



Multimodal transportation infrastructure investment and regional economic development: A structural equation modeling empirical analysis in China from 1986 to 2011

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ABSTRACT

It is often hypothesized that transportation infrastructure investment have a positive impact on economic growth and that economic growth also imposes needs for further infrastructure development. This paper proposes a structural equation model (SEM) to comprehensively consider the bi-directional relationship between multimodal transportation investment and economic development. To account for the complicated interactions between transportation investment and economic growth, travel demand is added as an endogenous variable in the model system. In addition, the SEM model system is formulated with variables that reflect transportation supply in geographically adjacent areas to investigate spatial spillover effects. Empirical analysis based on a panel dataset at the regional level in China from 1986 to 2011 is conducted. Results show transportation investment in the current region or other regions have impacts on economic growth, but are obviously different at national level and provincial level. These differences can be associated with phases of economic development, transportation investment policy, transportation infrastructure service level, spillovers from other regions, as well as reform policies carried out by the central government.

1. Introduction

The economic impact of public infrastructure investment has been controversy substantially. As a core component of infrastructure (Boarnet, 1996), transportation is vital to the operation of society, and transportation investment has been widely debated from both academy and policy perspectives. A large body of studies on the macro-level analysis of the economic impact of transportation investment has been conducted since the seminal work of Aschauer, (1989a, 1989b, 1989c). Although consensus has not been reached yet, it is generally believed that transportation infrastructure investment has a positive impact on economic growth (Boarnet, 1998; Cambridge Systematics, 2002). As shown in Table 1, the most common approach is to develop a production function model in which transportation infrastructure is treated as public capital (Fan et al., 2004; Fan and Bai, 2004). On the US aggregate economy, Aschauer, (1989a, 1989b, 1989c) found marginal product elasticity of 0.39 and for “core” public capital of 0.24. Munnell (1990a) followed the same procedure and estimated an elasticity of 0.33. Sanchez-Robles (1998) got positive effect in multiple developing countries. Munnell (1990b) used panel data, and reported

output elasticities of 0.15 and 0.06 with respect to public capital and highway capital, respectively. Crescenzi and Rodriguez-Pose (2012) analyzed Infrastructure and regional growth in the European, the results indicate that infrastructure endowment is a relatively poor predictor of economic growth. Sloboda and Yao (2008) find that when spending data rather than capital stock is used, all of the interstate spillover effects are negative and statistically significant. Negative results and less conclusive were reported in work of Holtz-Eakin (1994), Evans and Karras (1994), etc.. Although widely used, the production function model is a single-equation and static approach, not accounting for simultaneity among the different variables or any non-contemporaneous effects.

Therefore, more recent studies resorted to the cost function approach, which is able to show whether transportation investment can contribute to economic development and how this effect is realized. Cost functions such as translog cost function, Generalized Leontief cost function and dual cost function are used widely in related studies. Shah (1992), Lynde and Richmond (1993), and Vijverberg et al. (1997) adopted a transcendental logarithmic (translog) cost function to conduct the research and estimated output elasticities between

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Table 1
Output elasticity results of various studies.

Study	Country	Level	Data	Functional form	Infrastructure	Output elasticity
Munnell (1990a, 1990b)	U.S.	State	Pooled	C-D tranlog	Highway	0.060
Seitz (1993)	German	Nation	Pooled	Production function	Motorway	0.040
Fernald (1999)	U.S.	State	Pooled	Production function	Roadway	0.050
Pereira and Andraz (2007)	Portugal	Region	Pooled	Production function VAR models	Roads and Highways, Ports, Airports, and Railways	0.183
Garcia-Mila and McGuire (1992)	U.S.	State	Pooled	Production function	Highway	0.010
Bröcker et al. (2010)	European	Region	Cross-sectional data	Cost function	Road and Rail	12 out of 22 projects above 5%.
He and Zhang	U.S.	Metropolitan	Panel data	SEM	Highway	Short-run:0.200 Long-run:0.320
Finn (1993)	U.S.	State	Panel data	Production function	Highway	0.160
Liu (2010)	China	Province	Panel data 1978–2008	Production function	Highway and water way (Capital stock)	0.197
Yang (2010)	China	Province	Panel data 1994–2007	Production function	Transportation infrastructure investment	The eastern region: > 0.300 The central region: < 0.200 The northwest region: ≤ 0 The southwest region: ≤ 0.100
Dong and Chen (2009)	China	Region (Northeast)	Time series data 1986–2006	VAR model	Transportation infrastructure investment	0.390
Jin (2012)	China	Region Pearl River Delta region	Time series data 1994–2008	Spatial econometric model	Transportation infrastructure investment	0.196
Wang and Wang (2012)	China	Province(Liaoning)	Time series data 1984–2010	VAR model	Transportation infrastructure investment	0.356
Yang and Han (2011)	China	Nation	Time series data 1952–2006	C-D production function	Highway and Railway	Highway:0.224 Railway:0.087
Zhang (2007)	China	Province	Panel data 1993–2004	C-D production function	Transportation infrastructure investment	0.106 The eastern region:0.121 The central region:0.123 The western region:0.106

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