An Overview of Modern MRIO Databases

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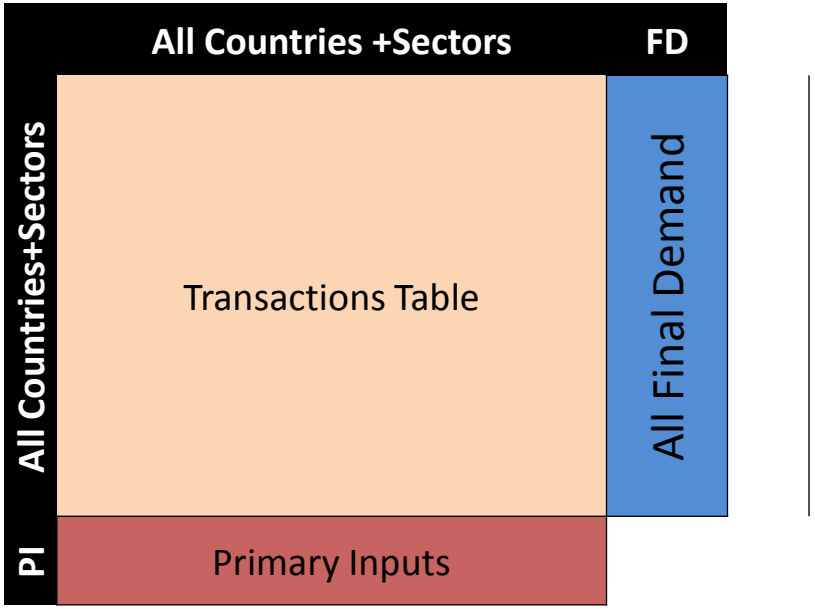
Norway

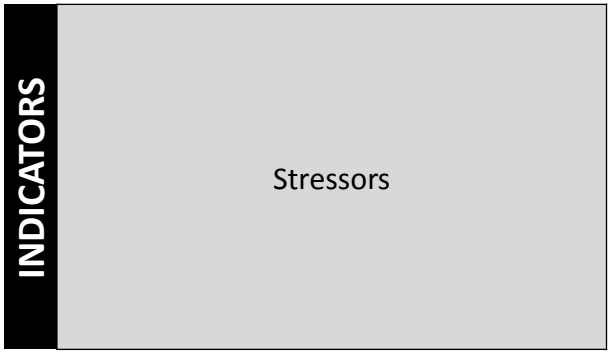
IO tables provide retrospective accounts

&

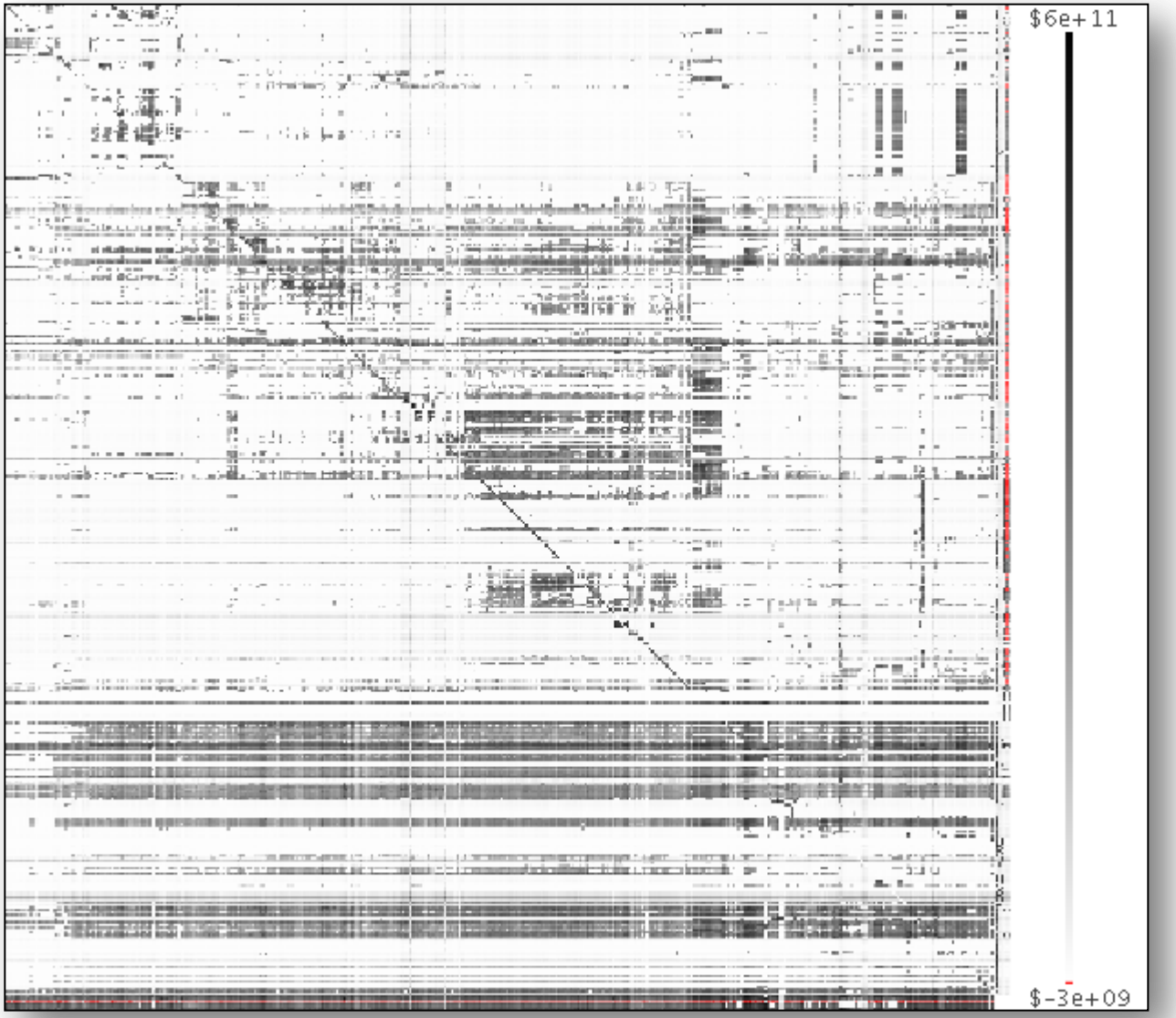
IO tables provide a data foundation for forward-looking models

IO Table Layout

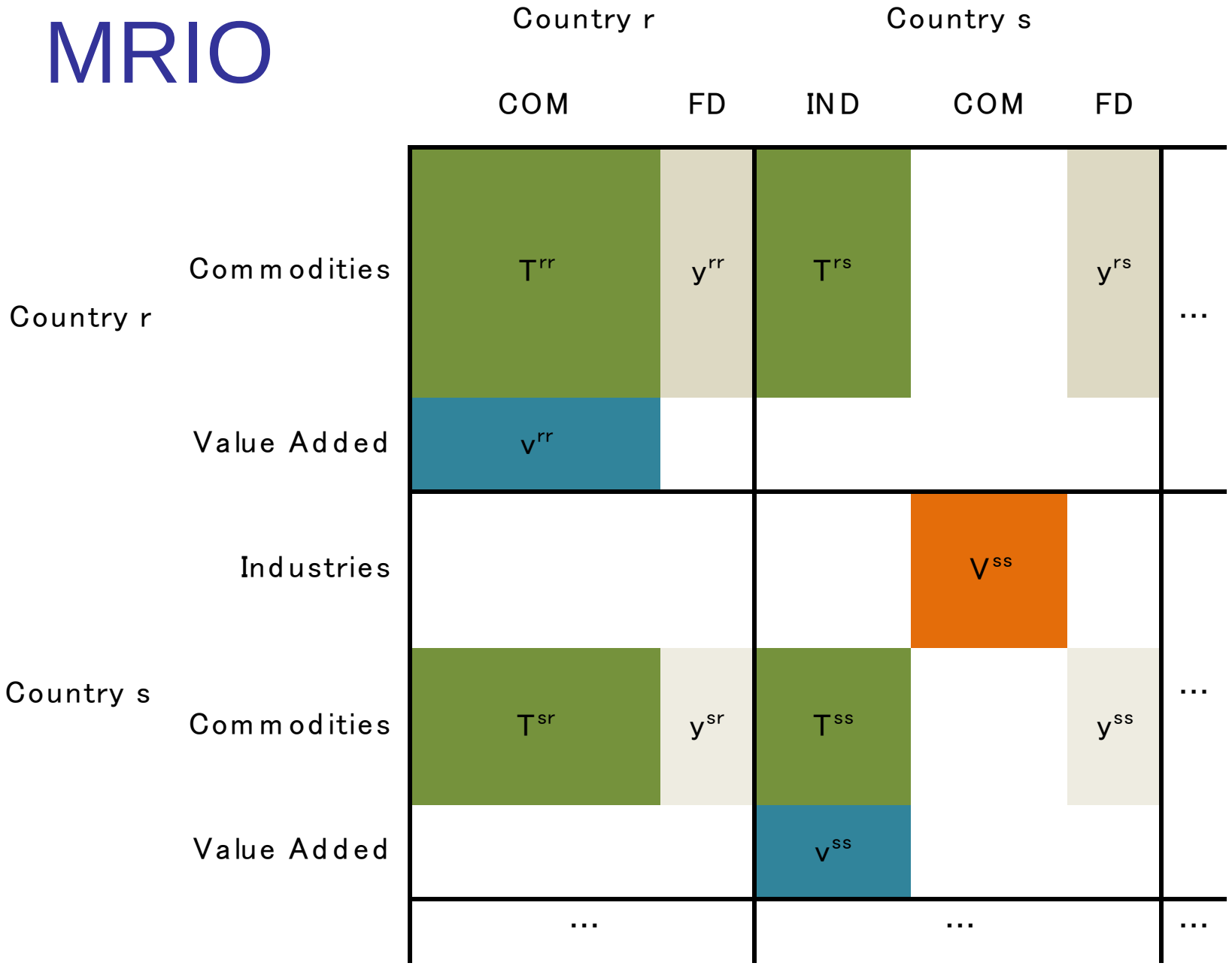




Japan



MRIO


Country r
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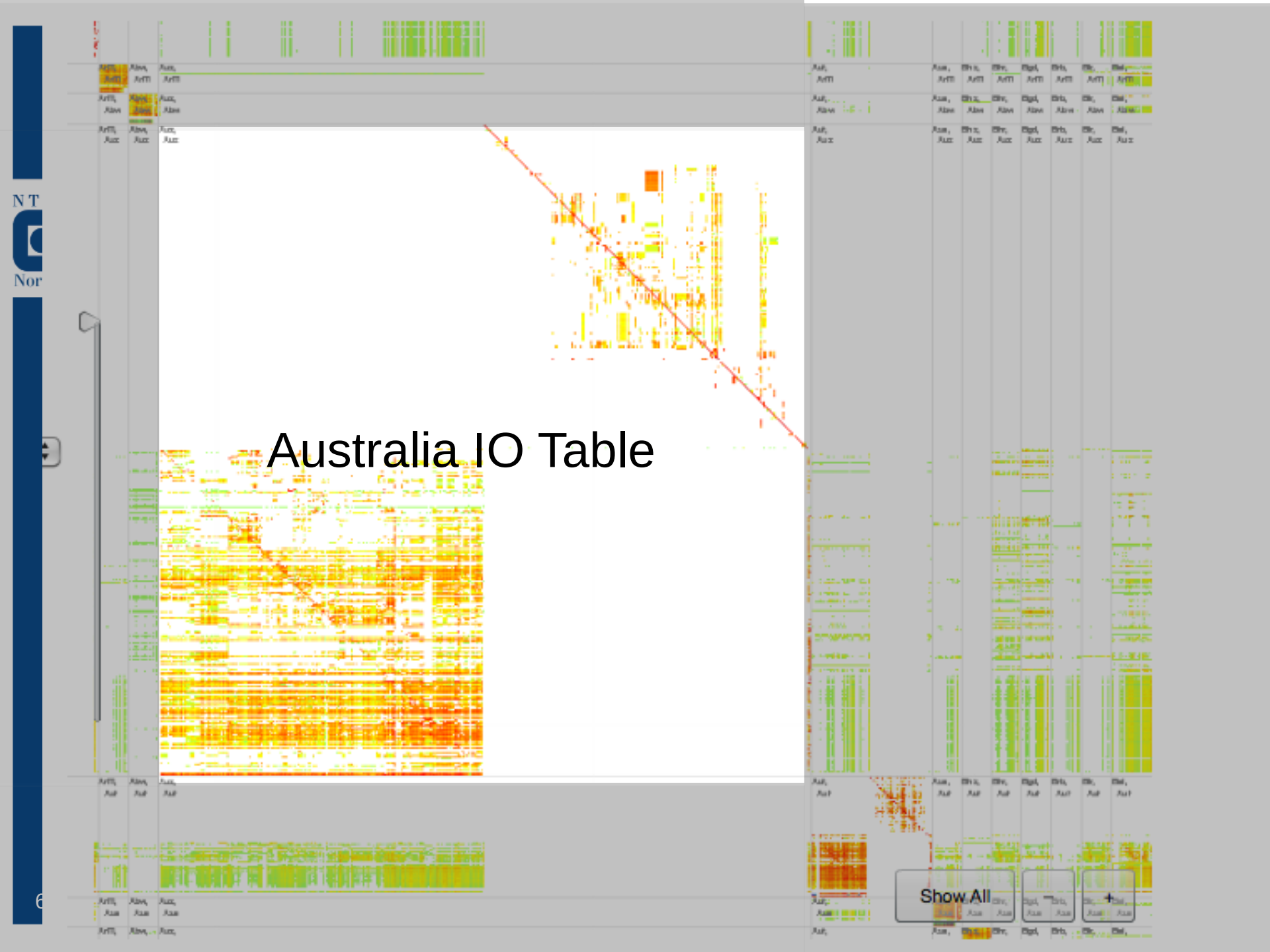
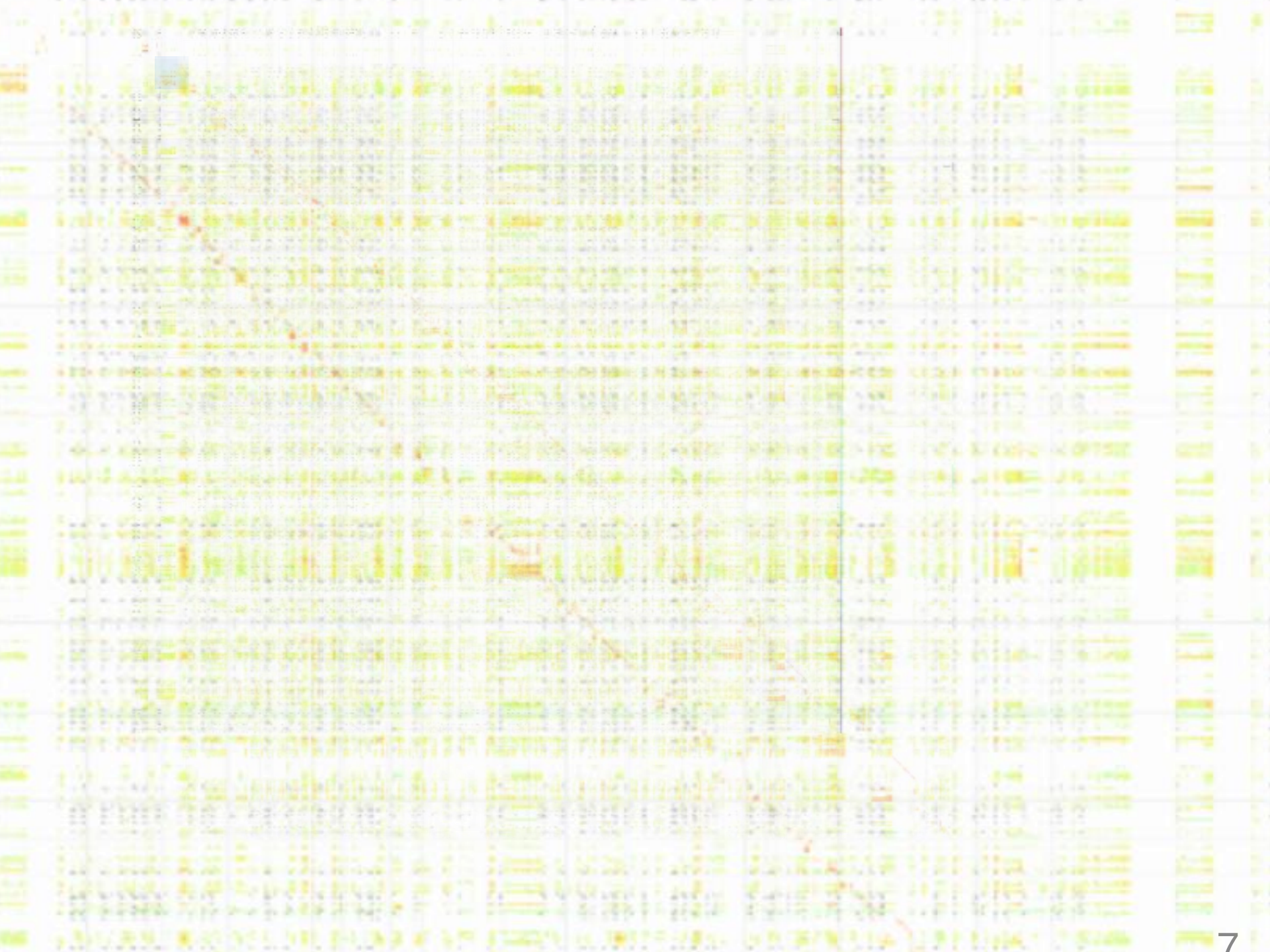
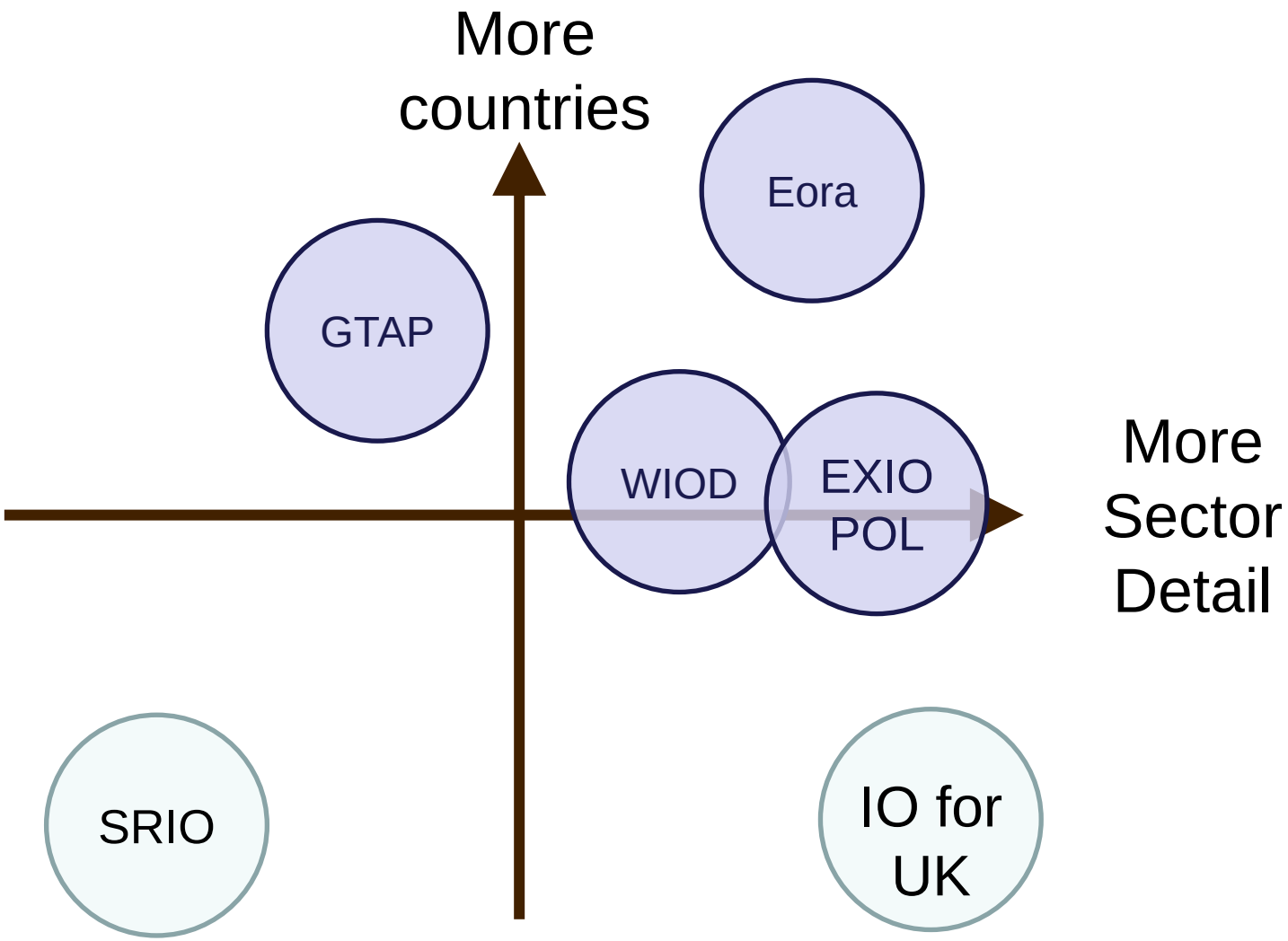

Australia IO Table
Show All




More countries
Eora
GTAP
WIOD
EXIO POL
More Sector Detail
SRIO
IO for UK

Why are MRIOs hard to build?

1. Different classifications
   - Solution: Fix to one, or use concordances

2. Conflicting source data
   - Solution: data hierarchy, or optimisation approach

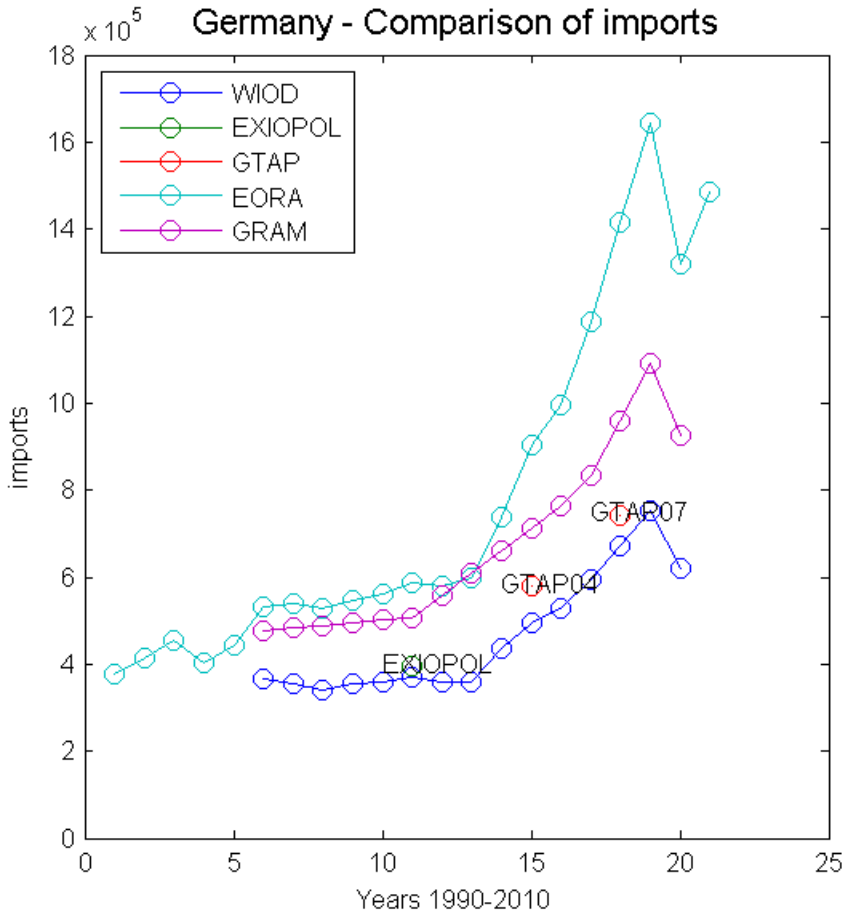
Data Conflict

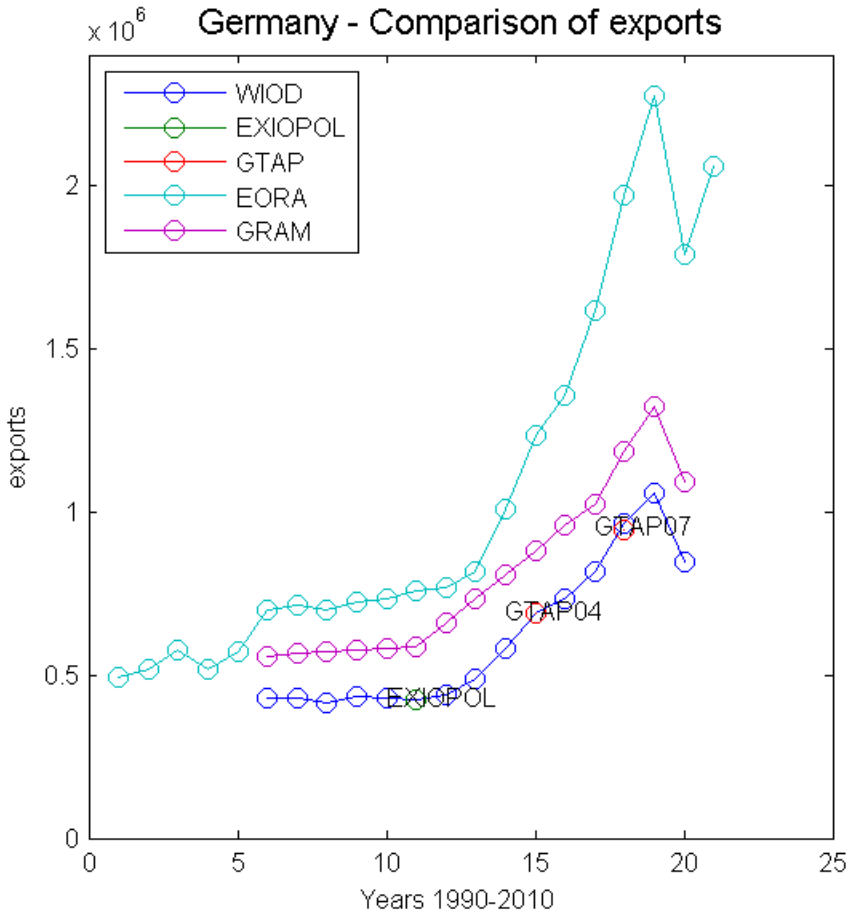
- US exports to Portugal ≠ Portugal imports from US
- GDP in Japan's IO table ≠ GDP in Japan's SNA
- UN SNA Main Aggregates ≠ UN SNA Official Country
- Balancing the MRIO table

Resolving Conflict

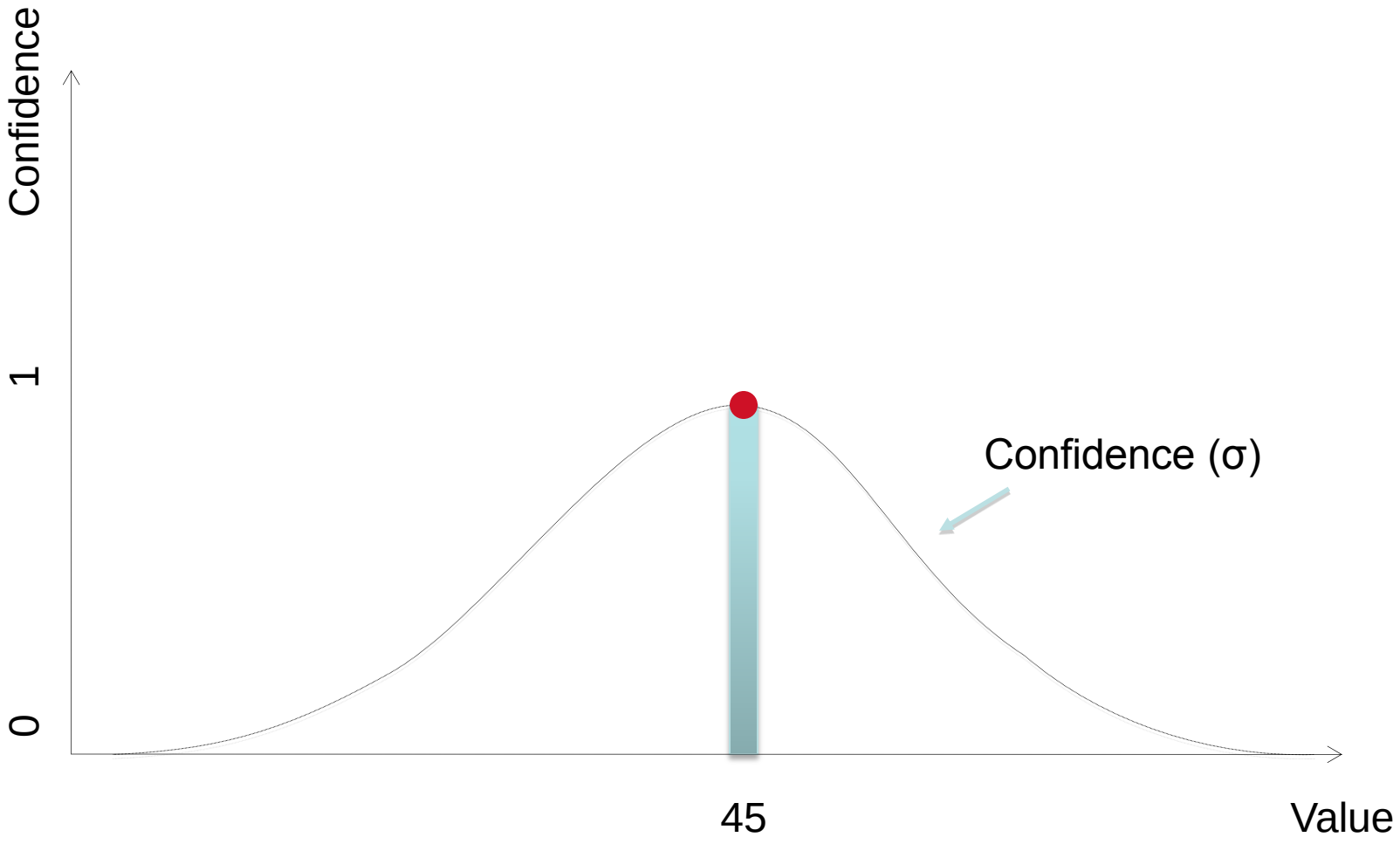
- GTAP: hierarchy of reliability
  - International trade > Macro data > energy data > IO table
- WIOD
  - SNA consistency
- Eora
  - Constrainted optimization with standard error (S.E.)

worldmrio.com/comparison

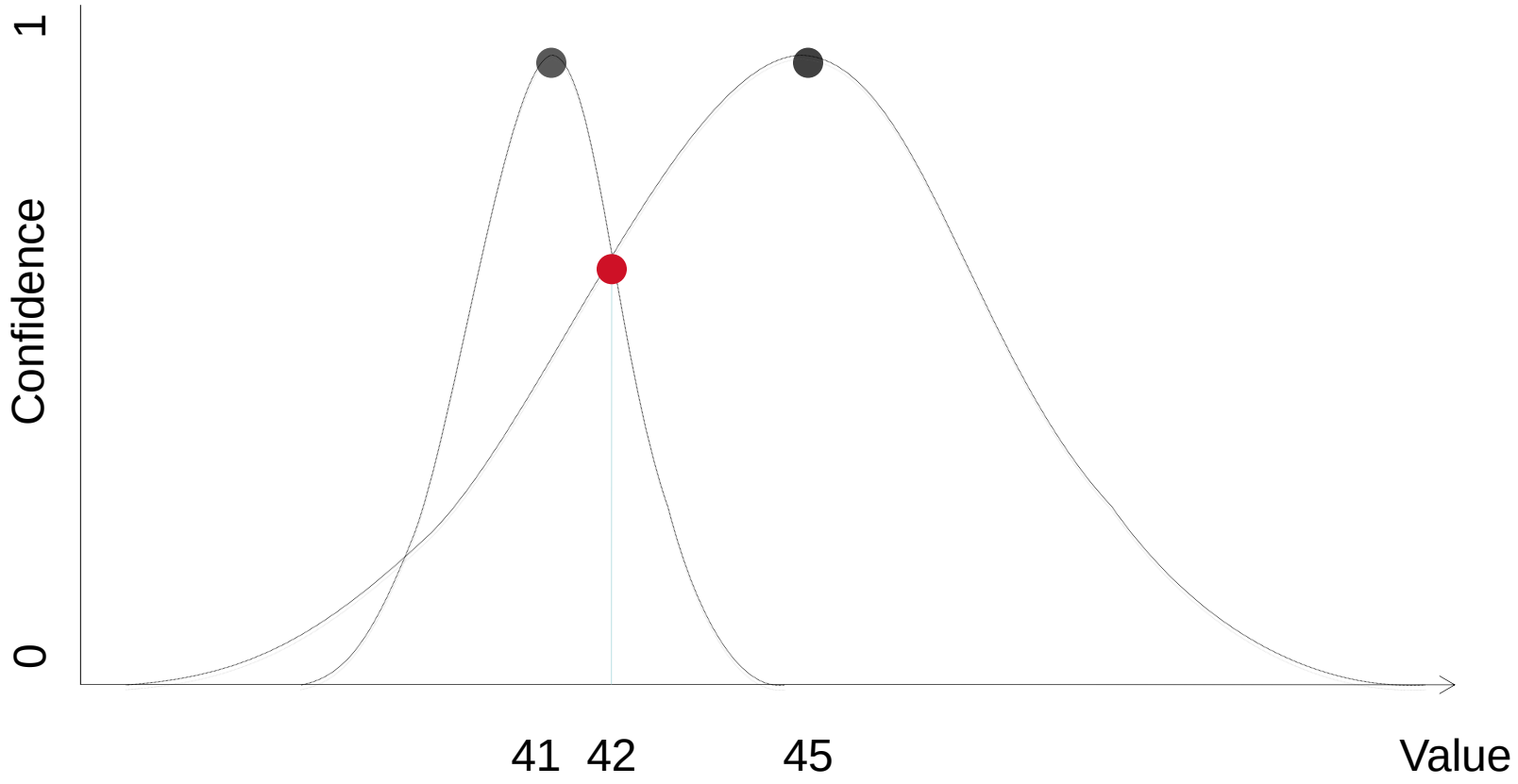




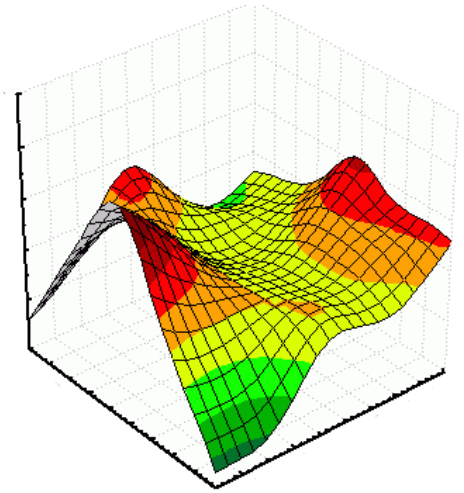
Resolving conflict using optimization



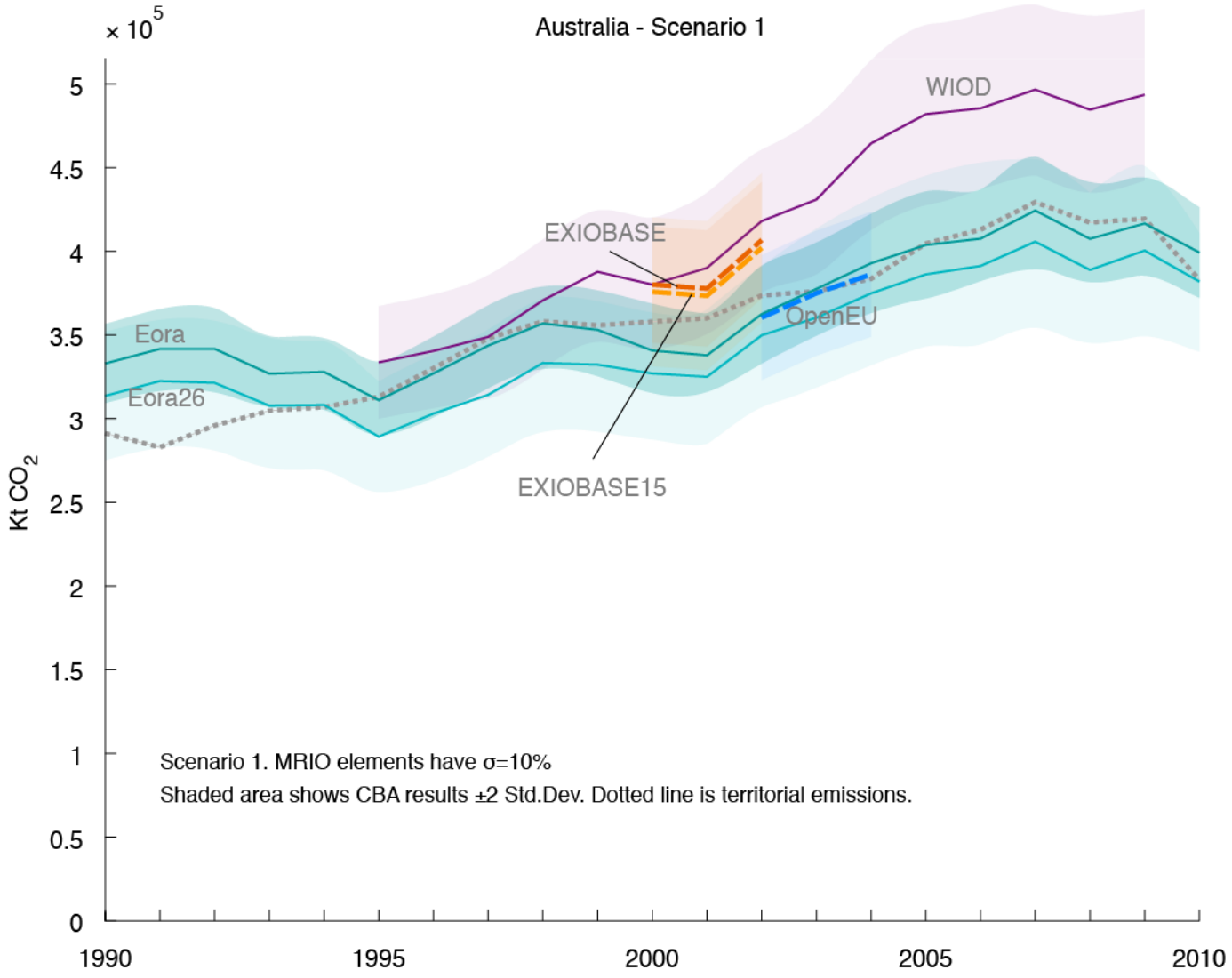
Resolving conflict using optimization



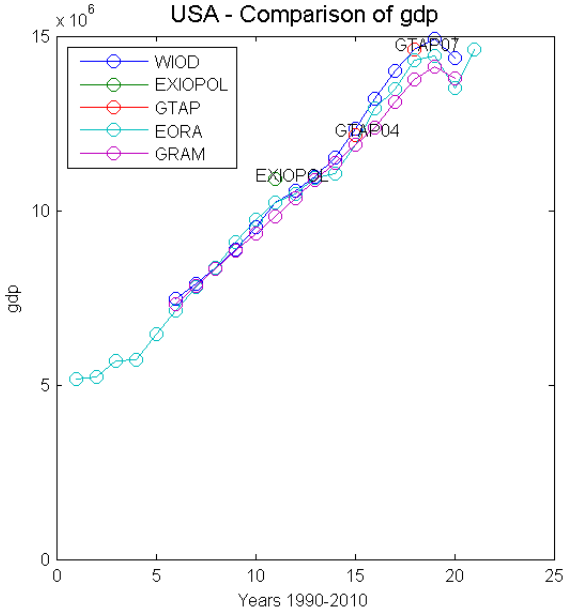
~70 million constraints/yr
>20 billion variables

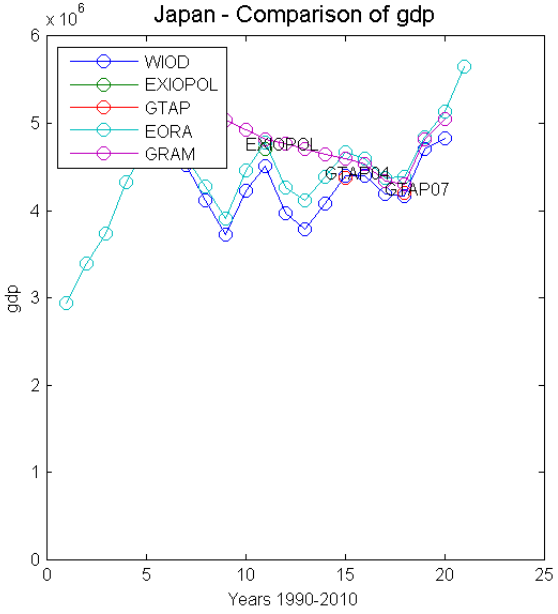


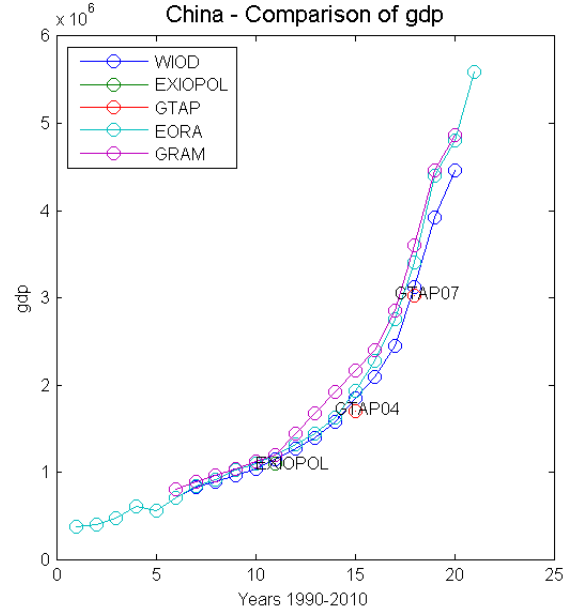
Data Reconciliation

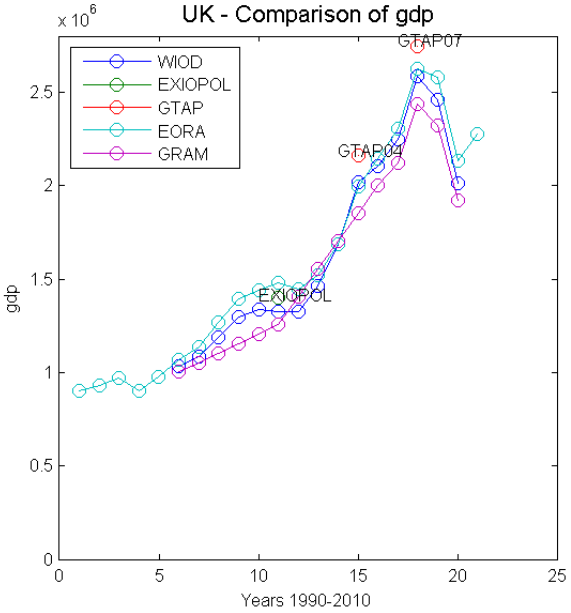


worldmrio.com/confidence





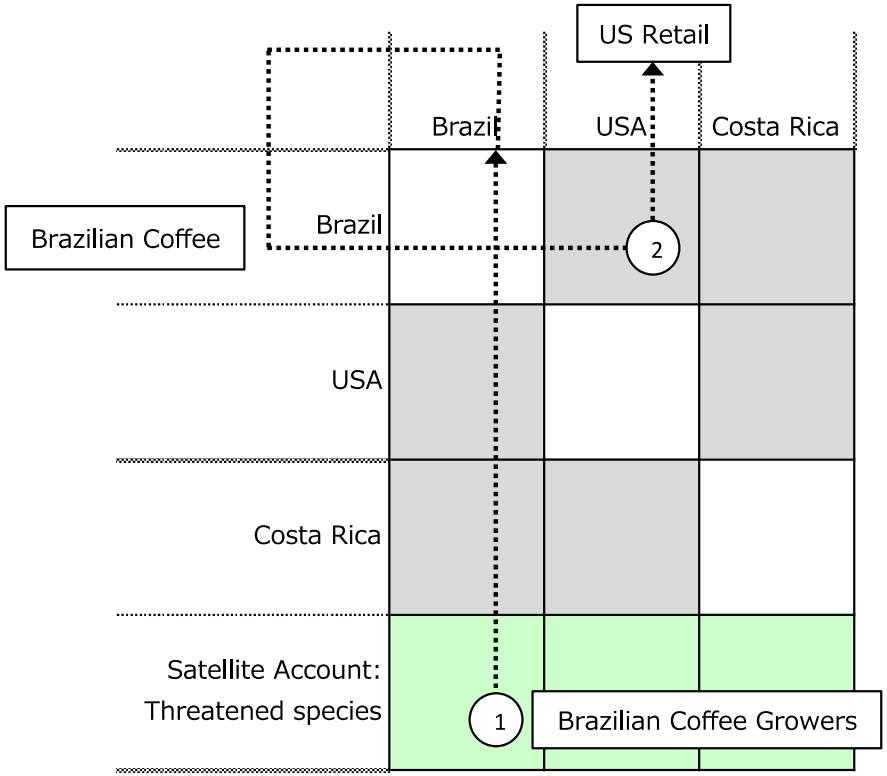




worldmrio.com/convergence

Applications

- Supply Chain Analysis
- Input dependencies
  - Resources: CO_2, food, fibre, water
- Network analysis



1 Number of species threatened by Brazilian coffee growers

2 Value of coffee exported by Brazil for US retailers

Global Supply Chain Analysis

Malawi agriculture industry →
Netherlands food processing industry →
Netherlands food products wholesale →
France food and beverages retail industry →
Final demand in France in food products sector

2.18E-02 GL blue water Madagascar agriculture industry -> France agriculture, hunting and related service activities industry -> France products of agriculture, hunting and related service
1.31E-02 GL blue water Ethiopia agriculture industry -> Final demand in Germany in the tobacco products sector
2.68E-03 GL blue water Belize agriculture industry -> Belize food & beverages industry -> UK re-export industry -> Final demand in UK in the re-import sector
2.56E-03 GL blue water Cameroon agriculture industry -> Netherlands manufacture of tobacco products industry -> Final demand in Netherlands in the tobacco products sector
1.83E-03 GL blue water Mauritius sugar cane industry -> Mauritius sugar cane products -> Mauritius sugar milling industry -> Mauritius sugar products -> UK manufacture of other food pro
3.04E-03 GL blue water Guinea agriculture industry -> Italy manufacture of food products and beverages industry -> Final demand in Italy in the food products and beverages sector
2.53E-03 GL blue water Mauritius sugar cane industry -> Mauritius sugar cane products -> Mauritius sugar milling industry -> Mauritius sugar products -> Germany food products -> Germa
1.36E-03 GL blue water Mauritius sugar cane industry -> Mauritius sugar cane products -> Mauritius sugar milling industry -> Mauritius sugar products -> Ireland manufacture of food produ
1.34E-03 GL blue water Dominican Republic agriculture industry -> Spain manufacture of other food products industry -> Final demand in Spain in the vegetable and animal oil and fat sec
1.86E-02 GL blue water Madagascar agriculture industry -> France manufacture of food products and beverages industry -> France food products and beverages products -> France man
4.04E-03 GL blue water Philippines food crops products -> Philippines other food products -> Italy hotels and restaurants industry -> Final demand in Italy in the hotel and restaurant servic
2.14E-03 GL
1.99E-03 GL
1.30E-03 GL
1.64E-03 GL
1.47E-03 GL
3.51E-03 GL
2.50E-03 GL
1.97E-03 GL
1.94E-03 GL
1.02E-03 GL
5.32E-03 GL
1.05E-03 GL
8.31E-02 GL
2.03E-03 GL
1.64E-03 GL
2.50E-03 GL
1.97E-03 GL blue water Jamaica agriculture industry -> Jamaica food & beverages industry -> UK manufacture of bread; manufacture of fresh pastry goods and cakes industry -> Final de
1.94E-03 GL blue water Egypt agriculture industry -> France manufacture of food products and beverages industry -> Final demand in France in the food products and beverages sector
1.02E-03 GL blue water Panama agriculture industry -> Italy manufacture of food products and beverages industry -> Italy food products and beverages products -> Italy manufacture of fo
5.32E-03 GL blue water Dominican Republic agriculture industry -> Spain manufacture of other food products industry -> Final demand in Spain in the other food products sector
1.05E-03 GL blue water Honduras agriculture industry -> Poland manufacture of food products and beverages industry -> Poland food products and beverages products -> Poland manufa
8.31E-02 GL blue water Mozambique agriculture industry -> Final demand in Germany in the food products sector
2.03E-03 GL blue water Argentina industrial crops industry -> Argentina fruits and nuts products -> Netherlands manufacture of food products and beverages industry -> Final demand in N
1.64E-03 GL blue water Costa Rica agriculture industry -> Italy manufacture of textiles industry -> Final demand in Italy in the textiles sector
1.01E-03 GL blue water Burundi agriculture industry -> Final demand in Germany in the food products sector
3.42E-03 GL blue water Ethiopia agriculture industry -> Netherlands hotels and restaurants industry -> Final demand in Netherlands in the hotel and restaurant services sector
3.09E-03 GL blue water Madagascar agriculture industry -> Austria agriculture, hunting and related service activities industry -> Austria products of agriculture, hunting and related service
2.50E-03 GL blue water Ethiopia agriculture industry -> Italy wholesale trade and commission trade, except of motor vehicles and motorcycles industry -> Final demand in Italy in the whole
1.97E-03 GL blue water Jamaica agriculture industry -> Jamaica food & beverages industry -> UK manufacture of bread; manufacture of fresh pastry goods and cakes industry -> Final de
1.94E-03 GL blue water Egypt agriculture industry -> France manufacture of food products and beverages industry -> Final demand in France in the food products and beverages sector
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3.42E-03 GL blue water Ethiopia agriculture industry -> Netherlands hotels and restaurants industry -> Final demand in Netherlands in the hotel and restaurant services sector
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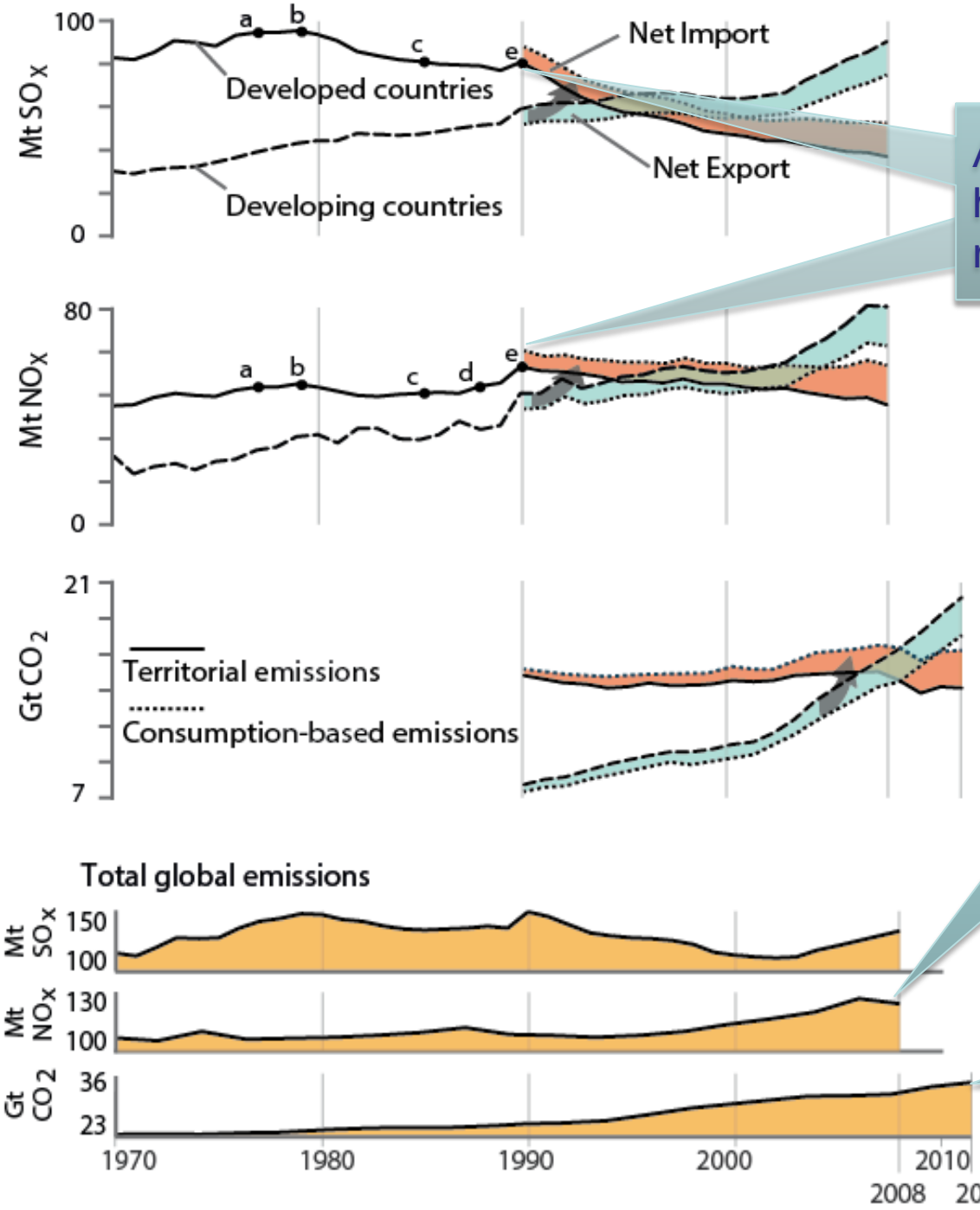
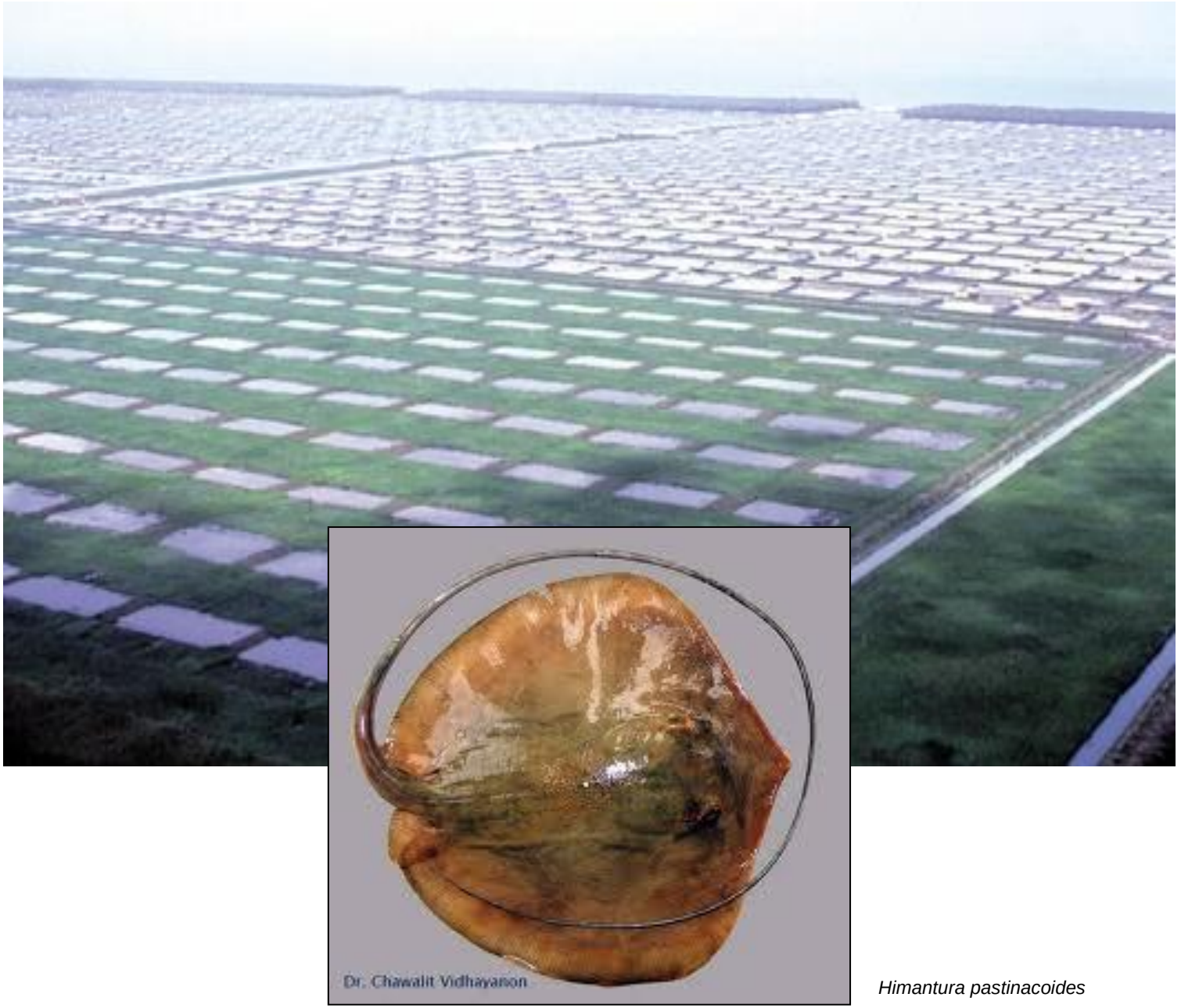


Air pollution has "fled" regulation

Despite successful domestic regulation in major emitters, global total NO_x/SO_x emissions have not declined.

CO_2 emissions are trending to do the same.



Himantura pastinacoides

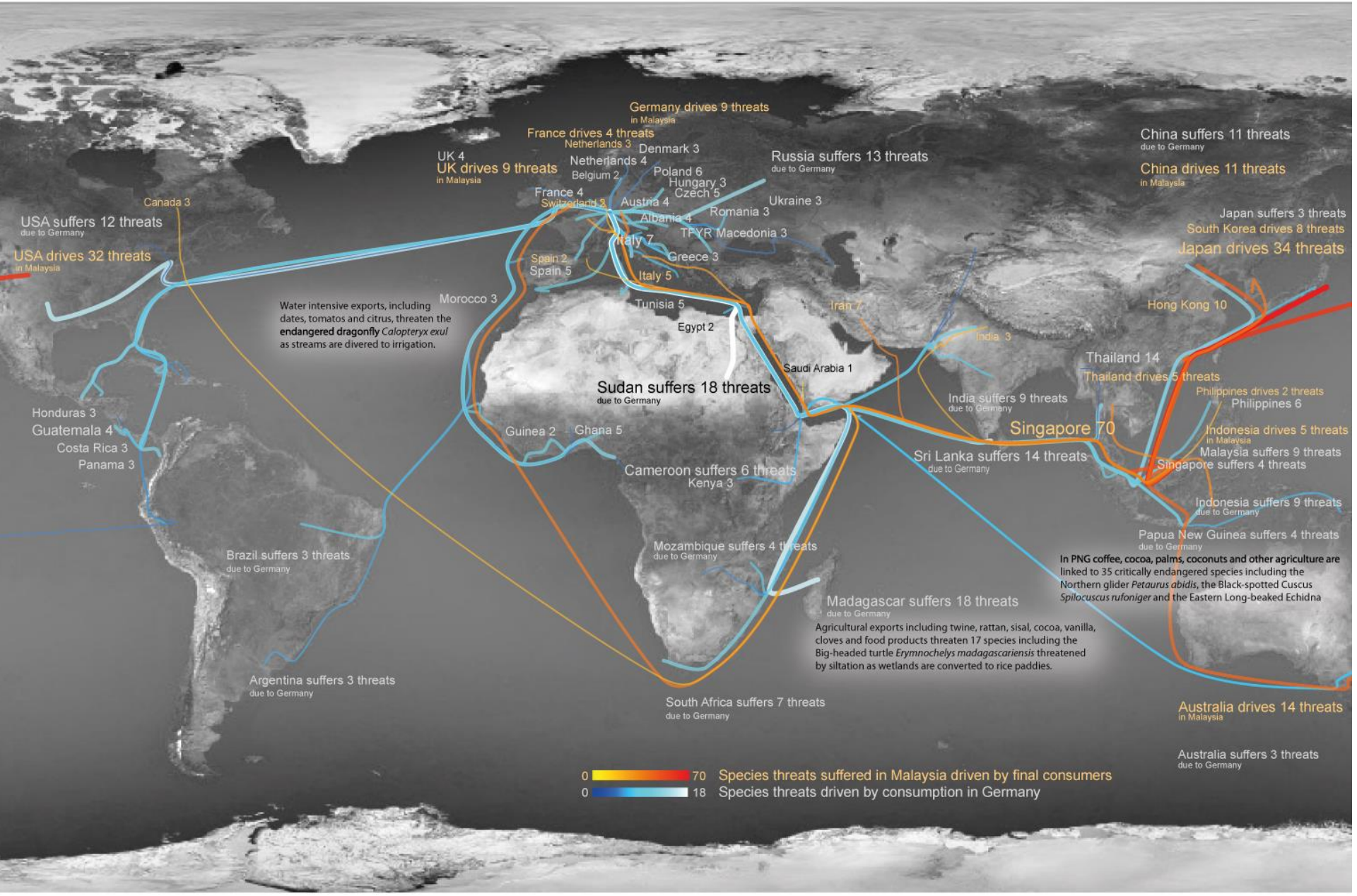
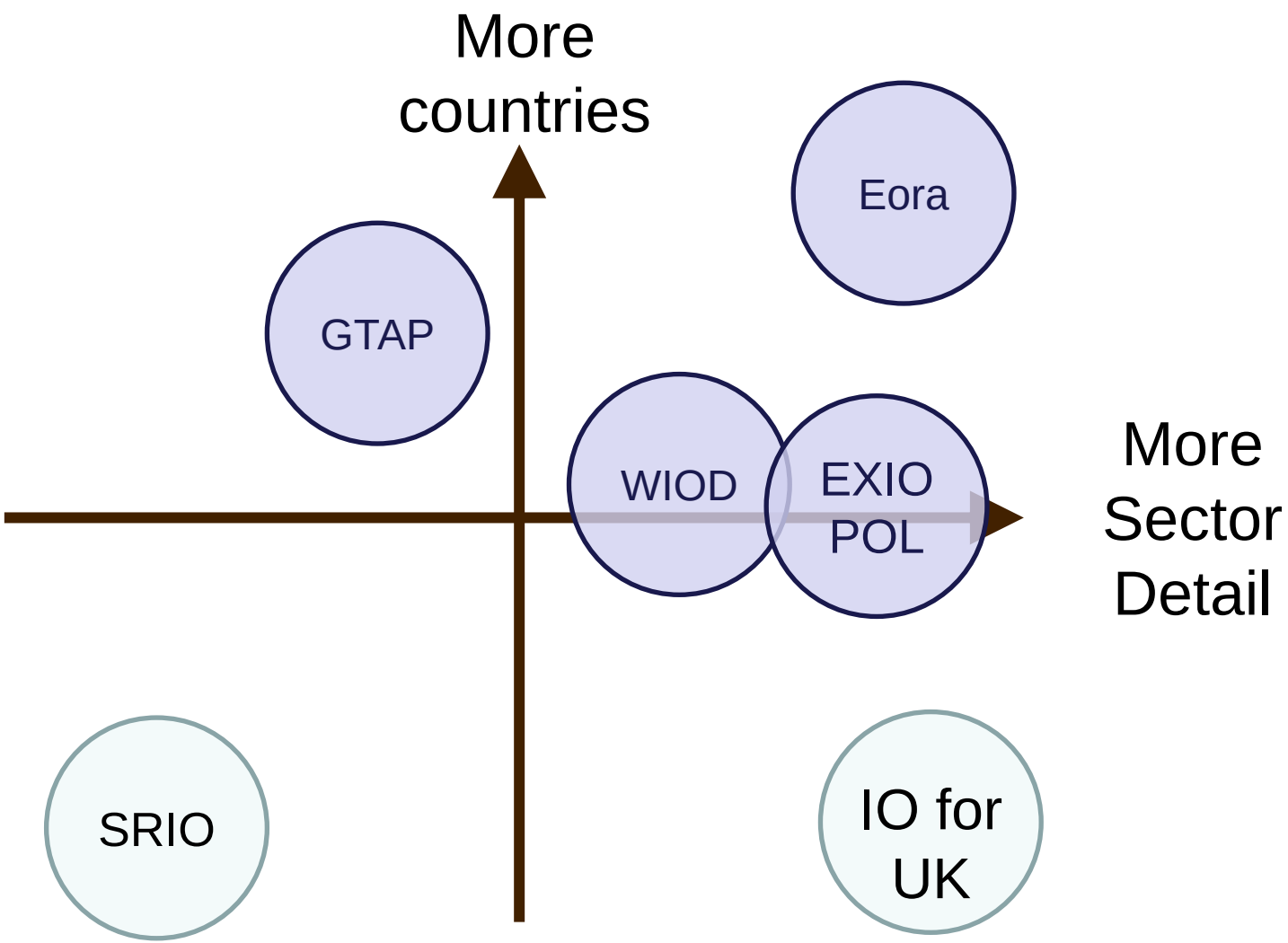


Figure 3S: Flow map of threats to species caused by exports from Malaysia (reds), and imports into Germany (blues). Note that the lines directly link the producing countries where threats are recorded, and final consumer countries. Processing stops in intermediate countries are accounted for but not explicitly visualized. **Malaysia suffers 488 species threats domestically;** exports, including palm oil, rubber, and cocoa, are linked to 276 of those. **Germany suffers 321 species threats domestically and drives an additional 395 through its imports.** Regional trade patterns can be observed (consumption in Southeast Asia drives impacts in Malaysia; German consumption drives impacts in Europe) but drivers and impacts are linked globally. http://worldmrio.com/biodivmap/

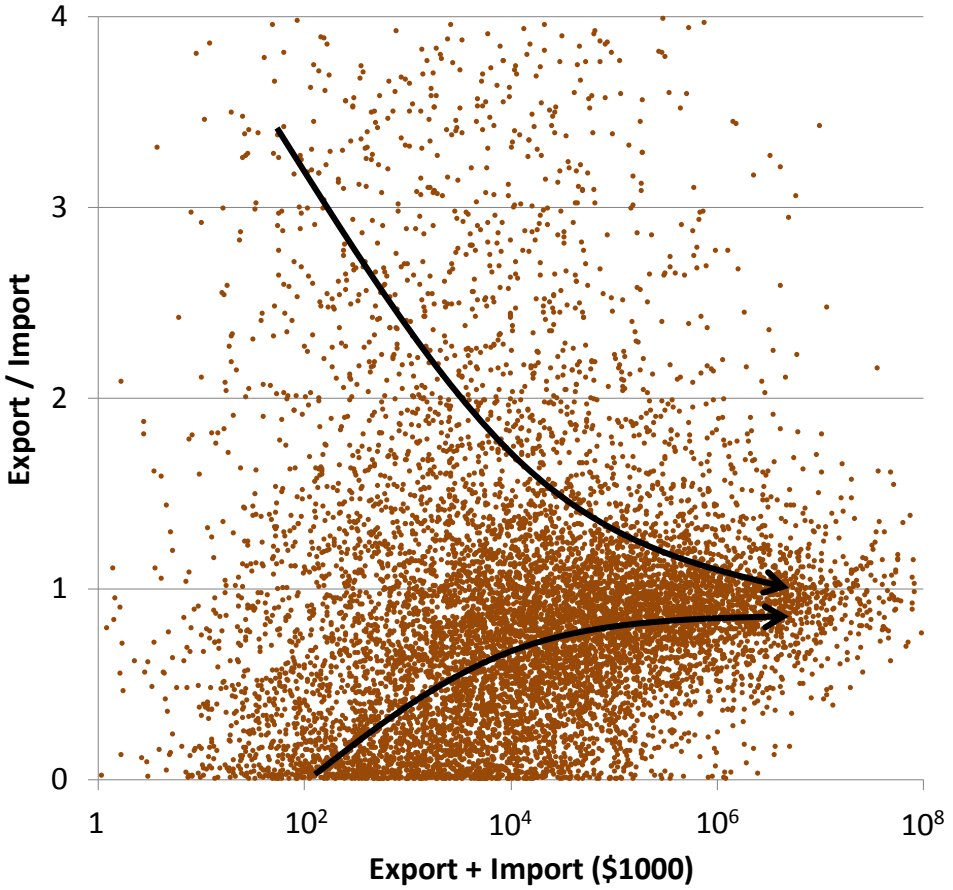
Available MRIOs



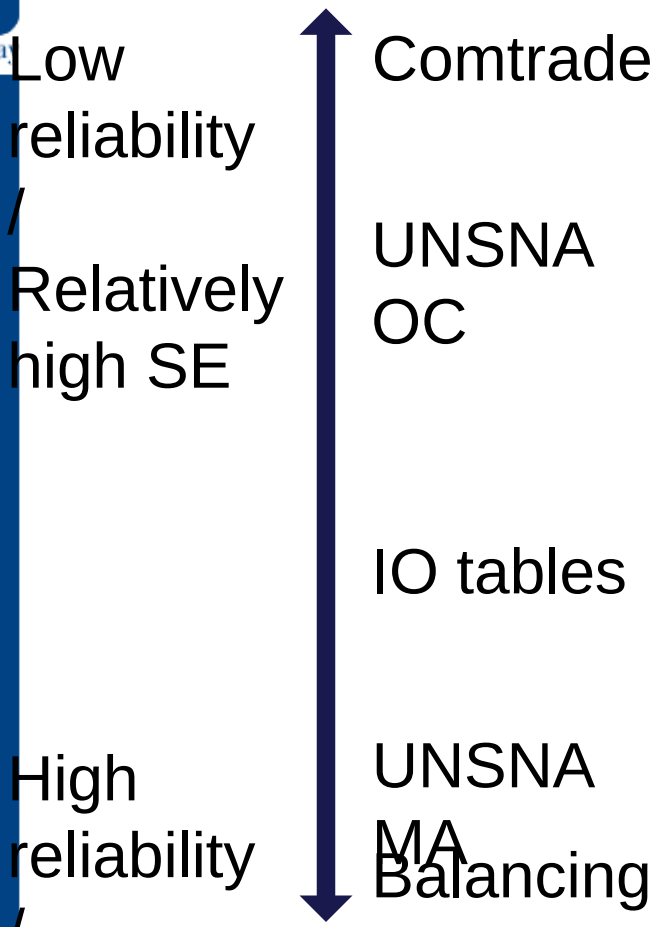
Reliability of Comtrade database

International trade by partner (187 countries x 187 countries)

- Expect export in FOB / import in CIF ≃ 1 or smaller
- The bigger values, the closer to 1
  - Strategy of SE setting is correct!
- **Need high S.E. for Comtrade constraints**



Order of the reliability in Eora



- Smallest low reliability value has ~2000% S.E.
- Biggest high reliability value has

Violation report

- How can we check the quality of constraints and results?

Lfd. Nr.	Constraint label	True RHS	Realised RHS	Std.Dev.	Abs.Adhr.	Rel.Adhr.
1	20140318_WorldMRIO_UsaUsa_w-…	2.50E+09	3.79E+09	4.37E+09	1.28E+09	29.33%
2	20140318_WorldMRIO_UsaUsa_w-…	1.07E+09	2.44E+02	2.01E+09	1.07E+09	53.38%
…	…	…	…	…	…	…

Constraints label

Eora solution

Differences

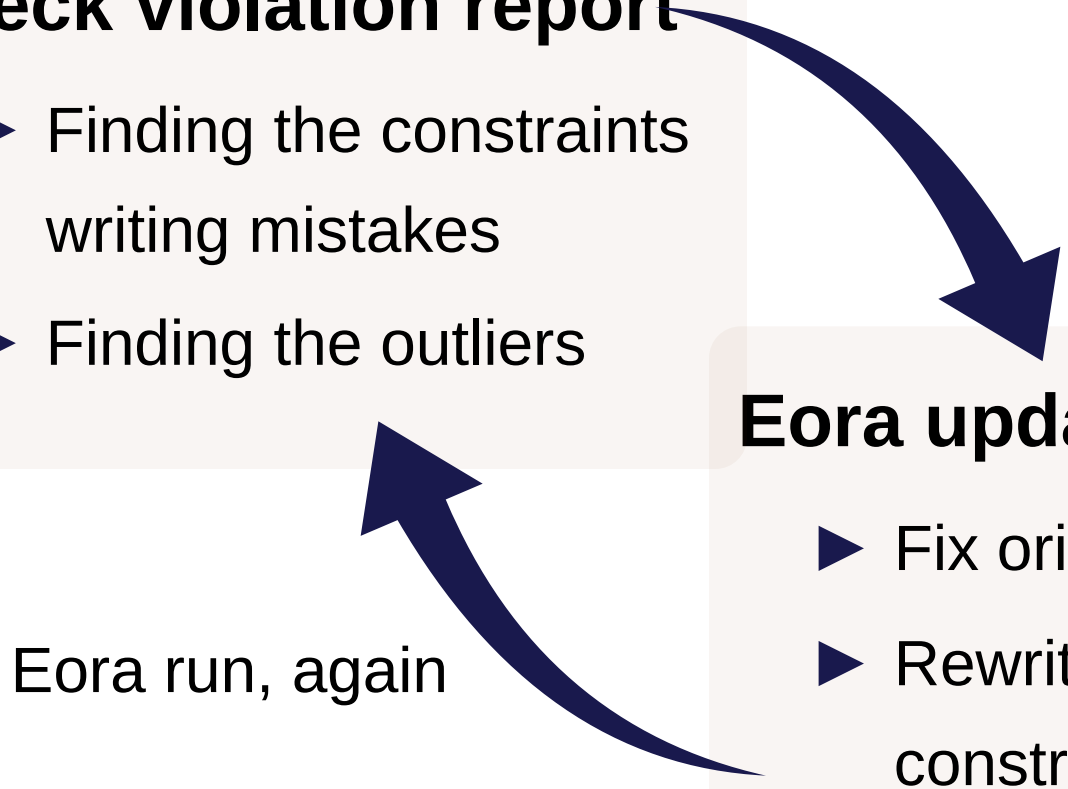
Constraints value

S.E

Eora improvements

Check violation report

- Finding the constraints writing mistakes
- Finding the outliers



Eora run, again

Eora updates

- Fix original data
- Rewrite constraints
- Remove outliers

Summary

- Eora uses constrainted optimization with S.E to resolve international trade asymmetry
- Strengths
  - Don’t discard conflicting data
  - Show S.E. for each solution data points and constraints
  - Find outliers in violation report