



Impact of high speed rail on housing values: an observation from the Beijing–Shanghai line [☆]



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ABSTRACT

This study investigates the *ex post* impact of the Beijing–Shanghai high speed rail (BJHSR) on housing values. A dataset including 1016 housing communities from the 22 cities along the BJHSR line are analyzed in the tradition of the hedonic pricing model using three estimation procedures: a robust ordinary-least square regression, a Box-Cox transformation technique and a spatial econometric model. After controlling for physical characteristics of housing property, neighboring environment and locational accessibility, the study finds that the establishment of the BJHSR service has a considerable regional impact (including local effects and spillover effects) on housing values in medium and small cities but a negligible impact in larger capital cities. This may be the results of the competitive nature of housing market in Chinese capital cities.

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1. Introduction

During the recent decade, high speed rail (HSR) experienced rapid development in China. The national HSR initiative was designed to reduce regional disparity by connecting the developed east and south coastal provinces with the underdeveloped provinces in the west and north through the four north–south and the four west–east dedicated HSR lines. In addition, in order to promote urbanization and economic activities, quite a few HSR stations were planned and built in suburban and rural areas. It is anticipated that the development of new HSR stations would stimulate the real estate sector. A large number of new housing properties were planned and developed in HSR served cities. Many new housing properties are built with the expectation that demand would increase due to HSR services. However, it is still unclear whether there is any linkage between HSR development and the prosperity of the housing market in these cities given that the benefits of accessibility improvement may be offset by the high price of HSR service.

Although the impact of rail infrastructure on housing value has been examined extensively, research findings are not consistent. Some find that the improvement of rail transport facilities

has a positive effect on housing value (Bajic, 1983; Knaap et al., 2001; Debrezion et al., 2007, 2011; Duncan, 2011) while others find the impact is minor (Bollinger and Ihlanfeldt, 1997; Andersson et al., 2010). Moreover, most analyses are focused on urban rail projects whereas the studies with a particular focus on HSR are quite limited. HSR differs from conventional railways (such as commuter rail, light rail and metro) in terms of service market and distance. Since HSR normally serves as a premium ground transportation mode, patrons who use the system are much different from conventional rail services especially in China where the price differences are very large relative to income. In addition, unlike an urban transit system, HSR provides an inter-city transport service normally by connecting major metropolitan centers with a distance between 160 and 800 km (Button, 2012). Because of the advantage of speed, HSR binds housing and labor markets together to a commuting region (Blum et al., 1997), which may thus make commuting at a larger geographic scale become possible.

To better understand the impact of HSR on housing values in China, we follow the classical hedonic pricing modeling with a focus on the Beijing–Shanghai HSR line, which is one of the most advanced HSRs in China. Such an investigation is critical as it improves our understanding of HSR's costs and benefits and its impacts on urban dynamics especially with respects to housing structure and locational patterns. The empirical results also have implications for urban planning and policies for other countries that are interested in building HSR systems.

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The rest of the paper is organized as follows: Section 2 discusses the theoretical motivation through a review of relevant studies. Section 3 introduces the hypothesis based on the discussion of the relationship between the Beijing–Shanghai HSR and the location patterns in the housing market. Section 4 discusses data and methodology. Section 5 presents empirical results and Section 6 summarizes and concludes.

2. Literature review

Early theory investigating the linkages between transportation and housing values followed Alonso (1964)'s monocentric model. It argued that residential activities are determined by trading off travel cost saving with distance to the central business district. The theory is expanded by Muth who considers housing as a bundle of services that are consumed by different households. The field was further developed by Rosen (1974), whose hedonic price model explained the composition of housing price by disentangling the bundle of housing services. Under such a framework, transportation accessibility is categorized as a spatial attribute and its marginal price is estimated in a hedonic price regression (Franklin and Waddell, 2003). Following this approach, the impact of improved transportation infrastructure on housing price has been frequently evaluated (So et al., 1997; Bae et al., 2003; Yiu and Wong, 2005). Ferguson et al. (1988) examined the relationship between urban transit and single family housing values in Vancouver and found that the urban transit had an impact of the housing market even before the system operations began. Most studies have focused on urban transit facilities, hence assessments on intercity passenger rail, especially HSR, is limited.

Some studies, for example, Armstrong and Rodriguez (2006) analyzed the benefits of commuter rail accessibility in Massachusetts and found that the system had a significant negative effect on property values due to noise and crime effects. Strand and Vågnes (2001) also confirmed a negative influence of railroad proximity on housing values due to environmental concerns in the case of Oslo. Debrezion et al. (2007) adopted a hedonic pricing model but found that housing property that is close to railway station is approximately 25% more expensive than equivalent housing that is outside the 15 km distance. Andersson et al. (2010) adopted a Box-Cox hedonic price model to assess the impact of HSR accessibility on housing price in southern Taiwan. Their study found that HSR only has a minor effect on housing price. They suspect that such a negligible effect is attributable to the high ticket price of HSR and entrenched residential location patterns that prevent system efficient utilization. Lack of appreciation of spatial dependence in housing value estimation appears to be a fundamental issue that impairs their empirical findings.

In fact, spatial dependence of housing values and with other attributes of housing property such as neighboring environment and accessibility, have generally been considered a statistical problem among hedonic real estate studies (Anselin, 1988; Pace et al., 1998; LeSage and Pace, 2009). Without addressing such an issue, research findings may be spurious and statistically biased. Some studies adopt spatial econometric estimation to address the spatial dependence in hedonic modeling, but the spatial impact of transportation infrastructure does not seem to be quantified appropriately. For example, Ibeas et al. (2012) adopted three spatial econometric models including a spatial autoregressive, a spatial error and a spatial Durbin to evaluate the impact of transport on real-estate value in the case of a Spanish metropolitan area. The impact of transport was measured by two dummy variables that indicate whether there is a bus stop or a suburban train station near a housing property. Since the dummy variables are created based on fixed thresholds of distance, the impact of accessibility

to transport facilities is limited. Other studies such as Cohen and Coughlin (2008), measured the accessibility using the distance between housing property and airport facilities, however, the magnitude of accessibility with regard to travel time was neglected.

In addition, since the completion of the Chinese HSR systems, the need to understand the socioeconomic benefits of such systems is emerging. Recent studies with a focus on the Chinese system have analyzed the impact of HSR accessibility from the perspective of travel time saving. For example, Cao et al. (2013) used an innovative GIS system and found that although most cities had accessibility gains by HSR compared to conventional rail, cities with dense population and high GDP levels tended to obtain more benefits. Chen (2012) argued that HSR development has resulted in dramatic time–space shrinkages and increased mobility between cities. Specifically, Shaw et al. (2014) confirms that the operation of HSR in China had a positive impact on the spatio-temporal accessibility pattern of Chinese cities as accessibility measured in travel time to many cities has been significantly improved. But again, the question of how the accessibility to HSR affects the regional economy in terms of the effect on housing values is not clear.

In sum, due to the potential issues in research design and statistical estimation, the impact of the Chinese HSR system on housing values is not well understood. To fill this gap, this study is conducted with a primary focus on two questions: (1) what is the impact of HSR on housing values in China? and (2) how do the effects differ by city size?

3. Beijing–Shanghai HSR and housing development

The Beijing–Shanghai high speed rail (BJHSR) line is one of the most advanced HSRs in China. It plays a critical role in promoting economic development by enhancing the accessibility between the political center Beijing and the financial center Shanghai. Using public financial support, the project started in April 2008 and was completed in November 2010. The rail line has a total distance of 1318 km and 24 stations were added along the line (see Fig. 1). The system has an operational speed of 350 km/h with a maximum speed capacity of 380 km/h. Because of the fast speed and the design of dedicated right of ways, the travel time between Beijing and Shanghai is dramatically reduced. The BJHSR has experienced an exponential increase of ridership since its formal opening in 2011. Until April 2014, the system has delivered over 200 million passengers with a daily rate of 200 thousand passengers.¹

Since the completion of the BJHSR, the real estate sectors in a few cities along the line have experienced rapid development. Given the different characteristics of housing demand and supply, the locations of housing properties have different effects across different cities. For instance, in most medium and small cities where land supply around the urban center area is relatively adequate, quite a few housing properties were built around the city centers. However, in many provincial capitals, where the cost of land acquisition in the city centers was all ready extremely high compared to noncapital cities, many recently developed housing properties were located in suburban or rural areas rather than in these already urbanized city centers. The different locational patterns of housing property in capital cities and noncapital cities is confirmed by the comparison of the average mean distance to city centers based on the housing samples included in this study (see Table 1). The average distance of housing properties to the city center is 15 km for capital cities whereas the value is only 10 km for noncapital cities.

¹ Data is obtained from the Chinese media report at <http://finance.sina.com.cn/roll/20140607/003319340443.shtml> (accessed on September 26, 2014).

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