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Analyzing urban infrastructure economic benefit using an integrated approach

Yu Sun[a,b], Yin Cui[a,*]

[a] College of Management and Economics, Tianjin University, Tianjin, China
[b] School of Public Administration, Tianjin University of Commerce, Tianjin, China

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ABSTRACT

Urban infrastructure economic benefit is the positive influence on urban economy generated by the use of urban infrastructure. This paper decomposes urban infrastructure economic benefit into four effects which are consumption effect, investment effect, government purchase effect and external demand effect for the first time and introduces an integrated approach to analyze its level taking four Chinese autonomous municipalities as an example. The level of urban infrastructure economic benefit is evaluated at first. Then the coordinated development among four effects is analyzed by constructing coupling coordination degree model. In final, the impact of the coordinated development among four effects on the level of urban infrastructure economic benefit is studied using panel regression model. The results show that raising the coordinated development level of four effects is beneficial to promote the improvement of urban infrastructure economic benefit. The proposed methods performed quite well at analyzing urban infrastructure economic benefit.

1. Introduction

As the basic condition of economic development, infrastructure has a significant impact on regional economic system (Achour & Belloumi, 2016; Aschauer, 1989; Castells-Quintana, 2017; Fan & Zhang, 2004; Lewis, 2014). It affects other industrial sectors in economy through external effect and spillover effect (Munnell, 1992; Laird, Nellthorp, & Mackie, 2005; Pradhan & Bagchi, 2013). Urban infrastructure economic benefit is the positive influence on urban economy generated by the use of urban infrastructure which includes attracting investment, promoting consumption, increasing revenue, stimulating export, and so on. With the expansion of urban scale and the rapid development of urban economy, the role of urban infrastructure has become more and more important in the process of economic development. Many large cities in the world highly attach importance to the construction of urban infrastructure and emphasize its role in promoting economic growth. The influence of urban infrastructure on economic development has become more and more obvious in modern society.

In recent years, China has been experiencing fast urbanization process (Sun, Song, Xiu, & Liang, 2013). Urban development promotes the inflow of productive factors to cities which leads to the enlargement of urban economic scale in China. At the same time, many Chinese cities face the problems of economic restructuring and transforming economic development pattern which determine the quality of urban economic development. Urban infrastructure is a necessary requirement for maintaining the effective operation of urban economy. It provides the fundamental services for urban economic activities. However, due to the shorter history of urban infrastructure construction, the development of urban infrastructure has many problems which lead to the weak operational efficiency and low utilization level of urban infrastructure in China. It is unfavorable to promote urban economic development. Thus, how to play the function of urban infrastructure in the process of economic development has become important subject for Chinese government and scholars.

Raising the level of urban infrastructure economic benefit is a common problem in many countries, especially developing countries. Urban infrastructure has an impact on different economic activities, not only economic growth. This paper tries to decompose economic system into four parts which are consumption, investment, government purchase and external demand according to the national economic identity

* Corresponding author.
E-mail address: cuiyin@tju.edu.cn (Y. Cui).

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in macroeconomics theory. The impacts of urban infrastructure on these four parts are named as consumption effect, investment effect, government purchase effect and external demand effect of urban infrastructure respectively. They affect each other and constitute urban infrastructure economic benefit. An integrated approach is proposed to analyze urban infrastructure economic benefit comprehensively. Four Chinese autonomous municipalities, which are Beijing, Tianjin, Shanghai and Chongqing, are taken as an example in this paper. They are more developed regions in China and their investment and construction scales of urban infrastructure are giant and increasing quickly year by year. But the basic function of urban infrastructure in the process of economic development has not been fully implemented in these cities. We evaluate the level of urban infrastructure economic benefit at first. Then whether these four effects of urban infrastructure have been developed in harmony or not is analyzed by constructing coupling coordination model which is a useful tool for measuring interactive effects. The impact of coupling coordination degree among four effects on urban infrastructure economic benefit will be studied using panel regression model.

The remaining part of this paper is organized as follows. Previous literature is reviewed in Section 2. Section 3 introduces the approach used in this paper. Its application and results are revealed in Section 4. Section 5 discusses the results. And Section 6 summarizes the main conclusions and recommendations.

2. Literature review

The relationship between infrastructure and economic growth has been analyzed by many scholars for a long time. Plenty of researches showed that infrastructure has a positive influence on economic growth. Aschauer (1989) studied the link between investment on public infrastructure and economic growth. He found that infrastructure was helpful to promote the increase of economic productivity. Since then, many scholars have started to analyze the economic impact of infrastructure. Hulten (1996) believed that the difference of infrastructural utilization level was the main reason of different economic development levels among countries. Datt and Ravallion (1998) concluded that many kinds of infrastructures such as transportation, electricity, gas, water and telecommunication have significant influences on economic growth. The research conducted by Calderson and Serven (2004) showed that telecommunication, transportation and electricity infrastructures have higher marginal productivity. Straub (2008) analyzed the link between infrastructure and economic growth in developing countries. Pradhan and Bagchi (2013) and Beyzatlar, Karacal, and Yetkiner (2014) used a panel data to investigate the relationship between transportation and economic growth respectively. Their results showed that there was a positive bidirectional relationship between transportation and economic growth. Castells-Quintana (2017) believed that the investment on infrastructure has an important impact on urban economic growth. Atems and Hotaling (2018) analyzed the economic impact of electricity infrastructure using data for a panel of 174 countries over the period 1980–2012. Its result indicated that electricity infrastructure has a positive and significant impact on economic growth.

Economic growth reflects the change of economic aggregate of one region during a certain period. Generally speaking, it is stimulated by investment, consumption, export, and so on. Several authors studied the impact of infrastructure on them. There were plenty of researches concerning the influence of infrastructure on different kinds of economic activities. Firstly, the improvement of urban infrastructure directly attracts investment. The enterprises usually prefer to invest in the city which has well-conditioned infrastructure. It is helpful to reduce production and transportation cost and raise total factor productivity (Agbelie, 2014; Donaubauer, Meyer, & Nunnenkamp, 2016). Transportation, energy and telecommunication infrastructures have significant effects on it (Bose & Haque, 2005; Melo, Graham, & Brage-Ardao, 2013; Winkler, Pudlik, Ragwitz, & Pfluger, 2016). Secondly, perfect urban infrastructure promotes cross-regional movement of people and raises urban consumption level. The city which has excellent infrastructure often draws many people to work and settle down in it (Hensher, Truong, Mulley, & Ellison, 2012). The increase of urban population enhances the demand of commodities and expands urban consumer goods market which brings about urban economic growth (Agbelie, 2014). Thirdly, the construction of urban infrastructure is beneficial to increase the revenue of government (De Silva, Simons, & Stevens, 2016). The raise of investment and consumption level spurred by fine urban infrastructure promotes urban economic growth which increases the revenue of urban government indirectly. Lastly, the establishment of urban infrastructure, especially transportation infrastructure, is conducive to urban export and boost the trade between the city and other regions (Cohen & Monaco, 2008; Cosar & Demir, 2016; Park & Seo, 2016).

In summary, previous researches revealed the significant link between urban infrastructure and economic development and held that urban infrastructure has a positive influence on economy. However, previous studies mainly paid attention to the influence of urban infrastructure on economic growth and rarely analyzed the effect of urban infrastructure on different components of economic system. Some researches analyzed the impact of infrastructure on consumption, investment, and so on. But fewer scholars studied the impact of urban infrastructure on economic development comprehensively. In addition, urban infrastructure has an impact on different kinds of economic activities and the relationship among these impacts is critical to urban infrastructure economic benefit. Nevertheless, previous researches referred to the research on this relationship rarely. This paper analyzes this relationship by evaluating the coordinated development level of four effects of urban infrastructure economic benefit. The impact of this relationship on urban infrastructure economic benefit will be studied. Therefore, this paper combines urban infrastructure with economic system and regards urban infrastructure economic benefit as a whole system. The analysis of urban infrastructure economic benefit is conducted from the perspective of the relationship among its different components. It is a supplement to the study on urban infrastructure economic benefit.

3. The approach for analyzing urban infrastructure economic benefit

The whole approach comprises indicator system and empirical methods. An important characteristic of this approach is the integration of many techniques to analyze urban infrastructure economic benefit. It is used to analyze the impact of urban infrastructure on the different components of economic system and reflect urban infrastructure economic benefit comprehensively. This approach provides a new perspective for analyzing urban infrastructure economic benefit.

3.1. Construction of indicator system

As important public goods, urban infrastructure has the obvious characteristic of external effect and spillover effect. It creates economic benefit by supplying fundamental service for the operation of economic system. Thus, urban infrastructure economic benefit refers to the impact of urban infrastructure on urban economy in this paper.

In this study, building urban infrastructure economic benefit indicator