

Constructing a Time Series of Chinese Multi-regional Input-output Tables at Provincial Level and High Sector Detail

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Abstract

A time series of MRIO tables for China's 30 provinces linking with 186 countries in the world is developed. The innovative series is constructed using an Automated Integration System for Harmonised Accounts (AISHA) tool. First, it is the first continuous time series of subnational MRIO tables in the world constructed by AISHA, while previous study mainly focus on the global level using national data. Second, it is at high sectoral detail than any other existed Chinese MRIO table. It distinguishes 135 commodity sectors in combination with 186 countries in Eora MRIO database. Third, it provides updated information from 1997 to 2010 therefore significantly improving timeliness. Fourth, Uncertainty analysis was also carried out for Chinese MRIO. These advances will dramatically improve the applications of Chinese MRIO tables for policy-makers and researchers.

Keywords: Chinese MIRO tables, structure of Chineses economy, trade linkages

1. Introduction

Multi-region input-output (MRIO) tables and their applications have aroused substantial interest in the forefront of environmental policy debates (Wiedmann et al. 2011; Wiedmann 2009; Wiedmann et al. 2007). Now the major MRIO tables have already been developed at the global level. The latest issue of *Economic Systems Research* has Special Issue: Global Multiregional Input-Output Frameworks. These are all country-specific MRIO tables constructed based on national IO tables and trade statistics and key features are summarized in Peters et al. work (Peters et al. 2011).

A time series UK-MRIO for carbon footprint is the first annual time series MRIOs in the world (Wiedmann et al. 2010) and it integrated economic and environmental accounts for the three world regions in the UK-MRIO model. Based on UK methodologies and applications, world MRIO for time series was launched in 2012 (Lenzen et al. 2012). They both are the important cornerstone for a time series of MRIO.

However, there is still lack of continuous subnational MRIO tables for widespread adoption in environmental problems. As for my knowledge, only Australian MRIO researchers are working on constructing a time series of highly disaggregated Australian MRIOs called *The Mother of all Australian MRIOs* (MoAusMRIO) (Wiedmann et al. 2012).

It uses An Automated Integration System for Harmonised Accounts (AISHA) tool developed by Prof. Manfred Lenzen and his Eora team to construct tables and up to now still not finished. MoAusMRIO features all regional Australian MRIO tables that are currently being developed or have been developed.

As the largest developing country and the second largest economy, China and its subnational economic development and trade linkages play a key role in the world. There have existed several versions of Chinese sub-national multi-region (Chinese MRIO) tables (Zhang and Qi 2012; State Information Center 2005). Table 1 summarizes the current Chinese MRIO state of the art. However, the widespread adoption of MRIO models to map the structure of Chinese economy has so far been hampered by a number of reasons. First, constructing a Chinese MRIO is labor-intensive and time-consuming. Second, current available Chinese MRIO tables either group all 30 provinces into grand regions, and/or aggregate detailed industries into broad sectors (Table 1). Third, Chinese MRIO tables are often not available as a long, continuous time series, and at the time of their release, the latest tables are at least five years outdated. Finally, Chinese MRIO tables currently provide only results without accompanying estimates of reliability and uncertainty. Therefore, limited resolution, untimeliness and data reliability of Chinese MRIO resulted in limited applications in environmental footprinting and life-cycle assessment, as well as driving forces analyses.

The shortcomings discussed above are overcome by a new time series of Chinese MRIO tables, which are constructed with the Eora multi-region IO database (www.worldmrio.com) (Lenzen et al. 2012) and uses AISHA tool at provincial level (30 provinces except Tibet, Hong Kong, Macao and Taiwan for the data availability) and detailed sectors (135 commodity sectors). The Chinese MRIO linking with a large number of foreign countries are measured in terms of most detailed information on regional coverage, sector coverage, continuity, timeliness and reliability.

2. Results

For each year of a time series, a heat map gives a general overview of the order of magnitude of the value in the corresponding table. Figure 1 presents the result of Chinese MRIO table for 2007. It shows the featuring the provincial and country classifications as they appear in the Chinese MRIO. The color indicates the order of magnitude of the corresponding value.

Figure 1(a) is the first diagonal block of Chinese MRIO table. The dark blue sectors in Figure 1(a) show a large intermediate demand and gross capital formation generated by construction in 2007 due to 2008 Beijing Olympic Games. The taxes on production minus subsidies on production are negatives of Beijing's production and distribution of gas and production and distribution of water (red color). Light blue represents the transport via railway and road from Beijing exports to Tianjin. And Beijing Catering Services imports from grinding of grains, processing of forage, refining of vegetable oil, slaughtering and processing of meat, and processing of other foods. Figure 1(b) demonstrates how zooming in on particular blocks reveals the nature of trade relationships, such as Zhejiang and Fujian manufactured products exported into the UK and USA.

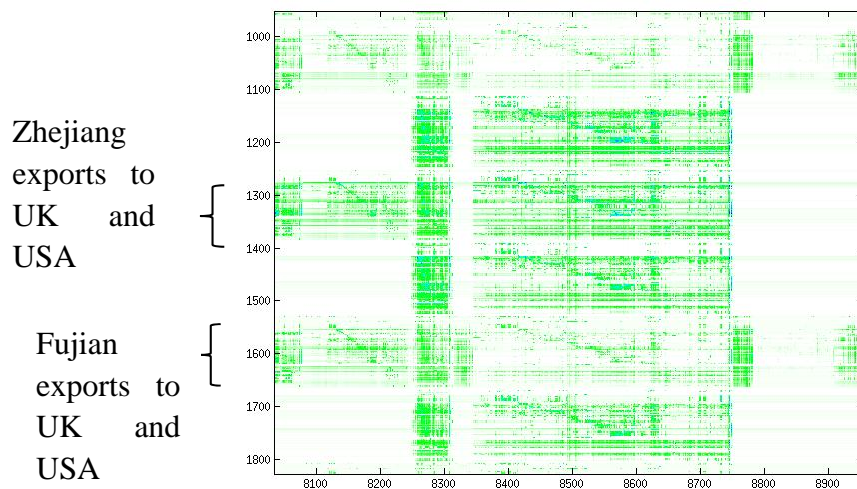
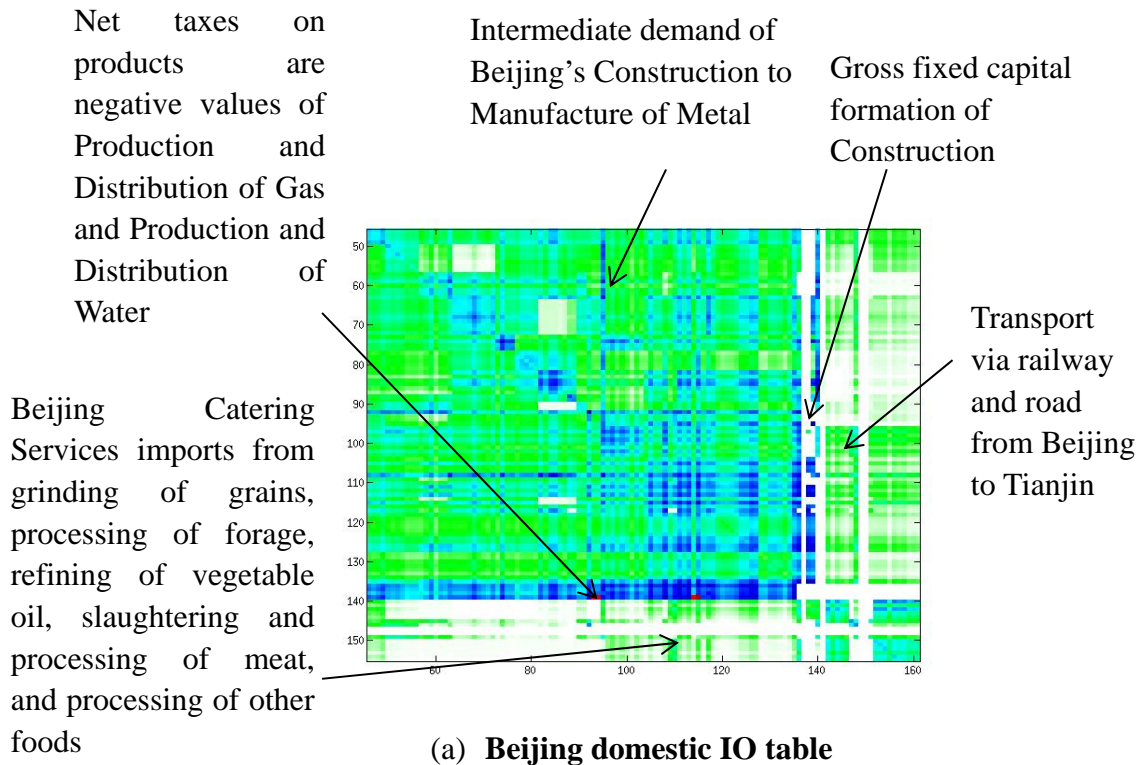


Figure 1 Heat map of the ChineseMRIO for 2007

3 An illustrative example

Chinese MRIO tables can be applied in various general input-output applications such as environmental footprinting and life cycle assessment. We provide an illustrative example of CO₂ emissions embodied in intra-national and international exports (Carbon Footprints for exports) using Chinese MRIO.

This study considers CO₂, CH₄, and N₂O emission as greenhouse gases (GHG) emission, which are calculated by CO₂ equivalents Liu(Liu et al. 2012).

Figure 2 illustrates that CO₂ emissions are mainly embodied in intra-national exports by destinations, which account for more than 75% of the total and the maximum proportion is 91.2% in 1998. The CO₂ emissions embodied in intermediate demand for production in foreign countries are almost two times of those of final demand in foreign countries.

Figure 3 and Figure 4 present the CO₂ emissions embodied in international exports for intermediate and final demand separately. From 1997 to 2010, the top four countries for CO₂ emissions embodied in exports to the intermediate demand of other countries are Japan, USA, Korea, and Hong Kong. USA, Japan, Korea, and Germany are the four largest countries of CO₂ emissions embodied in exports because of their final demand.

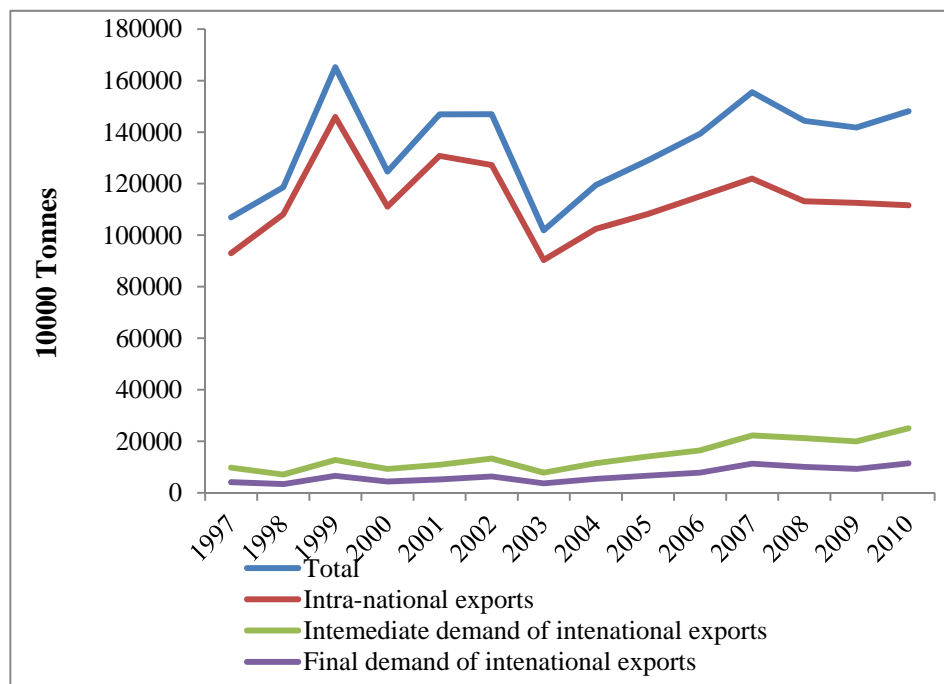


Figure 2 CO₂ emission embodied in exports by destinations from 1997-2010

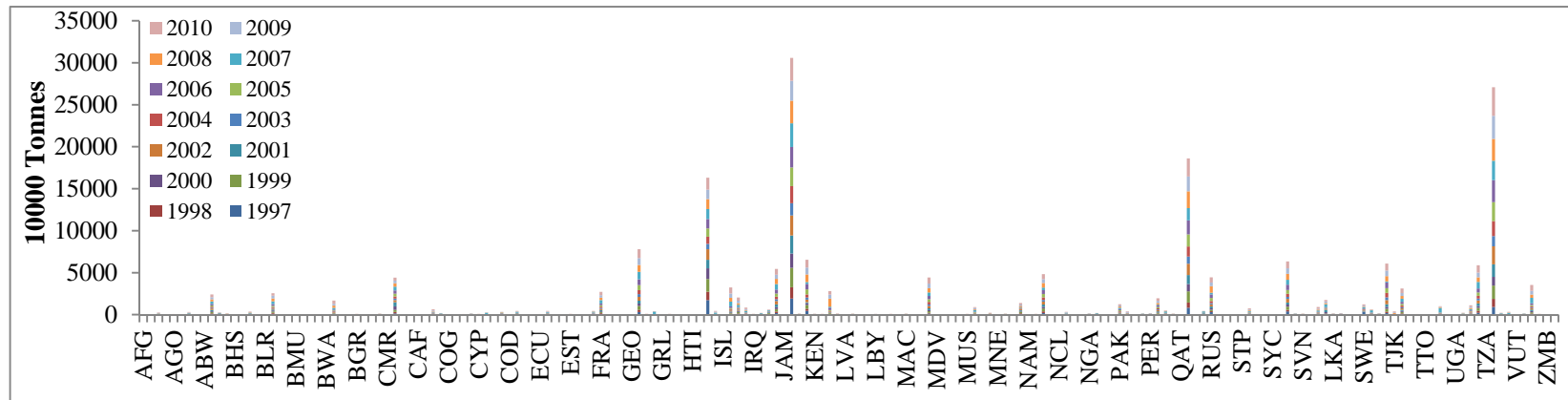


Figure 3 CO₂ emission embodied in exports for intermediate demand by destination countries from 1997-2010

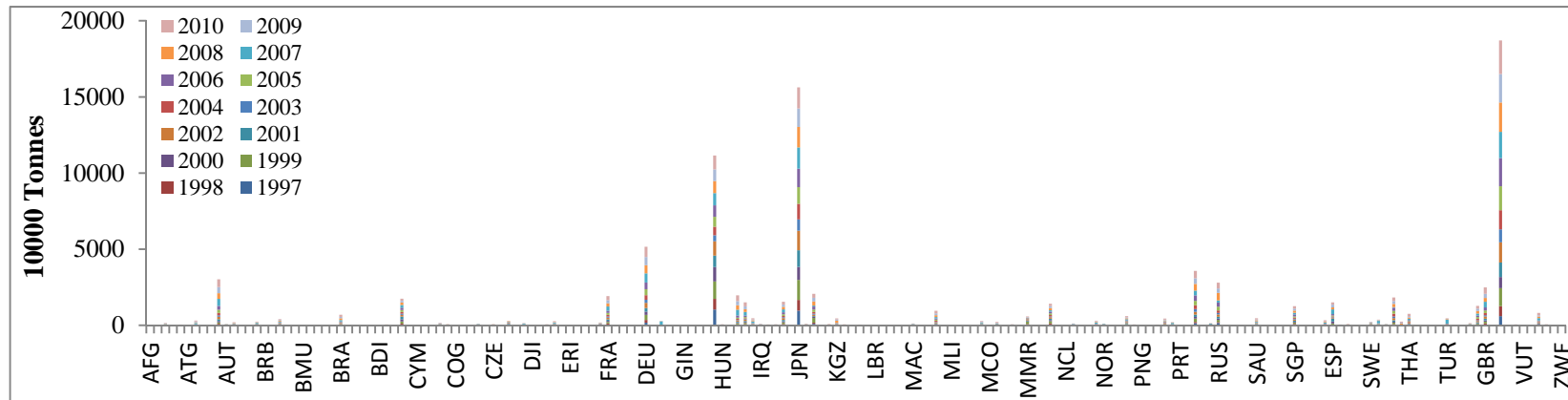


Figure 4 CO₂ emission embodied in exports for final demand by destination countries from 1997-2010

4. Conclusions

The paper demonstrated how to construct a time series of Chinese MRIO tables using AISHA. Up to now, the tables are the first continuous time series (1997-2010) at the subnational level with detailed classification of domestic regions and international trade with all the counties in the world. Uncertainty analysis was also carried out for Chinese MRIO tables.

Chinese MRIO tables can be applied in various extended input-output applications such as environmental footprinting and life cycle assessment. We provide an illustrative example of CO₂ emissions embodied in intra-national and international exports using Chinese MRIO. These innovations dramatically improve the applications of Chinese MRIO tables for policy-makers and researchers.

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