Hybrid Model Between Top-down and Bottom-up Model to Reflect System Changes, Case of Japan

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Overview

Top-down models capture macroeconomic linkages, but often struggle with substitution elasticities for new energy forms because data related to them, and to the forces that are likely to shape severe mitigation scenarios, is very limited. This research demonstrates use of parametric runs from the Japanese multi-region TIMES model (JMRT) to estimate electricity technology choice elasticities for a Japanese CGE model. We have employed the CRESH production function to estimate elasticities, which allows them to be different for each input.

Our focus is on large-scale renewable electricity production. Intermittency and geographical sensitivity are the two main factors that differentiate renewable electricity from conventional sources. Seasonal and diurnal variations in wind/solar electricity necessitate use of backup capacity and storage. Further, the most economic source in Japan – onshore wind, has better potential in regions with low electricity demand. This makes integrating the more or less isolated (10) grids of Japan a very important issue. The JMRT model employs 1 sq km grid GIS information on wind speeds, distances from the nearest road and from electricity grid for a very detailed description of wind potential.

Using CRESH parameters estimated from JMRT, CGE model becomes possible to reflect system changes.

Methods

In this reseatch, we have employed detailed dis-aggeregate technology model and dynamic recursive CGE model with technology bundle in electricity generation sector. Using technology mode (JMRT), we have estimated CRESH elasticities under different systems. Using the CRESH parameter for CGE model, we have simulated the impacts of system change on the cost of carbon mitigation and macro impacts, GDP, investment and so on, under the Kyoto carbon mitigation target as an example.

Results

Table1: CRESH Parameters

		Technology			
		Hydro	**Solar**	**Offshore**	**Onshore**
Scenario	**Reference**	**1.36****	**1.24*****	**4.27*****	**1.65*****
	Storage	**2.22**	**3.59*****	**7.57***	**5.76*****
	GE	**1.39****	**1.23*****	**3.95*****	**3.54 *****

Table 2: GDP Decomposition under Differe

	REF	GE	STO
C	**-0.65**	**-0.63**	**-0.45**

I	**0.04**	**0.04**	**0.05**
G	**0.27**	**0.27**	**0.28**
X	**-4.46**	**-4.41**	**-3.86**
M	**-2.94**	**-2.89**	**-2.45**
GDP	**-0.65**	**-0.64**	**-0.5**

Conclusions

Conventional top-down model fails to represent substantially different technological futures. Common deficiency of tech-bundle CGE is the lack of the real estimates for the model parameters. Using parameter estimated by detailed bottom-up which is complex enough make top-down model reflect technology completeness., the characteristics of each technology and system changes

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