Light-Rail Transit Stations and Property Values: A Hedonic Price Approach

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What are the effects of proximity to light-rail transit (LRT) stations on the value of single-family homes? Two forces are at work. Proximity to LRT stations may improve the accessibility of residents to the central business district and the rest of the urban area. Further, proximity to rail stations may result in transportation cost savings for nearby residents. These effects should be positively capitalized in property values. Alternatively, without attention to design, LRT stations may impose negative externalities on nearby properties, with a resulting decline in house values. Which of these effects predominates in the housing market with respect to station proximity? A study was undertaken to analyze sale prices of homes in metropolitan Portland, Oregon. Two distance models to LRT stations were compared. The first showed a positive capitalization of proximity to LRT stations for homes within 500 m (1600 ft or ¼ mi) of actual walking distance. This effect was equally felt for all homes within that distance zone. The second model found a statistically weak negative price gradient for homes within the 500-m zone. This implies a positive influence of proximity the closer the home is to an LRT station.

Proximity to light-rail transit (LRT) stations may positively or negatively affect the value of single-family homes in nearby residential neighborhoods. Having easy access to a station may improve the accessibility of residents to commercial centers and result in increased home values. Similarly, proximity to LRT stations may reduce commuting costs, which would be positively capitalized in housing values. Alternatively, a consequence of living near an LRT station may be increased noise, traffic, and other nuisances, with a resulting decline in home values.

This paper addresses the following questions:

- Does proximity to LRT stations affect the value of nearby homes?
- Is there a positive or negative effect?
- Is there a price gradient with respect to distance from an LRT station?

The study analyzes single-family home sales in areas of Portland, Gresham, and Multnomah County, Oregon, that are within a reasonable walking distance to an LRT station. The paper also reviews the development of LRT in metropolitan Portland and planning and design considerations of neighborhood LRT stations.

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BACKGROUND

In September 1986, an LRT line called MAX initiated service to Portland's Eastside. The 24-km (15.1-mi) line comprises 27 stations, 5 park-and-ride facilities, and 5 transit centers. The line was developed as part of the Banfield Transitway project, a package of 140 transit and highway improvements, which included freeway improvements to 6.9 km (4.3 mi) of the Banfield Freeway (I-84). Local planning for the LRT project began in the mid-1970s following rejection of an early 1960s proposal to build the Mt. Hood Freeway, a connection of I-5 and I-205 along the Powell Boulevard corridor (Figure 1).

The LRT line includes three different segments of stations. The segment along the downtown corridor has simple sheltered stations. The depressed Banfield Freeway segment has split-level stations. Passengers board at the freeway level, and transit access to commercial or residential areas is provided by buses arriving at overpasses or adjacent streets. In the third segment, surface stations along East Burnside Street are directly accessible by walking from nearby residential areas (Figure 2).

The stations can also be classified functionally in the following ways:

1. Transit stations that serve older commercial centers and connecting bus lines (e.g., Hollywood and Gresham Central);
2. Developed area stations that serve shopping centers with connecting and feeder bus services (e.g., Lloyd Center and Gateway);
3. Park-and-ride stations that serve commuters from low-density residential areas (e.g., Gresham City Hall); and
4. Neighborhood stations located in established low- and medium-density residential areas. These types of stations are the subject of this study.

PLANNING AND DESIGN OF NEIGHBORHOOD TRANSIT STATIONS

The Banfield Light-Rail Transit Station Area Planning Program was initiated in 1982 as a 2-year cooperative project that included the participation of Portland, Gresham, Multnomah County, Tri-Met, the Oregon Department of Transportation, and Metro. The objectives were to prepare detailed land use plans, evaluate potential, and adopt development strategies

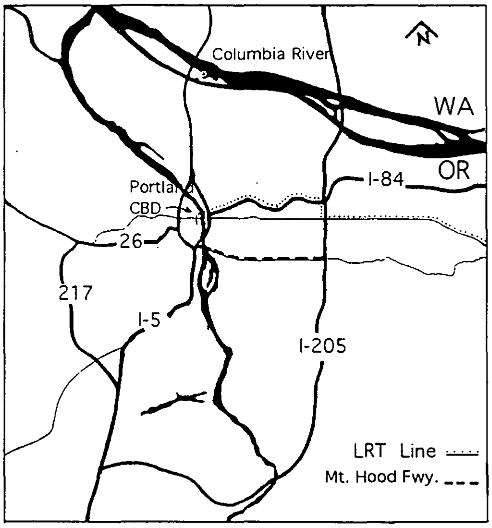

FIGURE 1 Portland metropolitan region.

for each of the 26 LRT stations between downtown Portland and Gresham.

In conjunction, the communities along the LRT line initiated changes to their zoning regulations. In 1984, Multnomah County designated LRT station area zones. The city of Portland adopted changes in its zoning code and comprehensive plan in the vicinity of the stations. Further, the cities of Portland and Gresham annexed large areas of mid-Multnomah County. As part of the annexation program, Portland adopted a new T-zone (transit overlay) to provide comparable regulations to Multnomah County transit zones and their accompanying regulations. The new T-zone serves a number of purposes that include encouraging transit-oriented development by promoting development mix and minimizing potential conflicts between vehicles and pedestrians near transit stations.

Higher densities, both residential and commercial, have been zoned within a half kilometer of LRT stations, especially along the Burnside arterial corridor. Transit supportive land use planning was done to generate relatively higher levels of transit trips while minimizing vehicular trips and parking demand.

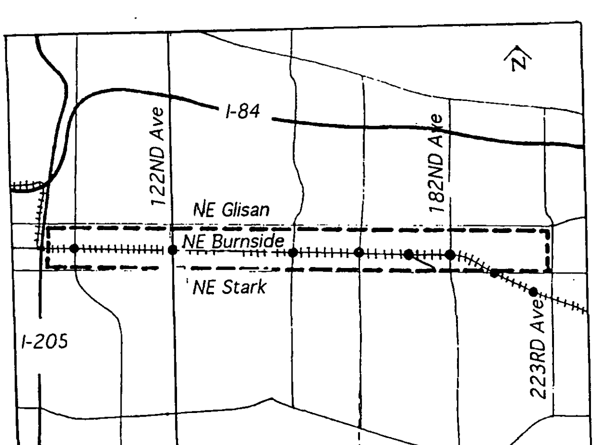

FIGURE 2 The study area.

However, potential LRT impacts on land development may not be achieved in the short run. Such influence would require, in addition to a transit-oriented zoning, a strong regional economy, availability of developable land, and a long-term market adjustment to accommodate new transportation improvements (*1,2*). In Portland, LRT has influenced land development only in selected areas around its corridor. Downtown Portland, downtown Gresham at the other end of the line, and the area around Lloyd Center were the major beneficiaries (*3*). Modest changes in land development have been identified in other areas along the MAX corridor, including the study area (*3*).

IMPACTS OF LRT STATIONS ON PROPERTY VALUES

Proximity to LRT stations improves the accessibility of residents to the central business district (CBD) and to other parts of the urban area served by transit. This benefit should be positively capitalized in property values (*4–7*). Further, proximity to rail stations may result in transportation cost savings for nearby residents (*8*). These travel savings would be reflected in home price capitalization for nearby properties. The Philadelphia-Lindenwold rapid transit is a prime example of these positive impacts (*9,10*). These impacts are more apparent in lower- and middle-class areas than in higher-income areas (*10,11*). Similar conclusions were reached by Nelson (*6*) concerning elevated rail line impacts on housing prices in Atlanta. On the other hand, Gatzlaff and Smith (*12*) concluded that proximity to Miami Metrorail yielded slightly increased property values in highly priced, growing neighborhoods relative to declining neighborhoods. They also found weak, inconclusive impacts for proximity after the announcement of the project and the system operation (*12*). Other potential benefits of proximity include a speculation value for nearby homes (*8*). This may result from the potential for future conversion to other uses, such as multifamily or commercial development.

Whether improvements in accessibility will positively affect land values is influenced by other planning and design measures for transit stations. Strong housing market demand and careful planning and zoning considerations may produce positive impacts. For instance, Toronto rail transit has had a major impact on residential land values. Property values near the Spadina subway line were $2,237 higher than they were elsewhere (*13*). Strong development controls were important in stimulating these positive effects. Similarly, Lee and others (*5*) concluded that the Bay Area Rapid Transit (BART) had a noticeable effect on residential property values in only some areas. Other studies showed inconclusive results in terms of detecting an overall increase in residential property values as a function of proximity to rail stations (*4,6,14*). In fact, land use impacts in terms of development patterns and land values would require the presence of other favorable factors in addition to rail transit proximity (*15,16*).

Without attention to design, LRT stations may impose negative externalities on nearby properties. These externalities may include noise, increased pedestrian and automobile traffic near the station, attraction of undesirable groups to neighborhoods, and the disruption and noise associated with the construction of such stations (4,6,12). Further, transit stations may create an incentive for higher-density development, in conflict with the characteristics of nearby stable neighborhoods.

In summary, net positive impacts could be observed if the market viewed improved accessibility more as a benefit than a nuisance. Conversely, net negative impacts could exist if the market viewed externalities as more important than accessibility to transit.

Study Area

The study area along the E. Burnside corridor MAX segment contains neighborhood-type LRT stations. The area extends from Interstate 205 (west) to N.E. 192nd Street (east), between N.E. Glisan Street (north) and S.E. Stark Street (south) (Figure 2). N.E. Glisan and S.E. Stark are each 500 m (¼ mi) from the light-rail tracks. The actual distance between some homes and a station is longer because of a cul-de-sac and other circuitous street configurations. Any residence that had an actual walking distance of more than 1.6 km from a MAX station was excluded. The study area is dominated by developments of single-family homes, with a few pockets of multifamily apartments. Sale prices of homes within the study area during 1988, 2 years after LRT operation began, were used for this study. During the study period, the average sale price for all homes was $47,912. For homes that are close to stations, less than 500 m (¼ mi) of actual walking distance, the average sale price was $40,554.

Model Specification

Hedonic analysis is used to isolate the effects of proximity to LRT stations on property values. The first model uses sales of homes that are located within the 1,000-m band width along the LRT line but distinguishes those that are within 500 m of actual walking distance to a station. A 500-m distance was chosen as a reasonable walking distance between homes and an LRT station. A second model was constructed using sales data for homes that are within a 500-m zone of actual walking distance.

The first model contains 235 home sales. It can be generally expressed as follows:

$$P_i = b_0 + b_1\, DDST_i + \Sigma_j\, b_{ij}\, X_{ij} + e_i \qquad (1)$$

where

P_i = sale price of each transacted home (i), $i = 1, \ldots, n$;
$DDST_i$ = dummy variable equaling 1 for all homes that are within a 500-m walking distance from a station and 0 otherwise;
X_{ij} = characteristic attribute (j) defining residence i, $j = 1, \ldots, k$; and
e_i = error term.

The second model includes 90 sales located within a 500-m (¼ mi) actual walking distance from an LRT station. It can be expressed as follows:

$$P_i = b_0 + b_1\, DST_i + \Sigma_j\, b_{ij}\, X_{ij} + e_i \qquad (2)$$

where

P_i = sale price;
DST_i = distance (m) of each home (i) from the station;
X_{ij} = characteristic attribute (j) defining residence i, $j = 1, \ldots, k$; and
e_i = error term.

A bundle of characteristic variables of each home were incorporated into the model to control for their effect on housing prices. These variables include the following:

1. Structural characteristics (area in square meters of both lot and house, the presence of a basement, the number of bedrooms, and age in years),
2. Jurisdictional identifier (whether the house is located in Portland, Multnomah County, or Gresham), and
3. Other important variables such as zoning type (whether the lot is zoned for single-family residential or multifamily residential use) and the school district. Because the school and the city variables are highly correlated with distance to the CBD, only the city dummy variables were included in the model.

RESULTS

Regression results for the first model are presented in Table 1. All characteristic attributes of the houses were significant at the 0.05 level and have the expected signs. For instance, a marginal increase in lot size and house area increase the house price significantly, whereas the age of the house negatively affects its price. Further, single-family residential zoning has a significant positive effect on sale prices. This could reflect the buying up of lower-quality single-family homes in multifamily zones for subsequent development or a depressing effect of multifamily zoning on single-family housing. Positive effects were also estimated for homes located in the city of Portland and Multnomah County as compared with the city of Gresham, which is interpreted as reflecting the effect of distance from the Portland CBD.

The interpretation of the positive coefficient of the dummy variable implies that LRT stations had a positive impact on home values within 500 m. There, property values were $4,324 higher than properties located within the study area but with walking distances greater than 500 m. The total contribution of proximity to stations in home prices, on average, is nearly 10.6 percent.

The second model uses a distance measure to detect price gradient of homes within 500-m actual walking distance. The results in Table 2 show that property values are estimated to decline with distance from an LRT station at a rate of $21.75/m ($6.60/ft). The significance of this estimate is weak, however. Thus, for properties within 500 m of actual walking distance, the accessibility and the speculative effects are apparently higher the closer the home is to the station. There is a detectable distance decay, but the results of the second model are not strong enough to imply a significant price gradient of distance to LRT stations. Nuisance effects may have played a role in reducing the potential benefits of proximity

TABLE 1 Results of Linear Regression of All Homes

Variable	Coefficient	T-score
Distance from nearest station (1=within 500 m.[1], 0=further)	4324	2.49*
Lot size in sq. meters[2]	3.98	4.19**
House size in sq. meters	210.35	6.67**
Presence of Basement (1=Yes, 0=No)	6330	3.75**
Number of bedrooms	3398	2.24*
Age of house in years	-384	-6.32**
Single family zoning (1=Yes, 0=No)	6661	3.46**
Located in Portland (1=Yes, 0=No)	4476	2.40*
Located in Multnomah County (1=Yes, 0=No)	6583	3.62**
Constant	16919	
Number of cases	235	
Coefficient of Determination (R^2)	.631	
Standard error of estimate	11018	
F-Ratio	42.66**	

[1] 1 meter = 3.28 feet.
[2] 1 sq. meter = 10.76 sq. feet.
* Significant at the 0.05 level (two-tailed test).
** Significant at the .005 level (two-tailed test).

to nearby homes. Short- and long-term nuisance effects caused by construction and operation of stations are two examples. The housing market may take a longer time to recover from such impacts.

CONCLUSION AND IMPLICATIONS

The results indicate that the housing market views proximity to an LRT station as a benefit with a distance decay effect. This effect is felt only for houses within 500 m of actual walking distance.

However, the benefits of accessibility to a transit station may not be as great as some expect. In an automobile-dominated city such as Portland, transit's role in people's travel behavior is minor. Such a role is exemplified in low ridership rates for LRT and other transit modes. In 1988, on an average weekday, MAX ridership was nearly 19,300 passengers. Only 2,317 passengers per day depart from the study area stations, on average. Therefore, the housing market may not be noticeably influenced by transit users' locational decisions. Nevertheless, the proximity to an LRT station may have produced modest benefits to nearby properties. These benefits are reflected by a price differential of nearly 10.6 percent for houses within walking distance. In addition, a statistically weak, negative gradient of $21.75/m ($6.60/ft) from the station was detected. This translates to $6,939 at the mean distance of 319 m (1,046 ft).

The finding of a net benefit indicates that the positive effects of accessibility are stronger than the nuisance effects. These effects may partially have to do with the design of LRT stations. Design treatment should be sensitive to potential impacts on nearby neighborhoods. Failure to do so may lead to an adverse price effect on homes (*17*).

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TABLE 2 Results of Linear Regression of Homes Within 500 m Actual Walking Distance of an LRT Station

Variable	Coefficient	T-score
Distance from nearest station (in meter units)	-21.75	-1.50
Lot size in sq. meters[1]	3.23	2.21*
House size in sq. meters[2]	270	3.68**
Presence of Basement (1=Yes, 0=No)	5073.35	1.49
Number of bedrooms	479.35	0.16
Age of house in years	-395.22	-3.83**
Single family zoning (1=Yes, 0=No)	11280.74	3.80**
Located in Portland (1=Yes, 0=No)	2157.35	0.69
Located in Multnomah County 2(1=Yes, 0=No)	9755.52	2.61*
Constant	20050	
Number of cases	90	
Coefficient of Determination (R^2)	.620	
Standard error of estimate	12602	
F-Ratio	14.476**	

[1] 1 meter = 3.28 feet.
[2] 1 sq. meter = 10.76 sq. feet.
* Significant at the 0.05 level (two-tailed test).
** Significant at the .005 level (two-tailed test).

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