

Economic Impact Analysis of Natural Disasters: CGE Modeling Approach

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As economic losses from natural disasters increase, assessing the economic impact of a future possible natural disaster is becoming increasingly important. A computable general equilibrium (CGE) model is a strong candidate as an impact assessment model. However, critics of CGE models state that key parameters are often not estimated econometrically. The purpose of this study is to calibrate a set of substitution parameters in a CGE model for the economic impact assessment of a natural disaster. We develop a recursive-dynamic multi-regional CGE model for Japan, and then calibrate a set of substitution parameters for the model. For the calibration, we employ a heuristic method in which the substitution parameters are adjusted to reproduce the actual economic impacts of the 2011 Great East Japan earthquake. Although this was a one-off event, the magnitude of its impact on the Japanese economy was large enough to distinguish it from other events.

The validity of the calibrated parameters is confirmed by reproducing the economic impacts of the Great East Japan earthquake in the CGE model. Statistically, the reproducibility of the simulation results is assured for the shock to industrial production in the first month after the earthquake. The dynamics of industrial production in the CGE model reproduce the actual path of industrial production well, excluding a region where there are many automaker assembly lines. This reveals two facts. The value of the substitution parameter affects the restoration path of industrial production, as well as the short-term impacts. However, the reproducibility also depends on the market clearing condition in the CGE model. The market clearing condition ensures that supply instantly equals demand in markets for goods and primary factors. On the other hand, the observed data reveal that inventory could delay the propagation of negative shocks, such as supply chain disruptions in the automotive industry.