An Empirical Study of the Impacts of an Express Rail Link on Property Prices—Hong Kong Evidence

by K. F. Man, PhD, and Peter P. Y. Mok

Abstract

This study investigates the price impact of compulsory purchase of underground strata for the construction of the Guangzhou-Shenzhen-Hong Kong Express Rail Link. Local media asserted that the scheme would adversely affect property prices and this formed the study hypothesis. Most of the current literature focuses on the impact of local transit networks while studies on the impact of the high-speed railways that cross borders are relatively rare. The study sample consists of 267 affected homes in Tai Kok Tsui, Hong Kong, which were transacted within one year before or after official published notice for the scheme. A hedonic pricing model was employed to analyze the impacts of the scheme on the prices of the affected homes. The study results show that the railway scheme has a positive effect (15.1% increase) on property price, all other things being equal. The research also shows that land-assembly activity related to the redevelopment process had an overwhelming positive effect (134.5% increase) on the property price.

Introduction

Hong Kong has one of the highest population densities in the world, with a population of about seven million within 1,100 square kilometers. About three-quarters of Hong Kong’s land area is zoned countryside where development is highly restricted; therefore, people are mostly cramped into small high-rise condominium flats. Postwar building activity was vigorous in the 1950s and 1960s but building quality was relatively low. Hong Kong has since developed from a port of entry for Chinese refugees to a well-established international financial center. In the past fifteen to twenty years, it has become the gateway to the booming mainland.

Contrary to the usual western practice of developing intercity air shuttles for passenger travel, China has vigorously pursued the establishment of a nationwide high-speed railway network system. As part of this effort, Hong Kong is to become linked to the national high-speed railway network system as the southern gateway to China. The terminus of the proposed Hong Kong section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (ExRL) is situated in West Kowloon, with the railway running entirely underground in Hong Kong to the boundary at Huanggang, where it will connect with the mainland network. More specifically, using underground tunnels the ExRL will cut through Tai Kok Tsui, a highly populated residential and commercial area in West Kowloon, which includes buildings constructed in the 1960s.

Notices of government resumption (acquisition of private land) were published on Novem-

1. According to the International Union of Railways, any railway line equipped for speeds equal to or greater than 250 km/h is regarded as a “high-speed line.” The ExRL is considered a high-speed line as the national rail network target is to run at a speed over 250 km/h.

The difference in results may be even negative. He posits that land value can be affected by externalities, including distance from and transportation to markets. Over 150 years later, Pollakowski asserted that housing price is not only determined by physical and environmental attributes but also by transportation accessibility attributes.

Although numerous research studies indicate that higher accessibility could have a positive effect on a property prices, a small proportion of research shows that the impact is insignificant or even negative. The difference in results may be due to the different measurement methods or perhaps other reasons.

The literature review that follows consists of two parts. The first part is concerned with how housing prices are affected by modes of transportation other than high-speed railways. The second part relates to the literature on how housing prices may be affected by a high-speed railway.

**Literature Review**

Most land value theories are rooted in the work of Von Thunen, whose analysis tries to explain variations in farmland values. He posits that land value can be affected by externalities, including distance from and transportation to markets. Over 150 years later, Pollakowski asserted that housing price is not only determined by physical and environmental attributes but also by transportation accessibility attributes.

Although numerous research studies indicate that higher accessibility could have a positive effect on property prices, a small proportion of research shows that the impact is insignificant or even negative. The difference in results may be due to the different measurement methods or perhaps other reasons.

The literature review that follows consists of two parts. The first part is concerned with how housing prices are affected by modes of transportation other than high-speed railways. The second part relates to the literature on how housing prices may be affected by a high-speed railway.
Research on Transportation Value Impacts
Research conducted after the enactment of the US Federal-Aid Highway Act finds positive price effects related to accessibility to highways. Adkins in 1959 reports that freeway access has a positive effect on property price.10 Similarly, Bone and Wohl report that property values near a thoroughfare in Lexington, Massachusetts, increased 180% over the study period compared to control-site values that increased by only 85%.11 Pendleton looks at the effect of accessibility on value and finds that a one-minute decrease in driving time to the central business district adds $63.68 to the price of a house.12 Gamble, Sauerlender, and Langley in 1974 report that property value increased by $2,950 due to the improvement of highway accessibility. They also report that properties within approximately one mile of a freeway right-of-way appreciated 12%–15% more than comparable properties that were located beyond one mile from the freeway.13 However, Reibel, Chernobai, and Carney analyze 5,566 house sales in California from 2000 to 2004 and find that homes within 0.4 mile of the

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freeway are $38,252 more expensive than homes sold right next to the freeway; they attribute the lower value to noise generated by the freeway traffic. Other studies have reported similar negative externalities for homes located a very short distance from freeways due to noise, pollution, and greater congestion.

The literature concerning how subway and train transit affect housing price also has reported positive value effects. In 1976, Dewees finds that residents living within one-third mile of a subway line experience travel-time savings from transportation facility improvements and these travel-time savings are capitalized in residential values. He also reports that every additional hour of travel to the subway line caused a decrease in property value of $2,370. A positive value impact was also found in 1991 by Voith, who reports that residential properties in census tracks served by a commuter rail system had a 4% to 10% premium over homes in census tracks that were not served by a commuter rail system. Nelson studied the impact of public transportation on high- and low-income households and finds that properties in low-income neighborhoods gained value with improved transportation services. It was argued that people living in low-income households were more likely to use public transportation and experience travel-time savings due to the improved service. Debrezion, Pels, and Rietveld find that in the Netherlands from 1985 to 2001, “dwellings very close to a station are on average about 25% more expensive than dwellings at a distance of 15 km or more.” They also report “an increase in house value of about 2.5%, ranging from 3.5% for houses close to the station to 1.3% for houses far away,” when the railway service frequency doubled. However, they find some negative effects on house prices due to crime and noise pollution along the railway line. In sum, most of the studies supported the fact that rail transportation facilities have a positive effect on property values.

Due to the different features of rail transit systems, the correlation between access to light-rail stations and residential property values may be different from that for heavy-rail transit. Al-Mosaind, Dueker, and Strathman find positive land value effects correlated to light-rail transit stations within a five hundred-meter walking distance. The Hess and Almeida findings support the findings of Al-Mosaind, Dueker, and Strathman. Hess and Almeida regression results suggest that for every foot closer to a light-rail station, the average property value increases by $2.31 (using geographical straight-line distance) and $0.99 (using network distance) for homes in the study area in Buffalo, New York. In other words, a premium of $1,300–$3,000, or 2.5% of the city’s median home value, could be earned for a home located within a quarter-mile radius of a light-rail station.

**Research on High-Speed Train Value Impacts**

High-speed railways are one of the most innovative passenger transportation developments.
since the Second World War. High-speed railways can be found in Asia and European countries. The first country to operate a high-speed railway was Japan, with its Shinkansen railway introduced in 1964. High-speed railways have operated in continental Europe for over three decades but in the United Kingdom only for about a decade. Most of the research studies find high-speed railways have a positive effect on commercial and residential property values.

The ex-post evaluation studies of the impact of high-speed railways in France (TGV Sub-Est, Paris-Lyon), Spain (AVE, Madrid–Seville), and Japan (Shinkansen) show that such railways increase commercial activities and hence have a positive effect on land values around high-speed rail stations.

Preston, Larbie, and Wall in their 2006 study suggest that an increase in property price coincided with the opening of the Ashford International high-speed railway station in 1996. They report Ashford (UK) domestic property prices and surrounding areas demonstrate a gradual upward trend. A regression analysis on Ashford property prices also shows that actual prices were 26.5% above the time-trend line since 1996, while properties in the South East section of the United Kingdom as a whole were 23.2% above the trend line. In other words, a 3% increase in property prices above that of the South East as a whole was recorded for Ashford. Likewise, the opening of the St. Pancras International high-speed railway station in 2007 had a positive impact on property price in the borough of Camden from 2006 to 2009. Pagliara, Barrasso, and Preston conduct an empirical study on 4,720 residential property transactions from 2001 to 2009 in the London borough of Camden and find that house prices increased by 11.8% in Camden compared to a 10.6% increase for other Inner London boroughs and a 1.9% increase for London as a whole.

The opening of a high-speed railway line in early 2007, connecting seven metropolitan areas on the west coast of Taiwan, drastically reduced traveling time along the west coast. Andersson, Shyr, and Fu look at the effect of this high-speed railway on property values and find it had positive effects on land values, especially commercial land values. Businesses are more receptive to paying higher prices and rents for sites with high-speed rail station proximity, because they can enjoy the convenience and benefits of more frequent business meetings with customers and suppliers from other metropolitan regions. Andersson, Shyr, and Fu also argue that the high valuation in the commercial property market would spill over into the housing market.

The Chinese high-speed railway, called Express Rail Link (ExRL), was first constructed in 2006. As such, empirical research on the ExRL effects on property prices is hard to find, though some of the media has reported that ExRL has a positive effect on property price. It is generally argued that high-speed railways can provide safe and predictable travel and enhance the accessibility of an area; hence an increase in commercial activity and a commensurate increase in land values are expected. However, Preston, Larbie, and Wall point out that much of this activity may be transferred from other areas and should not be viewed as a net gain.

Bowes and Ihlandfeldt, using hedonic pricing model methodology and Atlanta-region data for 1991–1994, find that properties one to three miles from a station were of considerably higher...
value than those farther away.\textsuperscript{31} However, properties within a quarter mile of a rail station were found to sell for 19\% less than properties more than three miles from a station. These results suggest that properties at an intermediate distance (one to three miles) enjoy positive externality effects from the transportation access provided by stations while houses located very close to stations suffer from negative externality effects.

Willigers's research suggests that high-speed railway development plans may not produce the anticipated increase in economic activities.\textsuperscript{32} The research of Lewis only concludes that “HSR tends to contribute to regional economic growth.”\textsuperscript{33} Bonnafous and Mannone conclude that the high-speed TGV railway in France was only of minor importance in the location decisions of most firms.\textsuperscript{34} Haynes also finds that high-speed railway accessibility is only one of a number of factors that influence business location decisions.\textsuperscript{35} Based on the literature, it appears that the effects of high-speed railways on property prices are mixed and may vary from one place to another, probably depending on other local attributes.

**Methodology**

**Hedonic Pricing Model**

Waugh was the first to adopt the hedonic approach in analyzing factors affecting prices in the agriculture market.\textsuperscript{36} This approach was further explained by Lancaster, who states that “consumers get utility from the attributes embodied in products.”\textsuperscript{37} Griliches was the first to use the hedonic pricing model in studying fixed assets, while Rosen was the first to use hedonic modeling in housing attributes analysis.\textsuperscript{38} Since then, this model has been widely used in housing studies.

A hedonic equation is constructed to model house price as a function of its own characteristics, such as size, neighborhood characteristics, and accessibility, and each attribute is assumed to be implicitly priced. Housing attributes in a hedonic equation may be classified into the three groups: locational (L), structural (S) and neighborhood (N) types, as described in Mok, Chan, and Cho.\textsuperscript{39} The property price (P) can thus be expressed as:

\[
P = f(L, S, N)\]

Locational attributes can include views, aspects, and floor level. Structural attributes include the size of flat and building age, while neighborhood factors can include proximity and commercial development.

Mathematically, the hedonic pricing model assumes that property price can be described by a vector consisting of a number of independent variables, in the forms of continuous, discrete, or dummy variables. Dummy variables are selected carefully for the relevant attributes. The dependent variable is the natural logarithm of the deflated transaction price. In this study, a semilogarithmic specification was proposed. Nine explanatory (independent) variables were included—FLOOR, GFA, AGE, D1, D2, D3, TIME, ASSEMBLY, DIVIDED—and the following regression equation was adopted:

\[
\text{PROPERTY} = \beta_0 + \beta_1 \times \text{FLOOR} + \beta_2 \times \text{GFA} + \beta_3 \times \text{AGE} + \beta_4 \times \text{D1} + \beta_5 \times \text{D2} + \beta_6 \times \text{D3} + \beta_7 \times \text{TIME} + \beta_8 \times \text{ASSEMBLY} + \beta_9 \times \text{DIVIDED} + \epsilon
\]
where the dependent variable PRICE represents the deflated sale price of a unit; $\alpha$ is a constant; FLOOR represents floor level; GFA represents the gross floor area of a unit; AGE represents the actual age of the building; $D_1$, $D_2$, and $D_3$ represent east-, south-, and west-facing aspects, respectively; TIME is a dummy variable delineating whether a transaction took place before or after the date of government resumption notice; ASSEMBLY is a dummy variable showing whether a flat is affected by land assembly efforts of the developers or their agents, as motivated under the Compulsory Sale for Redevelopment Ordinance; $DIVIDED$ is a dummy variable indicating whether a flat is divided into more than one subunit; $\varepsilon$ is the error term. Exhibit 2 shows the definitions and expected signs of the variables.

### Data

The alignment of the proposed high-speed railway requires the acquisition of title to the underground strata of 18 medium-rise buildings that were constructed in the 1960s and 1970s in the Tai Kok Tsui area of West Kowloon. A location plan of the affected buildings is shown in Exhibit 3. This neighborhood is homogenous in terms of locational and environmental characteristics. A judgment sample was collected, consisting of transactions data for 267 flats in this neighborhood and spanning two years: one year before the subject compulsory purchase notice and one year after.\(^{41}\) Housing-attribute data for the flats in the sample were collected by various means.\(^{42}\) All the flats affected are less than 700 square feet and classified as Class A or B residential flats as categorized by the Rating and Valuation Depart-

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**Exhibit 2** Explanatory Variables: Definitions and Expected Signs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Expected Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLOOR</td>
<td>the unit’s floor level in the building (discrete variable)</td>
<td>+</td>
</tr>
<tr>
<td>GFA</td>
<td>the gross floor area of the unit in square feet (continuous variable)</td>
<td>+</td>
</tr>
<tr>
<td>AGE</td>
<td>the age of the building concerned (continuous variable)</td>
<td>-</td>
</tr>
<tr>
<td>D1</td>
<td>a dummy variable for a flat facing east; value equal to 1 if faces east; 0 otherwise</td>
<td>+</td>
</tr>
<tr>
<td>D2</td>
<td>a dummy variable for a flat facing south; value equal to 1 if faces south; 0 otherwise</td>
<td>+</td>
</tr>
<tr>
<td>D3</td>
<td>a dummy variable for a flat facing west; value equal to 1 if faces west; 0 otherwise</td>
<td>-</td>
</tr>
<tr>
<td>TIME</td>
<td>a dummy variable delineating whether the subject transaction took place before or after the date of the government resumption notice; it takes a value of 1 if transaction took place after notice date and 0 otherwise</td>
<td>?</td>
</tr>
<tr>
<td>ASSEMBLY</td>
<td>a dummy variable showing whether the transaction relates to a flat acquired by a redevelopment company; it takes a value of 1 if flat was acquired by a redevelopment company and 0 otherwise</td>
<td>+</td>
</tr>
<tr>
<td>DIVIDED</td>
<td>a dummy variable indicating whether a flat is subdivided into smaller units; it takes a value of 1 if subdivided units are found and 0 otherwise</td>
<td>+</td>
</tr>
</tbody>
</table>

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\(^{40}\) Chapter 545 Laws of Hong Kong–Land (Compulsory Sale for Redevelopment) Ordinance was enacted in 1998 to facilitate the private sector taking part in the urban renewal process. Hong Kong has been under extreme redevelopment pressure due to its acute shortage of vacant land, particularly in the urban area. Under the compulsory sale ordinance, buildings fifty-years old or older are targeted for redevelopment.

\(^{41}\) The earliest transaction took place on December 3, 2007, and the latest transaction took place on November 30, 2009. A judgment sample is applied here that equates to the entire population of transactions representing the market segment during the chosen time period being studied.

\(^{42}\) The basic transaction details were obtained from a database of the Economic Property Research Centre (EPRC) and floor plan details were obtained from the Buildings Department. Additional land searches and further investigations, including talking with the sellers and buyers, were made on doubtful data.
Data Analysis and Interpretation

The descriptive statistics of the judgment sample are as shown in Exhibit 4. Based on the equation specification previously described, the results of the regression are as shown in Exhibit 5. Apart from two of the aspects relating to dummy variables, the regression results indicate that all variables are of the expected signs. The adjusted R-squared value is of 0.728677, which implies that the explanatory power of the estimate is high.

As a log-level model has been used in the estimation process, an incremental change in the regressors will cause a percentage change in the dependent variable, i.e., the housing price. For example, a one-year increase in building age will cause a 1.5% decrease in housing price; that is, the older the flat, the less expensive it is, all other things being equal. In the cases of the other three dummy variables, the regression results indicate that contrary to claims in the media, the proposed scheme actually causes the price of a flat to rise by 15.1%. Furthermore, the price of a flat in the sample increases by 134.5% if it is within a building targeted to be assembled by private developers. The results also indicate that flats that have been further divided into smaller units (hence more units) are priced 8.6% higher in the market.

What is striking in the results is that the proposed compulsory acquisition (of underground strata title) actually has a positive effect on the housing price by 15.1%. Flats that were targets of assembly pursuant to the Land (Compulsory Sale for Redevelopment) Ordinance were snapped up by developers and consequently fetched a higher price. Another interesting aspect of the study is that governmental tolerance or inaction in enforcing existing building laws and regulations on flat subdivision is recog-

43. According to the classification of the Rating and Valuation Department of the Hong Kong SAR government, flats are grouped into Class A (less than 40 sq. m.), Class B (40 to less than 70 sq. m.), Class C (70 to less than 100 sq. m.), Class D (100 to less than 160 sq. m.) and Class E (160 sq. m. or more).

44. The Rating and Valuation Department publishes a monthly price index for the various classes of residential flats to reflect the market price movement.

45. Percentage change due to one unit change in TIME variable = \exp(0.140367)-1 = 15.1% 

46. Percentage change due to one unit change in ASSEMBLY variable = \exp(0.852306)-1 = 134.5% 

47. Percentage change due to one unit change in DIVIDED variable = \exp(0.082078)-1 = 8.6%
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nized by the market to the extent that investors are prepared to pay a higher price (8.6% more) and then subdivide a flat illegally into several housing units to obtain a higher rental.

Conclusions

The plan for construction of the proposed Hong Kong section of Guangzhou-Shenzhen-Hong Kong Express Rail Link affects a total of 18 medium-rise buildings built in the 1960s and 1970s in Tai Kok Tsui. Media reports claimed that the alignment of the express rail would have an adverse effect on the property prices of the affected buildings. One of the reasons given for the claim is that the government-acquired strata will be protected by the Railways Ordinance and hence future development of the affected properties will be restricted. Another reason cited for adverse price effects is that the construction work might diminish the structural soundness and stability of the existing buildings. Whether or not the latter allegation is true is beyond the scope of the present analysis.48

The subject district is an old, mixed-use district and some developers and their agents have begun to actively assemble land for redevelopment purposes.49 The main purpose of this study was to test how the market would behave as a result of the proposed resumption (acquisitions) under the Railways Ordinance. The hypothesis, as proposed by media claims, is that the proposed resumption will adversely affect housing prices. This study also provides an opportunity to observe how and to what extent governmental intervention (resumption efforts) and market forces (land assembly efforts) affect property prices. To carry out the empirical investigation, data was collected on housing (flat) sales that occurred during a two-year period: one year before and one year after the date of the gazette notices of resumption.

The operation of market-driven land assembly action, as measured by the variable ASSEMBLY, indicates a great positive impact (134.5% increase) on the housing prices. Developers or their agents are eager to acquire housing units in this area and are willing to pay high premiums to acquire them.

The study regression results also indicate that the planned governmental resumption of underground strata title has had a positive effect on the housing price (15.1% increase). This means that the proposed express rail link has had a positive,

Exhibit 4 Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnPRICE</td>
<td>12.00</td>
<td>14.00</td>
<td>13.91</td>
<td>0.34</td>
</tr>
<tr>
<td>FLOOR</td>
<td>1.00</td>
<td>14.00</td>
<td>6.20</td>
<td>4.10</td>
</tr>
<tr>
<td>GFA</td>
<td>290.00</td>
<td>780.00</td>
<td>491.25</td>
<td>106.09</td>
</tr>
<tr>
<td>AGE</td>
<td>34.06</td>
<td>48.92</td>
<td>40.13</td>
<td>5.94</td>
</tr>
<tr>
<td>D1</td>
<td>0</td>
<td>1</td>
<td>0.13</td>
<td>0.34</td>
</tr>
<tr>
<td>D2</td>
<td>0</td>
<td>1</td>
<td>0.36</td>
<td>0.48</td>
</tr>
<tr>
<td>D3</td>
<td>0</td>
<td>1</td>
<td>0.15</td>
<td>0.35</td>
</tr>
<tr>
<td>TIME</td>
<td>0</td>
<td>1</td>
<td>0.64</td>
<td>0.48</td>
</tr>
<tr>
<td>ASSEMBLY</td>
<td>0</td>
<td>1</td>
<td>0.13</td>
<td>0.33</td>
</tr>
<tr>
<td>DIVIDED</td>
<td>0</td>
<td>1</td>
<td>0.25</td>
<td>0.43</td>
</tr>
</tbody>
</table>

N = 267

Exhibit 5 Regression Results

Dependent Variable: lnP
Method: Least Squares
Sample: 1,267
Included Observations: 267

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>13.649360</td>
</tr>
<tr>
<td>FLOOR</td>
<td>0.010307</td>
</tr>
<tr>
<td>GFA</td>
<td>0.001167</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.015256</td>
</tr>
<tr>
<td>D1</td>
<td>0.070169</td>
</tr>
<tr>
<td>D2</td>
<td>0.006480</td>
</tr>
<tr>
<td>D3</td>
<td>0.057560</td>
</tr>
<tr>
<td>TIME</td>
<td>0.140367</td>
</tr>
<tr>
<td>ASSEMBLY</td>
<td>0.852306</td>
</tr>
<tr>
<td>DIVIDED</td>
<td>0.082078</td>
</tr>
</tbody>
</table>

R-squared 0.737857
Adjusted R-squared 0.728677

48. No reports had been completed on this at the time the present research was performed.
49. Land is assembled under the Land (Compulsory Sale for Redevelopment) Ordinance, Cap 545, Laws of Hong Kong. This legislation greatly assists developers in the land assembly process, which in turn facilitates redevelopment in run-down urban areas in Hong Kong.
rather than detrimental, effect on the properties in the area. Thus, the hypothesis (i.e., the allegation put forward by the media) is unfounded.

A corollary of this study is that housing prices may be driven up by strong investment. Government acquiescence on illegal subdivision of housing units into small ones has created an opportunity for investors to maximize profit per flat, causing an increase of 8.6% in housing price.

All the above factors are related to government policy and regulation and the institutional changes related to it. The market responds correspondingly, through its own interpretations of policy and regulation and institutional changes. Nonenforcement of restrictions on subdividing units has increased developer demand and prices but also has led to deaths from fires in buildings with subdivided units. As a result, the government is now instigating actions to strictly enforce the relevant building regulations. How the market will react to this new corrective institutional change is yet to be seen.

About the Authors
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Additional Resources
Suggested by the Y. T. and Louise Lee Lum Library

American Public Transportation Association—Reports and Publications
http://www.apta.com/resources/reportsandpublications/Pages/default.aspx

International Right of Way Association
• *Tunnel Transport Infrastructure and Value Impacts in Australia*
• *Right of Way magazine, “What Lies Beneath”*

International Union of Railways—Publications
• http://www.uic.org/#publications

US High Speed Rail Association—Reports