Modeling spatiotemporal urban spillover effect of high speed rail infrastructure development

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(1) Motivation: The concept of spillover effects has been introduced and applied to high speed rail development to formulate the economic impact in increasing regional tax revenue (Yoshino・Abidhadjaev, 2017). The previous study covered the development of Kyushu Shinkansen (Kagoshima Route) in Kyushu region, Japan by JR-Kyushu. The construction started in 1991 and it stared operating in 2004 and becomes fully operational in 2011. According to the study, regional tax revenue had increased especially during construction period and after the line became fully operational. This study aims to extend the idea to the spatiotemporal modeling by developing the spillover effect extent estimation model.

(2) Approach: We use spatiotemporal land cover, land price panel, and municipality tax revenue data to first conduct a preliminary analysis to understand the regional trend. Then we develop the spatiotemporal spillover effect estimation model. The model takes those input data and estimate the spillover extent observed in 1 km grid land cover to highlight characteristics of the spillover effect around each station. The extent is optimized based on the compound annual growth rate in each target phase of high speed rail development. The estimated extent is then evaluated with the municipalities' property tax revenue.

(3) Result: The preliminary analysis suggests that the land price and the property tax revenue increased in the municipalities around high speed rail stations during construction period of Kyushu Shinkansen. However, the trend around each station varies during operation period. The result suggests some of the features around stations promote the spillover effect, while other features may obstruct the effect.

(4) Data:

- 「地方財政状況調査(1991, 2006, 2009)」Ministry of Internal Affairs and Communications.
- "Administrative Zones (1995, 2006, 2009)", "Publication of Land Price Data (1991, 2006, 2009)", "Land Use Tertiary Mesh Data (1991, 2006, 2009)" National Land Numerical Information, Ministry of Land, Infrastructure, Transport and Tourism.

(5) References:

Yoshino, N. and Abidhadjaev, U. (2017) Impact of infrastructure on tax revenue: case study of high-speed train in Japan. *Journal of Infrastructure, Policy and Development*, **1**(2), 1–20.

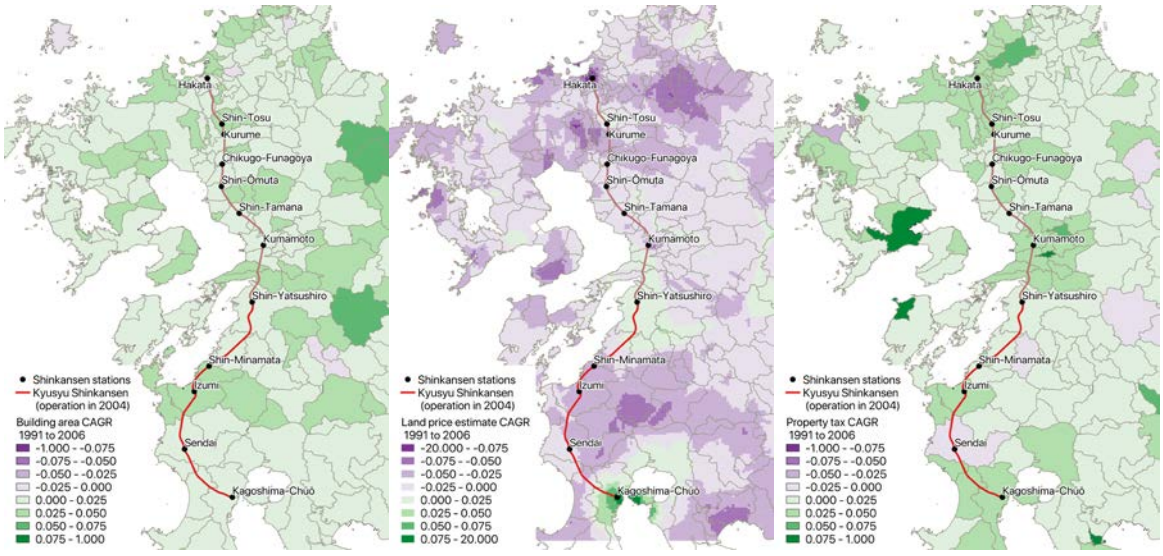

Figure 1: Compound annual growth rate (CAGR) of building area, land price estimate, and property tax revenue during construction phase (1991 - 2006)