

## Correlation Analysis between Embodied Emissions and Revealed Comparative Advantage(RCA)

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Policies to reduce Greenhouse Gas Emissions induce changes of economy. The economy of South Korea, which highly relies on trade, would respond to carbon taxes as the price of exports is incremented by the imposed carbon taxes on exports. In this sense, adaptation to carbon-tax-induced changes in exports is very important study area for policy makers.

This is a baseline study for the adaptation to carbon-tax-induced changes in exports in South Korea. This study aims to predict the vulnerable industries to a carbon tax and to analyze emission trends in competitive industries. In order to achieve these goals, we identify industries that emit large amount of CO<sub>2</sub> to produce and consume one unit of exports and examine the correlation analysis between competitiveness in exports and the embodied CO<sub>2</sub> in one unit of exports.

Focusing on South Korea, we use Single Regional Input Output (SRIO) method for the estimation of embodied CO<sub>2</sub> emissions in exports. For the competitiveness in exports, the traditional Revealed Comparative Advantage (TRCA) index and the new measure of RCA (NRCA for short) developed by Wang et al. (2014) are used. NRCA only takes into account the domestic value added, while TRCA considers gross export including both domestic and foreign value added. In this regards, utilization of NRCA index for estimation of industrial competitiveness in exports enables in depth analysis on pure competitiveness in exports of South Korea.

Applying the SRIO method to the World Input-Output Database (WIOD), we produce new panel data sets that reveal the embodied CO<sub>2</sub> emissions of 35 industries in the Korean economy. Data source for the embodied emissions in export is World Input Output table (WIOT) covering 40 countries from 2000 to 2009 and the WIOD's environment account of CO<sub>2</sub> emissions. Furthermore, RCA indices are estimated using WIOT from 1995 to 2011. The different time coverage occurs when WIOT and WIOD's environmental account provide the different up to date data of 2011 and 2009, respectively.

The motivation for this study comes from intuitive expectation that competitiveness in export has inverse relation to embodied emission in one unit of exports. However, it is revealed that there is no distinct relationship between the two indicators. A pattern, in the meantime, can be found that industries embodying low CO<sub>2</sub> emission per a unit of export and gaining big competitive advantages tend to export relatively large amount of commodities. From this result, it can be assumed that industries highly contributing to the gross exports are less vulnerable to carbon taxes as the embodied CO<sub>2</sub> emissions in a unit of export is lower than the other industries.

Besides, it is identified that vulnerable industries to carbon taxes are Wood and Products of Wood and Cork, Agriculture<sup>TM</sup>Forestry<sup>TM</sup>Fishery, Basic Metals and Fabricated Metal, and Transportation.

Lastly, the correlation analysis represents a tendency for industries having the low embodied emissions in one unit of exports and a big RCA. As time passes, the industrial competitiveness in exports increases, while the level of embodied emission per a unit of export decreases in most of industries gained big RCAs.

The major contribution of this paper is to generate a time series data of embodied CO<sub>2</sub> emission for the recent 10 years. This enables for the trend analysis of the embodied emissions in exports by industries. The other contribution is to apply NRCA index to correlation analysis. NRCA index does not underestimate the competitiveness in exports by considering the value added only created in the domestic market. Since this study focuses on a domestic production and consumption process, SRIO analysis is appropriate. However, future research suggestion is to utilize MRIO method for estimation of the embodied CO<sub>2</sub> emissions in order to take into account global production chains.