

Capitalization Effects of Rail Transit and BRT on Residential Property Values in a Booming Economy: Evidence from Beijing

Liang Ma, Runing Ye, Helena Titheridge

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Objective

To investigate the capitalization effects of proximity to rail transit and BRT in fast-growing Beijing.

Hypotheses

- H1:** The magnitude of capitalization effects of rail transit and BRT in Beijing is at least as strong as the effects found in North American cities.
- H2:** Effects of rail transit and BRT stations on property values vary among locations of stations, in particular, effects are lower at stations near the city center and greater at stations further away.
- H3:** Effects of rail transit and BRT stations on property values depend on the income level of neighborhoods around stations; in particular, effects are lower at high-income stations and greater at low-income stations.

Data

- The built-up area within the 6th Ring road of Beijing is our study area because most residents who worked in downtown commute within this area, and therefore this area can be designated a complete land market. Within the study area, there were eleven rail transit lines, and one BRT line operating in 2011.
- The attributes and transaction data of each residential property are available from a primary housing transaction website (www.soufun.com), based in China. We collected all the second-hand apartment transaction data within the study area from January to August 2011, and the data include property price per square meter, structural and locational information of property, and information on neighborhood amenities. After deleting the missing data, 1,695 observations are selected for the final model estimation.

Model Specification

$$LnP = c + \sum a_3 X_s + \sum a_2 X_n + \sum a_1 X_l + \sum a_0 X_p + \varepsilon \quad (\text{Model 1})$$

$$LnP = c + \sum a_3 X_s + \sum a_2 X_n + \sum a_1 X_l + \sum a_0 X_p + \sum b(X_p * Z_d) + \varepsilon \quad (\text{Model 2})$$

$$LnP = c + \sum a_3 X_s + \sum a_2 X_n + \sum a_1 X_l + \sum a_0 X_p + \sum b(X_p * Z_a) + \varepsilon \quad (\text{Model 3})$$

P is the sale price per square meter of the residential property; X_s indicates structural characteristics of the property, X_n indicates neighborhood conditions for the property, X_l indicates regional location of the property, and X_p indicates proximity to transit stations. Z_d indicates the property's distance to the city center; Z_a indicates the property's administration fee, which is used to represent the income level of the neighborhood; a_3 , a_2 , a_1 and a_0 are coefficients to be estimated; c is the model constant, and ε is the residual error.

Findings

Overall, we find an average price premium of around 5% for properties near rail transit stations, but no statistically significant effects are detected at BRT station areas. Moreover, we find that station-proximity effects tend to increase both in magnitude and spatial extent at stations farther away from the city center and at stations surrounded by low- and middle-income neighborhoods; for example, the price premium can be as high as 10% in some suburban and low-income station areas.

Location of rail and BRT stations in Beijing as of 2011



Rail transit and BRT in Beijing



Policy Implications

- Significant capitalization effect of rail transit implies the possibility of other creative financing strategies, such as "Rail + Property Development" (R+P) model, which has been successfully operated in Hong Kong for many years.
- This study also indicates that the priority to locate rail-transit stations should be in the low- and medium-income neighborhoods, whose residents are more dependent on public transit for daily travel activities, and in the meantime, planners should take actions to mitigate the negative externalities emitted by the stations, especially the negative effects for the high-income neighborhoods.

Transit Proximity Effects

For proximity variables, we find interesting results from the three models. Results of Model 1 detect statistically significant price premiums for properties within a half mile of station area; in particular, locating within a half mile of rail transit stations brings a 4.8% increase on property price. The magnitude of this proximity effect in Beijing is at the same level as the effects found in U.S. cities. Beyond the half-mile radius area, however, effects of proximity to rail transit are not statistically significant any more. Moreover, no statistically significant proximity effects are detected within a quarter mile of BRT stations, even significantly negative effects are found between one-quarter and one-half mile of BRT stations. The negative sign of coefficient may contribute to the factors that are not controlled in the model, but these results at least indicate that capitalization effect of this BRT line upon property value is negligible.

Proximity Variables	Coeff.	t-Statistics
Property located within in a half-mile of rail station (Dummy: 1=yes)	0.048***	3.036
Property located between a half and one mile of rail station (Dummy: 1=yes)	0.012	0.802
Property located within a quarter-mile of BRT station (Dummy: 1=yes)	-0.048	-1.153
Property located between a quarter and a half mile of BRT station (Dummy: 1=yes)	-0.062**	-2.307

Proximity Effects and Distance to City Center

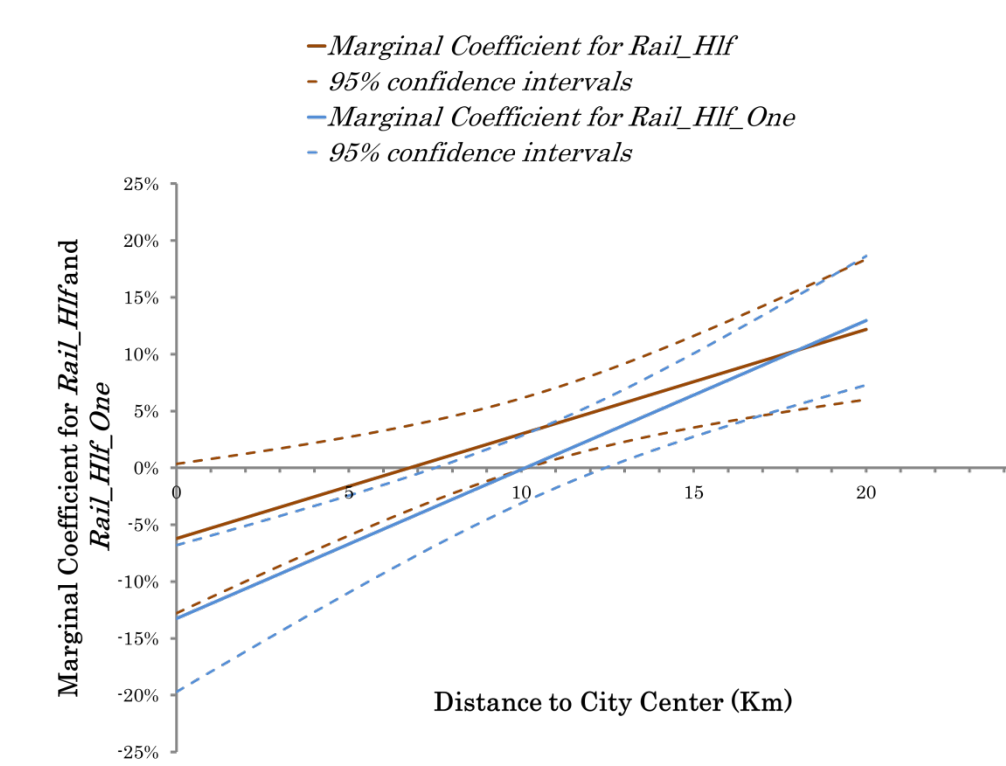
The interactions between station proximity and property's distance to city center are positive and statistically significant for three of the four interaction terms, indicating that premiums of access to transit stations increase as distance from the city center increases. In other words, the farther a station is from the city center, the larger the effect of the proximity to the station.

Proximity Effects and Income Level of Residents

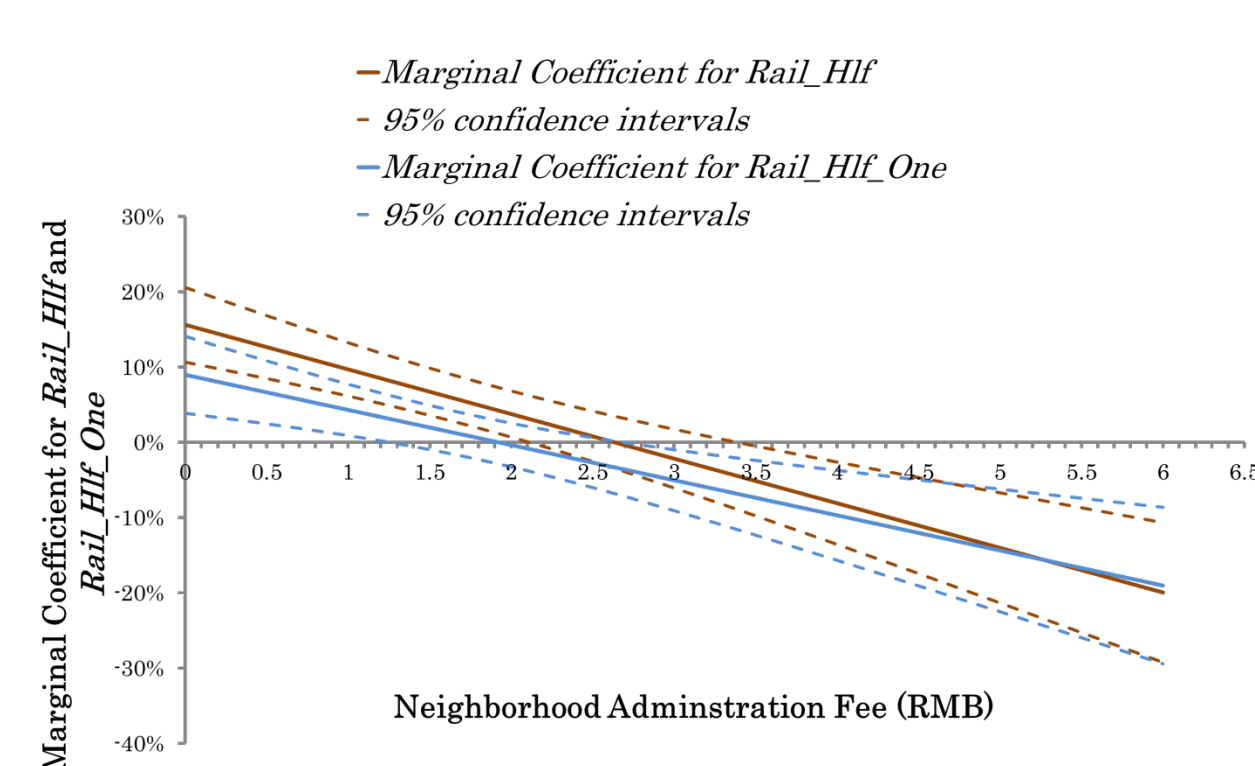
The interactions between station proximity and administration fee of neighborhood are negative and statistically significant for three of the four interaction terms, indicating that homeowners in high-end neighborhoods are reluctant to pay for being close to a transit station. In other words, the effects of station proximity are greater in stations surrounded by low- and medium- income neighborhoods

Interactions	Coeff.	t-Statistics
Rail_Hlf *Dis_Center	0.009***	3.251
Rail_Hlf_One*Dis_Center	0.013***	4.846
BRT_Qtr *Dis_Center	0.027***	2.689
BRT_Qtr_Hlf *Dis_Center	0.002	0.263
Rail_Hlf *Admin_Fee	-0.059***	-5.500
Rail_Hlf_One*Admin_Fee	-0.047***	-3.856
BRT_Qtr *Admin_Fee	-0.100**	-2.048
BRT_Qtr_Hlf *Admin_Fee	0.023	0.860

Marginal coefficient for Rail_hlf and Rail_hlf_one as conditioned by distance to city center.



Marginal coefficient for Rail_hlf and Rail_hlf_one as conditioned by administration fee



Structural Characteristics

All else being equal, one more living room and bathroom are associated with a 3.7% and 9.8% increase in property price; the south-faced design of houses raises property price by 4.4%; the price of business apartments is approximately 9.0% higher than the average apartment price; good ventilation design adds 5.5% additional value to the house; and low-rise or super high-rise buildings are not welcomed by homebuyers in Beijing.

Structural Variables	Coeff.	t-Statistics
# Bedrooms in the apt	0.008	0.913
# Livingrooms in the apt	0.037***	2.471
# bathrooms in the apt	0.098***	6.298
# kitchens in the apt	0.063*	1.738
Whether the apt towards south (Dummy: 1=yes)	0.044***	3.171
Whether the apt has been well furnished (Dummy: 1=yes)	0.090***	2.674
Building 6 or less storeys high (Dummy: 1=yes)	0.055***	3.572
Building 18 or more storeys high (Dummy: 1=yes)	-0.043***	-2.845
Both North and South walls have windows (Dummy: 1=yes)	-0.054***	-3.332
Age of the building	0.000	0.264

Neighborhood Characteristics

All else being equal, one RMB increase of neighborhood administration fee is associated with a 2.8% increase of property price, indicating home buyers' concern for the quality of neighborhood services; a higher ratio of green space within neighborhood and being close to a park are positively and significantly associated with property price, indicating residents of Beijing pay much attention to the natural environment within and around their neighborhoods; Being located within the districts of top middle schools, top elementary schools, and top kindergartens elevates the property price by 2.5%, 5.6%, and 3.0% respectively; and the ratio of commercial and entertainment land use around neighborhood is also significantly related to property price: the higher the ratio, the higher the property price.

Neighborhood Variables	Coeff.	t-Statistics
Fees for neighborhood admin and services (RMB/Sq. meter/month)	0.028***	7.216
Ratio of open space within neighborhood (percentage)	0.307***	5.524
Floor area ratio	-0.010***	-2.601
Have top-ranked middle school (Dummy: 1=yes)	0.025**	1.993
Have top-ranked elementary school (Dummy: 1=yes)	0.056***	4.253
Have top-ranked kindergarten (Dummy: 1=yes)	0.030**	2.305
Have parks within quarter mile of property (Dummy: 1=yes)	0.042**	2.004
Ratio of commercial and entertainment land use within quarter mile of property (percentage)	0.224***	4.139

Locational Characteristics

All else being equal, one kilometer distance from the city center and sub-centers is associated with a 3.5% and 2.5% decrease of property price. This result reconfirms the argument that Beijing is emerging in a polycentric urban pattern. Distance to the nearest arterial road is not significant, and this is probably due to the counteracting effects of being close to highway: accessibility and disamenities (e.g., noise and gas emissions).

Locational Variables	Coeff.	t-Statistics
Property distance to the city center (kilometers)	-0.035***	-26.597
Property distance to the city center (kilometers)	-0.025***	-14.067
Property distance to the nearest sub-centers (kilometers)	-0.022	-0.372