INTERNATNIONAL STRUCTURAL PATH DECOMPOSITION IN INDUSTRIAL ENERGY CONSUMPTION

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Overview

The main component of this paper will decompose industrial energy consumption using international input-output table. Over the past decade, many authors have been applying the decomposition analysis focused on the domestic production structure. Butalong with the development of international trade, energy use and environment issues also become complex(Duan et al; 2012).So, SRIO(Single-Region Input-Output) model is limited to explain changes in industrial energy consumption to reflect this tendency. For instance, if developed countries enhance energy efficiency by choosing to move energy-intensive plant abroad, in terms of global energy efficiency, that maybenothing but spatial relocation of energy consumption. So recently, the application of international Input-Output model has been steadily increasing for analyzing energy or environmental issues.

SDA(Structure Decomposition Analysis) is one of the most commonlyused methodology to explain energy use changes.But, previous SDA lack the ability to estimate the effects of changes in supply chain(Oshita et al.; 2011).In order to overcome this shortcoming, Wood and Lenzen (2008) developedSPD(structural path decomposition). SPD is motivated to aid policy application from SDA and to aid input-output life cycle analysis technique (Wood and Lenzen; 2008). Oshita et al.(2011) identify critical supply chain paths that drive changes in CO_2 emissions using SPD.

With this background, this paper tries to decompose international industrial energy consumption for six region(EU, NAFTA, East Asia, China, BRIITA(Brazil, Russia, India, Indonesia, Australia, Turkey),rest of world)during 1999-2009 using SPD. This paper made up of two parts. First is the structural decomposition of industrial energy consumption, and second is structural path decomposition of industrial energy consumption.

Methods

By Wood and Lenzen(2008), total energy consumption can be express as

$$\mathrm{C} = \mathrm{c}(\mathrm{I} - \mathrm{A})^{-1}\varphi\delta YP \qquad (1)$$

Where C istotal energy consumption, c isenergy intensity of industry I, A is Direct requirments matrix, φ isCommodity structural of final demand, δis Destination structure of final demand, Y is per-capita final demand, and Pis population. Then its decomposition equation can be expressed as (2)

$$
\begin{aligned}
dC &= dc\varphi\delta YP + cd\varphi\delta YP + c\varphi d\delta YP + c\varphi\delta dYP + c\varphi\delta YdP \\
&+ dcA\varphi\delta YP + cdA\varphi\delta YP + cAd\varphi\delta YP + cA\varphi d\delta YP + cA\varphi\delta dYP + cA\varphi\delta YdP \\
&+ dcAA\varphi\delta YP + cdAA\varphi\delta YP + cAAd\varphi\delta YP + cAA\varphi d\delta YP + cAA\varphi\delta dYP + cAA\varphi\delta YdP + \cdots
\end{aligned} \tag{2}
$$

The first line of (2) is the decomposition of first order impact, and the second line of (2) is the decomposition of second order impacts. Total energy consumption pathway can be analyzed based on Eq.(2)

Expected results

By using SPD method, I expect to elucidate main supply chains that drive changes in global energy consumption. This can aid practical implications from previous studies using SDA on similar issues.

References

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