

Title of paper

Economic and environmental assessment of carbon tax reform to meet Japan's INDC in Paris Agreement using E3ME macro-econometric model

Authors

*Soocheol Lee¹, Unnada Chewpreecha², Hector Pollitt³ and Satoshi Kojima⁴

Objective

The aim of this study is to determine the carbon cost(carbon tax rate) that will be required to meet 2030 greenhouse gas reduction targets stipulated in Japan's INDC should the 2030 energy mix announced by the Japanese government in April 2015 be realized, and to estimate the economic impact of such a tax. We also estimate the economic impact on GDP, employment, trade, and other parameters, should tax revenues from such a carbon tax be recycled to the public through reductions in consumption tax, income tax and lump sum subsidies to the households.

Methods adopted

Quantitative analysis in this paper is performed with reference to the E3ME(Energy-Economy -Environment Macro-Econometric model) developed by Cambridge Econometrics. This applied multi-national, multi-sectoral econometric model is global in nature, but our analysis is carried out at the national level.

This study investigates baseline scenario and 4 different policy scenarios to meet Japan's 2030 CO₂ reduction targets of 24.9% reduction in energy-related CO₂ accordingly (compared to 2005 level).

Table 1: Scenario descriptions

Scenarios	Descriptions
Base line Scenario	No carbon target, no policy to reduce CO ₂ emission by 2030.
Scenario 1	Only a carbon tax(with lump-sum transfer of tax revenue to households) has been introduced to meet the CO ₂ and approximately meet the electricity mix targets in 2030.
Scenario 2	In addition to a carbon tax(Scenario 1), revenues from carbon tax are recycled to

¹ Professor, Meijo University, 2. Senior researcher, Cambridge Econometrics, 3. Director, Cambridge Econometrics, 4. Principal Researcher, Institute for Global Environmental Strategies

	reduce income tax.
Scenario 3	In addition to a carbon tax(Scenario 1), revenues from carbon tax are recycled to reduce consumption tax.
Scenario 4	In addition to a carbon tax(Scenario 1), 10% of revenues from carbon tax are recycled to energy conservation investment and leftover revenues from carbon tax (after deduction to pay for energy conservation investment) is recycled to reduce consumption tax.

Major findings

In Scenario 1 there is a decrease in GDP due to the carbon tax's contractionary effect. However, under Scenario 2~4 this impact is much lowered and clearly show positive stimulus in economy but lower consumer demand due higher price as a result of carbon tax. In all scenarios Japan also benefits from a lower fossil fuel import bill. There is a net increase in imports in scenarios where energy conservation investment took place as some investment goods are imported.

In the last three scenarios there is a 10% energy conservation saving in the electricity sector (compared to baseline), which lowers electricity use. This savings is assumed to be the result of an increase in public sector investment expenditure which is funded by carbon tax revenues. Our analysis show that Japan can meet its energy target while increasing GDP above baseline by recycling revenue gained from a carbon tax in such as in Scenarios 2~4.

This analysis could further be expanded by investigating the other channels through which revenue could be recycled, such as social security benefits, corporation tax or further investment in energy efficient technologies.

Further analysis could show that one of these, or a combination of these, could lead to higher GDP results. However, this would not detract from the main message of this report that Japan can introduce a carbon tax without having negative effects on its economy.

References

Andersen, MS and P Ekins (2009) *Carbon-Energy Taxation: Lessons from Europe*. Oxford, IEA.

Cambridge Econometrics (2014) '*E3ME Manual, Version 6.0*', available online at www.e3me.com

Soocheol Lee, Hector Pollitt and Kazuhiro Ueta(2012), "An Assessment of Japanese Carbon Tax Reform Using the E3MG Econometric Model", *Scientific World Journal*, volume 2012, ID 835917, 1-9.

Soocheol Lee, Hector Pollitt and Park Seung-Joon(eds)(2015)"Low Carbon, Sustainable Future in East Asia-How to Improve Energy System, Energy Taxation and Policy Cooperation" Routledge.