

Spatial Structural Decomposition Analysis with a Focus on Product Lifetime

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Author: Yuya NAKAMOTO

A lifetime extension of a product reduces the demand of consumers for that product (Serrenho and Allwood, 2016), and hence reductions of intermediate input and energy input for the production of the product can be achieved (Kagawa et al., 2008). However, previous studies on automobile lifetime analysis have the following issues: (1) The scope of previous automobile lifetime studies has been domestic, whereas the supply chain of automobiles is global in scale; and therefore (2) It is unclear what impact changes in product lifetime in a country have on the structure of final demand through the global supply chain and carbon footprint associated with the global final demand.

To address these issues, this study estimated the carbon footprint associated with the global final demand of automobiles and auto-related petroleum of the U.S.A., Germany, and Japan, which account for 31% of the stock of passenger cars in the world in 2009, during 1995 to 2009. Using the World Input-Output Database (WIOD) (Timmer et al., 2015), we developed a comprehensive new method that offers a deeper understanding of the structural change in the global final demand of automobiles and discussed how the lifetime of automobiles of a specific country has contributed to their carbon footprints. From the results, we found that automobile lifetime extensions of the three countries greatly reduced their carbon footprints, and had a greater effect than technological changes in emission intensities of suppliers directly and indirectly involved in automotive manufacturing.