

# IDE Research Bulletin

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Research Summary based on papers prepared for publication  
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## **Development of a Geographical Simulation Model (IDE-GSM) and geo-economic dataset**

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### Development of a Geographical Simulation Model (IDE-GSM) and geo-economic dataset

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The Institute of Developing Economies (IDE) has been developing the Geographical Simulation Model (IDE-GSM) since 2007. The IDE-GSM is a unique numerical general equilibrium simulation model based on spatial economics and has two objectives: (1) to simulate the dynamics of locations of populations and industries in East Asia in the long-term and (2) to analyze the impact of trade and transport facilitation measures (TTFMs) on regional economies at the sub-national level.

This year, we have continued research in two directions, namely, studies on data compilation and parameter estimation and applications for TTFMs analyses. For the former direction, we are trying to compile a geo-economic dataset for Africa, where there are many countries that have no regional economic data or GDP by economic sector data at the national level. Thus, we need to develop a new method to estimate the regional GDP to compile a geo-economic dataset for Africa.

There are three methods we are developing for the data compilation for Africa. The first one is the application of the method proposed in Keola et al. (2015). This method utilizes mainly the nighttime light satellite imagery for estimating GDP in the manufacturing and service sectors at the sub-national level. For agricultural GDP, the method utilizes the land cover data and population data at the sub-national level. We are continuing to try to compile geo-economic data for Africa.

The second method we are developing is a method to estimate GCP by industrial sector within the manufacturing sector. There are many African countries that have sectoral GDP for agriculture, mining, manufacturing, and services, but not for sub-sectors in the

manufacturing sector. We are now trying to estimate the sub-sectoral GDP in the manufacturing sector from the various macro-economic data available for these African countries.

The third method is the way to automatically compile the road network data that is suitable for the GSM model, i.e., simplified network data among cities with the data of length and average speed. We are developing a method to extract simplified network data from a detailed road network shapefile with length and speed data.

For these three methods, we are planning to publish DPs in the coming year once the methods are proved reliable.

IDE-GSM enables us to predict the economic impacts of various TTFMs, such as lowering tariffs, customs facilitation measures, reduction in non-tariff barriers, and the development of transport infrastructure. In this project, we have carried out the analyses on various infrastructure development projects, economic corridors, and FTA/RTAs. Recently, China's One Belt One Road (OBOR) initiative has been attracting attention and the interest to ASEAN-India connectivity is on the rise. IDE-GSM is suitable to analyze the economic impacts of these large-scale infrastructure developments involving many countries.

During this year, we have conducted various analyses on TTFMs. Three of these analyses are summarized and compared in the papers below.

### **Economic Impacts of Economic Corridors in Mongolia: An Application of IDE-GSM (DP700)**

In this paper, we tried to estimate the economic impacts of the Central Asia Regional Economic Cooperation (CAREC) Economic Corridor 4a, 4b, and 4c projects, which enhance the connectivity between Mongolia and its surrounding countries, using IDE-GSMN, a computational general equilibrium model based on spatial economics. The estimation results show that the economic impacts for Corridor 4b, which connects China and Russia through Ulaanbaatar, the capital of Mongolia, are the highest compared with the other two corridors. Apart from Mongolia, Corridor 4b also economically impacts China, EU, and Russia; thus, cooperation among these four parties might be a suitable arrangement for development. The evaluation of large-scale economic development of corridors is not very easy without proper evaluation tools. This paper shows the efficacy of this simulation-based policy analysis to shape better development plans for Mongolia.

### **Economic Impacts of High-Speed Rail between Kuala Lumpur and Singapore: An Application of IDE-GSM (DP701)**

This paper examines the potential economic impacts of the Kuala Lumpur (KL) – Singapore High-speed railway (HSR) using a CGE model based on spatial economics,

called IDE-GSM. The simulations covered three different scenarios: (1) Singapore–KL non-stop express service, (2) Johor–KL local service, and (3) Singapore–Johor shuttle service. Simulations were also performed to compare the economic impacts of the project on Singapore and the thirteen states of Malaysia. Our simulation analysis revealed that the economic impacts of HSR for Malaysia and Singapore in the best policy mix are USD 1.589 billion and USD 641 million a year for 2030, respectively. We also derived the following policy implications: (1) the specifications of express/local services need be very carefully planned to avoid a “tunnel” effect, (2) the policy to facilitate business transaction and travel between Singapore and Malaysia alongside the HSR development is important to unlock the potential benefits, (3) a policy to upgrade and/or relocate the manufacturing in Kelang Valley and Johor is necessary to avoid excessive de-industrialization, and (4) the supporting infrastructure for the HSR is also needed to unlock the full potential of the HSR.

### **Analysis of Economic Potentials of Infrastructure Developments in and around Bhutan(DP702)**

This paper conducts a simulation analysis of a spatial economic model in Southern Asia, with a particular focus on Bhutan. It indicates the potential impacts of different infrastructure investments on regional economies in Bhutan and the neighboring countries. The results reveal that road infrastructure investments within Bhutan will likely increase regional accessibility, reshape the monocentric structure of the economy, and induce migration, thereby increasing the real wage for most of Bhutan’s regions. Furthermore, road infrastructure investments within India have some spillover effects on Bhutan, which can be magnified by further reduction in non-tariff barriers.

### **References**

Keola, Souknilanh, Magnus Andersson, and Ola Hall. "Monitoring economic development from space: using nighttime light and land cover data to measure economic growth." *World Development*, Vol.66, 2015, pp.322-334.