Evaluation of Supply Restriction due to a Huge Disaster

Topic: Input-Output analysis of disasters 2
Author: Takatoshi WATANABE
Co-Authors: Kiyoshi Fujikawa, Mitsuru Shimoda, Zuoyi YE

The threat of nature was shown off in the East Japan Great Earthquake occurred on March 11 in 2011 though mankind has received a lot of blessings from nature. The earthquake deprived of the life of 20 thousands of people (including the disappeared) and 270 thousand people lost the house. Moreover, the loss in an economic activity also received a lot of influences. The factories / offices in the quake-hit zone are severely damaged and it constrains the economic activities of the down-stream businesses of them in the current industrial relation structure.

An input-output table is a statistical table which records the intra industry transactions as well as those of final demands. The best use of input-output tables is the demand–driven equilibrium output determination model where inter-industry demand ripple effects are considered. Typical application of this model includes an analysis on economic effects of big events such as Olympics games or Expos. The demand–driven equilibrium output determination model assumes that all the goods and services demanded in the economy can be supplied somehow; in a word the economy is assumed to be free from the bottleneck in the supply chain. However, what has been closed up due to the earthquake was "supply restriction" due to the production damage in the quake-hit zone rather than "demand shrink" in the corresponding region. The classical input-output analysis cannot treat this type of restriction, this essay, therefore, will think how to model such a supply restriction.

The effects of the quake have something to do with complex and entangled elements. It is inappropriate, therefore, to use a single model to evaluate those effects. This essay will propose the following five kinds of modifications of traditional demand–driven equilibrium output determination model.

Model 1) Quake-hit zone exogenous model
  Model 1-1) Demand driven model
  Model 1-2) Supply driven model
  Model 1-3) Demand driven and supply driven hybrid model
Model 2) Non-substitutable input model
  Model 2-1) Regionally substitutable input model
  Model 2-2) Regionally non-substitutable input model

The statistics used in this essay is Japan inter-regional input output table 2005 issued by the Ministry of Economy, Trade and Industry, Japan. This essay implements several kinds of simulation analysis based on this table where the quake-hit zone is assumed to be Tohoku (North-East) region applying the above mentioned five models. The results of simulation would be reported in the conference.

Case 1) Electricity supply constraint case in Tohoku region
Case 2) Automobile components supply constraint case in Tohoku region
Case 3) Aver all supply constraint case in Tohoku region