

## The Economic and Environmental Consequences of a Carbon Tax in Japan

Topic: Input-Output Analysis: Sustainable Production and Consumption Policies - VIII

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The Japanese government has ratified the Paris Agreement and according to "Global Warming Countermeasures Plan (2021)" and the Ministry of the Environment aims to reduce the amount of greenhouse gases emitted in 2030 by 46% compared to that in 2013. The enforcement of a carbon tax is a significant policy for reducing CO<sub>2</sub> emissions in Japan. The carbon tax introduced in Japan is one of environmental taxes that imposes a tax to industries which emit a lot of CO<sub>2</sub> such as shipping, importers of crude oil, and importers of coal. The tax rate is determined according to the amount of direct CO<sub>2</sub> emissions due to the consumption of fossil fuels.

The Japanese government has introduced a global warming tax to CO<sub>2</sub> emissions from the consumption of fossil fuels including crude oil, coal, and natural gas since 2012. The current tax rate is 289 JPY per ton of CO<sub>2</sub> which is less than 1/10 of other countries which have implemented carbon tax. The Japanese government will impose a carbon tax on five industries including petroleum products (i.e., petroleum importers), coal products (i.e., coal importers), commercial power generation (i.e., power plants), city gas, and trading companies in 2028.

This study focuses on four industries of coal products, petroleum products, commercial power generation, and city gas and identifies industries which receive the largest impact from a carbon tax, using both the input-output price model and the supply-chains network model based on the price model. There are many studies that describe the advantages and disadvantages of carbon taxes, but few of them identify the economic and environmental effects of a carbon tax in the supply chain complexity.

This study quantitatively analyzes the carbon tax-induced effects in the detailed supply chain paths in Japan. Firstly, we estimated the monetary and physical amounts of fossil fuels imported by each of the above-mentioned four industries using the detailed physical input-output table of 2015. Secondly, we calculated the amount of carbon dioxide directly emitted by the four industries using the carbon dioxide emission factor provided by the Ministry of the Environment of Japan. Then we calculated the amount of carbon tax imposed on the four industries. The carbon tax rate has not been determined in Japan so far and therefore we assumed carbon tax rate following tax rates introduced in the EU countries. Finally, we calculated the changes in price index of domestic products due to the enforcement of the carbon tax.

From a result based on the 2015 input-output tables of Japan, we found that total Carbon Footprint of fossil fuels imported by four industries including coal products, petroleum products, commercial power generation, and city gas was about 926 Mt-CO<sub>2</sub>e. If a carbon tax of 2,890 JPY per ton of CO<sub>2</sub> emissions (i.e., the least carbon tax rate in the EU countries) is applied to the four industries, the government would obtain the revenue from tax of 2,678 billion JPY and the composite Laspeyres price index of domestic products would rise by 7%. Furthermore, we found that price increase effects in the supply chain groups centered around five industries of pig iron, basic petrochemical, in-house power generation, petrochemical aromatic, and crude steel (converter) increased the most. Based on the results of this study, we suggest that the government should financially support to improving energy efficiency within the supply chain groups identified in this study and determine the best way to use of tax revenues.