

# **Which countries own/control your supply chain?**

15th Input-Output Workshop

Osnabrück, 28 February 2024

Oscar Lemmers, Tom Notten, Khee Fung Wong, Leen Prenen, Dennis Dahlmans

# Disclaimers

- All authors are employed at Statistics Netherlands
- Part of the research was financed by the Dutch Ministry of Economic Affairs and Climate Policy
- 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.

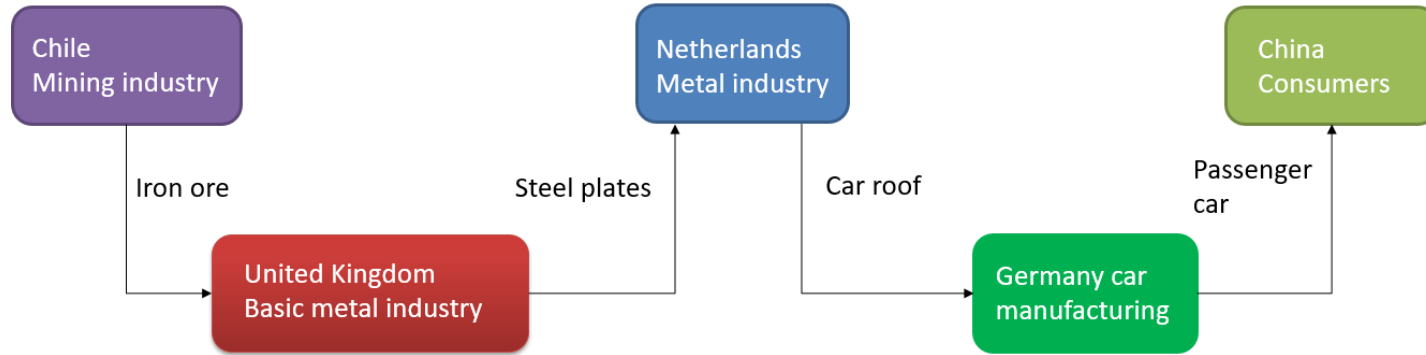
# Global value chains (GVCs) create dependencies

*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!

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

# Already focus on ownership in own country

- [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)
- (and so on)

# Analytical challenge: ownership elsewhere

Country of ownership of production in your supply chains matters

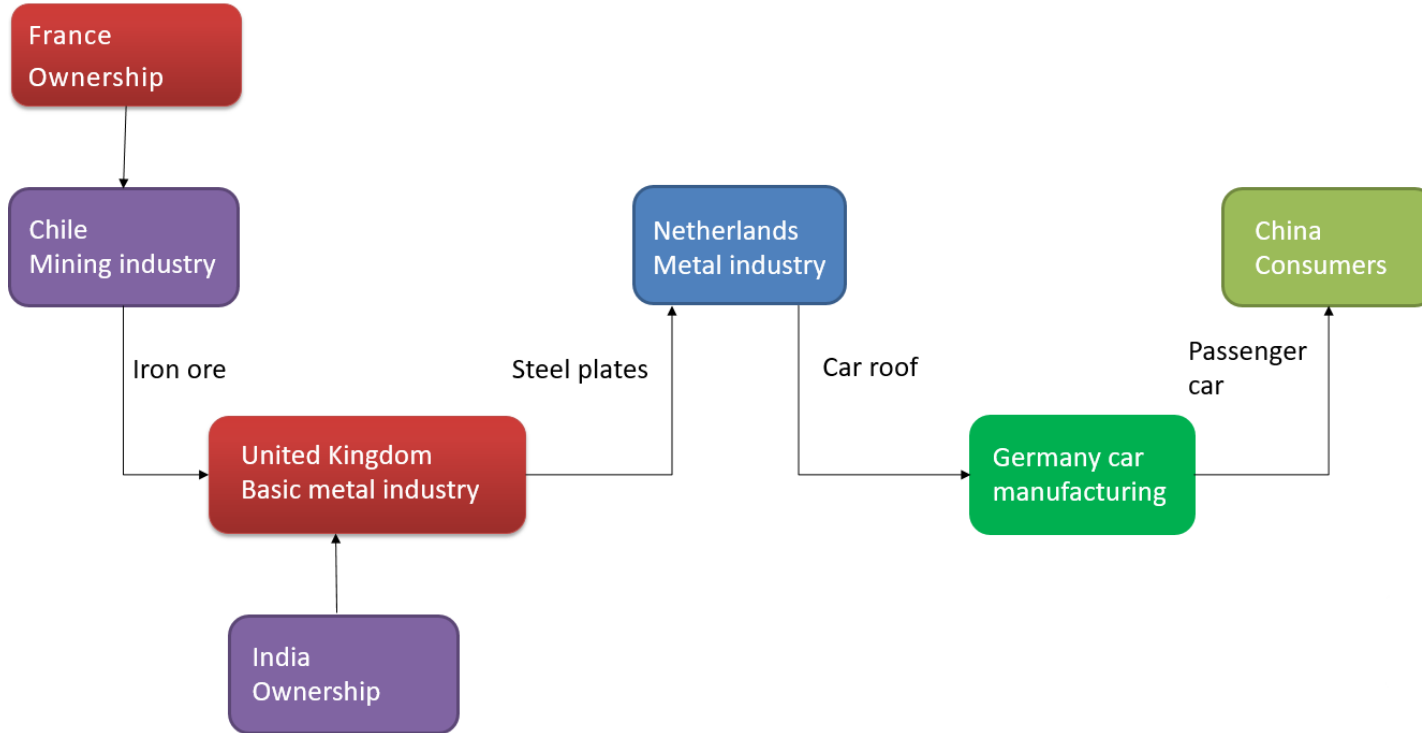
If country A owns production somewhere in the world that ultimately ends up in your supply chain, there is a dependence of country A

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

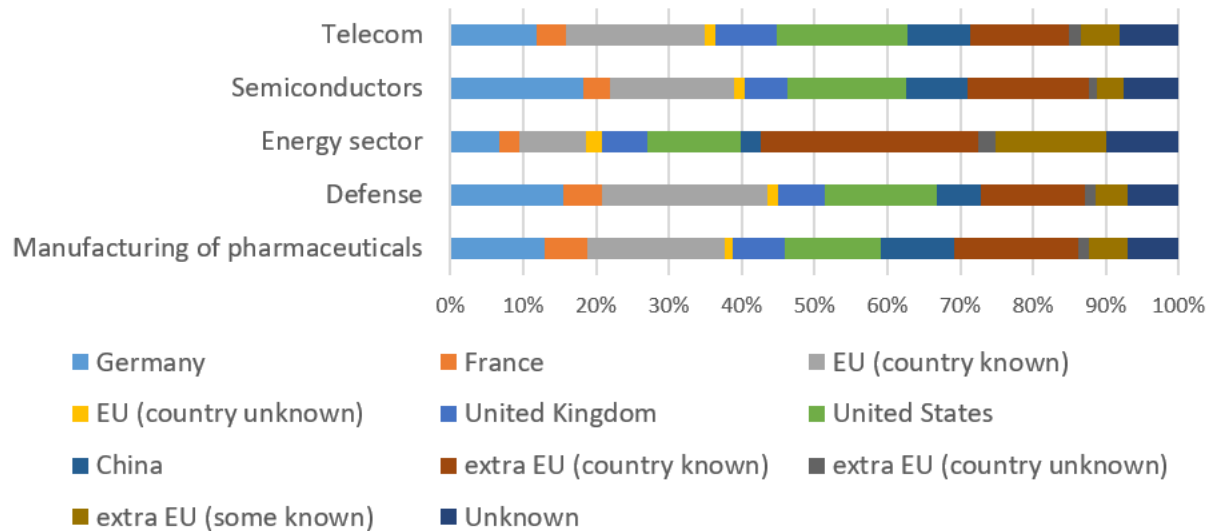
- Inter-country input-output table, over 60 countries and 35 industries, from [Asian Development Bank](#)
- Eurostat [Inward FATS](#): for each industry in each EU country, what is domestically owned, what is foreign owned, by country
- Eurostat [Outward FATS](#): for each EU country, given an industry 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***

# **Part I – the Netherlands**

# 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.

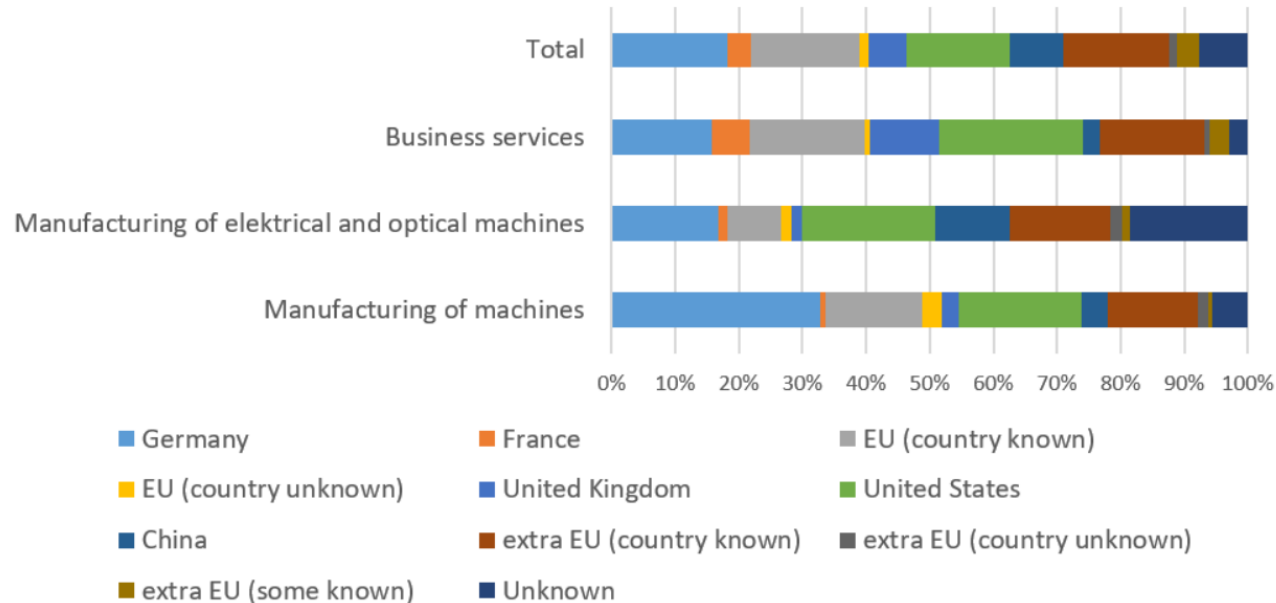
# Ownership in supply chain 5 Dutch industries, 2019



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

## Value added in a given industry due to supplies in the supply chain of the Dutch semiconductor industry, by country/region, 2019



Germany large in machines, US large in electrical & optical machines, large unknown part in that industry is Taiwan where we do not have ownership information

# Relatively large share of a country/region

Country of control - industry	Value added	Share in supplies by this industry
	x million euro	%
Other EU, countries known, construction	6	37
China, products of leather and shoes	0	37
Other EU, countries known, health and social work	1	36
Extra EU, countries known, coke, refined petroleum and nuclear fuel	6	34

A country might have a low absolute value in the supply chain of Dutch pharmaceutical manufacturers, but it might be relatively dominating in certain industries. Possible bottlenecks!

# **Part II – China/USA related content in EU production**

# China/USA related content in EU production

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

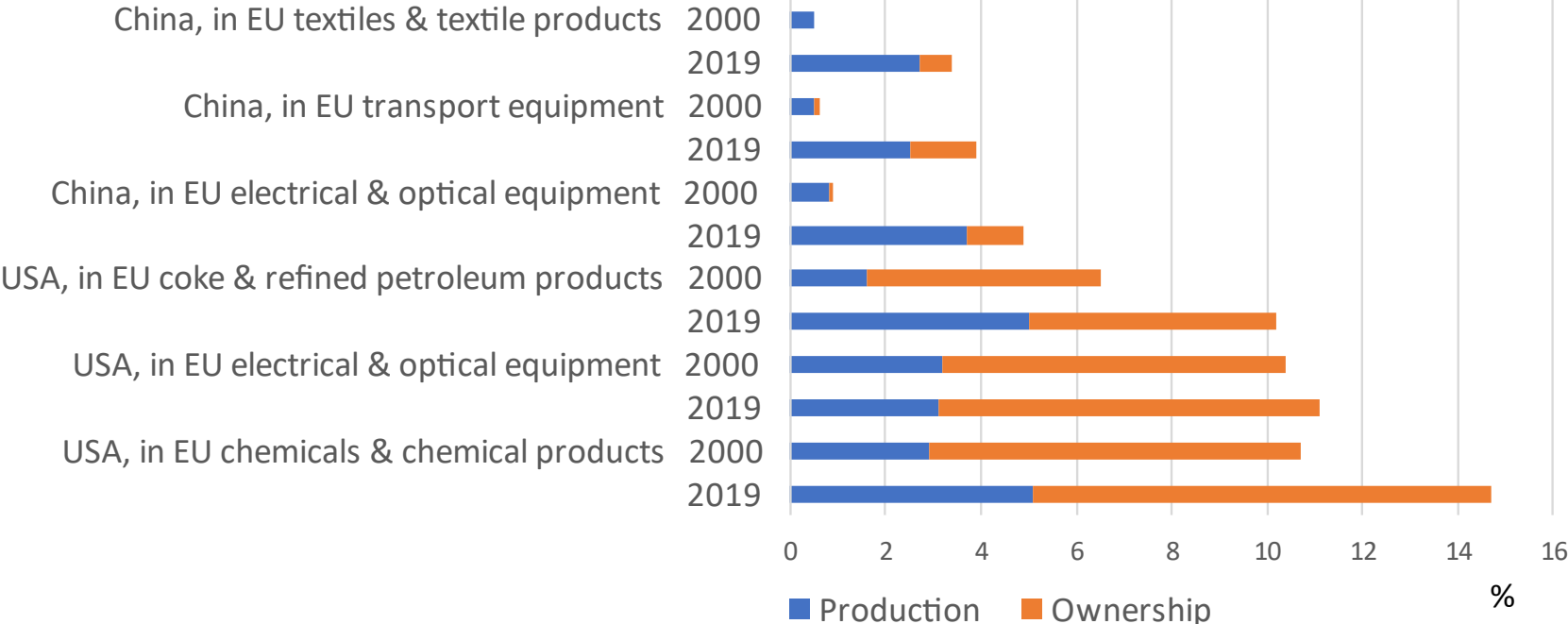
**USA related content:** inputs that are **produced in USA** and/or were under **American ownership** (similar: China related content)

## 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

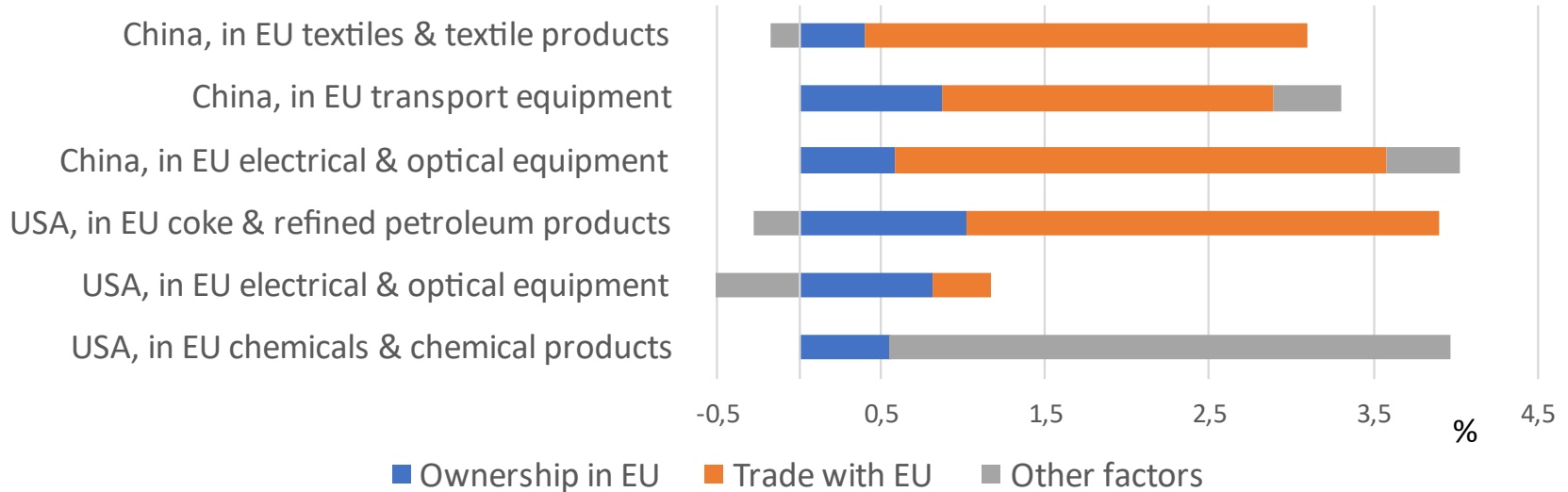
## Factors that can be influenced by EU policies

- 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.

**How to do this analysis?**

**A Structural Decomposition Analysis (SDA)**

# The structural decomposition analysis (I)

**Goal: decompose shift in US related content in an industry into factors**

- Ownership ( $\Delta S_{EU}$ ) of US firms in the EU
- Intermediate trade linkages of the US ( $\Delta(US_{EU})$ ) with the EU
- General defragmentation ( $\Delta V$ )
- Technology ( $\Delta B$ )
- Ownership ( $\Delta S_{nEU}$ ) 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 ( $\Delta F$ )

# The structural decomposition analysis (II)

- 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
- $X = (x_1, x_2, \dots, x_m)$  is production necessary to produce  $F$
- $I$  is the identity matrix

This is pretty standard

# The structural decomposition analysis (III)

- $B = m$  identical matrices  $\tilde{B}$  stacked on each other.  $\tilde{b}_{i,jk}$  = production of global industry  $i$  purchased by industry  $j$  in country  $k$  / output industry  $j$  in country  $k$ .  
 $B$  is a **technology matrix** – which industries – irrespective of country – are involved
- $T$ , **trade matrix**, such that  $T \circ B = A$  with  $A$  the usual technical coefficient matrix and  $\circ$  is elementwise multiplication
- $(I - T \circ B) x = F$  and  $x = (I - T \circ B)^{-1} F$ . Set  $L = (I - T \circ B)^{-1}$ . Then  $x = LF$ .

The change of  $L$  can be decomposed into changes of  $B$  and  $T$ : technology and trade

This is a bit less standard, but well-known in literature.

# The structural decomposition analysis (IV)

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

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

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

Plug (2) into (1) and split  $\Delta S$  and  $\Delta T$  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 (I - again)

**Goal: decompose shift in US related content in an industry into factors**

- Ownership ( $\Delta S_{EU}$ ) of US firms in the EU
- Intermediate trade linkages of the US ( $\Delta(US_{EU})$ ) with the EU
- General defragmentation ( $\Delta V$ )
- Technology ( $\Delta B$ )
- Ownership ( $\Delta S_{nEU}$ ) 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 ( $\Delta F$ )

# Which value added can be influenced?

Currently, look at value added created in country A or owned by country A. That is related to production country A has influence on.

## Is there more?

E.g., value added created in country X, embodied in a product that is exported to country A, used to create exports to country Y.

Country A can prevent this flow from X to Y. Should one add value added that flows through country A to the part that can be influenced? Or is it too much?

# 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 improvements: more industry and country ([Africa!](#)) detail IO-table
- Methodological improvement: take into account that foreign affiliates trade relatively often with the home country
- Paper: USA/China/EU related content in their respective production

# Questions, remarks, comments?

Now (if time permits), or later via

[o.lemmers@cbs.nl](mailto:o.lemmers@cbs.nl)