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The impact of urban rail transit on commercial property value: New evidence from Wuhan, China

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ABSTRACT

The interaction between rail transit and the urban property market is a vital foundation for planning transit-based policy such as Value Capture and Transit Oriented Development (TOD). Yet only few studies have reported the impact of transit access on commercial property value. This paper presents empirical evidence from Wuhan, China, to enrich the knowledge in the subject area. Spatial autoregressive models were employed to estimate the commercial value capture, based on 676 observations along Wuhan's metro rail line through the main business districts. Value appreciation was discovered within the 400 m radius of road network distance from Metro stations. The transit access premiums present as two tiers: 16.7% for the 0–100 m core area and approximately 8.0% within the 100–400 m radius. The result demonstrates the potential benefit of adopting value capture and optimising TOD planning to support sustainable urban rail transit investment. Amid rapid urbanisation in China, the evidence reported here could help better inform cities, across the developing world and beyond, of the benefits of adopting rail transit-based policy.

1. Introduction

TOD planning policy and Value Capture mechanisms have been recognised as effective methods to promote the sustainability of urban rail transit around the world (Batt, 2001; Cervero and Murakami, 2009; Jillella et al., 2015; Zhao and Larson, 2011). Research on the relationship between transit investment and the urban property market is the vital foundation for transit-based policy and TOD planning. Significant literature has been published related to this field: Debrezion et al. (2007), Wardrip (2011) and Mohammad et al. (2013) reviewed nearly 200 publications in the topical area. Recent studies include Hewitt and Hewitt (2012) on Ottawa; Pan (2012) on Houston; Kim and Lahr (2014) on New Jersey; Hurst and West (2014) on Minneapolis; Dziauddin et al. (2014) on Kuala Lumpur; Macfarlane et al. (2015) on Atlanta; and Sun et al. (2015) on Beijing. Most of those studies focus on residential property, but only a few pay attention to commercial property: Cervero (2004), Kim and Zhang (2005), Pacheco-Raguz (2010), Ko and Cao (2013), Nelson et al. (2015), Mohammad et al. (2017) –though with almost no focus on developing countries. Commercial function is an essential element in the rail transit station area, so studying the association between transit and commercial property would benefit TOD policy development. In this paper, this gap is addressed with a case study from Wuhan, China.

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Over the last decade, urban rail transit system development has been booming in urban China. Wuhan offers a case, typical of Chinese cities, that invests heavily in an urban rail transit system and enables the investigation of the effect of transit access on commercial property. The local government considers rail transit not only as an antidote to resolve traffic congestion and environmental pollution from cars, but also a stimulant to promote urban development and regeneration. With three rail transit lines in operation by 2014, an additional 14 lines are planned to extend the urban rail net work over the next fifteen years. Meanwhile, Wuhan is reported as one of the most prosperous commercial real estate markets in China (Sina, 2015). However, a mountain of debt, from monies borrowed for infrastructure investment, is now threatening the economic sustainability of the city (Barboza, 2011). Poor management and organisation of the transport system and land use will potentially reduce the benefit of rail transit investment (WLSP, 2015). Studying the impact of Wuhan's urban rail transit development on land value will support the local government's ambitious plan to realise their rail transit metropolis.

This paper reports on Wuhan's past and current experience on the association between rail transit and commercial property. The empirical documentation can inform policy decision making on TOD planning, for cities around the world. This paper first reviews recent literature related to this field, including studies from Chinese cities (Section 2). The spatial hedonic price models (Section 3.1) and data sources (Section 3.2) for our study are then introduced, before presenting the positive rail access effect detected in Wuhan and its combined policies (Section 4).

2. Literature review

In the international context, a very limited number of studies refer to the value appreciation in commercial property accruing from transit proximity. Reported research is as follows: Weinstein and Clower (1999) found that community retail properties in the DART corridor (Dallas and Denver) experienced a value jump of 29% compared to other areas of Dallas Texas. In a case study of Santa Clara County, California, Cervero and Duncan (2002) found substantial capitalisation benefits for Light Rail Transit (LRT) and commuter rail, of 23% and 120%, respectively. Using hedonic pricing models, Cervero (2004) discovered both positive and negative influence on commercial property, for different rail lines in San Diego, California. Kim and Zhang (2005) reported a positive impact of transit access on commercial land in Seoul, South Korea, but the premiums differed between locations. Pacheco-Raguz (2010) reported that the amount of commercial land use increased but the land value increased slightly near to Line#1 of the Metro system in Milan, Italy. Ko and Cao (2013) found that the Hiawatha light rail system in Minneapolis, Minnesota promoted a commercial property price increase of $24.6 per square foot, with the positive effect extended to an area of approximately 0.9 miles. Nelson et al. (2015) reported that, in both Dallas, Texas and Denver, Colorado, half of the positive effect of LRT access on commercial property dissipates at 0.06 miles, and three-quarters at 0.10 miles. In a recent study on Dubai, commercial property was reported to gain almost 40% in value within a 1000-m radius from a metro station (Mohammad et al., 2017). The studies mentioned mainly demonstrated cases from car-oriented cities in developed countries and findings vary from case to case.

Following the adoption of urban rail transit in many Chinese cities, a number of studies emerged, many of which focused on the impact on residential property. The most studied city is Beijing and some empirical data were observed from its LRT lines (Wang et al., 2004) and its Mass Rapid Transit (MRT) lines (Gu and Guo, 2008; Zhang and Wang, 2013; Zheng and Kahn, 2008). A recent study by Zhang et al. (2014) compared the variation in the effect from MRT, LRT and Bus Rapid Transit (BRT) lines in Beijing, and found the MRT to have both a wider impact zone and a higher premium than LRT and BRT. Other empirical evidence is also well documented from other Chinese cities, including Shanghai (Pan and Zhang, 2008; Pan et al., 2014); Guangzhou (Salon et al., 2014; Tian, 2006); and Shenzhen (Zheng and Liu, 2005). However, to the best of our knowledge, there is no literature estimating the rail transit impact on commercial property in Chinese cities, in either international or Chinese publications. As more and more urban rail transit systems are constructed and developed, and the commercial real estate market continues to boom in Chinese cities (Miner, 2015), additional empirical analysis is vital in supporting policy decision making. This study attempts to address this gap.

3. Method and data

3.1. Method

3.1.1. Multiple linear regression (MLR)

Hedonic price modeling (HPM) could explain the market value of a heterogeneous product by estimating the implicit price of the product's attributes. The HPM technique has been widely used to derive public infrastructure impacts on property prices, from other factors (Cervero, 2004; Mohammad et al., 2013; Rosen, 1974). The multiple linear regression model (MLR), using an ordinary least-squares estimator to represent the average marginal effect of the explanatory variables on dependent variables, is the initial and conventional HPM. The MLR models may take a linear form, log-log form or a semi-log form; theory does not prescribe one specific form over the other. Choosing which modeling form depends on the sample characteristics and the evaluation of model performance. In our study, we chose the semi-logarithmic model, where only the dependent variable undergoes logarithmic transformation, as it presented better in statistical indicators in experiments with our data. In this model form, the effect of a one unit price change on distance to transit station is calculated in percentage terms. The base MRL model in semi-log form is shown in Eq. (1):