

Generalized Global Unit Structures and Global Production/Value-added Networks: A World Input Output and Social Network Approach

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In this paper we analyze Global Production and Global Value-added Networks. For this purpose, we introduce a reliable approach to applying Social Network Analysis (SNA) to an input-output framework. Our approach involves two essential steps. In the first step, we derive global unit structures in different ways, namely by gross output and value-added, from a World Input-Output Table (WIOT) in the World Input Output Database (WIOD). In the second step, we investigate characteristics of Global Production Networks (GPNs) and Global Value-added Networks (GVNs) based on global unit structures, which differ from the existing GPNs and Global Value Chains (GVCs).

The unit structure approach in a single-region input-output (SRIO) model was developed by Ozaki (1980). In our experiment, we try to formulate the general type of the unit structure model and expand Ozaki's unit structure model into a global multi-region input-output (GMRIO) unit structure model. A global unit structure based on gross output (GUGO) is a square matrix that shows the required global direct and indirect intermediate transactions in order to produce one unit of final demand of a specific industry. We analyze a Global Production Network (GPN) in the GUGO. A limitation in Ozaki's unit structure model is the problem of double counting because his derivation method of unit structures is only based on gross output. In order to overcome a limitation of Ozaki's model, we propose a new approach: the derivation method of global unit structures based on value-added. An economic interpretation of the global unit structure in value-added (GUVA) is value-added impacts of global direct and indirect intermediate products to produce one unit of final demand of a certain industry. We investigate a Global Value-added Network (GVN) from our new approach to the GUVA.

GUGOs and GUVAs are well-suited for Network Analysis. There are two reasons for this. Firstly, GUGOs and GUVAs are Complete Networks. Secondly, GUGOs and GUVAs are derived from WIOT for the period from 1995 to 2011. Thus, cross-sectional and time-series international comparisons of network indices based on GUGOs and GUVAs at the country-industry level are possible. Therefore, our approach provides reliable and comparable results of network analysis based on the global unit structure framework. From the WIOD, we divide the 41 countries into 7 regions: Korea, the United States, China, Japan, EU, BRIIAT (Brazil, Russia, India, Indonesia, Australia, and Turkey) and ROW (the Rest of the World). In our study we focus our attention on key industries, such as Transport Equipment, Electrical and Optical Equipment, that can represent characteristics of GPNs and GVNs well. And we use a set of measures of network indices from SNA to identify GPNs and GVNs.