Bottleneck model for estimation of economic damage of earthquakes

Topic: An Input-Output Analysis for Disaster Damage: A Case Study on the Tokyo Epicentral Earthquake (Chair: Kiyoshi Fujikawa, Aichi Gakuin University)
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The Great East Japan Earthquake in 2011 caused damages to auto parts plants in the Tohoku and northern Kanto regions of Japan, which in turn caused parts supply disruptions that halted production at vehicle assembly plants across the country. This phenomenon is caused by the fact that intermediate inputs are at least in the short run completely non-substitutable, and is referred to as the bottleneck effect in this paper. The demand driven model (Leontief model) and supply driven model (Ghosh model) presented in the first presentation cannot handle such phenomena adequately. In this presentation, we introduce a model that emphasizes the idea of complete non-substitutability among inputs of production, while the demand driven model also assumes non-substitutability among factors. The difference between them is that this idea is used on the demand side of the input good in the demand driven model, while in the bottleneck model the idea is used on the production side. The idea of this model is new and has never been presented at an international conference before, and we believe it is important to introduce this model at IIOA because of its significant academic contribution.

In the Leontief model, the production function can be expressed as the ratio of the quantity of intermediate input goods divided by the input coefficient for each material, the smallest of which is the output. When Tokyo is hit by a disaster, the supply of intermediate input goods from Tokyo to the other region decreases. Since the numerator of each element of the production function becomes smaller, the amount of production will decrease. We estimate the decrease of output of the other region based on Tokyo metropolitan two-regional Input-Output table.

However, the magnitude of the change depends on how Tokyo's output is distributed among industries in other regions. In this presentation, we assume that the distribution ratio is the same as before the earthquake, although this is a strong assumption. Therefore, there is a problem that the bottleneck effect may be too strong in this model.