Title: Regional economic effects of transport infrastructure investment featuring trade gateway region
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Investment to transport infrastructure contributes to improve the productivity of the infrastructure and decrease generalized transport cost. This is a typical logic to explain how the investment to transport infrastructure produces benefit. It seems valid from a point of view of traditional cost benefit analysis (CBA) measuring only the efficiency of the investment project. However the traditional CBA does not mention who may gain the benefit, or who may lose the welfare. General equilibrium approach, considering multiple market equilibrium and multiple players, is needed to know the incidence of the benefit.

Spatial computable general equilibrium (SCGE) model, in particular, highlights inter-regional economic interaction through spatial transport network. When a SCGE model is applied to transport project appraisal, improving regional productivity or direct reduction of generalized transport cost caused by transport infrastructure investment is explicitly described. In many cases, the transport system described in the models are linkage between the regions classified in the models. For example, road network and rail network are assumed the transport system in the domestic or regional SCGE model, and international SCGE models treat ocean container transport system.

This paper however focuses on the 'domestic' regional economic impacts by investment to international transport system. Port, or airport, is an essential infrastructure for international trade. Actually it is impossible to export/import for island countries without such port infrastructure. International freight transport system should include the procedure of handling the cargo at international transport infrastructure in the "trade gateway" region. It means that the condition of transport system is asymmetric between the trade gateway region and other regions. The principal purpose of this paper is to build an appropriate methodology for assessing transport investment project considering the asymmetry.

We build a spatial computable general equilibrium model featuring international transport gateway region. The model assumes one 'small-open' country which has multiple regions. There exists only one trade gateway region in the country. International transport infrastructure such as port and airport is located on the trade gateway region. Therefore foreign goods should enter the country through the international transport infrastructure, and domestic goods should be exported through that. Other regions do not have any international transport facilities, therefore direct export/import is impossible

in such regions. When the tradable commodity is shipped from the region other than trade gateway to foreign country, the commodity must be transported to trade gateway region then it is exported. Domestic freight transport cost is imposed to price of the tradable commodity in addition to international transport cost.

The above geographical structure of the country reflects asymmetry in terms of transport condition for international trade activity. Our model also considers the asymmetry in terms of industrial structure between trade gateway and other regions. Trade transport systems using container port and international airport need specific field of transport activities such as customs clearance, vanning, warehousing, loading and so on. These kind of industrial sector are usually located near the international transport infrastructure and not observed in the regions other than trade gateway. Repairing and maintenance of international transport equipment are also region specific industries because ship and aircraft have to stay in port/airport. In order to take the industrial asymmetry into account of the model, we explicitly classify the international transport related sector from other sector.

In the model, international trade sector exclusively supplies the international tradable goods. We assume export sector and import sector individually and both of them exist only in trade gateway region. Export sector inputs primary factor and intermediate input and sells the goods to foreign countries. Value added for the export sector is generated by the value of transport service and other handling services related to international trade. Import sector inputs primary factor, intermediate goods and raw import goods from foreign countries and sells the import goods modified for domestic use. Value added for the import sector is also equivalent to transport service and other handling services related to international trade. Productivity of export/import sector depends on the efficiency of international transport infrastructure facility.

Sectors other than export/import sector exist in all regions. They produce the goods by inputting primary factor, domestic-made intermediate input and foreign-made intermediate input. The foreign-made intermediate input consists of imported goods for domestic use. Demanding for intermediate input needs domestic transport cost for delivery in addition to the mill price of the goods if the goods are not produced in the own region. We adopt Samuelson's iceberg transport cost concept for domestic transport, which means that a certain portion of the transported goods itself is consumed for shipping.

Both of international transport cost concept and domestic transport concept are applied to the demand for consumption by households residing in every region. Investment to the international transport infrastructure contributes to improvement of the productivity, then reduces the price of output of export/import sector. Investment to the domestic transport infrastructure directly contributes to reduce

the transport cost margin represented by iceberg type. Thus the model can assess the effects of international transport infrastructure project and domestic transport infrastructure project independently.

Since the model assumes asymmetric industrial structure namely different number of industrial sector between trade gateway region and other regions, the standard input-output table cannot be used as a benchmark equilibrium data. Export and import sectors appear only in trade gateway region, do not appear in other regions. We develop a methodology to compile the original multi-regional input-output table to the data format accommodating to our model.

As an example study, this paper builds a Japanese two-region SCGE model and applies to some virtual transport infrastructure projects. The original benchmark data is Tokyo Metropolitan I-O table which is a two-region table classified Tokyo and Rest of Japan. Industrial sectors, excluding international transport related sectors, are aggregated to one composite goods sector for simplicity. The system of multiple number of regions more than two is applicable, and it is the same for the number of sectors. The analysis assumes that Tokyo Metropolitan region is the gateway of Japanese international trade. Cost structures of export sector and import sector in Tokyo Metropolitan region can be derived from the modified benchmark data.

We evaluate the effects of the three infrastructure project scenarios; domestic transport infrastructure investment, international transport infrastructure investment and both of them. It is the novelty of this model that these types of policy scenario can be assessed by same platform. The domestic transport infrastructure project would contribute to nation-wide price reduction and strengthen the competitive power to foreign goods. The result actually shows that domestic infrastructure project brings positive benefit to all regions in Japan. On the other hand, international transport infrastructure project will cause different effects by region; negative benefit in trade gateway region and positive benefit in other region in this analysis. Improvement of international transport infrastructure contribute not only to price reduction of domestic goods but also to price reduction of imported foreign goods. In this case, imported goods become more competitive than the goods produced in the trade gateway region. The result moreover shows the effects of the package of the domestic and international infrastructure projects. Since SCGE model illustrates equilibrium in all markets, our model gives the change in prices and outputs for each sector in each region as well as regional benefit. The effects to export/import sector are explicitly and individually estimated by the model.