessary to map these dependencies

Use which data and methods to estimate ownership in the supply chain?

This presentation provides answers and suggestions for improvement.

Our new approach



Adding the ownership dimension brings another type of dependency to light

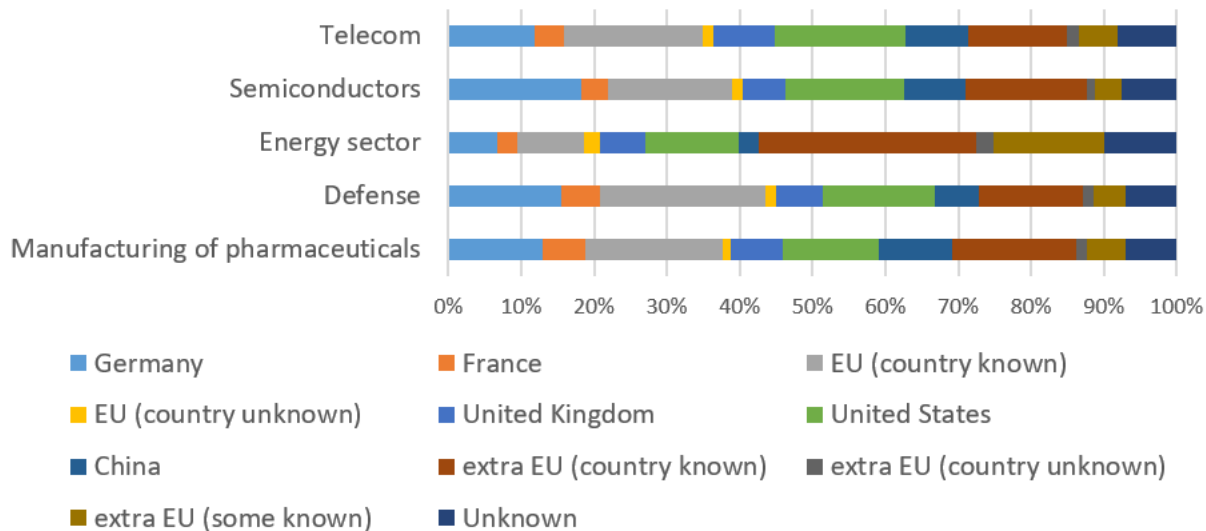
Data to map global value chains and ownership

- Inter-country input-output table, over 60 countries and 35 industries, from [Asian Development Bank](#)
- Eurostat [Inward FATS](#): for each industry in each EU country, what is domestically owned, what is foreign owned, by country
- Eurostat [Outward FATS](#): for each EU country, given an industry in a foreign country, how much is owned by the EU country
- BEA: similar data as Inward/Outward FATS for the United States
- [OECD AMNE](#) ([Cai et al. 2023](#)): for each industry in each country, what is domestically owned, what is foreign owned by which country. Based on sources above and FDI ***with estimates for the confidential part -> complete***

Method in a nutshell

- Used microdata for much better quality for the Dutch part of the GVC
- Map the supply chain of an industry in a country with data from the Asian Development Bank: how much is produced in which industry in which country? Standard input-output analysis.
- If 5% of production in British metal manufacturing is owned by firms from India, we assume that 5% of British metal manufacturing in any supply chain is owned by firms from India.

Ownership in supply chain 5 Dutch industries, 2019



Value added in foreign part supply chain of Dutch telecom is 12%, 4%, 18% and 9% under German, French, US and Chinese ownership, respectively.

Energy sector is very different from the rest; much production and ownership outside EU, e.g. Norway, Russia, Saudi Arabia

China/USA related content in EU production

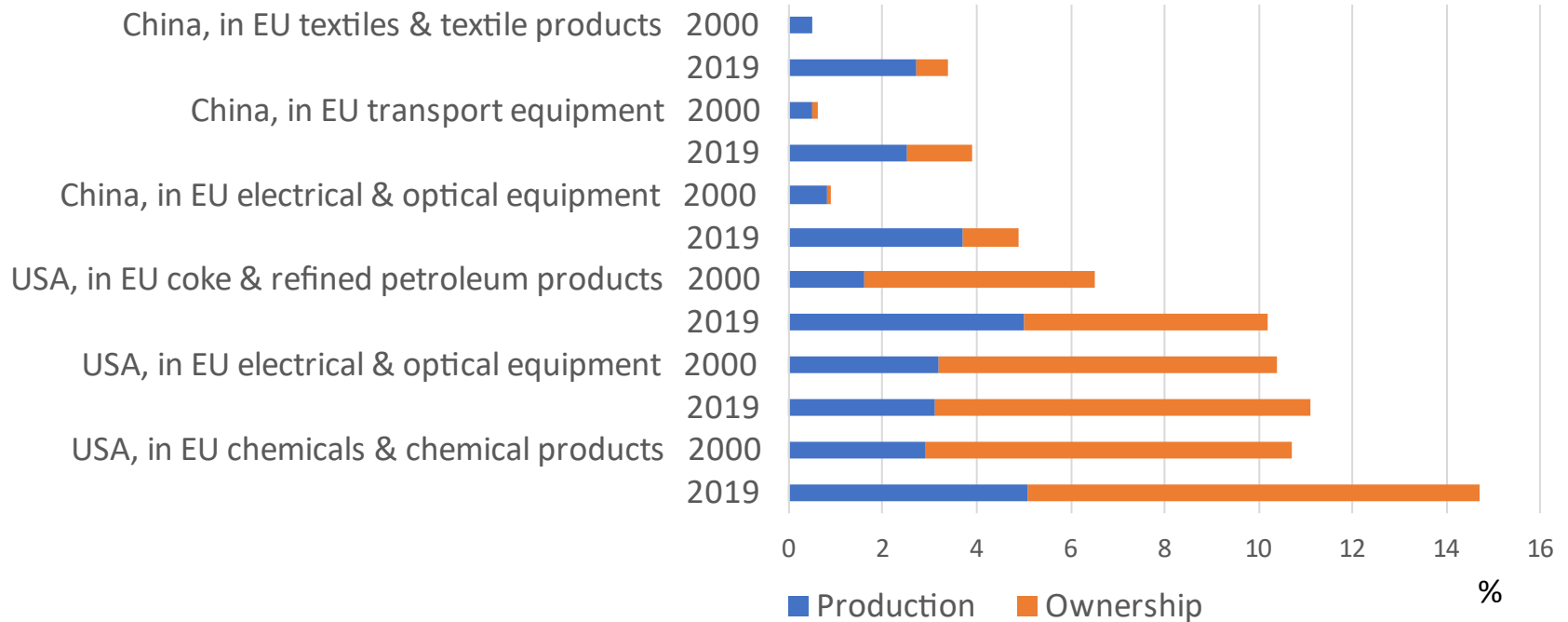
Consider the 2 largest trading partners of the EU: China and USA

USA related content: inputs that are **produced in USA** and/or were under **American ownership** (similar: China related content)

Research questions:

- How large is China/USA related content in EU production?
- How did this change over time?
- What are factors behind this change?
- Are there opportunities for policy involvement?

China/USA related content in EU production



Of inputs of 2019 EU chemical production, 5.1 % was produced in the USA and 9.6 % was produced elsewhere under USA ownership. Total 14.7 %.

Decomposing changes over time, 2000-2019

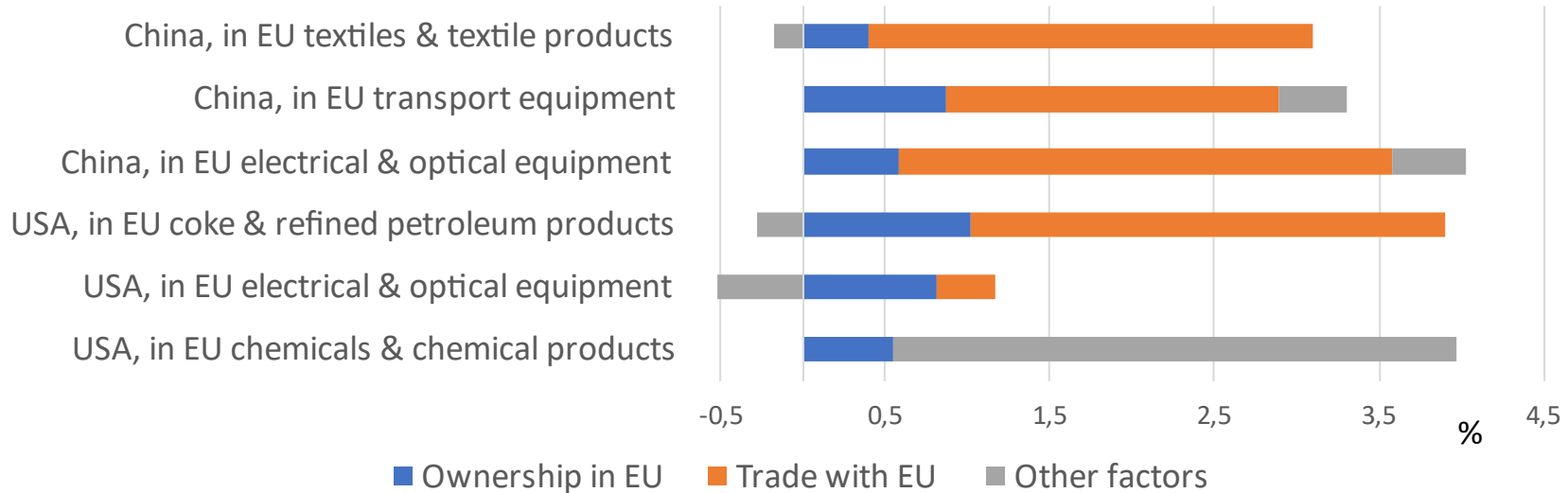
Factors that can be influenced by EU policies

- Investments by a country in the EU
- Exports by a country to the EU

Factors that cannot be, or difficult to be, influenced by policies (*the rest*)

- General trade fragmentation
- Changing technology
- Trade with both countries involved outside the EU
- Investments with both countries involved outside the EU

Decomposing changes China/USA related content, 2000-2019



- China related content in EU manufacturing of transport equipment rose 3.3%. 0.9%pt, 2.0%pt and 0.4%pt due to changes in Chinese ownership in the EU, Chinese trade with the EU and other factors, respectively.
- Size of factors that can be influenced by policies: generally large.

Conclusion & way forward

- One can map ownership in the supply chain of individual industries
- This ownership can be sizeable
- Changes USA/China related content in EU production mostly explained by changes in trade with/ownership in EU; can be influenced by policy

Policy makers ask for more detail in industry and country of ownership.

- Data improvement: using confidential Eurostat/ECB data
- Data improvement: more industry and country ([Africa](#)!) detail IO-table
- Methodological improvement: take into account that foreign affiliates trade relatively often with the home country

Questions, remarks, comments?

Now (if time permits), or later via

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The structural decomposition analysis (I)

- USA related value added = $S * V * L * F$
- $S = \text{share_US} = (s_1, s_2, \dots, s_m)$, s_i is a vector with the share of American ownership by industry in country i
- $V = (v_1, v_2, \dots, v_m)$, v_i is value added per unit production by industry in country i
- $F = (F_1, F_2, \dots, F_m)$ is final use, normalised by embodied value added
- $B = m$ identical matrices $\tilde{B}$ stacked on each other. $\widetilde{b_{i,jk}}$ = production of global industry i purchased by industry j in country k / output industry j in country k .
- T , trade matrix, such that $T * B = A$ with A the usual technical coefficient matrix
- $X = (x_1, x_2, \dots, x_m)$ is production necessary to produce F
- I is the identity matrix
- $(I - T \circ B) x = F$ and $x = (I - T \circ B)^{-1} F$. Set $L = (I - T \circ B)^{-1}$. Then $x = LF$.

The structural decomposition analysis (II)

$$\Delta(\text{USA related value added}) = \Delta(S * V * L * F)$$

$$\begin{aligned} &= \frac{1}{2} ((\Delta S)V_1L_1F_1 + (\Delta S)V_0L_0F_0) + \frac{1}{2} (S_0(\Delta V)L_1F_1 + S_1(\Delta V)L_0F_0) \\ &+ \frac{1}{2} (S_0V_0(\Delta L)F_1 + S_1V_1(\Delta L)F_0) + \frac{1}{2} (S_0V_0L_0(\Delta F) + S_1V_1L_1(\Delta F)) \end{aligned} \quad (1)$$

$$\Delta L = \frac{1}{2}L_1(T_0 + T_1) \circ (\Delta B)L_0 + \frac{1}{2}L_1(\Delta T) \circ (B_0 + B_1)L_0 \quad (2)$$

Plug (2) into (1) and split ΔS and ΔT each into two parts: one related to ownership in the EU/trade with the EU, one related to ownership outside the EU/trade outside the EU.

The structural decomposition analysis (III)

The shift in US related content in an industry is decomposed into factors

- Ownership (ΔS_{EU}) of US firms in the EU
- Intermediate trade linkages of the US ($\Delta(US_{EU})$) with the EU
- General defragmentation (ΔV)
- Technology (ΔB)
- Ownership (ΔS_{nEU}) of US firms outside the EU
- Intermediate trade linkages of the US ($\Delta(US_{nEU})$) with non-EU countries
- Intermediate trade linkages of other countries ($\Delta(Rest_of_world)$)
- Trade structure of total EU production by this industry for final use (ΔF)