

Construction of a Global Input-Output Table Embedding Chinese Provincial Multi-Regional Input-Output Table

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Outline

- **Introduction**
- **Databases**
- **Embedding the Chinese provincial MRIOT into global MRIOT**
- **An illustrative example**
- **Conclusions**

Introduction

- With the development of domestic regional integration and the continuous formation of opening-up pattern, the economic linkages between Chinese provinces, and those between the provinces and international economies are both becoming closer and closer;
- As the global value chain (GVC) continues to extend to the sub-national regions within the economies, the domestic value chain between Chinese provinces is also nesting into the global value chain;
- Currently, there is no systematic model or database that links the global input-output table with the sub-national input-output tables, so as to effectively depict the systematic circular flows of international and domestic value chains.

Databases

- **GTAP database relevant for MRIO Analysis**
 - GTAP 11 Data Bases;
 - Year 2017¹;
 - 142 countries and regions;
 - 65 sectors.

¹ As stated in Carrico (2020), the GTAP team will provide an updated MRIOT in the 11th version of GTAP database, which is, however, not ready for now. We therefore take the proportions in the MRIOT 2014 temporarily, and will update to the new-releasing version when it is ready.

Databases

- **China's customs data**
 - HS 8-digit level (8564 commodities in total);
 - Provincial imports tracked by the source countries;
 - Provincial exports tracked by the destination countries.

Embedding the Chinese provincial MRIOT into global MRIOT

- **Construction of global MRIOT**

- First, the GTAP variables are converted into an MRIO model with international transportation being exogenous; Taking the proportions from the GTAP MRIOT 2014 provided by the GTAP team to distribute the bilateral trade data across the consuming sectors and agents.

GTAP database	MRIOT	Description
<i>vd_fm</i>	Z^{rr}	diagonal matrices of intermediate use
<i>vi_fm, vx_md</i>	Z^{rs}	off-diagonal matrices of intermediate use
<i>vd * m</i>	y^{rr}	diagonal matrices of final demand
<i>vi_fm, vx_md</i>	y^{rs}	off-diagonal matrices of final demand
<i>vom</i>	x^r	total output
<i>v_fm, tax, margins, subsidy</i>	v^r	value added
<i>vst</i>	t^r	international transportation pool

Embedding the Chinese provincial MRIOT into global MRIOT

- **Construction of global MRIOT**

- Second, the international transportation pool is converted endogenously by distributing it to the suppliers by the proportions of the GTAP MRIOT 2014;
- In addition, according to the volume of trade, the countries and regions are aggregated to 19 countries and regions.

		Intermediate Use			Final Use			Total output
		China	USA	China	USA	
Intermediate input	China							
							
	USA							
Initial input								
Total input								

Embedding the Chinese provincial MRIOT into global MRIOT

- **Concordance of the sector classifications**

- The Chinese provincial MRIOT and the global MRIOT are mapped to 27 sectors.

No	Sector name	No	Sector name	No	Sector name
A1	Agriculture, forestry, animal husbandry and fishery products and services	A10	Non-metallic mineral products	A19	Transportation, storage and post
A2	Mining	A11	Metal smelting and rolled products, metal products	A20	Information transmission, software and information technology services
A3	Food and tobacco	A12	Transportation equipment	A21	Financial
A4	Textile	A13	Equipment and instruments	A22	Real estate
A5	Textiles, clothing, shoes, hats, leather down and its products	A14	Other manufactured products, scrap and repairs	A23	Rental and business services
A6	Woodworking products and furniture	A15	Production and supply of electric heating, gas and water	A24	Public management, social security and social organization; public facility management
A7	Papermaking printing and cultural, educational and sporting goods	A16	Building	A25	Education
A8	Petroleum, coking products and nuclear fuel processed products	A17	Wholesale, retail and repair	A26	Health and social work
A9	Chemical product	A18	Accommodation and meals	A27	Other community, social and personal services

Embedding the Chinese provincial MRIOT into global MRIOT

- **Processing of China's customs data**

- HS-IO correspondence relationship;
- HS-BEC correspondence relationship;
- Summarizing customs data by province and industry.

Embedding the Chinese provincial MRIOT into global MRIOT

- Harmonizing the MRIO-relevant accounts across the databases

$$\begin{array}{l}
 \min(e) \\
 \left\{ \begin{array}{l}
 \sum_{s=1}^{31} \sum_{r=1}^{31} Z^{s,r} = Z_g^{c,c} \\
 \sum_{s=1}^{31} \sum_{r=1}^{31} Y^{s,r} = Y_g^{c,c} \\
 \sum_{r=1}^{31} Z^{s,r} = Z_g^{s,c} (s = 32, \dots, 45) \\
 \sum_{s=1}^{31} Z^{s,r} = Z_g^{c,r} (r = 32, \dots, 45)
 \end{array} \right.
 \end{array}
 \quad
 \begin{array}{l}
 \sum_{r=1}^{31} Y^{s,r} = Y_g^{s,c} (s = 32, \dots, 45) \\
 \sum_{s=1}^{31} Y^{s,r} = Y_g^{c,r} (r = 32, \dots, 45) \\
 \sum_{r=1}^{49} \sum_{m=1}^{27} z_{m,n}^{s,r} + \sum_{r=1}^{49} \sum_{k=1}^5 y_{m,f}^{s,r} = x_m^s (s = 1, \dots, 49; m = 1, \dots, 27; f = 1, \dots, 5) \\
 \sum_{s=1}^{49} \sum_{n=1}^{27} z_{m,n}^{s,r} + \sum_{s=1}^{49} \sum_{m=1}^5 y_{m,f}^{s,r} = x_n^r (r = 1, \dots, 49; n = 1, \dots, 27; f = 1, \dots, 5)
 \end{array}$$

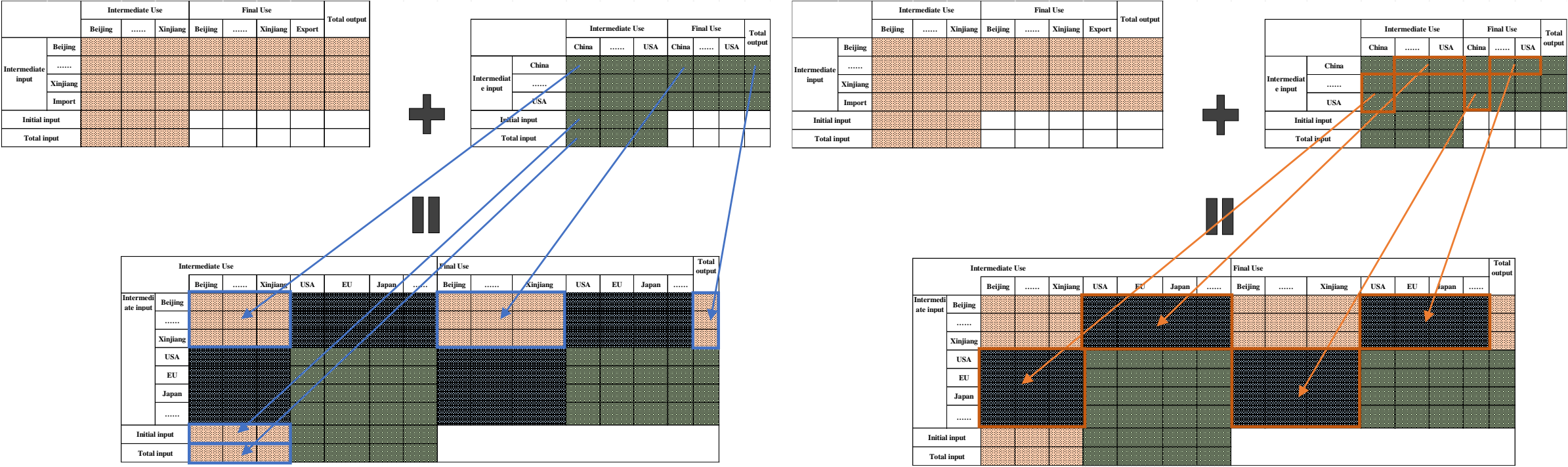
Embedding the Chinese provincial MRIOT into global MRIOT

- Harmonizing the MRIO-relevant accounts across the databases

$$\begin{aligned} e = & \sum_{s=1}^{31} \sum_{r=1}^{31} \sum_{m=1}^{27} \sum_{n=1}^{27} (z_{m,n}^{s,r} - \bar{z}_{m,n}^{s,r})^2 / |\bar{z}_{m,n}^{s,r}| \\ & + \sum_{s=1}^{31} \sum_{r=1}^{31} \sum_{m=1}^{27} \sum_{f=1}^5 (y_{m,f}^{s,r} - \bar{y}_{m,f}^{s,r})^2 / |\bar{y}_{m,f}^{s,r}| \\ & + \sum_{s=32}^{49} \sum_{r=1}^{31} \sum_{m=1}^{27} \sum_{n=1}^{27} (z_{m,n}^{s,r} - \bar{z}_{m,n}^{s,r})^2 / |\bar{z}_{m,n}^{s,r}| \\ & + \sum_{s=1}^{31} \sum_{r=32}^{49} \sum_{m=1}^{27} \sum_{n=1}^{27} (z_{m,n}^{s,r} - \bar{z}_{m,n}^{s,r})^2 / |\bar{z}_{m,n}^{s,r}| \\ & + \sum_{s=32}^{49} \sum_{r=1}^{31} \sum_{m=1}^{27} \sum_{f=1}^5 (y_{m,f}^{s,r} - \bar{y}_{m,f}^{s,r})^2 / |\bar{y}_{m,f}^{s,r}| \\ & + \sum_{s=1}^{31} \sum_{r=32}^{49} \sum_{m=1}^{27} \sum_{f=1}^5 (y_{m,f}^{s,r} - \bar{y}_{m,f}^{s,r})^2 / |\bar{y}_{m,f}^{s,r}| \end{aligned}$$

Embedding the Chinese provincial MRIOT into global MRIOT

- Harmonizing the MRIO-relevant accounts across the databases



An illustrative example

- (show later)

Conclusions

- **Potential application of the embodied MRIOT**
 - Depicting the economic linkages between Chinese provinces;
 - Tracing the economic linkages between Chinese provinces and other economies;
 - Studies involving both international regions and Chinese provinces;
 - The position and participation of Chinese provinces in GVC;
 - The related carbon emission and environmental issues.
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