Global supply chains in the bioeconomy

Martin Bruckner, Richard Wood, Daniel Moran, Nikolas Kuschnig, Hanspeter Wieland, Victor Maus, Jakob Gutschlhofer, Jan Börner, Stefan Giljum

19 June 2019

Method

- FABIO model
  - According to Google search:

Method

- Physical-monetary Multi-Regional Input-Output model
  - (I) Physical MRIO
  - (II) Monetary MRIO

		Country 1			Country …			Country m			Final demand (y)			Total output (x)
		Prod 1	Prod …	Prod n	Prod 1	Prod …	Prod n	Prod 1	Prod …	Prod n	y 1	y …	y m	
Country 1	Prod 1													Σ
	Prod …													Σ
	Prod n													Σ
Country …	Prod 1													Σ
	Prod …													Σ
	Prod n													Σ
Country m	Prod 1													Σ
	Prod …													Σ
	Prod n													Σ
	Land use													

Method: (I) physical MRIO

- FABIO: Food and Agriculture Biomass Input-Output database

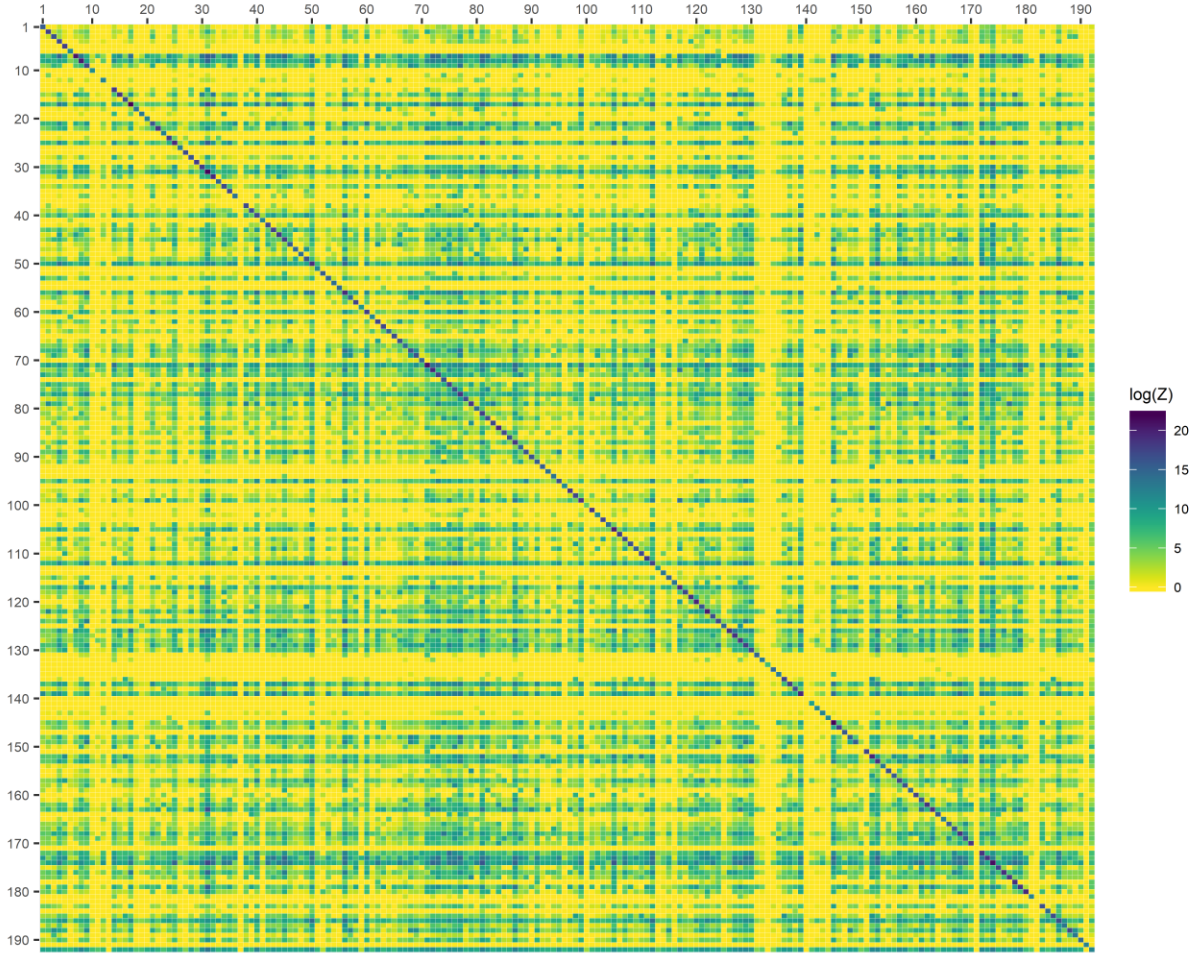
- 127 agricultural commodities
  - 64 crops
  - 32 processed products
    - veg. oils and cakes
    - sugars and beverages
  - 14 animal groups
  - 17 livestock products
    - meat, milk, hides, fats…
- 3 forestry commodities

- 192 countries
- 1986 to 2013

- Data sources:
  - FAOSTAT
    - Commodity balances
    - Bilateral trade data
  - Biofuels prod: IEA/EIA
  - Biofuels trade: UN Comtrade / BACI
  - Feed use: IMAGE model (Bouwman et al. 2011)

Method: (I) physical MRIO

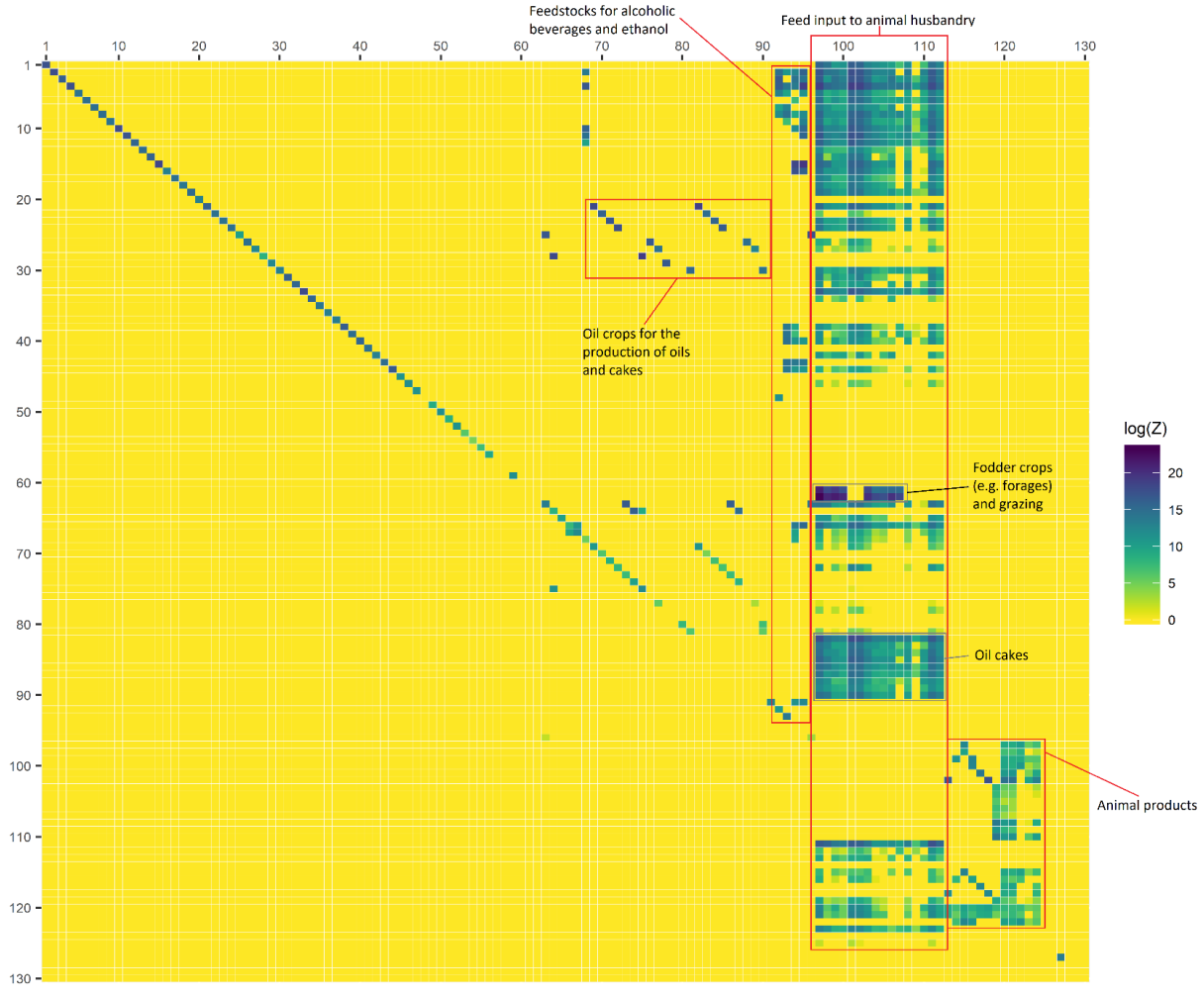
Trade linkages between 192 countries



Method: (I) physical MRIO

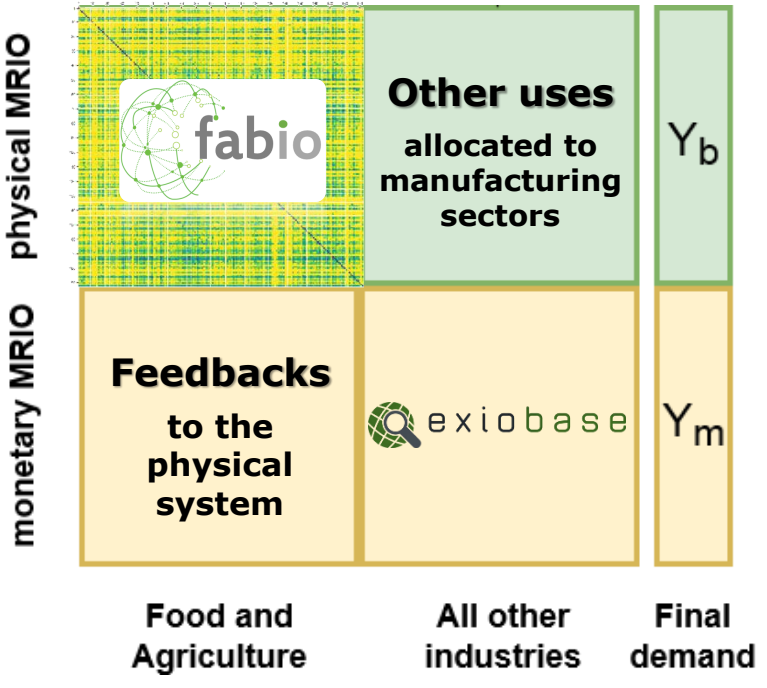
Processing linkages between 130 commodities

Input allocation among outputs according to
- mass shares
- value shares



Method: (II) monetary MRIO

- Linking FABIO with EXIOBASE
- Uses of 130 agri-food commodities as a production input for ~130 manufacturing products (non-food processing)
- Total dimension:
  35 000 rows and columns



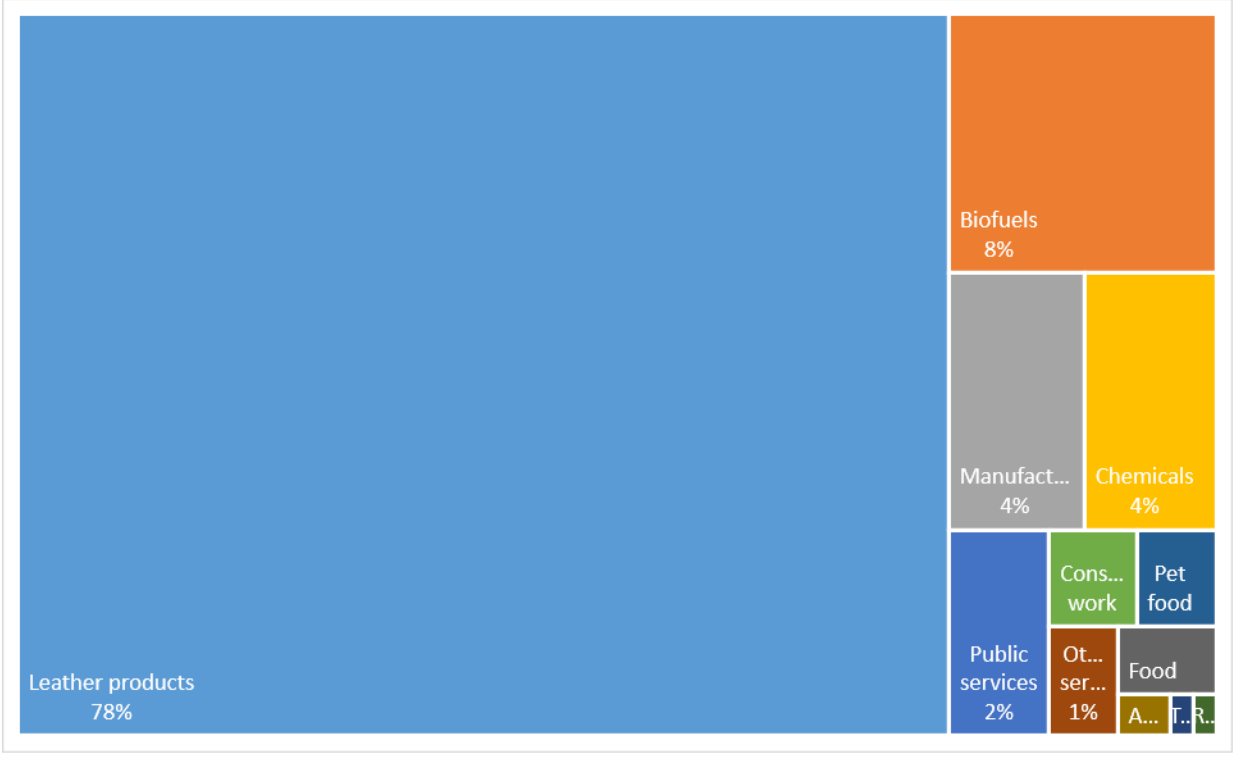
Results: Brazilian cattle

Mass-based allocation:
- **100 Mha grassland**
- **4.5 Mha cropland**
- **12 % non-food**

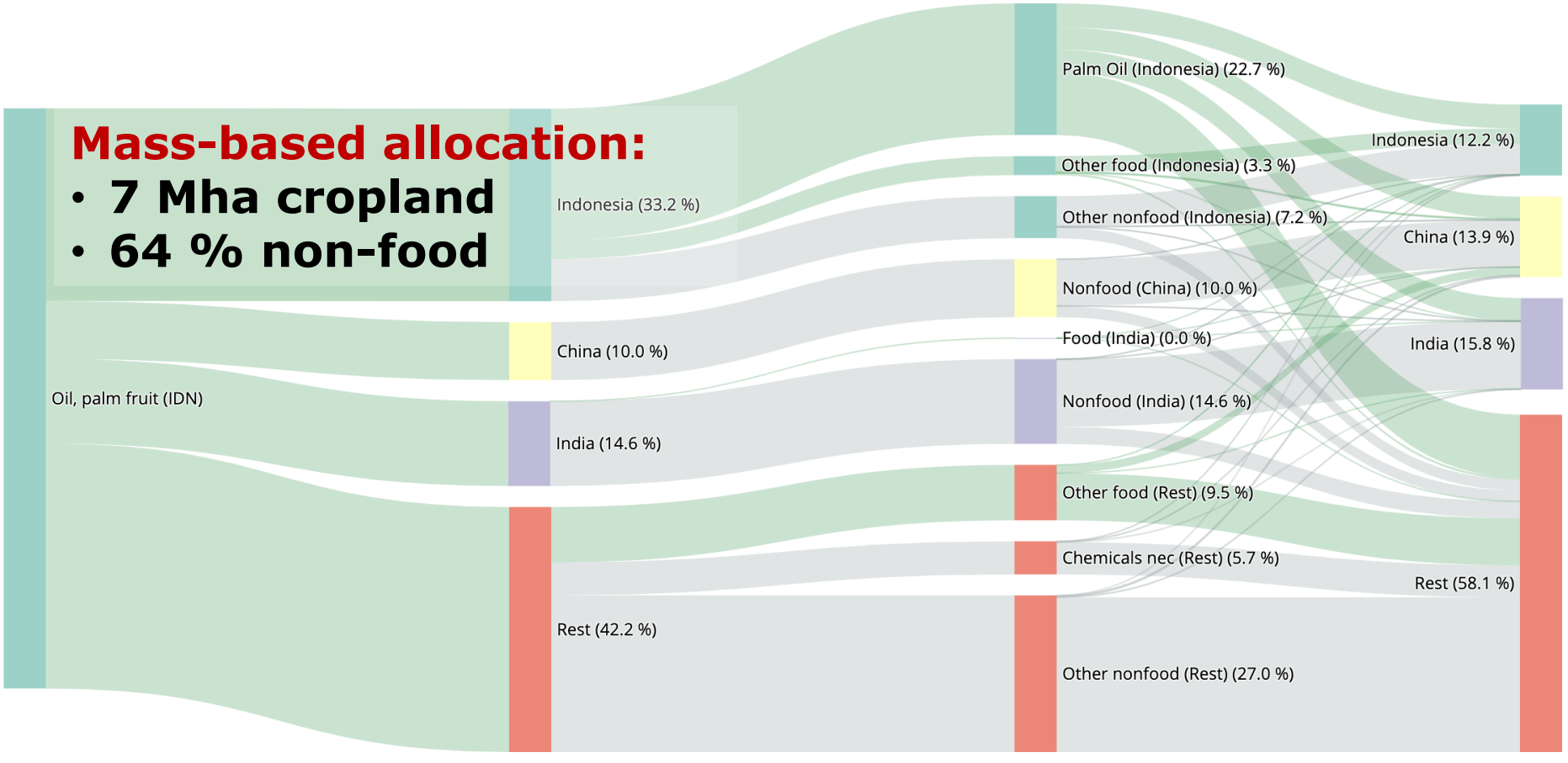
Value-based allocation:
- **100 Mha grassland**
- **4.1 Mha cropland**
- **6 % non-food**

Results: Brazilian cattle

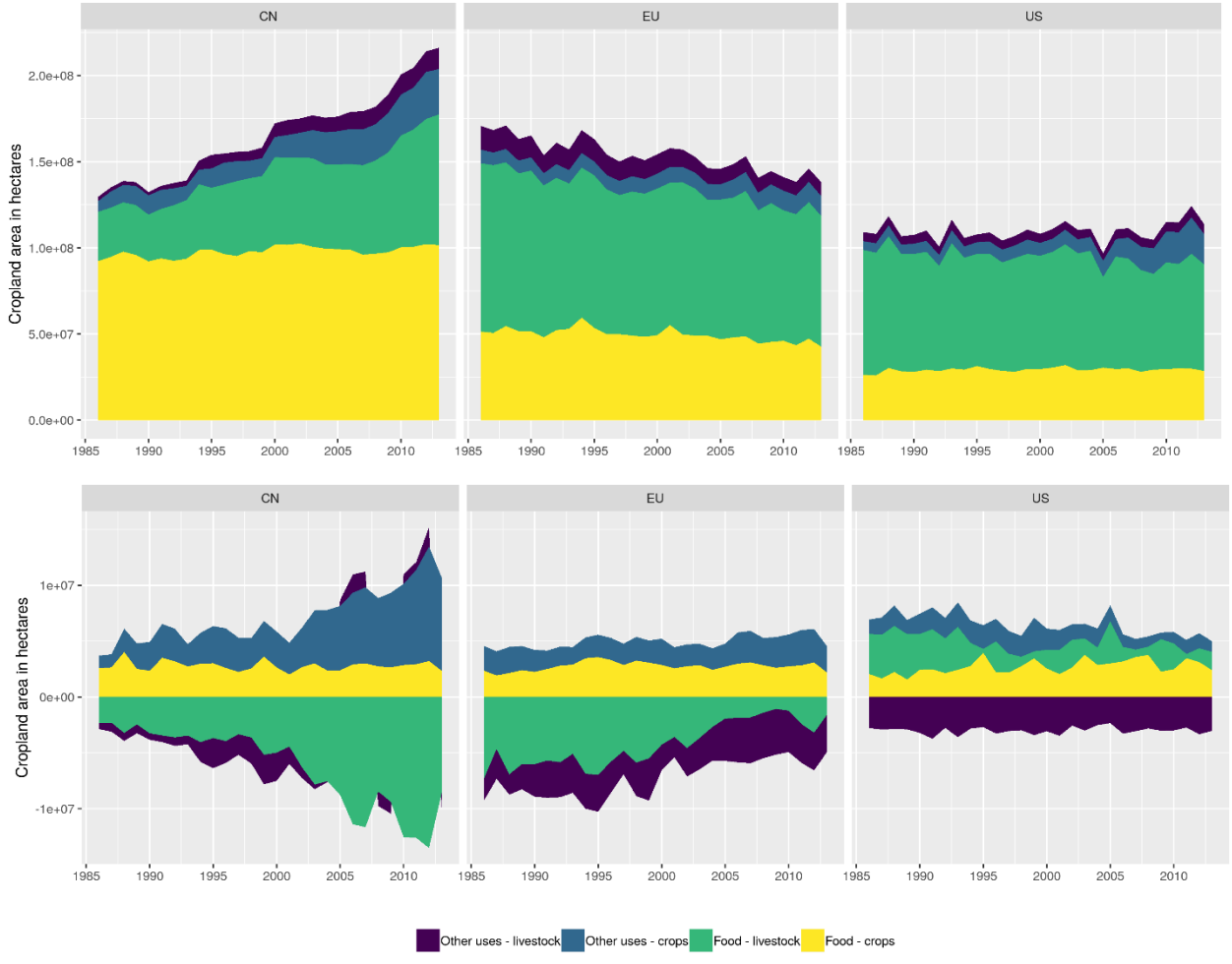
Non-food products (2013)



Results: Indonesian palm oil



Results: China – EU – US



Conclusions

- Hybrid MRIO is a useful tool to trace international agri-food supply chains

- FAOSTAT's high product and country detail
- EXIOBASE for full coverage of non-food products
- SUT/IOT framework
  - transparent organization of product flow data
  - allows mass and value allocation

Open Science

All codes & data are available:

- **GitHub** https://github.com/martinbruckner/fabio
  https://github.com/fineprint-global/

- zenodo http://dx.doi.org/10.5281/zenodo.2577067

- Bruckner, M., Wood, R., Moran, D., Kuschnig, N., Wieland, H., Maus, V., Börner, J. *(submitted)* FABIO – The Construction of the Food and Agriculture Input–Output Model. *Environmental Science & Technology*

Results: Comparison of models