Transit and Real Estate Rents

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Acknowledgements and Disclaimer

Support for this article came from the National Institute of Transportation and Communities with numerous co-sponsors including Utah Transit Authority, Portland Metro, TriMet, Lane County Transit, City of Provo, Utah, and Transportation for America (a subsidiary of Smart Growth America). The author acknowledges technical and editing assistance from Martin Buchert, Shima Hamidi, Sarah Hinners, Keuntae Kim and Guang Tian. The author acknowledges permission by CoStar to use its data for this study. The contents of this article reflect the views of the author, who is solely responsible for the facts and the accuracy of the material and information presented herein.

November 2016

Abstract

While there is a mixed literature on the association between transit proximity and real estate values, there is scant literature relating transit proximity to real estate rents. Using CoStar asking-rent data for real estate within one-mile corridors of several light rail transit (LRT), bus rapid transit (BRT), streetcar transit (SCT), and commuter rail transit (CRT) systems, the association between transit corridor proximity and rents with respect to one-half mile and between one-half and one mile of transit corridor centerlines is estimated. For the most part, SCT has the most robust outcomes. This is notable because economic outcomes to SCT systems may be the least understood given their recent emergence. LRT systems also had significant, positive associations between rents and corridor location. On the other hand, results for BRT are mixed with no statistically significant association with respect to office rent, a negative association with respect to the retail first half-mile distance band, but positive effects for rental apartments. Across all development types, proximity to CRT corridors either has insignificant associations or significant, negative ones. Implications are offered for land use planning along transit corridors based on transit type.

Overview

This article uses a commercial real estate database (CoStar) to estimate the association between office, retail and apartment rents and proximity to transit corridors. It is the first of its kind to use the same data across the nation, and apply it to four different kinds of transit modes. The article begins with a review of why transit ought to have a positive effect on real estate values, and by implication real estate rents. It proceeds to review the literature that estimates the contribution of transit proximity to real estate value. The literature is indeed mixed. A key limitation of the literature is that different methods are applied mostly to locally-gathered data and usually addresses just one land use—residential being the most common—and with respect to just one mode. The article crafts a model that is applied to the same commercial real estate database—CoStar—across multiple metropolitan areas testing for the effects of transit proximity on office, retail and apartment real estate rents. Moreover, it tests for differential effects based on the type of transit including light rail transit (LRT), bus rapid transit (BRT), streetcar transit (SCT), and commuter rail transit (CRT). Implications are offered for land use planning along transit corridors based on transit type.

Transit-Related Market-Value Outcomes

"Fixed-guideway" transit systems include heavy or "fifth" rail, such as the New York subway; light rail, such as provided in the Charlotte and San Diego metropolitan areas; non-tourist-related streetcar, such as those serving mostly downtown Portland, Seattle and Tampa; and bus rapid transit, such as the world's second-oldest such system operated in the Pittsburgh metropolitan area. These fixed-guideway transit systems advance agglomeration economies, which is a cornerstone of urban economic development. This part of the article: reviews the role of agglomeration economies in economic development; describes how the advantages of agglomeration economies are undermined by automobile dependency; and summarizes the role of fixed-guideway transit systems in supporting modern metropolitan economies. Transit and Real Estate Rents

Cities are formed and grow in large part by creating agglomeration economies (Glaeser, 2011). Anas, Arnott and Small (1998) define the term as “the decline in average cost as more production occurs within a specified geographical area” (p. 1427). Agglomeration economies tend to emerge in specific economic sectors, however. As more firms in a related sector cluster together, costs of production fall as productivity increases. These economies can spill over into complementary sectors (Holmes, 1999). Cities can become ever larger as economies of agglomeration are exploited (Ciccone and Hall, 1996). If cities get too large, however, congestion occurs, which leads to diseconomies of scale. The result may be relocation of firms, but this can weaken overall economies of scale in metropolitan areas (Bogart, 1998). For instance, highways connecting the city to outlying areas can induce firms to relocate from high to lower density areas. While agglomeration economies can arise in less densely developed areas, metropolitan area economic improvement is debatable (Boarnet, 1997). As cities spread out, the advantages of agglomeration economies are weakened.

One way to preserve agglomeration economies and reduce diseconomies is to increase the capacity of transportation systems; this is a role of fixed-guideway transit systems. Cervero et al. (2004) tested this proposition and found that within about 0.25 to 0.50 miles from transit stations, firms maximized the benefits of agglomeration economies. Belzer, Srivastava and Austin (2011) also found that firms in certain economic sectors benefitted from labor force accessibility to transit. In both cases, metropolitan-scale agglomeration economies are improved.

There is another aspect of agglomeration economies identified by Chatman and Noland (2011). Although transit systems can lead to higher-density development by shifting new jobs and population to station areas, the reason could be the redistribution of existing development to areas served by transit. But this will improve metropolitan-scale agglomeration economies as well.

In part because of their role in facilitating agglomeration economies, there is a growing body of research showing that rail-based transit improves metropolitan-scale agglomeration economies thereby enhancing overall economic development (see Nelson et al., 2009). Economic development occurs when rail transit improve the accessibility of people to their destinations (Littman, 2009) by reducing travel time and the risk of failing to arrive on time (Weisbrod and Reno, 2009). Graham (2007) concludes that at the metropolitan scale, adding transit corridors in built-up urban areas increases aggregate economic activity.

With the exception of heavy-rail systems, empirical studies of economic development outcomes to fixed-guideway transit systems are surprisingly few, as will be seen. Of course, economic development can be measured in many ways. One is by evaluating how the real estate market responds to the presence of transportation investments, such as rail stations. Higher values closer to stations imply market capitalization of economic benefits, which can occur only when economic activity increases. Although there is a large body of literature assessing the association between heavy rail transit station proximity and real estate values (see Higgins and Kanaroglou, 2015), the literature is small with respect to LRT systems, smaller still with respect to BRT systems, and non-existent with respect to SCT systems.

Light Rail Transit Property Value Effects

As of this writing, there are perhaps 14 hedonic studies of the association between LRT and property values. The first of this genre was Al-Mosaind, Dueker and Strathman (1993) who found that single-family home values increased 10.6 percent in value if they were within 500 meters of the Portland eastside (MAX) LRT line. Two other studies of the same LRT line were later reported by Chen, Rufflo and Dueker (1998) and Dueker and Bianco (1999). Using continuous distance, Chen, Ruffalo and Dueker found home values increase $32.20 per meter the closer homes are to the nearest LRT station, while Dueker and Bianco found that a home located very near an LRT station will gain about 5 percent of its value if within 400 feet away, only 2 percent over the next 200 feet, and just 1 percent over another 200 feet away from a station. In other words, the closer the home is to an LRT station the higher its value.

Voith (1993) found that home values rise 8 percent when they are within a census tract served by a LRT station in metropolitan Philadelphia. Weinstein and Clower (2002) found that assessed home values rose by 32 percent when within one-quarter mile of a Dallas DART station. Garrett's (2004) study of St. Louis' MetroLink found that home values fall 2.5 percent for every one-tenth mile away from the nearest LRT station. Similarly, Hess and Almeida (2007) found that median home values in Buffalo rise 2.5 percent if they are within 0.25 mile of MetroRail.

Applying similar data and methods to LRT systems in Sacramento, San Jose and San Diego, Landis, Guhathakurta and Zhang (1994) evaluated the association between LRT and single-family residential property values. For Sacramento, they found no statistically significant effect, while for San Jose they found values fall $1.97 per square meter for every meter closer to light rail (though they acknowledge this could be attributable to industrial and commercial uses that are co-located near rail stations). For San Diego, values increase $2.72 per square meter for every meter closer to the San Diego Trolley. Cervero et al. (2004) observe land use change along the San Diego line has been substantially non-existent because of its alignment along freight rail tracks within an industrial corridor (see also Higgins, Mark R. Ferguson and Pavlos S. Kanaroglou, 2014).

Three studies by Cervero and Duncan used similar data and methods to evaluate the association between LRT distance and property values. In their study of San Diego (2002a), they found that the value of multifamily homes rose 10 percent and 17 percent when more than 0.25 mile away from the San Diego Trolley's East Line and South Line, respectively. They surmise that nearby commercial uses created disamenity values perhaps because of the interaction with nearby freight rail service. In their study of San Jose, Cervero and Duncan (2002b) found that single-family homes and apartments rose by 1 to 4 percent if within 0.25 mile of San Jose's VTA LRT stations, but condominiums fell by 6 percent. They offered no explanation for this finding. Again using San Jose as their study area, Cervero and Duncan (2002c) found that commercial properties gained 23 percent in value if within 0.25 mile of an LRT station. The latter work is the first to report on nonresidential property value effects.

Nearly all of these studies assessed the relationship between LRT corridor or station proximity and residential property value, mostly based on 0.25- and 0.50-mile distance bands. Petheram, Nelson, Ewing and Miller refined the distance-band approach to assess value effects in 0.25-mile increments to 1.25 miles and beyond in Salt Lake County, Utah. When structural, neighborhood and location characteristics were controlled for, they found a positive relationship between LRT station proximity and rental apartment building values in each 0.25-mile increment to 1.25 miles but not beyond. In other words, their work challenges the half-mile TOD planning assumption.

However, as in all hedonic studies of the association between transit and property values, cause-and-effect outcomes are not claimed.

Two recent two works estimated the association between LRT station distance and commercial property values. In the first, Ko and Cao (2013) evaluate combined office and industrial property values with respect to distance from the Minneapolis-St. Paul Hiawatha light rail line using a quadratic transformation of continuous distance. Their study area was one mile from light rail stations, and used sales prices. They found that the light rail line confers significant price premiums for office and industrial properties to about 0.9 miles from light rail stations, or just about the full extent of their study area. They do not differentiate with respect to office or industrial properties. Moreover, being just one mile from rail stations, their study area design 179 may actually mask the full spatial effect of light rail stations.

Nelson et al. (2015) evaluated the distance-decay function of office rents in metropolitan Dallas with respect to LRT station distance. Using a quadratic transformation of distance applied to CoStar data, they find that office asking-rent premiums extend nearly two miles away from LRT stations, with half the premium dissipating at about two-thirds of a mile and three-quarters dissipating at nearly one mile.

In review, studies of the relationship between LRT proximity and property values, or rents, have been limited to mostly residential, owner-occupied properties with only one study addressing apartments. Only three studies address office property, none address retail property, and only one partially addresses industrial property.

Bus Rapid Transit Property Value Effects

As of this writing, there are only eight studies associating BRT proximity with property values with only two of those in the U.S. Three studies of the BRT system in Bogotá, Columbia, found that (1) residential rents increased by 6.8 percent to 9.3 percent for every five minutes reduction in walking time to the nearest BRT station (Rodíguez and Targa, 2004); (2) the asking price of properties within 500-meter BRT catchment areas were 7 percent to 14 percent higher than those in control areas (Rodríguez and Mojica, 2009); and (3) some price premium was found with respect to middle-income residential property and distance from the nearest BRT station, but not for low-income residential properties (Munoz-Raskin, 2010).

There are two studies of the BRT system operating in Seoul, South Korea. The first is by Cervero and Kang (2011), who found that within 300 meters of BRT stations residential land values increase from 5 to 10 percent, while non-residential land values increase from 3 percent at 150 meters away to 26 percent within 30 meters (see also Jun, 2012). A study of the Quebec City Métrobus by Dubé, Thériault and Dib (2011) found that proximity to the nearest BRT station increased housing prices from 2.9 percent to 6.9 percent.

Two studies of systems in the U.S. evaluated price premiums with respect to BRT proximity. In their study of the Pittsburgh East Line, Perk and Catalá (2009) found that a single-family residential property 100 feet away from a BRT station realized a premium of $9,745 compared to the same property located 1,000 feet away. The second study (Cervero and Duncan, 2002d) of the Los Angeles Metro Rapid BRT lines (Wilshire-Whittier Boulevards and Ventura Boulevard) a year after they opened in 2000 found that the BRT system conferred a small negative premium on residential property but a positive premium on commercial property. They reasoned that many BRT stops lie within redevelopment districts, which may dampen residential values until redevelopment occurs. Cervero and Duncan cautioned that the absence of dedicated travel lanes, the newness of service and underlying distress may have accounted for lower property value (see also Loukaitou-Sideris and Banerjee, 2000).

In sum, assessments of BRT-related value premiums are limited mostly to residential property and mostly outside the U.S.

Streetcar Transit Property Value Effects

As of this writing, there are no studies into whether and the extent to which SCT systems confer any property value premium.

Commuter Rail Transit Property Value Effects

There are very few studies assessing the relationship between CRT and property values. An extensive review provided by Higgins (2015) indicates negative to weakly positive but mostly insignificant associations with respect to residential properties, and strongly negative to strongly positive associations with respect to commercial properties. All used distance bands for analysis. The number of studies is small, however, and those using hedonic pricing are limited to the San Francisco Bay Area, Los Angeles and San Diego. Nonetheless, existing evidence suggests that CRT stations and corridors on the whole may impose negative property value effects.

Method, Data and Analysis

The number of studies evaluating the association between LRT, BRT, SCT and CRT station and corridor proximity on real estate values is small and even non-existent. No study uses the same data base for more than one system and no study applies the same database to more than one metropolitan area. In effect, all studies are unique to the system and area studied, and the number of those studies is small for many types of fixed guideway transit, and non-existent for certain nonresidential land uses.

This study helps to close many gaps in the literature by estimating the association between asking rents (a proxy for property value) for office, retail and rental apartments, and the presence of different types of transit (LRT, BRT, SCT, CRT) in bands of one-half mile and then one-half to one mile from transit corridors. The study includes: 10 metropolitan counties with LRT systems; 7 metropolitan areas with BRT systems (see also Nelson and Ganning, 2015); 3 SCT systems; and 5 CRT systems.

Hedonic (econometric) analysis can be used to estimate the extent to which benefits of transit accessibility are capitalized by property. Usually, the observed sales price of property, or sometimes the assessed value of property, is used for these studies. Asking rents have also been used as they reflect current market conditions and thus do not suffer from the lag in reporting sales or appraisals. Where available, asking rents may be more efficiently assembled for cross-section analysis than using reported sales or appraisals of property because of differences in the quality of data collected by local officials. Fortunately, CoStar provided cross-section asking rent data for all the metropolitan areas included in this study. Data are collected using standard, industry-driven protocols. CoStar data for the first quarter of 2015 were used by permission. The study thus uses the largest database of its kind assembled to analyze the association between transit accessibility and asking rents. In all, the database is comprised of about 40,000 structures comprising more than three billion square feet of space in the metropolitan counties constituting the study area.

Using literature as a guide, the standard hedonic model used for this study is generalized as:

$$\mathbf{R}_{i} = \mathbf{f}(\mathbf{S}_{i}, \mathbf{SES}_{i}, \mathbf{P}_{i}, \mathbf{U}_{i}, \mathbf{L}_{i,}) \quad (1)$$

where:

R is the asking rent per square foot for property *i*;

S is the set of structural attributes of property *i* including its architecture, mass, height, age and effective age, interior amenities, flow efficiencies and so forth;

SES is the set of socioeconomic characteristics of the vicinity of property *i* such as 278 population features, income, education;

P is a set of planning, zoning and other development restrictions applicable to property *i*;

U is a set of measures of urban form of the vicinity of property *i* such as the nature of surrounding land uses, terrain, physical amenities (such as parks), street characteristics and related; and

L is a set of location attributes of property *i* such as distance to downtown and other activity centers, distance to nearest major highways including freeway/expressway ramps, and distance to different public transit options.

Literature suggests that where these data can be assembled, ordinary least squares hedonic (regression) analysis can explain between about one fifth to three quarters of the variation in the observed rent for the properties. Because of resource constraints, the analysis excludes **SES**, **P** and **U** vectors, thus using only indicators of **S** where reported in CoStar, as well as some categorical measures of **L**. Nonetheless, an important feature of hedonic analysis is that despite missing attributes that could help explain more of the variation in market rents, the coefficients of reported variables used will nonetheless reveal an estimate of the market's willingness to pay for them. The large sample size also improves the robustness of analysis. Nonetheless, future analysis of individual metropolitan areas is anticipated. They will include at least **SES** and **U** vectors. The reduced-form model is comprised of these features:

R is the asking rent per square foot for property *i* reported by CoStar in the first quarter of 2015 for all properties in the metropolitan counties used in the study. By logging it, the semi-log model allows for coefficients to be interpreted as percent changes in rent attributable to dependent factors.

For the pooled metropolitan area analysis, CoStar data are applied to three major types of real estate it reports for all metropolitan counties in the analysis[1]: office, retail and rental apartments. In terms of the **S** (structure) attributes, every property *i* includes those attributes within its class listed in Table 1 with predicted sign of association with respect to rent and why.

L is comprised of three attributes indicating whether property *i* is within one-half mile or one-half to one mile of any of the BRT, LRT and SCT transit corridor centerlines in our study.

Also included are binary variables for each of the metropolitan counties in which the transit systems operate (excluding Valencia County, New Mexico as the referent because it has the smallest population). These helps account for the composite of attributes uniquely associated with those counties such as socioeconomic composition, weather, terrain, region of the country,

[1] Normally, statistical analysis is applied to samples of a universe. In this case, the study includes the universe of all properties reported by CoStar. As CoStar data come from real estate brokerages participating in its network, the data exclude non-participating brokerages or entities and properties not for rent including those that that owner-occupied among others. However, lacking CoStar data for the Tacoma market, its streetcar system is excluded.

underlying economic structure, and so forth. As is customary, the association of direction is not predicted between rent and location within these metropolitan county controls.

The model allows for estimating the association between rents and properties within one-half-mile bands of transit corridors to one mile, as opposed to discrete distance from transit stations. The importance of this distinction will be discussed later.

It is important to note that, as in the case of many studies reviewed above, the model is estimating the association between rents and location within discrete transit distance corridors on a cross-section basis. Moreover, similar to all studies reviewed above, the analysis considers only a snapshot in time (first quarter of 2015) and does not assess before-and-after effects, such as values before transit was installed and then later. Nor does it estimate rents with respect to corridors that are comparable in all other respects except lacking transit. As a standard cross-section analysis, if no positive, statistically significant association is found between rents and transit corridor location the implication is that transit corridor location does not matter but other corridors might. The analysis would not suggest non-transit corridors that have an association, only that transit corridors do not have an association. Conversely, if there is a negative association the implication is that other corridors might confer a positive association but again the study is not designed to identify which of those non-transit corridors have a positive effect, only that a negative association is found with respect to transit corridors.

It is also important to note that future analysis is anticipated that will be applied to individual systems. This future work will: measure continuous distances from parcels to the nearest transit station; include CoStar's submarkets within a given metropolitan area; add socioeconomic controls from the census such as race and median household income at the census tract or block group level; and consider measures of urban form. The current work will inform the design of future research.

Hedonic regression results follow. Interpretations and implications are offered at the end.

Office Rents along Transit Corridors

Table 2 presents regression results for office rents. The correlation coefficients (not reported for brevity) do not show problematic collinearity. Nearly all the structure variables are significant and possess the correct signs. Class A rents are also higher than Class B rents as expected. The GLA variable is not significant though it has the correct sign. As larger buildings tend to be Class A or B, are newer or renovated, and have more stories than smaller ones, it may be that those variables combined effects render the GLA coefficient insignificant. The FAR variable is also not significant. There may not be sufficient variation between cases to have the model detect significant differences from the mean. One reason is probably that zoning codes across the U.S. have an effective cap on FARs given parking and height requirements.

Of primary interest is the association between office rents and location within distance bands of transit modes. Notably, BRT systems do not appear to have a statistically significant association with respect to location in either distance band. LRT systems do not seem to have a statistically significant rent association with respect to location in the closest half-mile band, but have a small, positive association with respect to the next half-mile. Others (see Cervero et al., 2004) have noted that many LRT systems are built along existing freight rail rights-of-ways and have had little effect on development near them. While that may be the case, this analysis finds that LRT has a positive and significant effect on office rents in the next half-mile band. There are strong, positive associations between rents and both distance bands with respect to SCT systems, with the largest effect seen in the first half-mile.

Retail Rents along Transit Corridors

Regression results pertaining to retail rent are reported in Table 3. Nearly all structure variables that are significant have the correct signs. The exception is the binary variable for renovation. On the other hand, the continuous variable for rent with respect to the age of the structure is positive and perhaps quite sensitive to age. Perhaps renovated retail space is not as attractive to the market as newer space, all things considered. Notably, power centers as a class of retail was the only retail category with rents significantly higher than the referent, being regional malls.

Retail results are decidedly different than what was found for office rents. Being within one-half mile of a BRT line reduces rents by 2.5 percent, with no effect across the next half-mile. Remotely accessed perusal of BRT lines in Phoenix, Las Vegas, Eugene, Kansas City and Cleveland indicate BRT stops occur mostly at or near office centers with very little retail accessibility so this may account for weak performance. In contrast to office results, a positive association between retail rent and location within the closest half-mile of LRT corridors is found with a slightly smaller association with respect to the next half-mile. Remotely accessed perusal of several LRT systems show they often have retail activities at or very near stations. Streetcar transit has the largest positive association between rents and location within the closest half-mile but no significant association beyond. As data are limited mostly to three downtowns (Portland, Seattle and Tampa), these results may reflect the decision to locate SCT lines where high-value retail already exists. Consistent with office outcomes as well as with overall expectations, there is a negative association between CRT proximity and retail rents.

Apartment Rents along Transit Corridors

Table 4 presents regression analysis for the association between apartment rents and location within the two half-mile distance bands along fixed-guideway transit corridors. All significant coefficients for the structure variables have the expected signs of direction. Note is made that rents for subsidized (such as HUD Section 8 vouchers) or restricted housing (such as to low-income households) are significantly lower negative but rents for student housing is significantly higher, all as expected (see Table 1).

Of all types of real estate products included in this study, apartment rents responded more consistently with respect to BRT, LRT and SCT systems. Indeed, the closer apartments were to those corridors, the higher the rent. Consistent with expectations, however, proximity to CRT corridors is not associated with any difference in rent. The differences between the three other transit types is also quite interesting with SCT proximity commanding by far the highest rent followed at about half the level by LRT and then BRT with the lowest premiums.

Review and Implications

Table 5 synthesizes the significant coefficients for rent premium by transit mode for office, retail and rental apartment developments. For the most part, SCT has the most important outcomes. This is also notable because, for the most part, economic outcomes to SCT systems are the least understood given their recent emergence. But for the first distance band along LRT corridors, there is a positive association between rents for all development types and proximity to LRT corridors. Results for BRT are mixed, with no statistically significant association with respect to office rent, a negative association with respect to the retail first distance band, but positive effects for rental apartments. However, across all development types, proximity to CRT corridors either has an insignificant association or a negative one. This is not surprising given the freight-corridor nature of CRT systems.

This study may have implications for lands use and transportation planning in general, using urban design to improve real estate capitalization effects of transit, meeting the needs of emerging demand especially for residential development near transit stations, and capturing the value created by transit to increase transit supply.

Land use and transportation planning needs to be informed by how market respond to such investments as fixed guideway transit systems. For the most part, studies on the association between transit investment and real estate rents or values are mixed. Using the same database and the same model applied across multiple metropolitan areas should improve expectations of outcomes to future transit investments. Generally, this study suggests the following:

- Office rents are responsive to SCT systems and less so for LRT systems though in the latter respect the combination of LRT location and urban design can improve outcomes;

- Retail rents are moderately responsive to LRT systems and quite responsive to being very close to SCT corridors; and
- Apartments are especially attractive to all systems except CRT corridors as rents are influenced by, in order from most to least though in all cases positively: SCT, LRT and BRT systems.

The outlier is CRT systems which are uniformly associated with negative rents, if there is an effect at all. Reasons for this are posed next.

Urban design may be used to either offset otherwise adverse effects of transit on land uses, or create new market opportunities. For instance, many light rail systems, especially ones built before about 2000, followed freight corridors and did little to truly connect existing or potential nodes to each other. This study suggests a glaring missed opportunity to design LRT systems to attract office development along many LRT corridors. As older land uses become opportunities for redevelopment (see Nelson 2014), public-private partnerships may be created to overcome inherent adverse interactions between LRT (and other) systems, and real estate development.

A particular opportunity seems to be missed in maximizing the real estate investment potential of CRT systems. For the most part, these systems follow freight corridors and function merely as a kind of transshipment point connecting workers originating in the suburbs to jobs in cities or other activity centers *away from* CRT stations. Land use planning that recognizes redevelopment opportunities along CRT corridors and around CRT stations, combined with thoughtful urban design, could create new economic development opportunities though perhaps mostly for office and office-serving retail trade.

The robust results showing how apartment rents respond to SCT, LRT and BRT system proximity would seem suggest that something is missing in America's residential choice opportunities: the demand for living near these sorts of transit options is large and unmet. Nelson (2013) for instance, calculates that if all homes built between 2010 and 2030 were accessible to fixed guideway transit options, the demand would still no be met. While residential demand for location near SCT and LRT systems may seem intuitive, this study suggests a potential niche for BRT systems. In terms of rent premium, BRT systems are capitalized positively only among apartments. A planning and urban design strategy may be to identify and facilitate apartment development near BRT systems. Retail and office land uses may follow once residential demand is addressed.

There is a concern that expanding fixed guideway transit systems may be more difficult in the future than in the past, mostly because of questionable federal commitment. But much of the cost of expanding those systems can be accomplished through a value-capture arrangement. Conceptually, a portion of the increased property value and sales activity attributable to transit proximity can be apportioned to system expansion and maintenance. Though numerous models and some examples exist, this is an area in need of policy development.[2]

Future work will focus on specific metropolitan areas with their individual systems. These analyses will include local submarket differentiations as well as socioeconomic considerations. It is hoped that by using a common database and method, one can derive reasonably reliable estimates of real estate rents associated with different transit modes for multiple metropolitan areas. This will help clarify planning, urban design, market demand, and value capture opportunities for future transit investments.

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[2] See http://www.cts.umn.edu/Research/Featured/ValueCapture/index.html%7C.

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Table 1
Structure Variables and Predicted Direction of Association with Respect to Rent

Office Structure Variables	Expected Sign
Gross Leasable Area (GLA)—Larger structures confer more amenities	+
Class A—Higher rents relative to Class C space[a]	+
Class B—Higher rents relative to Class C space[a]	+
Vacancy Rate—Percent of GLA that is vacant; higher vacancies reduce values	-
Stories—Number of floors; higher buildings command higher rents	+
Year Built—Newer buildings command higher rents than older ones	+
Renovated—Renovated buildings command higher rents than others	+
Floor Area Ratio (FAR)—Higher FARs imply more efficiencies and higher rents	+
City Center—Structures located in downtowns command higher rents	+

Note:
a Class C space is the referent for type of office space

Retail Structure Variables	Expected Sign
Gross Leasable Area (GLA)—Lower rent per square foot for increasing size	-
Strip Center—Lower rent relative to regional malls[a]	-
Power Center—Higher rents relative to regional malls[a]	+
Neighborhood—Lower rents relative to regional malls[a]	-
Community—Lower rents relative to regional malls[a]	-
Vacancy Rate—Percent of GLA that is vacant; higher vacancies reduce values	-
Stories—Number of floors; higher buildings command higher rents	+
Year Built—Newer buildings command higher rents than older ones	+
Renovated—Renovated buildings command higher rents than others	+
Floor Area Ratio (FAR)—Higher FARs imply more efficiencies and higher rents	+
City Center—Structures located in downtowns command higher rents	+

Note:
a Regional malls is the referent for type of retail space

Retail Structure Variables	Expected Sign
Ave Unit Square Feet—Lower rent per square foot as average size increases	-
High Rise—Higher rent relative to garden apartments[a]	+
Low Rise—Higher rent relative to garden apartments[a]	+
Mid Rise—Higher rent relative to garden apartments[a]	+
Vacancy Rate—Percent of GLA that is vacant; higher vacancies reduce values	-
Stories—Number of floors; higher buildings command higher rents	+
Acres—Total land area; more land generates more amenities and higher rents	+
Subsidized—Higher percentage units subsidized reduces rent[b]	-
Restricted— Higher percentage units restricted reduces rent[c]	-
Senior—Higher percentage units restricted increases rent[d]	-
Student—Higher percentage units restricted increases rent[e]	-
Year Built—Newer buildings command higher rents than older ones	+
Renovated—Renovated buildings command higher rents than others	+

Notes:

a Garden apartments is the referent for type of apartment unit

b Utilizing low and moderate income rent subsidy programs

c Restricted occupancy other than senior and student

d Age-restricted which means smaller units and more rent per square foot

e Student-restricted which means smaller units and more rent per square foot

Table 2
Summary of the Association between Location in <0.5 mile and 0.5 to 1.0 mile Transit Corridors and Office Space Asking-Rents

Variable	Beta	Std. Error	t-score	sig. p
Constant	0.993	0.091	10.969	0.000
Structure Controls				
GLA	-0.000	0.000	-1.081	0.280
Class A	***0.175***	0.004	42.301	0.000
Class B	***0.068***	0.002	28.493	0.000
Vacancy Rate	***-0.001***	0.000	-17.221	0.000
Stories	***0.003***	0.000	5.900	0.000
Year Built	***0.000***	0.000	2.268	0.023
Renovated	***0.008***	0.003	2.401	0.016
FAR	-0.000	0.000	-0.974	0.330
City Center	***0.020***	0.004	4.812	0.000
Regional Controls				
Allegheny	0.103	0.090	1.149	0.250
Arapahoe	0.127	0.090	1.414	0.158
Bernalillo	0.104	0.090	1.152	0.249
Broward	0.172	0.089	1.926	0.054
Clark	0.108	0.089	1.211	0.226
Collin	0.199	0.090	2.217	0.027
Cuyahoga	0.061	0.089	0.679	0.497
Dallas	0.112	0.089	1.249	0.212
Davis	0.067	0.090	0.742	0.458
Denver	0.185	0.090	2.062	0.039
Harris	0.157	0.089	1.754	0.080
Hennepin	0.040	0.089	0.445	0.656
Hillsborough	0.134	0.089	1.501	0.133
Jackson	0.067	0.090	0.749	0.454
King	0.218	0.089	2.432	0.015
Lane	0.125	0.091	1.373	0.170
Maricopa	0.177	0.089	1.980	0.048
Mecklenburg	0.157	0.089	1.759	0.079
Miami-Dade	0.291	0.089	3.249	0.001
Multnomah	0.166	0.090	1.846	0.065
Palm Beach	0.198	0.089	2.210	0.027
Pierce	0.142	0.090	1.586	0.113

Sacramento	0.188	0.089	2.105	0.035
Salt Lake	0.080	0.089	0.898	0.369
San Diego	0.265	0.089	2.969	0.003
Sandoval	0.077	0.093	0.824	0.410
Santa Fe	0.203	0.094	2.163	0.031
Tarrant	0.135	0.089	1.507	0.132
Weber	0.003	0.090	0.029	0.977
Transit Associations				
BRT<0.50	0.006	0.006	1.011	0.312
BRT0.50-1.00	0.004	0.009	0.397	0.691
LRT<0.50	0.005	0.005	1.000	0.317
LRT0.50-1.00	***0.023***	0.007	3.465	0.001
CRT<0.50	***-0.022***	0.006	-3.698	0.000
CRT0.50-1.00	0.007	0.006	1.188	0.235
SCT<0.50	***0.050***	0.011	4.462	0.000
SCT0.50-1.00	***0.039***	0.014	2.714	0.007
Model Performance				
N	15,909			
Adjusted R^2	0.344			
F-Ratio	182.36			
F-Ratio sig.	0.000			

Note: Significance level at p<0.10 of the two-tailed *t* test. Significant associations are highlighted.
Source: Data from CoStar.

Table 3
Association between Location in <0.5 mile and 0.5 to 1.0 mile Transit Corridors and Retail Space Asking-Rents

Variable	**Beta**	**Std. Error**	**t-score**	**sig. p**
(Constant)	-1.150	0.134	-8.605	0.000
Structure Controls				
GLA	***-0.000***	0.000	-1.754	0.079
Strip Center	0.000	0.029	-0.001	1.000
Power Center	***0.162***	0.070	2.302	0.021
Neighborhood	-0.030	0.029	-1.029	0.303
Community	0.030	0.040	0.758	0.449
Vacancy Rate	***-0.000***	0.000	-7.537	0.000
Stories	***0.010***	0.002	4.615	0.000
Year Built	***0.001***	0.000	17.982	0.000
Renovated	***-0.014***	0.007	-2.062	0.039
FAR	-0.003	0.002	-1.374	0.170
City Center	***0.066***	0.007	9.130	0.000
Regional Controls				
Allegheny	0.098	0.063	1.565	0.118
Arapahoe	0.193	0.062	3.087	0.002
Bernalillo	0.147	0.063	2.340	0.019
Broward	0.277	0.061	4.536	0.000
Clark	0.187	0.061	3.069	0.002
Collin	0.235	0.062	3.800	0.000
Cuyahoga	0.069	0.062	1.115	0.265
Dallas	0.127	0.061	2.069	0.039
Davis	0.138	0.063	2.200	0.028
Denver	0.254	0.063	4.034	0.000
Harris	0.176	0.061	2.885	0.004
Hennepin	0.194	0.062	3.146	0.002
Hillsborough	0.164	0.062	2.660	0.008
Jackson	0.058	0.062	0.933	0.351
King	0.291	0.061	4.755	0.000
Lane	0.205	0.067	3.054	0.002
Maricopa	0.150	0.061	2.455	0.014
Mecklenburg	0.213	0.062	3.457	0.001
Miami-Dade	0.400	0.061	6.545	0.000
Multnomah	0.212	0.062	3.403	0.001

Palm Beach	0.301	0.061	4.920	0.000
Pierce	0.222	0.062	3.606	0.000
Sacramento	0.193	0.062	3.125	0.002
Salt Lake	0.154	0.062	2.499	0.012
San Diego	0.332	0.061	5.422	0.000
Sandoval	0.201	0.080	2.524	0.012
Santa Fe	0.306	0.076	4.048	0.000
Tarrant	0.133	0.061	2.173	0.030
Weber	0.089	0.063	1.416	0.157
Transit Associations				
BRT<0.50	***-0.025***	0.009	-2.832	0.005
BRT0.50-1.00	-0.021	0.013	-1.540	0.124
LRT<0.50	***0.025***	0.011	2.382	0.017
LRT0.50-1.00	***0.021***	0.012	1.769	0.077
CRT<0.50	***-0.035***	0.011	-3.101	0.002
CRT0.50-1.00	***-0.023***	0.010	-2.198	0.028
SCT<0.50	***0.063***	0.024	2.658	0.008
SCT0.50-1.00	0.016	0.026	0.624	0.532
Model Performance				
n	12,861			
Adjusted R^2	0.203			
F-Ratio	69.137			
F-Ratio sig.	0.000			

Note: Significance level at $p<0.10$ of the two-tailed *t* test. Significant associations are highlighted.
Source: Data from CoStar.

Table 4
Association between Location in <0.5 mile and 0.5 to 1.0 mile Transit Corridors and Apartment Space Asking-Rents

Variable	Beta	Std. Error	t-score	sig. p
Constant	-1.117	0.072	-15.415	0.000
Structure Controls				
Ave Unit Sq.Ft.	***-0.000***	0.000	-39.455	0.000
High Rise	-0.002	0.016	-0.106	0.915
Low Rise	0.003	0.002	1.187	0.235
Mid Rise	***0.075***	0.004	19.354	0.000
Vacancy Rate	***-0.001***	0.000	-5.845	0.000
Stories	***0.010***	0.001	12.768	0.000
Acres	0.000	0.000	1.525	0.127
Subsidized	***-0.036***	0.004	-9.375	0.000
Restricted	***-0.085***	0.003	-26.926	0.000
Senior	0.003	0.005	0.570	0.569
Student	***0.056***	0.009	6.255	0.000
Year Built	***0.001***	0.000	17.626	0.000
Renovated	-0.007	0.006	-1.317	0.188
Regional Controls				
Allegheny	0.058	0.030	1.890	0.059
Arapahoe	0.139	0.030	4.621	0.000
Bernalillo	0.023	0.030	0.747	0.455
Broward	0.189	0.031	6.167	0.000
Clark	0.024	0.030	0.813	0.416
Collin	0.129	0.030	4.242	0.000
Cuyahoga	0.001	0.030	0.039	0.969
Dallas	0.086	0.030	2.886	0.004
Davis	0.043	0.032	1.366	0.172
Denver	0.188	0.030	6.279	0.000
Harris	0.084	0.030	2.826	0.005
Hennepin	0.123	0.030	4.119	0.000
Hillsborough	0.068	0.030	2.273	0.023
Jackson	-0.030	0.030	-0.988	0.323
King	0.231	0.030	7.739	0.000
Lane	0.049	0.031	1.589	0.112
Maricopa	0.029	0.030	0.976	0.329
Mecklenburg	0.042	0.030	1.392	0.164

Miami-Dade	0.126	0.030	4.135	0.000
Multnomah	0.105	0.030	3.522	0.000
Palm Beach	0.176	0.030	5.875	0.000
Pierce	0.093	0.030	3.122	0.002
Sacramento	0.115	0.030	3.842	0.000
Salt Lake	0.061	0.030	2.025	0.043
San Diego	0.260	0.030	8.647	0.000
Sandoval	0.079	0.053	1.493	0.136
Santa Fe	0.102	0.034	2.972	0.003
Tarrant	0.056	0.030	1.880	0.060
Weber	-0.023	0.032	-0.721	0.471
Transit Associations				
BRT<0.50	***0.030***	0.005	6.125	0.000
BRT0.50-1.00	***0.017***	0.006	2.702	0.007
LRT<0.50	***0.045***	0.005	9.800	0.000
LRT0.50-1.00	***0.025***	0.004	6.248	0.000
CRT<0.50	-0.001	0.008	-0.076	0.940
CRT0.50-1.00	0.009	0.006	1.456	0.145
SCT<0.50	***0.108***	0.009	11.594	0.000
SCT0.50-1.00	***0.090***	0.009	9.524	0.000
Model Performance				
N	12,971			
Adjusted R2	0.510			
F-Ratio	270.982			
F-Ratio sig.	0.000			

Note: Significance level at $p<0.10$ of the two-tailed *t* test. Significant associations are highlighted.
Source: Data from CoStar.

Table 5
Summary of the Association between Location in <0.5 mile and 0.5 to 1.0 mile Transit Corridors and Office, Retail and Apartment Space Asking-Rents

Mode Distance Band	Office	Retail	Apartment
BRT<0.50	ns	-2.5%	3.0%
BRT0.50-1.00	ns	ns	1.7%
LRT<0.50	ns	2.5%	4.5%
LRT0.50-1.00	2.3%	2.1%	2.5%
CRT<0.50	-2.2%	-3.5%	ns
CRT0.50-1.00	ns	-2.3%	ns
SCT<0.50	5.0%	6.3%	10.8%
SCT0.50-1.00	3.9%	ns	9.0%

ns means not significant