Which products are traded in your supply chain and how do they score on risk indicators?

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Disclaimers & acknowledgement

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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.

Outline presentation

- Why more product detail in supply chains?
- How did we obtain that detail
- Indicators associated with risks and some results for the supply chain of a Dutch industry
- Improvements, applications and conclusion

Why more product detail in supply chains?

General background

- In recent decades all kinds of global value chains emerged
- Led to dependencies on energy products and raw materials
- Other dependencies emerged due to outsourcing

- At the start of the COVID-19 pandemic: export restrictions of pharmaceuticals and face masks by several countries
- EU dependency on Russian gas showed when supply was cut
- Tariffs are back on the agenda – might lead to a cascade of tariffs

International integration has benefits; might lead to risks as well

Questions by policy makers

If there is a **foreign event**, a natural disaster, local strikes, geopolitical tensions, sudden export bans for specific products etc. What is the **link of this country/this product with domestic industries, firms, regions and consumers**?

Can you get the goods elsewhere? Concentrated world market or not? Are there alternative suppliers in the EU? Are there **risks**?

What is the **impact of the foreign event** on the domestic economy? (out of scope for Statistics Netherlands, not for others)

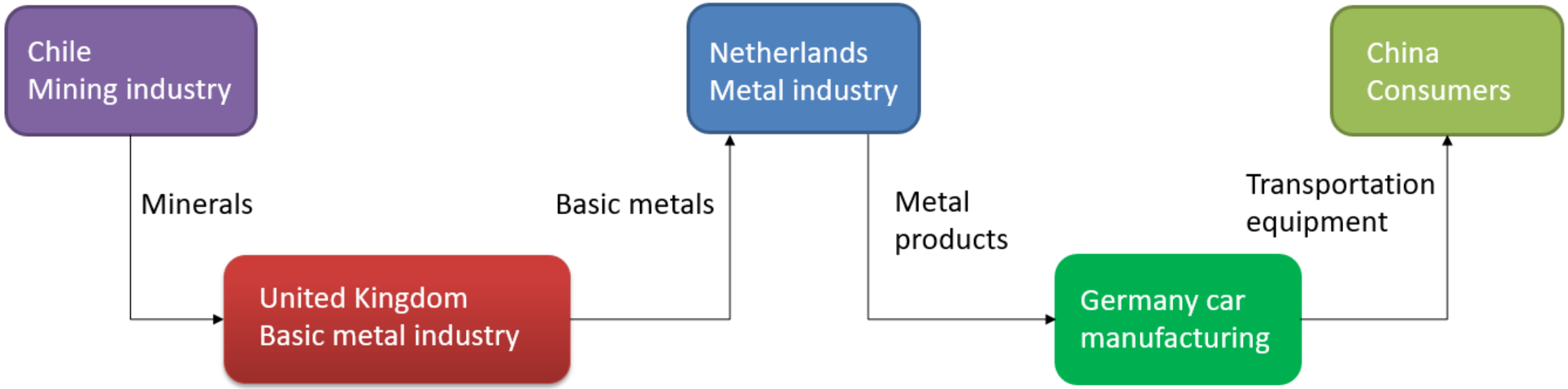
We translated this into statistics

- Take a domestic industry, map its supply chain, add **detailed products**, by country
- Possible to use a **detailed specific national industry of interest**
- As **timely** as possible (in autumn 2025, we could do 2023, or 2024 with additional assumptions)

Not: Netherlands uses a lot from Russian mining industry

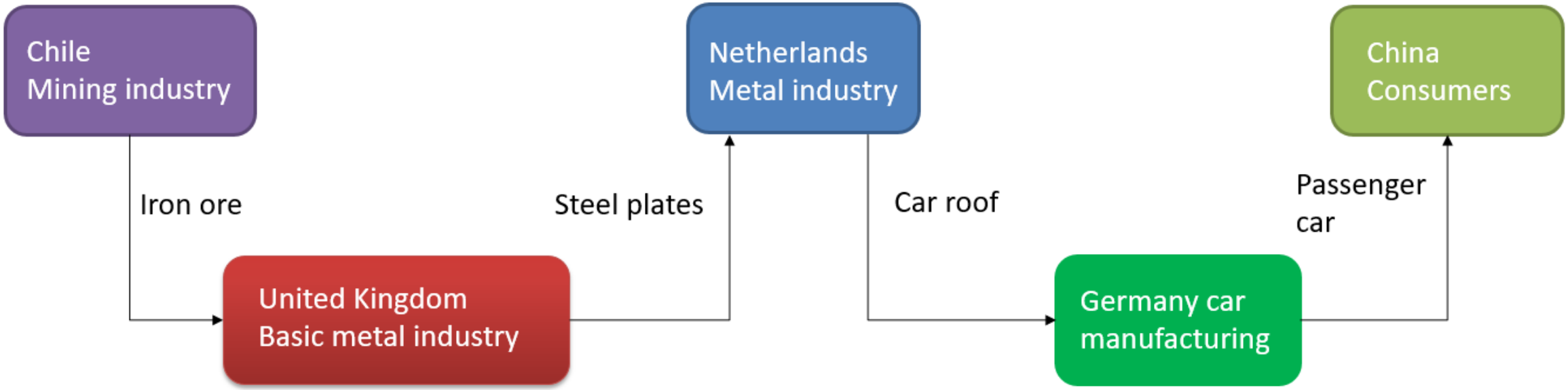
But: Netherlands imports x of Russian coal, a% is re-exported, b% is used by these industries, they produce cde% for these customers at home and use z% to produce for customers abroad

Before our project: no detailed information



See, e.g., Kuzmenko & Čechura (2023) how to derive the countries in the supply chain where production for you is located and in what industries.

After our project: detailed product information

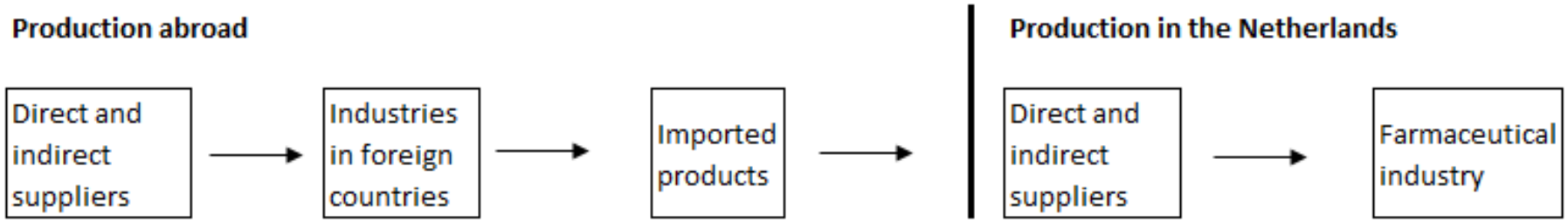


Detailed product information: about 5000 products traded between industry A in country 1 and industry B in country 2

How did we obtain more detail?

General approach: combine micro & macro

Data and methods for deriving the supply chain of a given industry



Data used to derive the link	ADB MRIO	FIGARO supply table	Dutch input-output table, trade data	Dutch input-output table
Methodology used to derive the link	Input-output analysis	Link products & industries	Lemmers & Wong, Aerts et al.	Hypothetical extraction method

Mapping the Dutch part of the supply chain

- Policy makers point out the critical industries.
- **Map Dutch part of supply chain** of those industries.
- Estimate how much **imports of which products** the Dutch supply chain needs.
- **Correct for** imports from a country that are not used for Dutch production but for **re-exports**.
- **Account for heterogeneity**: industry A and industry B might import the same product, but from different countries.

Mapping the foreign part of the supply chain

- Estimate **how much foreign industries trade with each other**. Input-output analysis using ADB ICIO.
- **Incorporate coarse product data**. Used FIGARO SUTs; derive that metal manufacturers in United Kingdom sell *metal products* to German furniture manufacturers and German shipyards.
- **Refine the product level**. BACI data from CEPII – very detailed trade data. United Kingdom sells small screws and large steel plates to Germany. These are the *metal products*!
- Use detailed Dutch data to **refine industry allocation of specific products**. It shows that furniture manufacturers generally use small screws and that shipyards generally use large steel plates.

Data

- Dutch supply and use table, who produces/uses which product
- Dutch input-output table, how are industries linked
- Dutch imports by enterprise, which product from which country

Could use public data only, Dutch data not necessary, but does help

- Inter-country input-output table, over 60 countries and 35 industries, from Asian Development Bank
- FIGARO supply and use tables (Eurostat & EC-JRC), 56 countries, 64 industries, 64 products, who produces what for whom
- BACI trade data (CEPII), imports and exports, all countries, ~5000 products

Indicators associated with risk and some results for the supply chain of Dutch manufacturers of pharmaceuticals

Indicators associated with risks in literature

By request of the ministry, following EC-study Arjona et al., 2023:

1. **Import value** by country of import. Threshold value: 10.000 euros
2. **World market concentration**. Herfindahl-Hirschman index (HHI). Threshold: 0.25.
3. **Import diversification of the Netherlands**. HHI. Threshold: 0.25
4. **Non-EU share in EU-imports**. $\frac{extra\ EU\ import\ value}{total\ EU\ import\ value}$. Threshold: 50%
5. **Substitution ratio EU**. $\frac{extra\ EU\ import\ value^{EU}}{total\ EU\ export\ value^{EU}}$. Threshold: 100%
6. **Centrality**. Weighted out-degree centrality.

Variables in the database for the ministry

- Industry in the Netherlands (five in our case)
- Country that exports a good somewhere in supply chain of the industry
- The exported product (about 5,000 different products)
- Six indicators associated with risk

A **product by country combination** somewhere in the supply chain is **flagged** if all their 6 corresponding indicators surpass the thresholds.

Examples of flagged goods in imports for (suppliers of) Dutch pharmaceutical manufacturers, 2019

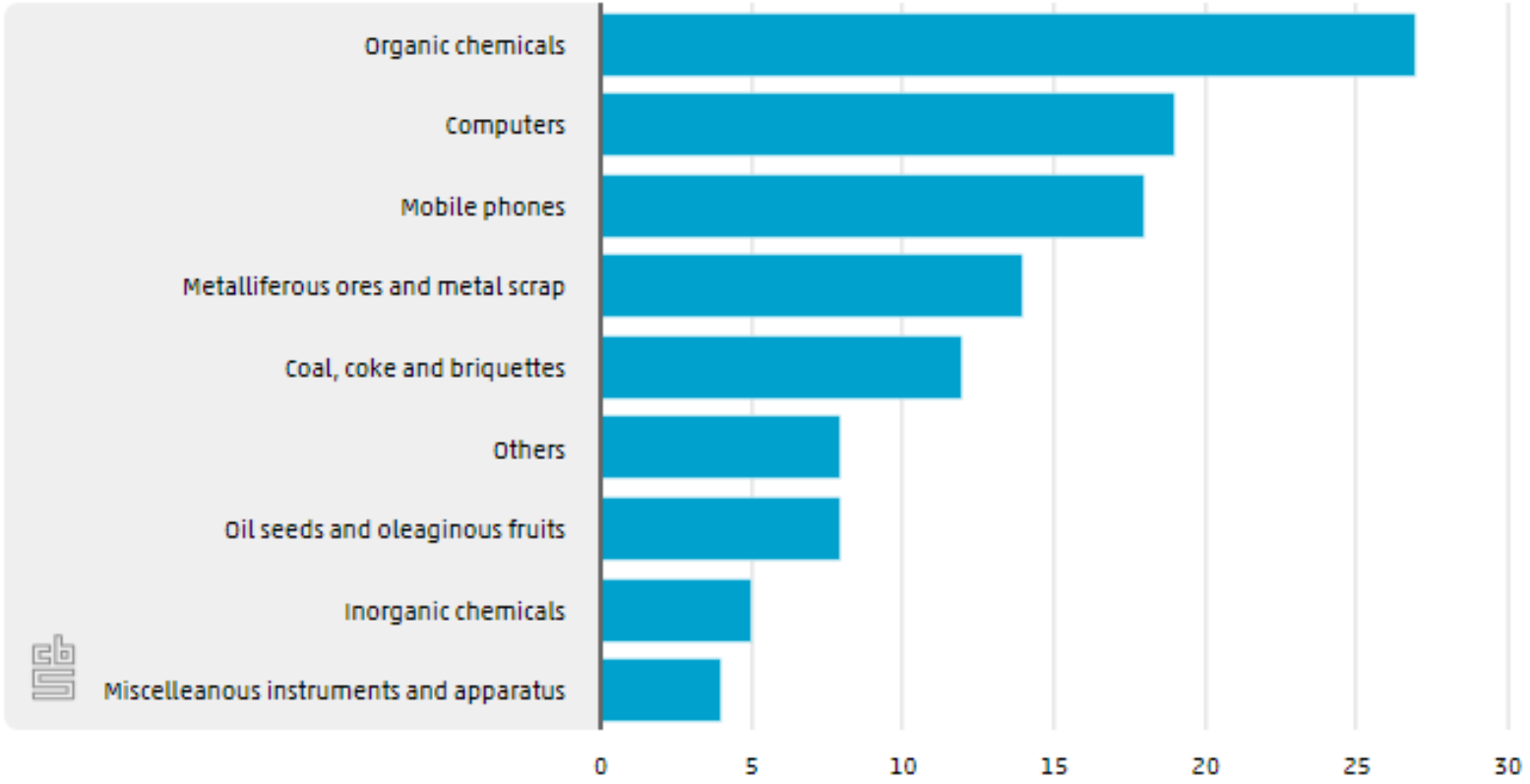
	Castor oil	Chloramphenicol
Originating from	Germany	China
Import value	15.000 euros	1,2 million euros
Share of country in world market	2%	90%
Share of country in imports of this product	45%	83%
World market concentration	0,77	0,81
Dutch import diversification	0,42	0,71
Non-EU share in EU-imports	77%	79%
Substitution ratio EU	3,12	2,64
Centrality	In highest quarter	In upper half

Source: Statistics Netherlands calculations based on ADB, Eurostat/JRC, BACI

See also "Mapping and testing product-level vulnerabilities in granular production networks" by Berthou, Samek & Haramboure (OECD)

What type of goods are the flagged products?

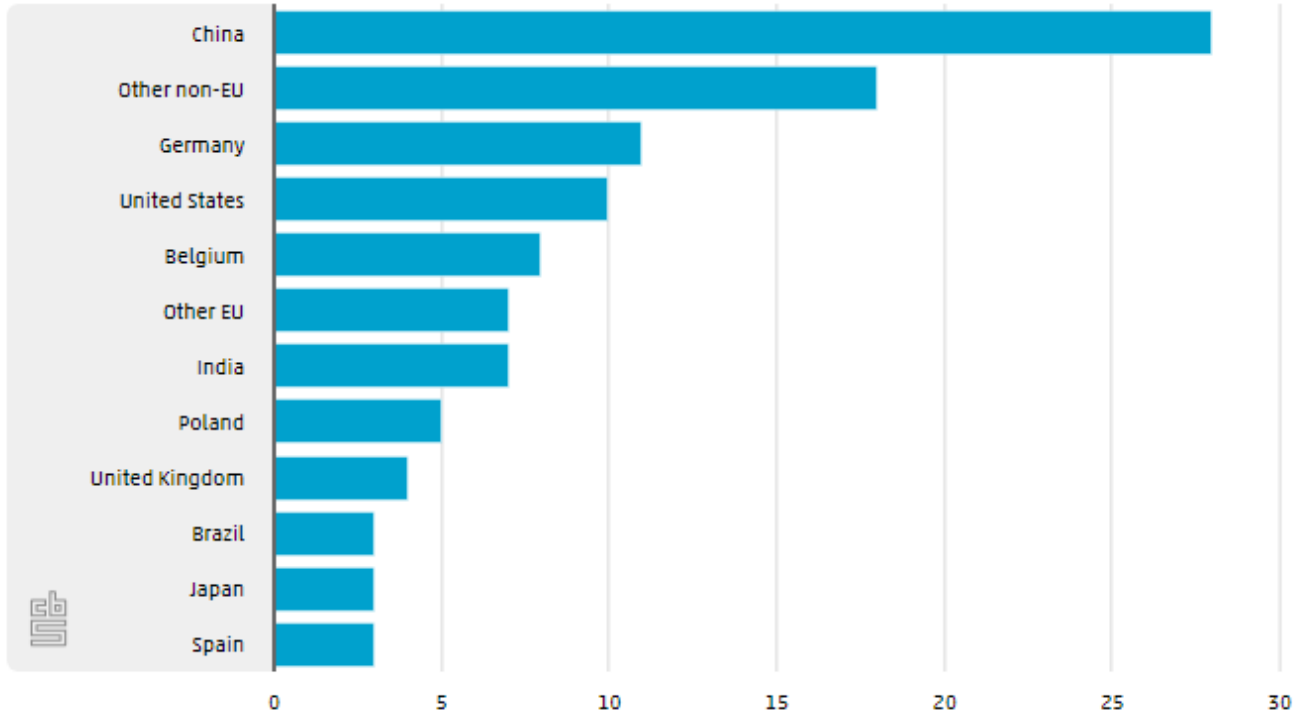
Flagged goods in the supply chain of the Dutch pharmaceutical industry, upstream trade, by country, 2019



Source: Statistics Netherlands calculations based on Asian Development Bank, Eurostat/JRC, BACI

Who produces flagged goods in the supply chain?

Flagged goods used in Dutch imports in the supply chain of the Dutch pharmaceutical industry, by country, 2019



Source: Statistics Netherlands calculations based on Asian Development Bank, Eurostat/JRC, BACI

China, Germany and the United States dominate. Not surprising given that these countries are among the most important import partners

Improvements, applications & conclusion

Improvements

- Follow more closely the construction of multi-country input-output table FIGARO
- Use BEA or Japanese data that contains more detail about which industry produces/uses which product
- Use OECD BIMTS data that has some corrections for re-exports
- Use upcoming data that has more info on African countries
- Use AIPNET ("what products are used to produce a specific product") by Fetzer, Lambert, Feld & Garg (2024)

Examples of other applications

- Critical raw materials in the Dutch supply chain (Bohn, Notten, Ramaekers, Wong, 2023): imported from where by whom, directly and indirectly (products containing critical raw materials)
- Tariffs in the Dutch supply chain (Notten, Wong, Rooyakkers & Dahlmans, 2024, executive summary): tariff costs on Dutch imports of same magnitude as indirect tariff costs in supply chain
- Early warning indicators, linking very timely trade data to products in supply chains of an industry (*just an idea for now*)

Conclusion

- We devised new methodology to map detailed products in the supply chain of an industry – under certain assumptions
- The methods can be applied using public data only
- We mapped products in the supply chain of 5 Dutch industries and connected products to indicators associated with risk.
- Methodology has other applications as well

What is a problematic risk? Policy makers have to decide.

What happens if… That is for other institutions (e.g., OECD, EC-JRC) to derive; they can use our methods and data.

Questions, comments, suggestions?

Always welcome!

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In Dutch: Report, methodological details and detailed tables here

(**Paper in English available** on request)