An analysis on Relation between Consumption Based Emissions and Tax

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1) The Research Question
This analysis study starts from the a question that â€œâ€™is a national tax system dependent on CO2 emissions?â€• â€˜, and â€œâ€™have there any relationship betweendoes consumption based CO2 emissions correlate to and taxes?â€™. We implement a correlation analysis between CO2 and tax embodied in consumption. Also Additionally, we considered take into account that the implicit carbon price, which is the total CO2 emissions (included including CO2 embodied in consumption) , that effect on the total tax. Then we estimate effect of implicit carbon price on GDP per emission.
2) The method used
We use both Multi-Regional Input-Output (MRIO) analysis and Single-Regional Input-Output (SRIO) approaches. SRIO assumes a closed economy, so it covers only domestic supply chain. However, MRIOA enumerates global supply chain and thus only consider imports to final consumers with trade in intermediate consumption calculated endogenously (Peters et al., 2011).
The estimation of consumption based CO2 emission consists of multiplying a diagonal matrix of CO2 emissions coefficient to Leontief inverse matrix and diagonal matrix of final demand. Leontief inverse matrix represents the supply chain. Calculation of consumption-based tax uses the different tax input data depending on our choice of SRIO or MRIO. The SRIO approach uses production taxes and domestic intermediate goods taxes in order to calculate the diagonal matrix of tax coefficient. However, in the MRIO approach, the diagonal matrix of tax coefficient is derived from production tax, domestic intermediate goods tax, import intermediate goods tax, export tax, and import tariff data. Similarly, the consumption-based tax is calculated by multiplying tax coefficient diagonal matrix to Leontief inverse matrix and final demand diagonal matrix (or final demand matrix). Using SRIO and MRIO methods, we obtain the consumption-based CO2 emission and taxes. Then, we can build regional linear regression equation having total emissions (including consumption based emission) as an independent variable and total tax (including consumption based tax) as a dependent variable. The estimates of regional independent parameter is obtained through regression analysis is considered the implicit carbon price. In addition, we draw a scatter plot that put regional implicit carbon price on the x-axis and GDP per emission on the y-axis. Also we can set the global regression equation having implicit carbon price as the independent variable and GDP per emission as the dependent variable.
3) the data used
We use the GTAP (Global Trade Analysis Project) 9.0 database, which has 140 regions and 57 commodities. GTAP provides data of benchmark years of 2004, 2007 and 2011 data. In this study we utilize 2011 data for SRIO analysis. In addition, for the MRIO analysis, we considered the data of 2004, 2007 and 2011. We constructed the global input output table for MRIO analysis. This table is handling the international transport endogenously. The international transport matrix using international trade for intermediate commodities add intermediate input-output matrix and the international transport matrix using international trade for final goods add final demand matrix.
4) Results
Results of regional regression obtained from the SRIO analysis show the lower implicit carbon price in the case of low GDP per emission countries (China, Russia, Iran, South Africa, India and South Korea) than other countries. However, high GDP per emission was shown in the countries such as Japan and EU countries. These countries present higher implicit carbon price as well. Also, the result of global regression shows that one unit increase of implicit carbon price induces increase of GDP per emission by 0.7567. In the meantime, results of global regression analysis

using the MRIO method illustrate that an increase of one unit of implicit carbon price increments GDP per emission as well. But, the relationship becomes weak year-by-year; the result was 1.5752 in 2004, 1.3262 in 2007, 1.1423 in 2011.

Comparing implicit carbon prices resulting in SRIO and MRIO approaches, implicit carbon price using the MRIO method is lower than the result obtained by the SRIO approach. In particular, the gap between the two implicit carbon prices is bigger on Japan and EU countries. The reason for this gap is that MRIO analysis reflects the effect of international trade. Therefore, we conclude that carbon pricing effect is diminished by international trade.

5) Novelty of the research

In this study, the implicit carbon price has different definition than the other studies. It is determined as total emissions impact on the total amount of tax to the implicit carbon price while the other studies estimate the implicit carbon price based on financial incentives for greenhouse gas reduction.