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The impacts of mass transit on land development in China: The case of Beijing

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ABSTRACT

Land development impacts of mass transit have long been studied in the developed economies. Yet relatively little is known by the outside world about the Chinese experience due to China's rather short history in the development of modern mass transit and land/property market. This paper attempts to fill the gap by presenting evidence from China, with a detailed case study of Beijing. Selecting three newly built suburban transit lines in Beijing, the study examined land development context and estimated hedonic housing price models to measure the proximity premiums associated with these three lines. The empirical evidence in Beijing, one of the first tier mass transit cities in China, shows that investments in mass transit can have significant and positive impacts on land development. Properties with transit proximity enjoy sizable price or value premiums. The study also confirms the international experience: transit impacts on land development are unlikely to occur automatically; they rely greatly on supportive regional and site conditions. Integrated planning and design for mass transit and land development are critical to expand and maximize the return of transit investments.

1. Introduction

Investing in mass transit is a national strategy in China for mobility provision. On March 1, 2005, the central government issued a policy formally to give a top priority to public transit. Since then resources allocated from the government for mass transit development have been increased steadily. By the end of 2010, the construction and operation of metro rail transit (MRT), light-rail transit (LRT) and/or bus-rapid transit (BRT) had taken place in 25 cities. Inter-provincial high-speed rail (or HSR in operational speeds of 200–350 km per hour) are also booming. Large metropolitan regions such as Shanghai, Guangzhou and Wuhan have begun to develop high-speed commuter rail (popularly called Urban Rail with a design speed of up to 200 km per hour) to link the regional core cities with the surrounding small- to medium-sized cities.

Two main reasons led the central and the local governments of China to put emphasis on mass transit. One is the mobility needs. Along with rapid economic growth and substantial urbanization, demand for inter- and intra-city travel in China has increased enormously. While private motorization continues to rise, the governments are aware of that, given the large amount of total population and limited resources in this country, only mass transit could offer a wise as well as sustainable solution to meet the growing mobility demand. The second reason of emphasizing mass transit comes from the intention of the government to play its role in shaping urban expansion. During the three decades of China's economic reform and development since 1980s, urban expansion took place at a large scale and fast pace throughout the country. Concerns have arisen that the new urban expansion is going toward the Chinese version of sprawl (Cervero & Day, 2008; Ding, 2004; Zhang, 2000). The year of 2011 witnessed China turning into an urban country, with its urban population exceeding 50%. Urbanization will continue in the coming two to three decades. In the process, mass transit can and should play a strategic role in providing sustainable mobility and in shaping urban transformation. It is expected that mass transit investments would guide the spatial expansion of the urban area away from car-oriented sprawl and toward the desirable, transit-based nodal plus corridor development.

The question would then be: did China's mass transit investments achieve the intended purposes? Daily experience suggests that most, if not all, mass transit lines in urban China are serving large volumes of passengers, demonstrating the achievement of the mobility-provision purpose. Validating the second purpose however requires empirical research. The main objective of this paper is to report empirical evidence of mass transit impacts on land development in China. The topic has long been studied in the developed economies.

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Yet relatively little is known by the outside world about the Chinese experience due to China's rather short history in the development of modern mass transit and land/property market.

The theoretical framework for this study is built on locational theory in urban economics. The central feature of the theory states that there exists interdependence among location decisions, land rent and spatial structure; Economic agents choose locations that maximize their profits or utilities. Hence "land rent differentials over space can be explained by transportation cost savings" (Richardson, 1978, pp. 15–16). Public transit increases access and reduces transportation cost (relative to the no-transit case *ceteris paribus*). The improved access in turn would invite competitions among the potential land users in the station areas and along the transit routes. Through the competition, the one who is willing and capable to pay the highest land rent would win the right to use the land. In other words, the transit impacts on land development could be revealed from the value of the land near transit. Based on the theoretical framework, the study examines the capitalization of transit access in land or property values in Chinese cities, with a detailed case study in Beijing.

The rest of the paper is organized as follows. The next section provides literature review on public transit development and its impacts in selected Chinese cities; we then describe three mass transit routes which were recently built to connect city center with the suburban areas in Beijing. In the fourth section, housing project data, hedonic model and spatial econometric methods are used to analyze the capitalization of the three transit routes. The findings are also presented in this section. The final section comes with the discussion and conclusions.

2. Land development impacts of mass transit: empirical evidence from selected Chinese cities

The capitalization of transit access in property values has long been investigated by scholars and policy analysts (Cervero & Duncan, 2002; Cervero & Murakami, 2009). A premium in property price induced by transit services measures the rate of capitalization and indicates positive impact of transit investments, which can be used to develop transit-based policies such as value-capture and transit-oriented development strategies (Batt, 2001). The ongoing interest in the topic has generated a sizable body of literature from different places in the world. Two recent papers reviewed more than 150 publications on this topic (Debrezion, Pels, & Rietveld, 2007; RICS, 2002). These publications however were primarily based on the transit systems in the United States or European countries. Some transit-related studies come from Latin America or developed Asian economies. Mass transit development and its land development impacts in China are relatively rarely told in the existing English literatures. This is partly due to the short history of the development of modern mass transit and land/property market in China. Yet, there are some empirical studies in Chinese journals examining the capitalization of public transit routes. In the following, we present a literature review of the empirical studies on transit routes in selected four major cities in China.

Beijing: Among the first tier of Chinese cities investing in modern mass transit, Beijing has received relatively more research attention than others. Wang, Zhu, and Zhang (2004) studied City Rail, i.e., Line #13, a light-rail system serving the northern suburban area of Beijing.

From a sample of 150 new homes built in 2001-04 along the City Rail line, Wang et al. (2004) found that home price decreased 246 Yuan (about US$36.2[2] per sq. m.) for every kilometer increase in distance to the station. The finding, however was based on simple price comparisons of homes which were grouped by the spatial relationships with the ring roads and with the rail stations (i.e., whether the home is in the areas delineated by the 2nd, 3rd, 4th, 5th, and 6th ring road; whether the home is located within the distance buffer of 1 km, 2 km, 3 km, and 4 km from the rail station). Without controlling for the influence from other factors, for example, home and neighborhood characteristics, the difference in average prices provides limited information on the independent effect of City Rail.

A more rigorous study by He and Zheng (2004) used hedonic model to estimate average housing price as a function of the distance to the station, along with other control variables. The distance variable was measured in binary term depending on whether the sample was located in one of the five distance buffers: <0.5 km, 0.5–1.0 km, 1.0–2.0 km, 2.0–3.0 km, and >3 km. They found that capitalization of City Rail access was presented mainly in the <0.5 km buffer. On average, housing price within the 0.5 km buffer was 1000 Yuan (about US$147 per square meter) higher than that outside the buffer. The model performance however is unknown as the authors did not report the details of modeling output in the published article. Zhang, Ma, and Zhu (2007) applied a similar analytical technique as He and Zheng's paper (2004) except that they defined distance buffers in 0.3 km intervals. They concluded that the influence of City Rail on housing price took place in the area of 1 km from the station and the most significant effect was observed in the 0.3 km distance buffer. The magnitude of the price premium was measured at approximately 206 Yuan (US$30.3 per sq.m.), approximately 1/2–2/3 of what He and Zheng reported (2004). Liang, Kong, and Deng (2007) also utilized hedonic price modeling technique to estimate the price premium associated with City Rail. The study differs from previous studies in measuring distance to transit station as a continuous variable. A total of 16 other variables were included to control for the effects from regional access, structural characteristics, and neighborhood amenities. Their results indicated a premium of 0.464 percent or 28 Yuan (US$4.12) per sq.m. for every hundred meters closer to the station. The distance coefficient, however, only showed a marginal level of statistical significance. It is likely due to the limited sample size ($n = 70$) relative to a model of 18 coefficients being estimated.

A few studies have reported the capitalization of other mass transit lines in Beijing. One published work by Gu and Guo (2008) investigated the effects of Batong Line on housing price. They found no significant evidence system wide. In the submarket of Tongzhou District, which is the eastern portion of Batong, they obtained a significant coefficient for the interaction term between Distance to the Station and the indicator variable Tongzhou. Nevertheless, it is unclear from the incomplete model specification whether the observed effect should be attributed to district location or to transit access.

In another paper, Zheng and Kahn (2008) reported their empirical findings in Beijing on the capitalization of local public goods in housing prices. Proximity to Beijing's rail transit stations was among the local public goods considered by the authors. The study utilized a sample of 900 housing projects in year 2004 and 2005 from the Beijing Housing Transaction Registration System. They then estimated hedonic models of average housing prices as functions of distances to MRT or LRT stations and bus terminals. They obtained estimates of price elasticity of distance to MRT, LRT, and major bus stops being −0.16, −0.04, and −0.08, respectively. However, when the effects of access to parks, schools, university, and other local public goods were controlled, only the coefficient associated with MRT remained statistically significant.

Shanghai: With a sample of 80 apartment sales along Subway Line 1, Chu and Zhou (2004) estimated a linear hedonic price model and obtained a station proximity premium of 25.6 Yuan (US$3.76) per square meter for every hundred meters closer to the station. A

[2] The median exchange rate is 1 US dollar equals to 6.8 Yuan in year 2008, when the data were collected. The exchange rate was provided by the Bank of China, available at: http://www.bankofchina.com/sourcedb/lswhpj/.