# Identifying Critical Sectors in the Restructuring of Low-Carbon Global Supply Chains

Topic: Input-Output Analysis: Trade and Global Value Chains Policies - I
Author: Keitaro Maeno

Based on recent events such as the COVID-19 pandemic and Russia/Ukraine conflict, global supply chain (GSC) restructuring has become an important issue for industries worldwide. In this urgent situation, industries need to transform their existing GSCs into new GSCs which have a low-carbon structure, in other words, they need to conduct low-carbon GSC restructuring to mitigate the climate change. The key questions for the low-carbon GSC restructuring are as follows. First, which sector (i.e., supplier) included in the relevant GSC can achieve the greatest CO2 emission reduction through GSC restructuring, in short, which sector should be a policy target for relevant low-carbon GSC restructuring? Second, to what extent can the CO2 emissions of a relevant GSC can be reduced through GSC restructuring?

To answer these research questions, this study empirically investigated the impact of relevant GSC restructuring targeting every sector using a practical hypothetical extraction method: HEM model. Specifically, this study applied a hybrid HEM model combined partial HEM and global extraction method (Dietzenbacher and Lahr, 2013; Dietzenbacher et al., 2019) to estimate the impact of â€œa unitâ€• of relevant GSC restructuring targeting every sector included in a relevant GSC (i.e., marginal restructuring of a relevant GSC). In this study, marginal GSC restructuring is defined by one percent extraction and substitution of a trade coefficient between a targeted sector and the other sectors included in a relevant GSC.

Furthermore, this study incorporated an indicator of the comparative advantage (i.e., the revealed comparative advantage index) of an extracted sector (i.e., a restructured sector in the relevant GSC) into the hybrid HEM framework to decide a reasonable partial extraction ratio reflecting a substitutability of an extracted sector. Through this process, this framework can describe the practical scale of relevant GSC restructuring and estimate the CO2 emission reduction potential of practical GSC restructuring.

The novelty of this study is the provision of intuitive and accurate evidence for the relationship between GSC restructuring and CO2 reduction to policymakers who are willing to implement low-carbon GSC restructuring by extending the scenario-based HEM into practical and flexible framework as a simulation tool for the real world.

As a case study, this study applied the practical HEM framework to the latest world input-output database (WIOD) in 2014 and estimated the impacts of restructuring Japanese and German automotive GSCs on CO2 emissions. The results showed the Chinese electrical equipment sector and Russian basic metals sector had the largest CO2 reduction effect by the unit of the restructuring of the Japanese and German automotive GSCs, respectively. The results indicated that these sectors should be a policy target for the low-carbon restructuring of the relevant automotive GSCs. Additionally, the results highlighted practical CO2 reduction potentials based on a reasonable scale of the relevant GSC restructuring, reflecting the substitutability of restructured sectors included in the automotive GSCs. The results implicated optimal strategies for the low-carbon GSC restructuring according to an attitudes of policy makers or GSC managers.

Finally, this study shows a guideline for policy makers to utilize the proposed framework. Furthermore, referring to the existing policies related to the GSC restructuring or the climate change mitigation in the real world, this study discusses effective policy implications for CO2 mitigation

through GSC restructuring.