Use of the Real Estate Market to Establish Light Rail Station Catchment Areas

Case Study of Attached Residential Property Values in Salt Lake County, Utah, by Light Rail Station Distance

Susan J. Petheram, Arthur C. Nelson, Matt Miller, and Reid Ewing

Considerable literature reports the price effects of light rail transit accessibility on residential properties built principally for owner–occupants. Few studies show the relationship between light rail transit and rental apartment building values; those that have done so have evaluated outcomes within narrow bands of distance from light rail transit stations. The present study closes some of this gap in the research. The association between TRAX, the light rail system operated by the Utah Transit Authority serving Salt Lake County, Utah, and the value of rental apartment buildings in bands a distance from light rail stations of 0.25 mi out to 1.5 mi was estimated. When structural, neighborhood, and location characteristics were controlled for, a positive relationship between TRAX station proximity and rental apartment building values was found to 1.25 mi but not beyond. The implications of these findings are offered.

Extensive literature shows that light rail stations increase the value of the property around them. Planning for transit-oriented development (TOD) attempts to recognize this through the design of TODs to maximize value enhancements. It seems to be an article of faith that the benefits of a transit station are maximized within about 0.5 mi. One way to know how far TODs should extend from stations is to assess how the market responds to station proximity according to distance. This article reviews the literature and theory on the effect of light rail stations on apartment property values, poses a theory and a methodology to test the theory, reviews the results, and offers implications for planning of station areas.

LITERATURE

The authors are indebted to Guerra et al. for laying the groundwork on this issue (*1*). They noted that TOD planning is commonly based on a 0.5-mi radius from transit stations but varies on the basis of local conditions. The assumption is that an area within a 0.5-mi radius from transit stations is the most appropriate catchment area for transit users. TOD plans thus regulate markets to maximize transit use within these planned catchment areas. Guerra et al. asked the following question: Does the half-mile circle best represent transit station catchment areas? (*1*). To answer it, they compiled variables for station catchment areas from 1,449 high-capacity transit stations in 21 U.S. cities. They found that different catchment areas have little influence on ridership predictions. Still, they found some evidence for the use of a 0.5-mi catchment area for residential land uses and recommend this to be a reasonable starting point for station area planning.

Canepa argues, however, that housing and employment density and urban design can push catchment areas to 1 mi or perhaps more (*2*). This increase in catchment area can be achieved through the removal of physical barriers between land uses and transit stations, especially through the creation of direct pathways to transit stations with little if any need to stop. At an uninterrupted walking pace of about 3 mph, 0.5 mi can be covered in 10 min, and with a slightly quicker pace or a tolerance for slightly longer walking time, up to a mile can be covered.

One measure of TOD catchment area design not considered directly in the literature is the market response to transit station proximity. An extensive literature has reviewed the hedonic price effects of transit stations to the values of several classes of property. Perhaps the most complete studies are those of Guerra et al. (*1*) and Bartholomew and Ewing (*3*).

A key purpose of TODs is to provide housing options near transit stations. Because of their capital-intensive nature, the principal residential options are attached rental and owner-occupied condominium forms of housing, that is, apartments and condominiums. The literature reporting the value effects of proximity to a transit station is limited. Cervero and Duncan evaluated the value effects of both forms of housing for distances of 0.25 and 0.5 mi from rail stations in Los Angeles and San Diego in California (*4, 5*). In Los Angeles, Cervero and Duncan found that values were double for apartments within 0.25 and 0.5 mi from a station but were 6% lower for condominiums (*4*). In San Diego, Cervero and Duncan reported, premiums of 17% and 10% for apartments near East Line and South Line light rail stations, respectively (*5*). Cervero and Duncan also reported that the value of condominium and apartments between 0.25 and 0.5 mi from light rail transit stations increased

Metropolitan Research Center, University of Utah, Room 235 AAC, 375 South 1530 East, Salt Lake City, UT 84112. Corresponding author: S. J. Petheram, s.petheram@utah.edu.

Transportation Research Record: Journal of the Transportation Research Board, No. 2357, Transportation Research Board of the National Academies, Washington, D.C., 2013, pp. 95–99.
DOI: 10.3141/2357-11

2% to 18% (but that the value of single-family homes decreased up to 4%) (*6*). The work in San Diego was synthesized by Cervero and Duncan (*6*) and Duncan (*7*). These are the studies pertinent to the theory and methodology used in the present study, which are presented next.

HYPOTHESIS, CONTEXT, METHODOLOGY, AND MODEL

As others have done previously, the authors hypothesize that a positive relationship exists between the presence of a light rail station and the value of rental apartment residential units. The null hypothesis is, technically, that no relationship exists.

The hypothesis was assessed in Salt Lake County, Utah, which has had a light rail system operating since the late 1990s. It is called TRAX. The line initially developed runs from downtown Salt Lake City south to Sandy; it was completed in 1999. A line subsequently developed runs from downtown to the University of Utah; it was completed in 2003. Two other lines were completed in 2011, with one extending into the center of West Valley City and the other extending to a new master-planned community called Daybreak. By the end of 2011, 41 stations were connected along 35 mi of track.

TRAX stations were not accompanied by master land use plans or ordinances facilitating TOD, unlike the light rail systems constructed in Dallas, Texas; Charlotte, North Carolina; Portland, Oregon; Sacramento, California; and San Diego. The Salt Lake County context thus allows an assessment of market responsiveness to light rail in the absence of local planning efforts to manipulate land markets to steer development to transit, if not away from other areas.

The hypothesis can be tested by the hedonic methodology. It assumes that property is a bundle of attributes and that the observed prices of goods reflect the utility (called the "implicit prices") of those attributes (*8*). For residential property, previous research shows that location, structure, and neighborhood attributes constitute the usual array of attributes (*9*).

Of particular interest to the authors was whether the market for rental apartments values proximity to TRAX rail stations and, if so, how far away any market premium extends. Prior research indicated that only distance bands have been used to measure this effect. Notably, Guerra et al. measured the differences in the values of apartments within 0.25- and 0.5-mi bands around rail stations and those of apartments more than 0.5 mi away (*1*). Because the authors of the present study were interested in measuring the catchment area as constructed by the market, they made the choice to measure value with respect to location within 0.25-mi bands around TRAX stations. The model has the following general formulation:

$$Y = f(S, L, N, \text{TRAX})$$

where

- Y = value of rental apartment property per square foot of rental space, the dependent variable;
- S = vector of structural characteristics, such as total building area, number of units in apartment complex (larger complexes usually have more amenities than smaller ones), and effective property tax rate;
- L = vector of location attributes, such as distance from the central business district, nearest park, nearest major educational facility, nearest regional shopping center, and nearest freeway interchange;
- N = vector of neighborhood socioeconomic attributes, such as income, household size, and racial or ethnic composition and other household characteristics within the block group in which an apartment building is located; and
- TRAX = distance of nearest point of apartment structure parcel to centroid of nearest TRAX in 0.25-mi bands to 1.5 mi away.

METHODOLOGY, DATA, AND DEFINITIONS OF VARIABLES

As others have done previously, multivariate regression analysis was chosen as the methodological approach. This allows differentiation of variations in the value per square foot of rental apartment space with respect to specific influences, with special reference to distance from transit stations.

The data principally come from three sources. The attributes and locations of apartment buildings come from the Salt Lake County assessor's office. As Utah is a nondisclosure state, which means that sellers have no legal obligation to report sales prices, the assessor's office nonetheless uses third-party reporting services to appraise apartment property in a reasonable manner. As the differential between assessed values for property taxation purposes and sales prices is about 0.4%, the authors are confident that the assessed values are reasonable proxies for market values (Chris Stavros, Statistical Division director, Salt Lake County Assessor's Office, personal communication, June 1, 2012).

A second source of data was the census. The final source of data was the state of Utah's clearinghouse for geographic information systems. This clearinghouse includes geographic information system layers for road networks, intersections, schools, parks, water bodies, elevation, and so forth. The distance of each apartment building to a wide range of natural and developed features, as well as its elevation, was measured to control for these effects on market value. The linear-logarithmic specification was chosen, as it can reveal the change in rent per square foot associated with a 1% change in continuous variables and a change in value with respect to the distance band from transit stations. Distance bands were further evaluated against each other by use of Helmert contrast coding in a second regression. The specific variables, descriptions, measures, and predicted signs are reported in Table 1.

RESULTS

Regression results are reported in Table 2. For the most part, statistically significant coefficients possess the expected signs. As the size of the apartment building increases, the value per square foot decreases; this is a normal expectation, as it reflects a declining average cost per unit as the scale increases. Scale still matters, however, because the larger the apartment complex (whether it is a single building or multiple buildings), the higher the value per

TABLE 1 Variables, Measures, and Predicted Associations

Description of Variable	Measure	Association with Dependent Variable
Dependent variable: value per square foot of rentable area	Continuous	na
Control variables		
Structure		
Total number of rentable square feet	Continuous	−
Part of apartment buildings of 5 to 9 units	Binary	+
Part of apartment buildings of 10 to 19 units	Binary	+
Part of apartment buildings of 20 to 49 units	Binary	+
Part of apartment buildings of 50 to 98 units	Binary	+
Part of apartment buildings of 99+ units	Binary	+
Floors	Continuous	−
Location		
Location within Salt Lake City	Binary	+
Distance to nearest park	Continuous	+
Distance to nearest regional mall	Continuous	a
Distance to nearest college or university	Continuous	+
Distance to nearest freeway exit	Continuous	+
Distance to nearest supermarket	Continuous	+
Elevation	Continuous	+
Effective tax rate	Continuous	−
Neighborhood		
Median household income	Continuous	+
Percentage college educated	Continuous	+
Percentage non-Hispanic white	Continuous	+
Number of persons per household	Continuous	−
Walk score	Continuous	+
Experimental variables		
Distance to nearest TRAX station within 1,320 ft	Binary	+
Distance to nearest TRAX station between 1,321 and 2,640 ft	Binary	+
Distance to nearest TRAX station between 2,641 and 3,960 ft	Binary	+
Distance to nearest TRAX station between 3,961 and 5,280 ft	Binary	+

NOTE: All continuous variables were transformed to natural logarithms. Binary variables remain the same (i.e., they are not transformed). For some variables, the sign may not be predictable, and thus, an ambiguous (labeled "a") association can occur. na = not applicable.

square foot. The reason is that larger complexes confer more amenities to renters than smaller ones. In addition, many larger complexes charge for extra services (such as covered parking, fee-based pool and recreation facility privileges, plus on-site personal care services and commissaries). These charges generate additional revenue to the project owners and thus enhance market value. Building height, though, reduces value at the margin. Although one would normally expect building height to confer views that would add value, very few buildings with more than three floors were found, so the variable for floors merely indicates the number of floors that a person must walk up, which can depress values per square foot for buildings of three or more floors.

Location attributes were significant and expected. A location within Salt Lake City conferred a higher value per square foot because of the wider range of amenities and services available within the city than elsewhere in the county. Natural elevation also mattered, as better views of the mountains and valley are availed at higher elevations than at lower elevations. Distance from the nearest college or university also mattered, as many apartment occupants are also post–secondary education students. The effective tax rate (total assessed taxes divided by the total number of rentable square feet) reduced the value per square foot, as expected, after central city location and other location features were controlled for. Although accessibility to regional malls might be considered desirable, being too close can confer a negative influence.

Neighborhood features also performed as expected. Higher median household income and the non-Hispanic white share of the population at the block group level increased rents, and more people per household had a dampening effect. A key accessibility variable, Walk Score (*10*), was also significant.

Of primary interest was the relationship between the distance from a TRAX station and rental apartment value. The coefficients showed a general pattern of declining value per square foot as the distance from the nearest TRAX station increased. As the mean value of apartment buildings in Salt Lake County is about $\$87/ft^2$, the coefficients suggest value premiums of \$7, \$4, \$5, \$4, and $\$4/ft^2$ for each 0.25-mi band outward from the nearest TRAX station. After about 1.25 mi, the effect of proximity became insignificant. A second regression performed by use of Helmert contrast coding of the distance band variables confirmed this pattern. Values for distance bands up to 1.25 mi were significantly different from the mean for subsequent distance bands.

INTERPRETATIONS, IMPLICATIONS, AND FUTURE RESEARCH

The analysis suggests that the market-driven catchment area for light rail transit accessibility extends about 1.25 mi, at least for the Salt Lake City metropolitan area. This would seem to cover an

TABLE 2 Regression Results

Variable	Beta	*t*-Score	*p*-Value
Constant		–326.406	**
Structure			
Total number of rentable square feet	–22.047	–14.741	***
Part of apartment buildings of 5 to 9 units	2.459	1.959	**
Part of apartment buildings of 10 to 19 units	11.543	5.370	***
Part of apartment buildings of 20 to 49 units	14.989	4.615	***
Part of apartment buildings of 50 to 98 units	45.888	9.216	***
Part of apartment buildings of 99+ units	79.108	13.252	***
Floors	–4.359	–3.250	***
Location			
Location within Salt Lake City	7.803	4.918	***
Distance to nearest park	0.075	0.155	
Distance to nearest regional mall	2.630	2.766	***
Distance to nearest college or university	–1.767	–2.312	***
Distance to nearest freeway exit	0.395	0.605	
Distance to nearest supermarket	–0.527	–0.733	
Elevation	65.234	2.878	***
Effective tax rate	–32.816	–5.922	***
Neighborhood			
Median household income	4.240	1.595	*
Percentage college educated	2.300	2.037	**
Percentage non-Hispanic white	10.865	2.976	***
Number of persons per household	–7.292	–1.470	*
Walk score	5.400	2.996	***
Experimental variables			
Distance to nearest TRAX station within 1,320 ft	7.276	2.975	***
Distance to nearest TRAX station between 1,321 and 2,640 ft	3.628	2.133	**
Distance to nearest TRAX station between 2,641 and 3,960 ft	4.739	3.021	***
Distance to nearest TRAX station between 3,961 and 5,280 ft	3.621	2.701	***
Distance to nearest TRAX station between 5,280 and 6,600 ft	3.647	2.318	***
Distance to nearest TRAX station between 6,601 and 7,920 ft	1.678	0.991	

NOTE: Equation statistics: $N = 1{,}301$; standard error of the estimate = 13.594; adjusted $R^2 = .526$; F-ratio = 163.914; F-ratio significance = 0.000.
*$p < .10$; **$p < .05$; ***$p < .01$.

area in which the distance to light rail stations is much longer than that which previous literature has indicated that transit riders are willing to walk to access transit. Although the anomalous results may be specific to the Salt Lake City metropolitan area, the authors observe that the area has done little to steer development to TODs. The present results might be interpreted as the minimum distance that the rental apartment market values proximity to a light rail transit station.

This is not to say that everyone within 1 mi of transit stations in the study area uses transit; the vast majority do not. The authors suspect that the 1.25-mi distance is capturing two market influences. First, an option value may be associated with a transit station being within 1.25 mi of rental apartments. As gasoline prices increase relative to incomes, apartment renters may wish to hedge expectations of higher automobile costs in the future by being willing to pay a little more for rent within 1.25 mi of transit stations now.

Second, private investments may be favoring transit station areas over others, thus producing more jobs and accessibility to goods and services near stations than farther away. Public investments may also lead to more attractive streets, safer sidewalks, and more investment in public amenities near transit stations than elsewhere. The market would thus capitalize these investments as amenities even if most apartment renters do not use transit. Further analysis that introduces measures of the presence or proximity to public investments may help evaluate these additional influences on the market.

Additional research is needed along several fronts. First, by use of the approach used in the present study, analysis could be extended to other metropolitan areas to measure market-driven catchment areas for rental apartments, especially in areas where planning is engaged to steer development to light rail transit stations. Second, the approach used in the present study could also be used to estimate catchment areas for other kinds of residential development, such as detached and attached owner-occupied options. Third, it could also be used to measure market-driven catchment areas for nonresidential land uses by class or category of use.

As Canepa observed, people may be willing to walk far more than the 0.5 mi from their homes to access rail transit (*2*), as the literature suggests. The present research indicates that the market may value the light rail transit option to at least 1.25 mi from rental apartments.

ACKNOWLEDGMENT

The authors acknowledge the generous support of the U.S. Department of Housing and Urban Development for research leading to this article.

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The views and opinions presented here are solely those of the authors.

The Transportation and Economic Development Committee peer-reviewed this paper.