Effect of Metrolink Light Rail Stations on Residential Property Values in St. Louis County, Missouri, USA

Tenholder, N.,[1] Hung, M. C.[2*] and Wu, Y. H.[3]
[1]Spire, 5024 Kain Drive, St. Louis, MO 63119, USA
[2]Geography/Geographic Information Science, Northwest Missouri State University, Garrett-Strong Science Building 1333, 800 University Drive, Maryville, MO 64468, USA, E-mail: mhung@nwmissouri.edu
[3]Department of Humanities and Social Sciences, Northwest Missouri State University, Garrett-Strong Science Building 1227, 800 University Drive, Maryville, MO 64468, USA, E-mail: ywu@nwmissouri.edu
** Corresponding author*

Abstract
This study investigated how light rail stations in St. Louis County impact the property values (especially single-family owner-occupied properties) for residences located nearby using publically accessible data. The preliminary finding indicated that a premium is present for properties located near transportation facilities; however, the effect is inconsistent for light rail in other cities. Assessment data was analyzed to determine if single-family properties located in the station area have higher property values compared to a control area. Station and control areas were designated at 365 meters (1,200 feet) and between 548 and 853 meters (1,800 and 2,800 feet), respectively. Regression modeling was used to measure differences in assessed values between the station and control areas while controlling for house size. Of the nine station areas with sufficient data, five showed positive effects from being located within 365 meters (1,200 feet) of a station. Premiums ranged from 4.1% to 7.1%. The remaining four station areas showed no effect. Additionally, analysis of sales values indicated that properties in the station areas are valued higher than is indicated by the assessed value.

1. Introduction

MetroLink, the St. Louis light rail system, began service in 1993 by connecting Lambert International Airport to downtown and later to Scott Air Force Base in Illinois (the original blue line). In 2006, a new section of MetroLink (red line), the Cross-County Extension, opened. The extension added several important employment centers in parts of central and south St. Louis County to the existing transit system. To date, MetroLink runs a total of 46 miles with 37 stations, and carries an average of over 41,000 riders each day (Metro, 2011).

A better understanding of how light rail affects surrounding property values can be used to build support for expansion. Expanded mass transit promotes numerous goals, including decreased carbon emissions, less traffic congestion, regional integration, social interaction, more efficient urban development patterns and access to jobs, especially for low-income workers. Building new rail facilities, especially in already developed areas, is typically a contentious issue. Some property owners prefer to be located near new transit while others fear a loss of property values. In addition, properties located near stations could be taxed on a portion of the premium they receive from construction of the station. This revenue could be used to help finance construction.

Previous studies had considered only time savings as the source of the demand for proximity to mass transit (Lewis-Workman and Brod, 1997, Ryan, 1999 and Hess and Almeida, 2007). For most commuters living on the Missouri side of the St. Louis region, riding MetroLink results in little to no time savings. Most destinations which can be accessed by rail can be accessed more quickly by car; because traffic congestion to downtown is light due to the lower percentage of jobs located downtown, less than 10% of the metropolitan workforce (Bogart, 2006). However, cost savings can be equally powerful. Cost savings will become more important as gas prices rise over the long term, especially for commuters who pay for parking, or if owning an automobile becomes unnecessary. Taking only vehicle operating costs into consideration, the break-even point for using rail versus driving (any additional driving distance costs more than MetroLink) is 15 miles round trip if driving an SUV and 23 miles if driving a typical small sedan (Gallagher, 2012).

There is an extensive body of literature (Bajic, 1983, Vessali, 1996, Lewis-Workman and Brod, 1997, Chen et al., 1998, Weinstein and Clower, 2002, Garrett, 2004, Hess and Almeida 2007 and Jackson, 2010) which demonstrates a connection between housing markets and transportation infrastructure. Generally, housing areas which require less travel to employment centers are more expensive. The amount of the premium paid for desirable location is dependent on the mode of transportation and varies between metropolitan areas. Unlike other rail transit systems built through newly developed suburban areas (such as the western Blue Line of Portland, Oregon's MAX), the Missouri portion of MetroLink was built through already fully developed portions of the St. Louis area. Because the areas located near the rail stations were not designed with transit in mind, they do not take full advantage of their proximity to rail transit. There is a single study examining the St. Louis MetroLink system (Garrett, 2004). Eight different models were used to investigate both nuisance effects of being near a MetroLink track and distance to station. The study area was confined to single-family houses in St. Louis County along the older Red Line. The evidence that there is a nuisance effect was very weak, with six of the eight models showing no negative effect from being near a rail track. The distance to a station was found to have a positive effect of up to 30% for houses located within 450 meters (1,500 feet) of a station.

The research question is, do residential properties located near MetroLink stations in St. Louis County have higher values? The literature on such effect shows that each system is unique. In order to determine if any effect exists in St. Louis, it needs to be studied individually. Also, major changes in the housing market had occurred, and continue to occur, since Garrett's study in 2004. Region wide, residential properties averaged 3.5% appreciation between 1990 and 2010. Between 2008 and 2010, there was an average of 8% depreciation (Gallagher, 2011). This study expanded the study by Garrett (2004) and study the new extension into central and south St. Louis County.

Limited to resources (funds and labor), this research intended to be a preliminary study to explore the effect of rail on property values and promote public awareness of such effect in St. Louis metropolitan area, MO. This study focused on single-family, owner-occupied properties. The data for this research was collected from Internet, i.e. publically accessible data. Previous studies (Chin and Foong, 2006, Mathur, 2008, Kim et al., 2011, Seo and Rabenau, 2011, Albert et al., 2011 and Fauria and Mathur, 2012) indicated in addition to property characteristics, locational amenities and neighborhood characteristics are also factors affecting property values. Unfortunately, such data (locational amenities and neighborhood characteristics) is not available to everyone. It was therefore decided to focus on property characteristics. Additionally, the station areas and control areas are constructed so that neighborhood characteristics remain similar. Single-family properties are preferred by many owners and renters. There are more transactions for such type of property than other types of property in the current market (Austin Board of Realtors, 2013, Cook, 2013 and Dunn, 2013). Owner-occupied properties are better taken care of than rented properties, which in turn makes the house values consistent between house owners. Previous studies (Knight and Trygg, 1977, Guiliano, 1989, Landis, 1995, Chen et al., 1998 and Ryan, 1999) reported inconsistent premiums in different metropolitan areas, as well as between stations within the same metropolitan area. There were many different types of properties included in those studies, which may cause averaging or canceling-out effects and therefore affect their final findings. Focusing only on a certain type of properties enabled us to remove such unplanned effects and explore the real effect of rail stations.

2. Background

Previous studies suggested that property values could be affected by many environmental settings, such as playground (Albert et al., 2011), school (Chin and Foong, 2006 and Mathur, 2008), business (Mathur, 2008 and Fauria and Mathur, 2012), type of property (Kim et al., 2011), crime and overall life quality (Mathur, 2008), microneighborhood (Seo and Rabenau, 2011), and transportation (Knight and Trygg, 1977, Bajic, 1983, Vessali, 1996, Lewis-Workman and Brod, 1997, Chen et al., 1998, Cervero and Susantono, 1999, Gihring, 2001, Bowes and Ihlanfeldt, 2001, Weinstein and Clower, 2002, Garrett, 2004, Hess and Almeida, 2007, Jackson, 2010 and Duarte and Ultramari, 2012). In terms of transportation, many studies had found positive effects on the value of residential properties located near rail facilities. However, the effect differs with each station, and each system is unique and creates different positive and negative externalities which affect surrounding properties.

Ryan (1999) summarized several explanations for the inconsistent results in the literature. Some had proposed that other land market factors, such as zoning requirements and economic growth, have a stronger effect on local land values which dwarfs any transportation effects (Knight and Trygg, 1977). Another explanation (Giuliano, 1989) for inconsistent results is that early studies, usually looking at the effects of interstate highways, showed strong positive effects while later studies showed small or no effects. This is because travel time savings were large at first, and later transportation improvements resulted in diminishing returns; there was little value placed on small time savings (Ryan, 1999). Landis (1995) claimed that when a new facility is placed in an area, the property values will initially rise, but over time that facility becomes part of the normal, expected infrastructure. As property values adjust over time, variances in properties are harder to discern. Another possible explanation for inconsistent results is that not all studies have separated the positive effects from being near a station (increased accessibility) and the negative effects from being near a rail line (noise, lack of view). Chen et al., (1998) concluded that there are two separate effects in the Portland MAX system. The positive accessibility effect outweighed the negative effect, and this can explain why some studies have underestimated the positive effects in some light rail systems.

Nearly all of the previous studies measuring price effects of light rail stations used hedonic price modeling. Using this methodology, straight-line distance from the parcel to the station is analyzed along with a multitude of other independent variables possibly affecting property values. These variables include housing factors (such as size of house, size of parcel, number of bedrooms and bathrooms, pool) and neighborhood factors (such as crime rate, prestige, distance to employment centers) to derive the expected sale value of each property. The difference between the expected and the actual sales value is the "leftover" portion which is explained by proximity to the station. Most studies had found a gradual drop in premium as properties move farther away from the station and calculated the premium for each foot closer to the station.

Among nine similar studies reviewed, five (Al-Mosaind et al., 1993, Lewis-Workman and Brod, 1997, Garrett, 2004, Weinstein and Clower, 2002 and Hess and Almeida 2007) demonstrated clear positive effects within a small (500-700 meters or 1,650 – 2,300 feet) radius of the station. Seven studies (Al-Mosaind et al., 1993, Landis, 1995, Lewis-Workman and Brod, 1997, Chen et al., 1998, Weinstein and Clower, 2002, Garrett, 2004 and Hess and Almeida 2007) used straight-line distance to the station. Three studies (Al-Mosaind et al., 1993, Landis, 1995 and Ryan, 1997) found a positive correlation between closeness to light rail stations and property values. The effect was generally within 500 meters (1,640 feet) straight-line distance. Positive effects had been found even in smaller metropolitan regions (Garrett, 2004 and Hess and Almeida 2007) with slow or negative growth and lower ridership numbers. Increases in property values had ranged from 2% - 5% in Buffalo, NY (Hess and Almeida 2007), 10.6% in Portland, OR (Lewis-Workman and Brod, 1997), and 12.6% in Dallas, TX (Weinstein and Clower, 2002).

If proximity to light rail stations increases property values, the announcement of construction should lead to speculation and price increases as developers seek opportunities to build and homeowners anticipate future benefits. Gatzlaff and Smith (1993) found little to no impact on house prices from a proposal to build light rail in Miami. They also find that each rail system and city is unique. "However, it does appear that transit is most successful when placed in dense corridors and coordinated with other land use policies" (Gatzlaff and Smith, 1993). This has not yet been done with the St. Louis MetroLink. The Missouri portion of the system is located entirely in already developed, mature areas. Future changes in land use could lead to increased property values near stations. It remains to be seen if any property value increase occurs in the short-term, or if it must be combined with long-term land use changes.

3. Study Area and Data

Approximately 2.5 million people live in the greater St. Louis metropolitan area (United States Census Bureau, 2012). The Missouri portion of the metropolitan area includes: St. Louis City, St. Louis County, Jefferson County, and St. Charles County. Like many other Midwestern metropolitan areas, it continues in the processes of transition from a manufacturing based economy and suburban expansion over the last several decades.

MetroLink starts from the east at Scott Air Force Base in Illinois, through the Illinois portion of the St. Louis metro, across the Mississippi River underneath the Eads Bridge, through downtown, to midtown and the Washington University/BJC medical complex and into Forest Park. At that point the line splits with the Red Line heading north to the University of Missouri St. Louis and ending at the airport. The Blue Line goes from Forest Park heading west through the Washington University area to Clayton (the county seat and dense office center), then heads south and goes several miles into inner suburbs and ends at Shrewsbury near the St. Louis City limits.

This study considered only MetroLink stations within the St. Louis County (see Figure 1). This includes the majority of the population of the Metro service area. According to the 2010 Census, the county population is 998,984, median home value is $175,000 and median household income is $56,939 (United States Census Bureau, 2012).

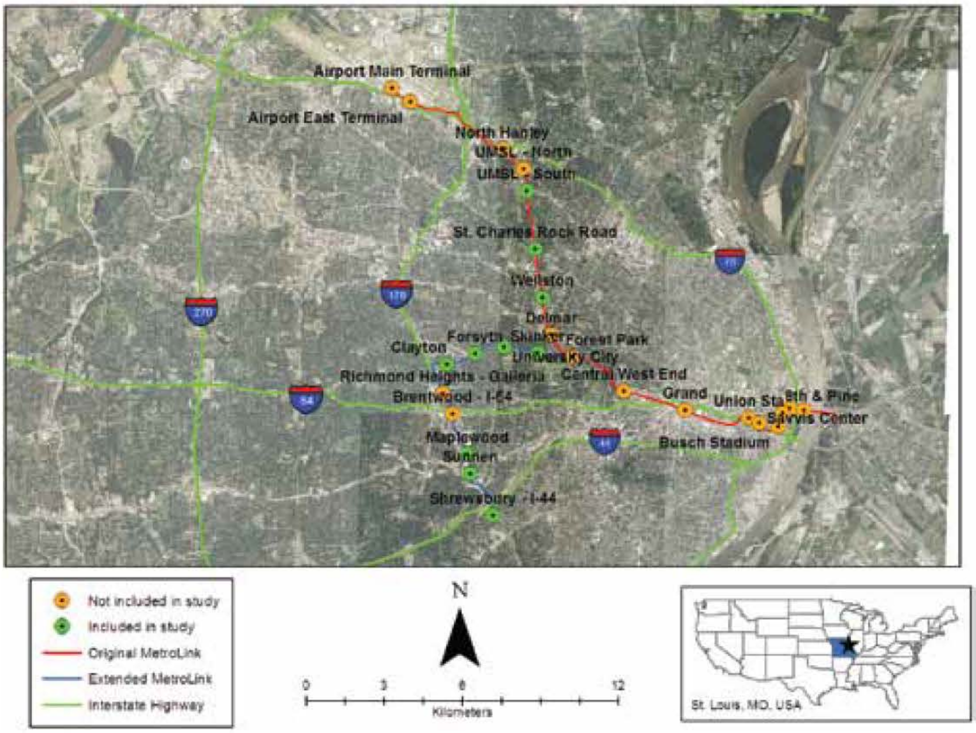

Figure 1: Study area and MetroLink rail system. Only Missouri side (west of Mississippi River) is shown in this figure

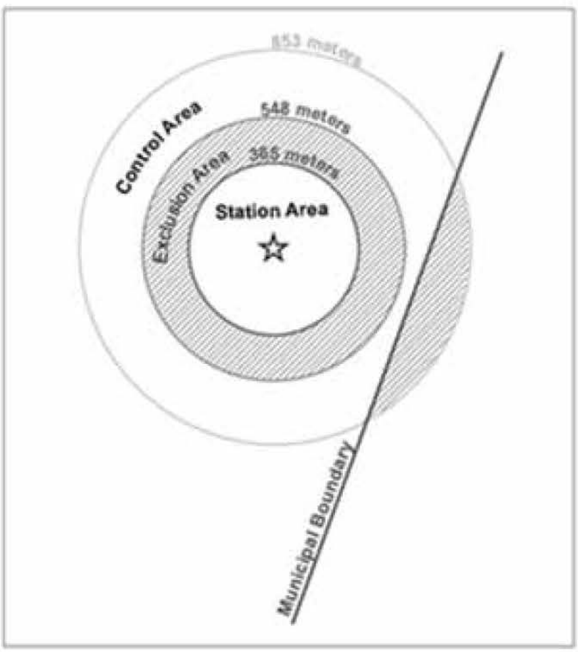

Figure 2: Station and control areas

Several stations were excluded from this study because of lack of single family residential properties, or the inability to allow the configuration of a station and control area in the same municipality, as illustrated in Figure 2.

There were 10 stations meet the criteria within the study area. Two of the stations (Forsyth and St. Charles Rock Road) were split into subareas based on municipality. This created a total of 12 station areas (see Table 1).

Table 1: Station areas to be studied

Station Area	Municipality	# Single-Family, Owner-Occupied Parcels in Station Area
Shrewsbury	Shrewsbury	74
Sunnen	Maplewood	59
Maplewood	Maplewood	61
Clayton	Clayton	97
Forsyth (Clayton Subarea)	Clayton	23
Forsyth (University City Subarea)	University City	106
University City	University City	250
Skinker	University City	31
Wellston	Wellston	36
St. Charles Rock Road (Wellston Subarea)	Wellston	8
St. Charles Rock Road (Pagedale Subarea)	Pagedale	41
UMSL - South	Normandy	16

Parcel data including assessment values was obtained from the St. Louis County Department of Planning. Assessment values are as of January 1, 2011. Assessment data includes a shapefile of all 300,000+ parcels in the county. The coordinate system is State Plane Missouri East NAD 1983. Locations of rail stations, also included in basemap data provided by the Department of Planning, were confirmed by visual inspection of aerial imagery. Relevant attributes include: assessed value, land use, owner-occupied, square footage of residential space, and municipality. Assessed value was determined by the county assessor and was intended to be equal to the true market value of the property. Assessed values were derived from a proprietary statistical procedure which uses recent sales of comparable properties to interpolate a value for each parcel. Sales value was the actual price which a property is sold for. This is considered the true measure of actual property value. In this study, assessed value is the primary means of comparison.

4. Geostatistical Analysis of Properly Values

This study compared assessed values in the station area to a control area. Only single-family residences were considered. There were too many variables not included in the data to directly compare commercial and industrial properties. The size of house is controlled for. The station area consisted of all single-family, owner-occupied, residential properties located within 365 meters (1,200 feet) of the station. The control area (see Figure 2) included all single-family, owner-occupied, residential properties located between 548 and 853 meters (1,800 and 2,800 feet) from the station. Two station areas (Forsyth and St. Charles Rock Road) fall within two different municipalities. These station areas were split into subareas.

Previous studies (Lewis-Workman and Brod, 1997, Weinstein and Clower, 2002, Garrett, 2004 and Hess and Almeida, 2007) had shown that positive effects are restricted to 400 meters (1,312 feet) around a station. Garrett (2004) found positive effects up to 445 meters (1,460 feet) away in St. Louis. A 365 meter (1,200 feet) radius ensured that if the effect covers a smaller area, it will not be missed because it is diluted by properties too far away. The control area was small enough to ensure that the properties are comparable, but far enough away to avoid any positive effect from the station. The hedonic price modeling methodology used in previous studies (Al-Mosaind et al., 1993, Bowes and Ihlanfeldt, 2001, Hess and Almeida, 2007 and Ryan, 1999) takes into account housing variables and neighborhood variables to determine what the value should be. As a preliminary study using publically accessible data, neighborhood characteristics were simplified to be consistent for station area and control area. In addition, only square footage was selected as the housing characteristic. Regression analysis was performed for each station area and control area as expressed in equation (1). The Ordinary Least Squares tool from ArcToolbox in ArcMap version 9.3 was used for the calculations.

$$D = a*E+b$$

Equation 1

where D is the dependent variable (expected assessed value), E is the explanatory variable (square footage of the residence), a is the coefficient for the explanatory variable representing the additional assessed value gained from each additional square foot, and b is the constant.

For the stations located in the municipality of Wellston (Wellston and St. Charles Rock Road Wellston subarea), the ages of the residences are bifurcated in a way different from the other stations. Most of the houses in Wellston were constructed in the 1910's and 1920's and have an average value of $22,145. By contrast, 21% were built since 1999 and have an average value of $51,164. This is a distressed neighborhood with a high rate of vacancy. In Wellston, 37% of all parcels are vacant, compared to the county rate of 5.6%. In order to increase the accuracy of the model, age was added as a second explanatory variable for these two stations. A new binary field was created; any property built since 1999 was given a value of 1 and 0 otherwise. Thus, the regression equation used for the Wellston and St. Charles Rock Road Wellston subarea stations is shown in equation (2):

$$D = a*E+a_2*E_2+b$$

Equation 2

where E_2 is the second explanatory variable with 0 meaning the house was built before 1999 and 1 meaning the house was built in 1999 or later, and a_2 is the coefficient for the second explanatory variable representing additional assessed value gained by being constructed since 1999. The coefficients and constants for each station and control area are listed in Table 2. An example of results from the regression analysis is shown for Skinker Station in Figure 3. Running equation (1) on all single family, owner-occupied properties in the municipalities included in the study (29,383 total observations) resulted in an r2 of .782. This indicated that assessed value is adequately explained by using square footage as the only independent variable.

5. Calculation of Premium

Using regression allows for analysis of the spatial distribution of properties which have assessed values that are higher or lower than expected. The deviation (residual), as expressed in equation (3), between the expected assessed value and the assessed value is assumed to result from the effect of location on property values. The equation for determining the premium for proximity to the light rail station is shown in equation (4). Expected assessed value is calculated by Ordinary Least Squares tool for each parcel according to equation (1) or (2). Expected assessed value is what the assessed value should be according to the line of best fit if the regression equation perfectly explained the assessed value.

Residual = Assessed Value - Expected Assessed Value

Equation 3

Premium = Avg. Residual of Station Area – Avg. Residual of Control Area

Equation 4

Table 2: Regression results

Station	r^2	a	a_2	b	# observations
Shrewsbury	0.786	81.98		59635	518
Sunnen	0.637	59.42		65858	292
Maplewood	0.694	77.49		37620	447
Clayton	0.805	206.31		18381	584
Forsyth (Clayton subarea)	0.845	267.64		123595	314
Forsyth (University City subarea)	0.792	173.58		11144	714
University City	0.727	145.01		39142	999
Skinker	0.617	80.61		195796	235
Wellston	0.862	13.67	47387	53187	143
St. Charles Rock Road (Wellston subarea)	0.867	47.07	59885	41561	39
St. Charles Rock Road (Pagedale subarea)	0.229	22.98		26879	241
UMSL - South	0.539	31.9		37086	177

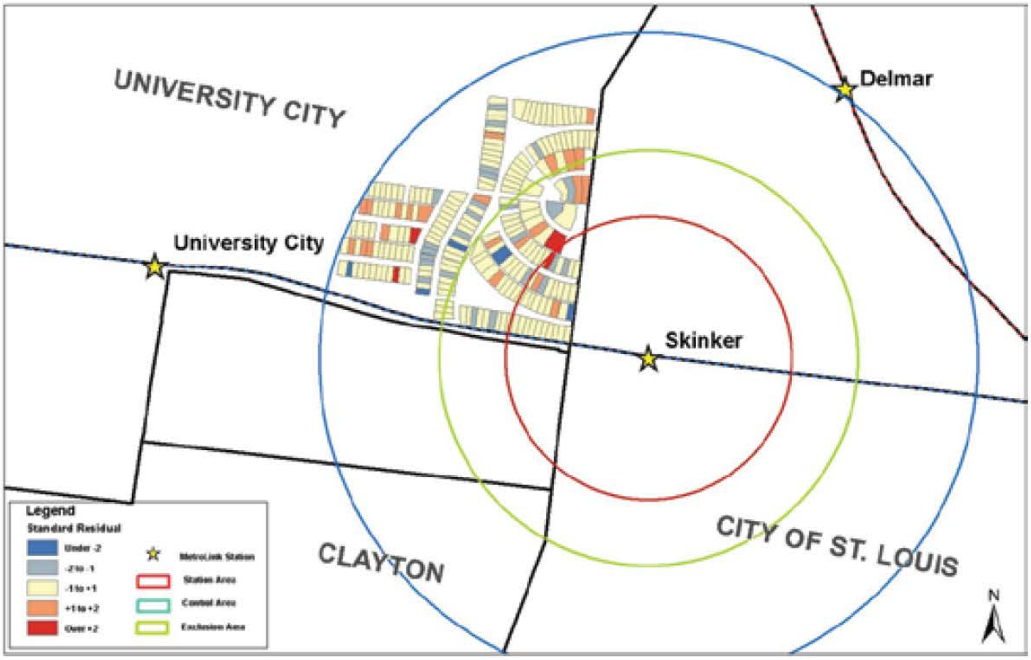

Figure 3: Results of regression on station and control area

Table 3: Comparison of station and control areas residual and premium

Station	Station Area Assessed	Expected	Residual	Control Area Assessed	Expected	Residual	Premium (%)
Shrewsbury	170688	171456	-762	168517	168745	-228	-0.3
Sunnen	145494	141363	4941	149014	150794	-1780	4.5
Maplewood	123921	116610	7311	121925	123347	-1422	7.1
Clayton	559262	549698	9564	444369	458891	-14522	5.0
Forsyth (Clayton subarea)	-	-	n/a	-	-	n/a	n/a
Forsyth (University City subarea)	431609	430778	831	403194	403626	-432	0.3
University City	430873	420017	10859	404945	417265	-12320	5.5
Skinker	447948	446174	1774	411005	409235	1770	0
Wellston	34558	34365	193	26881	26542	339	-0.4
St. Charles Rock (Wellston subarea)	-	-	n/a	-	-	n/a	n/a
St. Charles Rock (Pagedale subarea)	52431	51393	1038	47396	48421	-1025	4.1
UMSL - South	-	-	n/a	-	-	n/a	n/a

Analysis of the spatial distribution of residuals ensured that there is no overriding spatial pattern in the wider area which affects the station and control areas. For instance, if an interstate highway cuts through the control area but not the station area, properties near the highway will likely have lower assessed values, but this is not a result of the proximity to the station.

Assessed value and expected assessed value for each station and control area is shown in Table 3. The average residual in the station and control areas is shown, and the percentage difference between the station and control areas is calculated. The use of regression allows for the differing effects of house size in each neighborhood to be taken into account.

Three of the station areas (Forsyth Clayton subarea, St. Charles Rock Road Wellston subarea, and UMSL – South) had an insufficient number of residential parcels in the station area (23, 8, and 16 respectively) and were not included in the regression results. Of the nine station areas included in the premium calculation, five (Sunnen, Maplewood, Clayton, University City, St. Charles Rock Road Pagedale subarea) showed positive results. The remaining four (Shrewsbury, Skinker, Wellston, and Forsyth University City subarea) deviated from the control area by less than one percent positive or negative. The difference between the station area residual and the control area residual (shown in the right column of Table 3) is the premium which a property receives from being located near the rail station. The positive results averaged a 5.2% premium for properties in the station area as compared to the control area. This is consistent with the literature. Generally, premiums have been in the range of 5-10% and inconsistent across different stations.

Table 4: Features of walkability for stations

Category	Features
Walkable	• All streets have sidewalks • The travel path consists of public right-of-way • The travel path is direct, and nearly a straight line • Sidewalks are in good, even condition, without major cracks • Pedestrian crossings are provided where necessary and are well marked • If a major street is crossed, pedestrian signals and crosswalks are provided • The entire route is accessible for those with disabilities, according to ADA criteria • Buildings are located close to the sidewalk • There are few large, open areas, such as parking lots along the route • Buildings along the route are scaled appropriately and contain detail (no long, blank walls) • Landscaping and curbs are used to create an obvious walking path between the street and the station platform • There is enough street activity to provide a sense of security • Street trees provide shade and protection from wind and rain • The street can be safely used by automobiles, bicycles, and pedestrians
Somewhat walkable	• Some streets have sidewalks • Some "short-cuts" may be necessary across private properties • The travel path is not direct as not all streets connect on a grid pattern • All major streets can be crossed safely • Many buildings are set back farther from the street • The pedestrian path between the street and station platform is not well marked • Some streets have heavy traffic or vehicles traveling at high speed • Streets can be used by bicycles, but no separate or wide lane provided • Streets may have few pedestrians and inconsistent lighting at night
Not walkable	• Most streets do not have sidewalks • The travel path is very indirect • Many streets do not interconnect (cul-de-sacs) • There are frequent large, open areas along the route • The entrance to the station is designed for automobiles only • Streets may have heavy traffic or cars traveling at high speed • The travel lanes of the street cannot be safely used by cyclists • Some "short-cuts" are required across private property, fences, or retaining walls • There may be vacant or dilapidated buildings along the route

6. Station Variables

Previous studies had found a positive effect from some light rail stations but not others (Vessali, 1996 and Ryan, 1999). In order to determine what factors cause a station to have a positive effect, each station under study was categorized. These categorizations are for descriptive purposes only. They are intended to provide qualitative information about each station, not quantitative analysis. The categories include: destination, parking, and neighborhood walkability.

Some stations are located at major destinations, such as a university. These stations may have less positive effect on residential properties since fewer riders start a trip from that point. Stations with park-and-ride lots may have smaller effects on nearby properties because it is easier for riders to drive to that station, therefore proximity is less important. The neighborhoods surrounding MetroLink stations were originally built decades before the light rail system was constructed. Because of this, the station areas were not designed to integrate with MetroLink. Each station area was examined to assess how high-density and walkable the residential properties are. This is a subjective analysis which takes into account factors such as: presence and condition of sidewalks, how direct the route is, major street crossings, disability access, landscaping, and visual design of the street. Examining stations differently, rather than considering them all the same, may uncover new insights not included in previous studies. Detailed criteria for assessing walkability are listed in Table 4. Each station area was categorized as walkable, somewhat walkable, or not walkable. To meet the criteria for each category, an area will have most of the features.

Based on the regression analysis described above, the data did not demonstrate any relationship between parking, destinations, or walkability and the presence of premiums. There were not enough stations included in this study to determine if any of the station variables, or some combination of them, have an effect on the premium of residential properties located near rail stations. Table 5 shows the categorization of each station area and the correlated premium. It is possible that station areas rated as not walkable have a lower premium than station areas which are walkable or somewhat walkable. These eight stations rated as walkable or somewhat walkable have an average premium of 3.1%, compared to the one rated as not walkable which has a premium of -0.3%. Considering the number and type of parking spaces could provide more information. The UMSL-South station has relatively few surface parking spaces, and the Clayton station has a multi-story parking garage. This could have a different impact from the large surface parking lots at the Shrewsbury, Wellston, and St. Charles Rock Road stations.

Table 5: Effect of station variables on premiums

Station	Parking	Destination	Walkabillity	% Premium
Shrewsbury	Yes	No	No	-0.3
Sunnen	No	No	Yes	4.5
Maplewood	No	No	Somewhat	7.1
Clayton	Yes	No	Somewhat	5
Forsyth (Clayton subarea)	No	No	Yes	n/a
Forsyth (University City subarea)	No	No	Somewhat	0.3
University City	No	Yes	Yes	5.5
Skinker	No	Yes	Yes	0
Wellston	Yes	No	Somewhat	-0.4
St. Charles Rock Road (Wellston subarea)	Yes	No	No	n/a
St. Charles Rock Road (Pagedale subarea)	Yes	No	Somewhat	3.3
UMSL - South	Yes	Yes	No	n/a

7. Sales Value

The major data obstacle in this methodology is the accuracy of assessed value in determining actual property value. Assessed values were determined from a mass appraisal process where the specifics and intangible qualities of each house were not considered. However, using a large dataset should offset any individual inaccuracies (Weinstein and Clower, 2002). To ensure that variances in assessed values average out, values of recent sales (2010-2011) were compared to the property's assessed value. This was done in the station and control areas to determine if assessed value deviates from actual property value.

It is possible that there is a difference in sales values between the station and control areas that is not reflected in the assessed values. If so, assessed value will not differ between the station and control area, but the sales values will. Using two different data sources to measure value differences provides increased confidence in the research findings. Sales values should act as a validation of the assessment data. If no effect is found using assessment data, the sales data will help to determine if there is no premium, or if the premium exists but is not reflected in the assessed value. Sales value data came from St. Louis County Assessor's Office via the interactive GIS property viewer (http://maps.stlouisco.com/propertyview).

The variation between the assessed value and the sales value was calculated as a percentage of the assessed value, as expressed equation (5). The average of sales in each station and control area was then calculated to determine how over or under valued that area is according to assessment values. Only station or control areas with at least three sales transactions in the time period were included. A total of 131 sales transactions were included. The average variation is only -0.43%; the assessed value among all sales deviates from the actual sales price by less than one percent. This means that overall, assessed value is an accurate measurement of actual property value. However, Table 6 demonstrates that the variation between assessed value and sales value are not uniform across the station and control areas. In Table 6, positive numbers in variance indicate that assessed value is higher than sales value (in other words, assessed value is overestimated compared to sales value), while negative numbers indicate otherwise. Positive numbers in difference indicate that properties in control area are estimated higher than station area, comparing to sales value.

$$\text{Variation} = 100 * ((\text{assessed value} - \text{sales value}) / \text{assessed value})$$

Equation 5

With the exception of the University City station, all the station areas where data was available showed they were undervalued compared to the control areas. The difference ranged from 2.2% to 16.7% with an average of 7.7%. This indicates that properties in the station area are worth more (compared to the control area) than is accounted for in the assessment data. This could be because the mass appraisal model does not take into consideration proximity to light rail stations. There were an insufficient number of arms-length sales in the time period to determine variation between assessment and sales values for Wellston, St. Charles Rock Road, and UMSL – South.

Table 6: Difference between sales value and assessed value

Station	Station Avg. Variance (%)	Control Avg. Variance (%)	Difference
Shrewsbury	-3.0	+3.9	+6.9%
Sunnen	+8.0	+14.5	+6.5%
Maplewood	+1.1	+10.3	+9.2%
Clayton	-2.7	-0.5	+2.2%
Forsyth (Clayton subarea)	-5.7	+0.4	+6.1%
Forsyth (University City subarea)	-12.6	-6.6	+6%
University City	+2.8	-3.4	-6.2%
Skinker	-10.8	+5.9	+16.7%
Wellston	n/a	n/a	n/a
St. Charles Rock Road (Wellston subarea)	n/a	n/a	n/a
St. Charles Rock Road (Pagedale subarea)	-3.9	n/a	n/a
UMSL - South	n/a	+33.9	n/a

8. Discussion

There are no discernible correlations between parking, destination stations, or walkability and assessed value increases (Table 5), to our surprise. However, it was found that the premium is inconsistent across different stations. This analysis was hindered by the small number of stations (only 12 which are statistically unreliable in terms of sample size) in the study area. We believe a larger sample of stations may provide different results and show relationship between these station characteristics and property values. Further research can focus on the effects of station characteristics in this study area or across various metropolitan areas with similar rail transportation system. A better understanding of what factors lead to property value premiums will lead to better designed transit systems and neighborhoods.

Based on the results of this study, models used to calculate assessed values for residential properties should be re-examined to ensure that all relevant variables are included. While not all of the variables used to develop the assessment data in this study are known, it appears that single-family, owner-occupied houses located near light rail stations are systematically undervalued, compared to actual sales data. Limited to available sales data within the study area and duration (131 transactions between 2010 and 2011 for these 12 stations), this study did not use sales data to assess the increased house values. A major shortcoming of doing so is the disagreement between the assessed values and actual market values. Further research can collect a larger sample of sales data and use sales data to analyze the premium.

This study examined only one type of properties, single-family, owner-occupied properties. Other types of property may be affected by the distance to rail stations differently due to different groups of people within the demographic structure (renting vs. owning, families vs. singles, younger vs. older generations, etc.). Additional research can focus on various property types, such as duplexes, townhouses, condominiums, apartment buildings, rented properties, etc. It is worth the effort to examine different types of properties individually or collectively (Kim et al., 2011). In this study, only two categories of distance were used, station area (within 365 meters, or 1200 feet) and control station (between 548 and 853 meters, or 1800 and 2800 feet). Such simplification and generalization is likely to overlook small details on the effect of distance to rail stations. Further research can focus on using greater details on distance categories (or no categories at all, just Euclidean distance or walking distance to rail stations) to examine the effect of distance to rail stations. The results of this research apply only to light rail systems common in Midwestern, auto-dependent metropolitan areas. The heavy commuter rail and subway systems common in high-density, transit-oriented, coastal cities have greater speeds and generally allow access to a higher proportion of the urban core. Therefore, the premiums for residences located near stations in this study are not relevant to other types of rail systems.

9. Conclusion

Using publically accessible data, this study examined the effect of rail systems on the value of a certain type of property (single-family, owner-occupied properties). The preliminary findings suggest that a premium exists for single-family owner-occupied residential properties located near MetroLink stations in St. Louis County, MO. This premium is not consistent across all stations. Given that stations are located in a variety of environments, this is not surprising. This inconsistency of premium across stations is in agreement with findings from many previous studies. Further, there are different types of properties. Many of previous studies did not distinguish these different types of properties. To explore the effect of rail on different types of properties, this study focused on only one type of properties. However, the preliminary findings lead us to conclude that premium is variable from stations to stations, despite type of properties.

Out of the nine station areas with sufficient data, five showed a premium as a result of being located near (within 365 meters) a light rail station. Premiums ranged from 4.1% to 7.1%. The remaining four station areas showed no effect, as differences between control and station areas were less than 1%. However, analysis of sales prices indicated that three of the four areas which showed no effect were undervalued in their assessed values. The remaining one area had insufficient sales data in the study period to determine variation between assessed value and sales value.

References

Al-Mosaind, M., Dueker, K. and Strathman, J., 1993, Light-rail Transit Stations and Property Values: A Hedonic Price Approach. *Transportation Research Record*, 1400, 90-94.

Albert, G., Abo-Kalla, H. and Baron, M., 2011, Transport and Environmental Variables and the Impact of Cultural Differences on Playground Use. *Journal of Urban Planning and Development*, Vol. 137(3), 291–297.

Austin Board of Realtors, 2013, Press Release: July Housing Statistics, Available Online From: https://www.abor.com/news_media/press_releases/2013/p17_13.cfm.

Bajic, V., 1983, The Effects of a New Subway Line on Housing Prices in Metropolitan Toronto. *Urban Studies*, Vol. 20(2), 147–158.

Bogart, W., 2006, *Don't Call it Sprawl*. Cambridge, UK: Cambridge University Press.

Bowes, D. R. and Ihlanfeldt, K. R., 2001, Identifying the Impacts of Rail Transit Stations on Residential Property Values. *Journal of Urban Economics*, Vol. 50(1), 1-25.

Cervero, R. and Susantono, B., 1999, Rent Capitalization and Transportation Infrastructure Development in Jakarta. *Review of Urban & Regional Development Studies*, Vol. 11(1), 11-23.

Chen, H., Rufolo, A. and Dueker, K., 1998, Measuring the Impact of Light Rail Systems on Single-Family Home Values: A Hedonic Approach with Geographic Information System Application. *Transportation Research Record*, Vol. 1617(1), 38-43.

Chin, H. and Foong, K., 2006, Influence of School Accessibility on Housing Values. *Journal of Urban Planning and Development*, Vol. 132(3), 120–129.

Cook, S., 2013, National Survey of Renters: Single Family and Multifamily, Available Online from: http://www.memphisinvest.com/national-renter-survey-2013, accessed Sep. 9, 2013.

Duarte, F. and Ultramari, C., 2012, Making Public Transport and Housing Match: Accomplishments and Failures of Curitba's BRT. *Journal of Urban Planning and Development*, Vol. 138(2), 183–194.

Dunn, C., 2013, July Sales of Single-Family Houses in Rhode Island Increase 22 Percent over Same Month Last Year, available online from: http://www.providencejournal.com/breaking-news/content/20130822-july-sales-of-single-family-houses-in-rhode-island-increase-22-percent-over-same-month-last-year.ece, accessed Sep. 9, 2013.

Fauria, A. and Mathur, S., 2012, Impact of Targeted Redevelopment of Central Business District on Housing Prices in the Surrounding Neighborhoods: Evidence from Oakland, California. *Journal of Urban Planning and Development*, Vol. 138(3), 244-253.

Gallagher, J., 2011, To buy or rent? There's no simple answer. St. Louis Post-Dispatch, March 13.

Gallagher, J., 2012, Tips to Lessen the Pain at The Pump. St. Louis Post-Dispatch, March 4.

Garrett, T., 2004, Light-Rail Transit in America. Federal Reserve Bank of St. Louis. <http://www.cfte.org/news/garrett.pdf> (January 20, 2011).

Gatzlaff, D. and Smith, M., 1993, The Impact of the Miami Metrorail on the Value of Residences Near Station locations. *Land Economics*, Vol. 69(1), 54–66.

Gihring, T. A., 2001, Applying Value Capture in the Seattle Region. *Planning Practice & Research*, Vol. 16(3/4), 1-12.

Giuliano, G., 1989, Literature Synthesis: Transportation and Urban Form. Federal Highway Administration, Contract number DTFH61-89-P-00531.

Hess, D. and Almeida, T., 2007, Impact of Proximity to Light Rail Rapid Transit on Station-Area Property Values in Buffalo, New York. *Urban Studies*, Vol. 44 (5/6), 1041-1068.

Jackson, M., 2010, Apartment Seekers Willing to Pay More to be Near Light Rail. Denver Post, 14 June.

Kim, G., Hong, T., Han, S. and Lee, S., 2011, Analysis of Development Cost Based on Planning Characteristics of Multifamily Housing Development Projects. *Journal of Urban Planning and Development*, Vol. 137(3), 207–219.

Knight, R. and Trygg, L., 1977, Evidence of Land Use Impacts of Rapid Transit Systems. *Transportation*, Vol. 6, 231-47.

Landis, J., 1995, BART Access and Office Building Performance. University of California Transportation Center. *Working Paper Number 309*. Berkeley, CA.

Lewis-Workman, S. and Brod, D., 1997, Measuring the Neighborhood Benefits of Rail Transit Accessibility. *Transportation Research Record*, Vol. 1576, 147–153.

Mathur, S., 2008, Impact of Transportation and Other Jurisdictional-Level Infrastructure and Services on Housing Prices. *Journal of Urban Planning and Development*, Vol. 134(1), 32–41.

Metro, 2011, Fiscal Year 2010 Annual Report. <http://www.metrostlouis.org/About/PublicationsResources.aspx> (October 3, 2011).

Ryan, S., 1997, The Value of Access to Highways and Light Rail Transit. PhD. Dissertation, University of California, Irvine, CA.

Ryan, S., 1999, Property Values and Transportation Facilities: Finding the Transportation-Land Use Connection. *Journal of Planning Literature*, Vol. 13, 412-417.

Seo, W. and von Rabenau, B., 2011, Spatial Impacts of Microneighborhood Physical Disorder on Property Resale Values in Columbus, Ohio. *Journal of Urban Planning and Development*, Vol. 137(3), 337-345.

United States Census Bureau, 2012, American Fact Finder: Profile of General Population and Housing Charactereristics. <http://factfinder2.-census.gov/faces/nav/jsf/pages/index.xhtml> (May 22, 2012).

Vessali, K., 1996, A Review of the Empirical Literature. *Berkely Planning Journal*, Vol. 11, 71-105.

Weinstein, B. and Clower, T., 2002, An Assessment of the DART LRT on Taxable Property Valuations and Transit Oriented Development. University of North Texas Center for Economic Development and Research. <http://www.unt.edu/cedr> (September 19, 2011).