IDENTIFYING THE IMPACTS OF LIGHT RAIL STATION LOCATION ON RESIDENTIAL PROPERTY VALUES IN THE CITY OF SACRAMENTO

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IDENTIFYING THE IMPACTS OF LIGHT RAIL STATION LOCATION ON RESIDENTIAL PROPERTY VALUES IN THE CITY OF SACRAMENTO

A Thesis

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Abstract

of

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Statement of Problem

The Sacramento Area Council of Governments (SACOG) Blueprint depicts a way for the Sacramento region to grow through the year 2050 by way of a "Preferred Scenario" which promotes compact, mixed-use, transit-oriented development (TOD). Senate Bill (SB) 375 looks to reduce greenhouse gas emissions in California by creating high-density TOD based communities that emphasize transit as the preferred mode of transportation. With a focus on the City of Sacramento, it is uncertain as to whether the Regional Transit light rail has a positive or negative effect on residential property value, thus the high-density TOD goals of the Blueprint and SB 375 are in question.

Conclusions Reached

Hedonic Regression analysis revealed that Regional Transit light rail does have a positive impact on residential property value. As distance from light rail station increased, the positive effect on property value decreased. The analysis also revealed that

being too close to a light rail station (within 1/10 of a mile) yielded negative effects because of nuisance factors. Thus, the results argue in favor of high-density TOD goals of the SACOG Blueprint and SB 375.

_______________________________________, Committee Chair
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Chapter 1

INTRODUCTION

Continuing concerns about urban sprawl, traffic congestion, and central city deterioration have led policymakers and planners to seek out more efficient, equitable, and environmentally favorable land use patterns. Moreover, an interest in high-density development, creating sustainable and livable environments, and implementing land use that takes advantage of transit stations (otherwise known as transit-oriented development or TOD) has emerged (Caltrans, 2009). Subsequently, this movement has resulted in a focus on the opportunities offered through public transit, particularly fixed rail transportation.

The U.S. Department of Transportation considers rail transit to be a successful mechanism in addressing the problem of sprawl and traffic congestion, while also improving air quality and encouraging pedestrian-oriented activity and design (U.S. Department of Transportation, 2008). While others have noted that there are other more cost effective ways to achieve the same objectives. For example, *Essential Smart Growth Fixes for Urban and Suburban Zoning Codes,* explores 11 essential fixes to common barriers local governments face in implementing smart growth. Topics in this document include mixing land uses, fixing parking requirements, modernizing street standards, managing storm water, and adopting smart annexation policies (U.S. EPA, 2009).

While the public benefits of rail transit may seem obviously clear, the location of transit stations can have uncertain effects on the monetary value of residential and commercial property, especially when specific location and exact distance are taken into consideration. According to Ferguson, Goldberg, and Mark (1988), changes in access and transportation can have impacts on urban land and housing markets, including both price effects and land use effects. The impact of rail transit on property values has been studied by researchers from multiple perspectives, including different types of systems (e.g., rapid, commuter, light rail), residential versus commercial property, and studies that have attempted to isolate both positive and negative effects (Parsons Brinckerhoff, 2001). The results from these various studies have produced mixed results, causing researchers to continue examining the issue.

It is important to examine the effect of light rail stations' locations on property values because researchers still do not know how the location of light rail stations affect property values, including whether the stations increase or decrease property value. Part of this uncertainty is because of the various unknown externalities that are associated with the relationship of proximity. Furthermore, recent trends in land use and related environmental concerns have led to statewide policy and regional models that promote transit-oriented development (TOD). The Sacramento Area Council of Governments (SACOG) adopted a Preferred Blueprint Scenario as a guide to sustainable development through the linkage of land use and transportation. The Preferred Blue Print Scenario depicts a way for the region to grow through the year 2050; specifically by promoting compact, mixed-use development and more transit choices as an alternative to low-density development (Sacramento Regional Blueprint, 2009b). Modeled on the SACOG

Blueprint Scenario and focused on redesigning communities to reduce green house gas (GHG) emissions, and encouraging sustainable living through anti-sprawl and transit-oriented development, the California State Legislature subsequently passed Senate Bill (SB) 375.

With transit playing such a prominent role in land use as spelled out by the SACOG Blueprint and SB 375, along with unknown externalities associated with proximity to property, it is desirable to further examine the effect of public transit station location on property values. This thesis is focused on determining the impacts of Regional Transit light rail station location on residential property values in the City of Sacramento. This chapter introduces the issue by presenting an overview of Sacramento's light rail system along with an examination of public support for this current system. This is followed by an overview of SB 375 and the SACOG Blueprint as they relate to transit-oriented development.

Sacramento's Light Rail System

The Sacramento Regional Transit (RT) system was created by the California State Legislature in 1971 (Sacramento Regional Transit, 2009). Since that time, the system has grown is scale and has experienced increased ridership. RT currently operates 97 bus routes and 37.4 miles of light rail which links the eastern and northeastern suburbs with Downtown and South Sacramento, covering a total 418 square-mile service area (Sacramento Regional Transit, 2009). Buses and light rail run 365 days a year using 76 light rail vehicles, 256 buses powered by compressed natural gas (CNG) and 16 shuttle vans (Sacramento Regional Transit, 2009). Buses operate daily from 5:00 a.m. to 11:30 p.m. every 15 to 75 minutes, and light rail trains begin operation at 4:30 a.m. with service every 15 minutes during the day and every 30 minutes in the evening. The Blue Line trains run until 1:00 a.m. and the Gold Line to Folsom runs until 7:00 p.m. (Sacramento Regional Transit, 2009). Figure 1 illustrates RT's System Map, showing the light rail blue and gold line routes, and Figure 2 illustrates light rail routes and station stops.

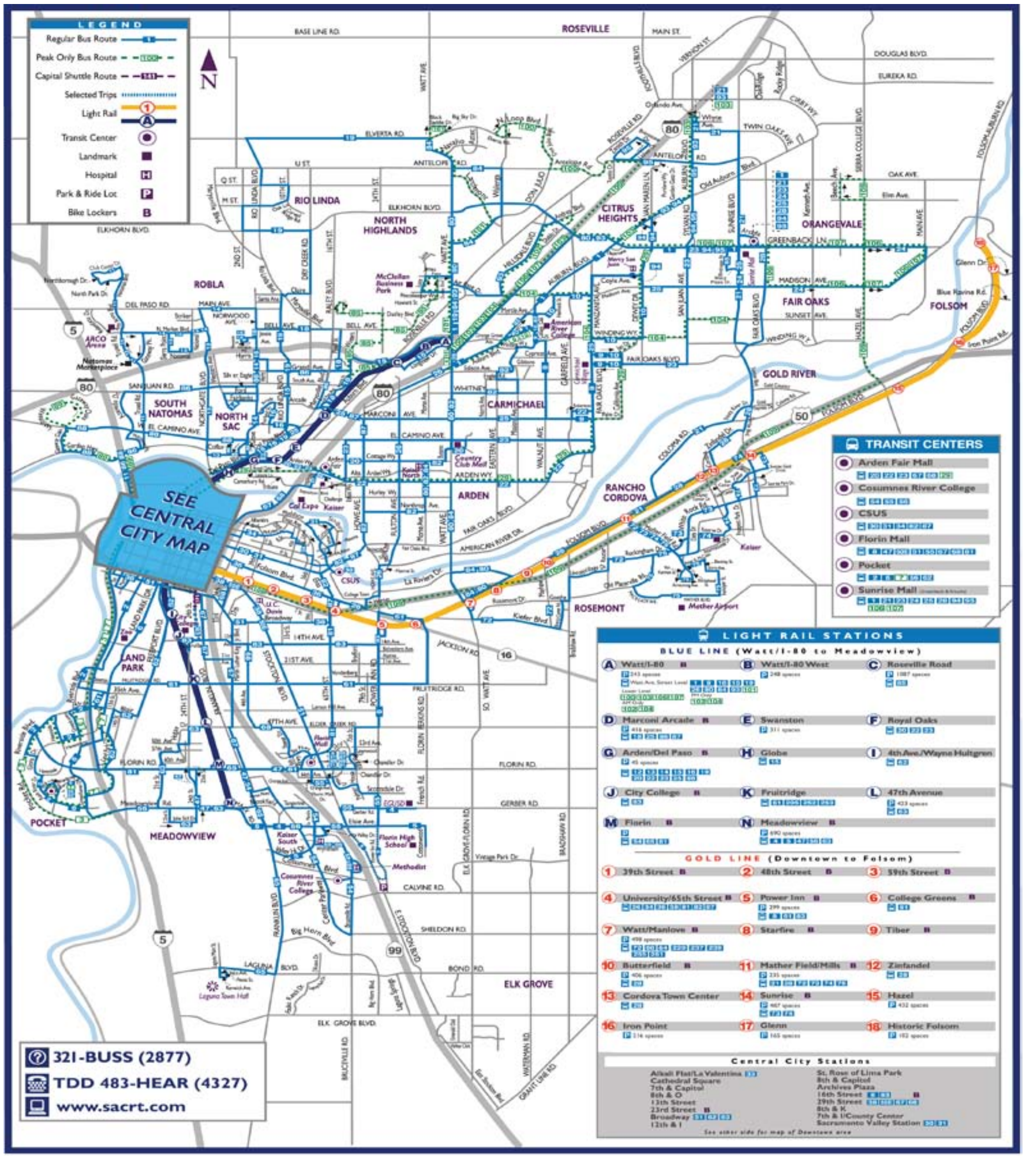

Figure 1. Sacramento Regional Transit System Map (Sacramento Regional Transit, 2009).

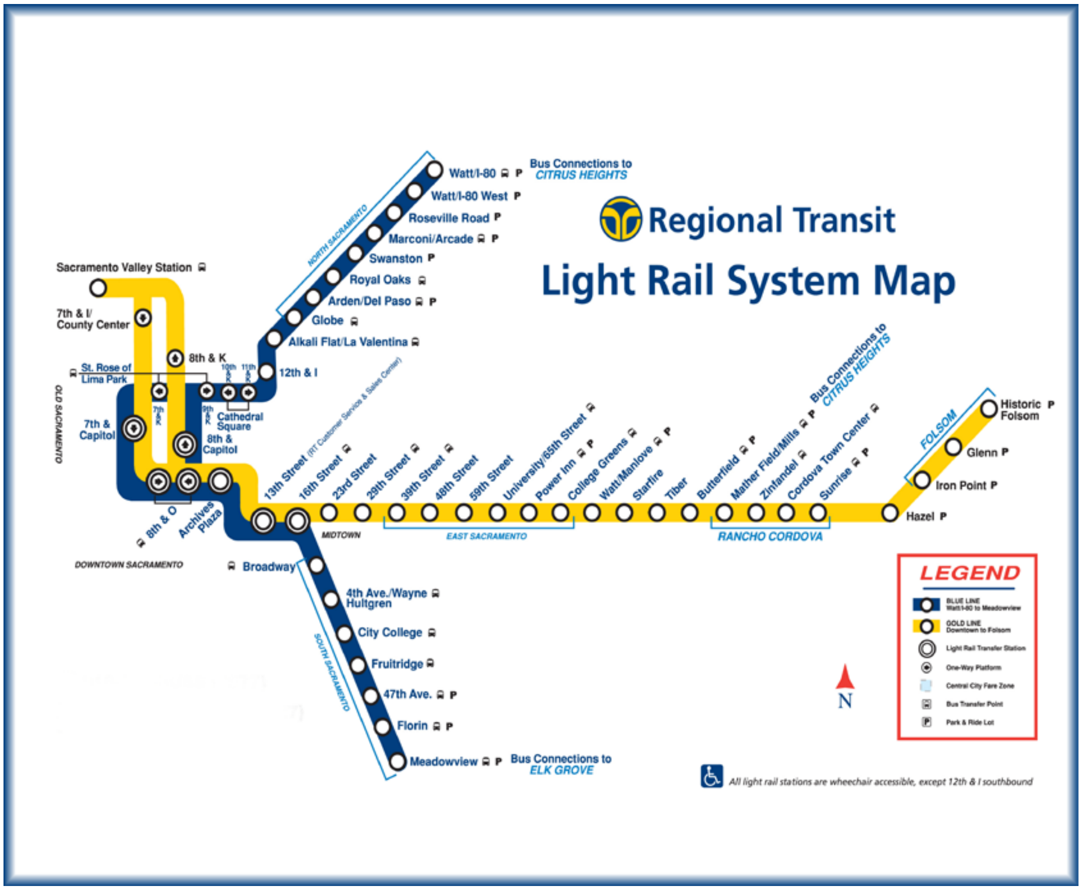

Figure 2. Sacramento Regional Transit Light Rail Routes and Station Stops (Sacramento Regional Transit, 2009).

Annual ridership has steadily increased on both the bus and light rail systems from 14 million passengers in 1987 to more than 31 million passengers in FY 2007. Weekday light rail ridership averages approximately 50,000, which accounts for approximately 40% of the total system ridership, while bus weekday ridership has reached an average of approximately 58,000 passengers per day (Sacramento Regional Transit, 2009).

While ridership has increased over the years, RT is not a self-supporting system. This means that fare revenues do not generate enough to pay for operational expenses.

Recently, in an effort to close the gap on a $9 million budget deficit for Fiscal Year 2010, RT implemented fare increases. These increases went into effect on September 1, 2009. Table 1 displays the current Bus and Light Rail Fares.

Table 1

RT Bus and Light Rail Fares (Regional Transit, 2009)

Bus & Light Rail Fares	Current Fare
Basic fare (age 19-61)	$2.50 (single pass) $6.00 (daily pass)
Discount Fare (age 62+, student, and disabled)	$1.25 (single pass) $3.00 (daily pass)
Passes & Stickers	
Basic Daily Pass	$6.00
Discount Daily Pass	$3.00
Basic Monthly Pass	$100.00
Basic Semi-Monthly Pass	$50.00
Senior/Disabled Semi Monthly-Sticker	$50.00
Super Senior Monthly Sticker (age 75+)	$25.00
Student Semi-Monthly Sticker	$40.00
Student Monthly Sticker	$50.00
Ticket & Pass Booklets	
10 Basic Fare Tickets	$25.00
10 Discount Fare Tickets	$12.50
10 Basic Daily Passes	$60.00
10 Discount Daily Passes	$30.00

RT uses a proof-of-payment fare structure throughout the system, meaning that passengers buy their tickets at self-service machines (or elsewhere), and must produce their ticket if asked to do so by a fare inspection officer (Sacramento Regional Transit, 2009). RT fare revenues provide approximately 20% of the money needed to operate bus and rail transit service from year to year, and the remainder of the money needed comes from federal and state governments, developer fees, and local sales taxes (Sacramento Regional Transit, 2009). Measure A, passed by voters in 1988, is a 1/2¢ sales tax that supports road and public transportation improvements in Sacramento County. The Sacramento Regional Transit District receives approximately 1/3 of the tax (or 1/6¢) (Sacramento Regional Transit, 2009). Measure A was set to expire in 2009; however, in November 2004, voters approved an extension of the sales tax until 2039 with transit receiving 38.25% of the 1/2¢ tax (Sacramento Regional Transit, 2009). The local transportation sales tax is a local match used to acquire state and federal money for the RT capital program and to support transit operations. The remainder of RT’s funding comes from local county developer fees. These fees are levied by the County against new developments within unincorporated Sacramento County and can only be used for capital projects within each of the districts in which they are collected. Through these developer fees, new real estate developments share the cost of providing public services required to accommodate increased traffic congestion and diminished air quality (Sacramento Regional Transit, 2009). The policy of subsidizing light rail use by setting fares at a level that does not cover operating cost implies that the social benefits of its use exceeds the private benefits (positive externalities). Thus, this study is an attempt to see if these positive externalities are measureable through increased property values for homes located near a light rail station.

Thought RT is not operationally cost-effective and currently requires government subsidies to operate, media and public support for RT light rail has been mostly positive. Light Rail Now (2000) asserted that Sacramento's light rail transit system is a model of success for many smaller American cities considering a light rail system. The article notes that light rail ridership increased more than 50% since 1990, that it is particularly attractive to more affluent suburbanites traditionally wedded to travel by car, and that air quality concerns have convinced Sacramento decision-makers to expand the light-rail system while slightly slowing the growth of highways (Light Rail Now, 2000). An article in the Sacramento Business Journal highlighted that a double-digit increase in light-rail ridership helped lead the nation’s largest quarterly increase in public transportation ridership in 25 years (Turner, 2008). Sacramento’s light-rail ridership increased 16.5 percent in the third quarter of 2008 and the local light-rail service had the third-highest percentage increase in the nation (Turner, 2008). The support for the light rail system, particularly as a means to improve air quality in the Sacramento, validates its inclusion in the regional and state plans to reduce carbon emissions.

SACOG Preferred Blueprint Scenario

The Sacramento region has placed a great deal of emphasis on transit-oriented development and the concept of linking land use to public transportation. The

Sacramento Area Council of Government (SACOG) developed a regional plan, the Blueprint, as a vision for growth that promotes compact, mixed-use development and more transit choices as an alternative to low-density development (Sacramento Regional Blueprint, 2009c). The Blueprint Plan offers a “Preferred Scenario” that depicts a way for the region to grow through 2050 in a manner consistent with high-density, compact, transit-oriented development. This “Preferred Scenario” is in contrast to the “Base Case” which is a projection of how the area would grow if current local government (low-density) growth and land-use plans are followed through to 2050 (Sacramento Regional Blueprint, 2009c). Figure 3 is a visual example from SACOG of how development in the Sacramento region might look in the year 2050 using existing patterns (Base Case Scenario) versus high-density patterns (Preferred Scenario).

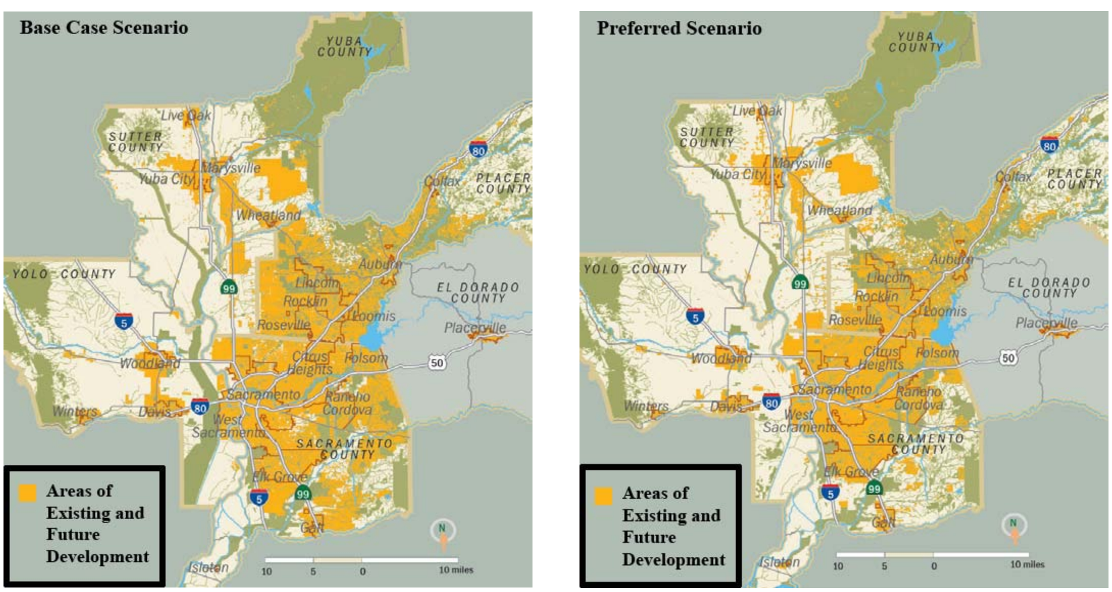

Figure 3. SACOG Base Case and Preferred Scenarios for Growth in 2050 (SACOG, 2007, pp. 2-3).

The Blueprint includes the Metropolitan Transportation Plan (MTP) for 2035, which also intends to further the link between transportation and land use. The MTP plans to invest $42 billion in the transportation system in the six-county Sacramento region over the next 28 years (Metropolitan Transportation Plan, 2008). The MTP Brief on transit expansion indicates that transit expansion and investments can become tools to shape land-use objectives of the Blueprint and that infill and compact development require high-level transit service (MTP Transit Expansion, 2006).

The adoption of the Blueprint by the SACOG Board of Directors was the result of extensive research and public input. The SACOG Board's action capped two years of study and public involvement aimed at creating a comprehensive land use scenario for the region (Sacramento Regional Blueprint, 2009a). SACOG officials recognize the importance of the existing transit system and TOD in achieving the Blueprint goals. In reference to the Blueprint, Martin Tuttle, the previous SACOG Executive Director, stated, “by embracing the concepts of this scenario, our region's leaders are rejecting business-as-usual development in favor of more walkable, transit-oriented communities that better integrate jobs and housing” (Sacramento Regional Blueprint, 2009a). In the SACOG Regional Report, SACOG Executive Director Mike McKeever emphasized the role of transit in reducing Greenhouse Gases and the Blueprint’s principles of compact, mixed-use, transit-oriented development (Sacramento Regional Report, 2009).

As a regional plan based on smart growth principles, the SACOG Blueprint has attracted the media attention to the Sacramento Region. A recent article in the

Sacramento Bee focused on the Capital being a leader in transit-oriented planning, noting that this model of development could inspire national transportation, energy and climate legislation, and influence future infrastructure investment and real estate development (Leinberger, 2009). The *Wall Street Journal* also recognized the Sacramento region in an article focused on rising fuel costs and the strategy undertaken by the Blueprint Model (Campoy, 2008). With Sacramento focused so heavily on integrating transportation and land use policy, it is essential to consider the effects of rail transit on property value, thus determining if pursuing these long-range plans are advantageous

SB 375 and The Role of Transit Oriented Development (TOD)

In 2006, Governor Schwarzenegger signed into law Assembly Bill (AB) 32, the California Global Warming Solutions Act (authored by Assembly Members Fabian Nuñez and Fran Pavley). The landmark bill established the first-in-the-world comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, cost-effective reductions of greenhouse gases (GHG) (California Air Resources Board, 2006). The new law commits California to reducing global warming pollution to 1990 levels by 2020 (a 25% reduction) and adopted mandatory reporting rules for significant sources of greenhouse gases (California Air Resources Board, 2006). On September 20, 2008, Governor Schwarzenegger signed SB 375 (Steinberg, 2008) to carry out the climate change goals of AB 32 through land use measures. Specifically, it requires California's 18 metropolitan planning organizations to show that their future planning scenarios will result in a reduction in carbon (GHG) (The Planning Report, 2007). One of the goals of SB 375 is to limit the state's GHG emissions by curbing suburban sprawl (low-density development) increasing transit-based, high-density development through various incentives, such as California Environmental Quality Act (CEQA) exemptions (Office of the Governor, 2009). This shift from low to higher-density development involves the use of public transit, whereby development is centered on public transit stations, thus referred to as transit-oriented development (TOD). A more formal definition, developed by the California Department of Transportation’s Statewide TOD study, describes TOD as

> Moderate to higher density development, located within an easy walk of a major transit stop, generally with a mix of residential, employment, and shopping opportunities designed for pedestrians without excluding the auto. TOD can be new construction or redevelopment of one or more buildings whose design and orientation facilitate transit use. (Parker, McKeever, Arrington, & Smith-Heimer, 2002, p. 12)

In the City of Sacramento, transit village projects include the 65th Street/University Transit Village and the Swanston Station Transit Village, while completed TOD projects include the Upper Eastside Lofts, Globe Mills and 1409 R Street. Figures 4, 5, and 6 show images of these completed TOD projects.

Figure 4. Upper East Side Lofts (Local Government Commission, 2009).

Figure 5. Globe Mills (MFMalinowski AIA and Applied Architecture Inc., n.d.).

Figure 6. 1409 R Street (14 & R, n.d.).

The 65th Street/University Transit Village plan provides a mix of housing types in East Sacramento and intensifies residential and commercial mixed-use development opportunities to increase RT ridership (bus and light rail) at the 65th Street transfer station (City of Sacramento, 2009). One of the first developments at 65th Street was student housing, called the Upper East Side Lofts, completed in 2007 and leased to California State University, Sacramento. The City intends to build additional office, retail, and residential mixed-use in the 65th Street planning area. The Swanston Station Transit Village, located in the North Sacramento Community Plan Area, encompasses roughly ¼ to ½ mile radius around the existing RT Swanston Light Rail Station, and will include residential mixed-use, office and retail (City of Sacramento, 2009). As a long-range plan, the Swanston Station Transit Village Plan will provide land use, parking/circulation, open space and infrastructure goals, policies and objectives, and implementation measures which will guide land use and development decisions around the station over the next twenty years (City of Sacramento, 2009). These TOD projects are examples of the type of transit-centric land use that the SACOG Blueprint and SB 375 promote.

Encouraging smart growth through TOD is a primary goal of SB 375. This assumes that development around transit is beneficial, appeals to consumers, and that there is a demand for it. This study is, in part, an attempt to measure whether this is the case. If there is increased consumer demand near a light rail station, then prices of homes sold should effectively be higher. Additional factors to consider are costs and market conditions. While TOD may present environmental benefits, TOD can be costly, and this cost is ultimately transferred to the consumer. Due to innovative and often high-quality design, TOD can be more costly to build (Parker et al., 2002). Furthermore, the success of TOD depends on market conditions, including financial feasibility. Financial feasibility includes the costs of development and operating, as well as ready access to capital (Parker et al., 2002).

What Will be Examined

Public transit, and particularly light rail transit, plays a critical role in the implementation of both SB 375 and the SOCOG Blueprint. Furthermore, the linkage of land use and transportation, as seen in transit-oriented development, is central to the successful implementation of both the Blueprint plan and SB 375. However, the effects that public transit has on property value are not entirely clear. If transit-oriented development, along with the expansion of rail transit is going to occur as part of SB 375 and the SACCOG Blueprint, then it is necessary to determine what the effects will be. This thesis attempts to answer the question of what impacts the location of Regional Transit light rail stations have on residential property values in the City of Sacramento, using a hedonic pricing model. Structurally, this thesis has five chapters that build the analysis then culminate in findings and policy implications. Chapter 2 offers a review of the academic literature on the topic, Chapter 3 describes the data used in the regression model, Chapter 4 provides an explanation of the regression analysis, and Chapter 5 concludes with a summary of findings and a discussion of land-use related policy lessons learned based on the regression results. The following chapter provides a literature review of published academic articles and reports examining the effects of transit station location on property value.

Chapter 2

LITERATURE REVIEW

The impact of rail transit on property values has been studied by researchers from different perspectives, including analyses of different types of systems (e.g., rapid, commuter, light rail), of residential versus commercial property impacts, and studies that have attempted to isolate both positive and negative effects. The property types included in these studies are residential (single-family, multi-family, and condominiums) and commercial. Table 2 summarizes these studies; based on researchers, city-regions/transit systems, types of property studied, sample characteristics, methods, and findings. Some of the analyses point to a positive relationship between proximity to rail transit stations and property value. Furthermore, there is little evidence that suggests that proximity to rail transit actually decreases property values, although implications for further research include the consideration of influential variables outside of transit station proximity, significance of results, and conclusiveness of findings.

This chapter includes a review of the academic literature and reports related to the effects of public transit proximity on property values. I categorize this review into three sections based on property type: 1) Residential Property (single-family, multi-family and condominium), 2) Commercial Property, and 3) Residential and Commercial Property. The intent of this literature review is to provide general knowledge on the issue and identify any gaps that would justify further analysis.

Table 2

Study Characteristics

Author(s) (Year Published)	City/Region(s) (Transit System)	Type of Property Studied	Sample Characteristics	Methods	Research Findings
R. Gail Grass (1992)	Washington, D.C. (METRO-Metrorail)	Residential	Parcel regression = 6,004 observations Level regression = 9 observations	Hedonic price equation Ordinary Least Squares (OLS)	Metro station openings cause residential property values to rise by $1,827 in adjacent areas.
Dean H. Gatzlaff Marc T. Smith (1993)	Miami, Florida (Miami Metrorail)	Residential	912 single-family detached residential properties	Hedonic models	Found weak evidence that there was any major effect to residential values due to announcement of the development of the Miami Metrorail.
Daniel Baldwin Tangerine Maria Almeida (2007)	Buffalo, New York (Metro Rail)	Residential	2002 assessed value for 7,357 residential properties	Regression model of annual repeat sales	All Stations Model revealed that, throughout the system, a typical home located within one-quarter of a mile of a rail station could earn a premium of $1,300-$3,000 to the median home value of $59, 300 Individual Stations Model indicated that effects were not felt evenly throughout the system.

Table 2 continued

Author(s) (Year Published)	City/Region(s) (Transit System)	Type of Property Studied	Sample Characteristics	Methods	Research Findings
Hong Chen Anthony Rufolo Kenneth J. Dueker (1997)	Portland, Oregon (MAX)	Residential	830 single-family homes sold between 1992 and 1994	Hedonic pricing model	At 100 meters (328 feet) away from stations, each additional meter (3.28 feet) farther away from the LRT station resulted in a $32.20 decrease in price for an average price house at $85,724
Murtaza Haider Eric J. Miller (2000)	Greater Toronto Area, Canada (Subway and Highway)	Residential	27,400 freehold sales during 1995	Spatial autoregressive (SAR) models	Location and transportation factors were not strong determinants of housing values. However, proximity of 1.5 km to a subway added approximately $4,000 to property value.
Arthur C. Nelson (1999)	Atlanta, Georgia (MARTA-Metropolitan Atlanta Rapid Transit Authority)	Commercial	30 sales of office commercial property between 1980 and 1994	OLS regression equation	The price per square meter falls by $75 for each meter away from the center of transit stations and rises $433 for location within SPIDs

Table 2 continued

Author(s) (Year Published)	City/Region(s) (Transit System)	Type of Property Studied	Sample Characteristics	Methods	Research Findings
Sherry Ryan (2005)	San Diego, California (SDMTS - San Diego Metropolitan Transit System)	Commercial	Aggregate office/industrial property data for 3 market areas, East County (n=356), South Bay (n=103) and Centre City (n=1779)	Hedonic price analysis	Proximity to transit stations was not valued by office firms in any of the three market areas
David R. Bowes Keith R. Ihlanfeldt (2001)	Atlanta, Georgia (MARTA-Metropolitan Atlanta Rapid Transit Authority)	Residential and Commercial	Total observations = 22, 388	Hedonic and Auxiliary models	Properties within a quarter-mile from a rail station were found to sell for 19% less than properties beyond three miles from a station.
Robert Cervero Michael Duncan (2002)	Los Angeles, California MetroLink and Metro Rapid Transit	Residential and Commercial	Multi-family = 3,803 Condo = 13,462 Single-Family = 40, 966 Commercial = 1,241	Hedonic Price models	For condominiums, the study revealed that if located near BRT stops, then they generally sold for 5.1% less Single-family houses mirrored results of condominiums for the most part, but were statistically less robust than condominiums. Results for commercial properties were uneven and unclear.

Residential Property

Several studies in numerous cities and counties examine the effects of rail transit station proximity on single family and multi-family residential properties. It is evident that considering factors, such as property and house characteristics and neighborhood effects (low, moderate, high-income neighborhood) are necessary in order to extract the transit stations true effect on the property values.

A study by Grass (1992) examined the relationship between public investment in METRO (Metrorail) and property values in several neighborhoods in Washington, DC to determine if public investment in heavy rail transit systems increases residential property values. The study used a hedonic price equation, which is estimated by using the ordinary least squares (OLS) technique and a dependent variable that measures a home's price. OLS is a statistical method of modeling the relationships among a dependent variable and multiple causal variables. It is used to predict the influence of one explanatory variable on the dependent variable, holding the values of the other explanatory variables constant. A hedonic pricing model is one that beaks down the price of a good or service, such as real property, into separate components that determine the price. Thus, hedonic models can estimate values for individual characteristics bundled together to form a good or service (Shepler, 2001).

The Grass (1992) study used *average property value in station and control areas* as the dependent variable with distance from the city center, average number of bathrooms, average number of houses that are 10-40 years old in station and control areas, and average building size as independent variables. It is important to note that using average property values instead of individual values can be problematic because one cannot predict individual effects. The dummy variable distinguished between the control and impact areas, which Shepler (2001) studied for years 1970 and 1980. The impact area was the area within a one-quarter mile radius from the station, while the control area selected for each impact area was based on its having the same characteristics as the impact neighborhood (economically stable, experienced few negative effects from METRO, and commenced operations during the study period) (Grass, 1992).

The Grass (1992) study used two regression equations, one that tests the effects on *average property value in station and control areas* (parcel regression) and another that tests the *log average property value in station areas* (average level regression). The former equation uses aggregate sales prices derived from the U.S. Census of Population and Housing, while the latter equation is a "fuller regression" that uses parcel data for property value derived from Lusk's District of Columbia Real Estate Directory Service. The parcel regression contained 6,004 observations, while the average level regression contained nine observations. The average property value in the sample was $91,372 and the results of the study reveal that the Metro station openings cause residential property values to rise by $1,827 in adjacent areas.

Similarly, Almeida and Hess (2007) discovered positive effects in their study, which examined the impact of proximity of light rail stations on residential properties values in Buffalo, New York. Hedonic models were constructed using single-family and multi-family residential properties within a half-mile of 14 light rail stations. The independent variable was *assessed property value*, which was a function of four vectors of independent variables that measure: (1) proximity of property to light rail station, (2) housing characteristics, (3) locational amenities, and (4) neighborhood characteristics. As in the previous study by Grass (1992), it was useful to estimate the importance of such characteristics and amenities when defining the relationship between light rail station proximity and residential property value. The study uses two models - the “All Stations Model” and the “Individual Station Models” – to capture the estimated effects. The former provides an analysis of the cumulative effects of rail proximity on adjoining station area properties for the entire light rail system, while the latter uses individual regression models for each of the 14 stations to reveal any effects not felt evenly throughout the system.

The results of the All Stations Model revealed that, throughout the system, a typical home located within one-quarter of a mile of a rail station could earn a premium of $1,300-$3,000, or 2%-5% of the city’s median home value (Almeida & Hess, 2007). The model further suggested, however, that three independent variables – number of bathrooms, size of parcel, and location on the East or West side of Buffalo – were more influential than rail proximity in predicting property values. The result of the Individual Stations Model indicated that effects were not felt evenly throughout the system, with some station locations having a greater positive effect on property values than other station locations.

Not all studies have been able to identify a strictly positive relationship between transit station proximity and residential property value. For example, a study by Gatzlaff and Smith (1993) examined the impact of the development of rail transit on residential property, focusing on the effect of the Miami Metrorail on the value of residences near eight station locations. The study used data from the Florida Department of Revenue 1990 Dade County Property Tax Records, and extracted a sample size of 912 single-family detached residential properties based on homes that sold at least once between 1971 and 1990. The study employed two methods: (1) constructing a repeat-sales index using the pooled sample of the properties surrounding the Metrorail stations and compare it to an identical index for the entire county and (2) using a hedonic regression to evaluate the variation in property values before and after the announcement of the development of the Metrorail system.

The method employed was a hedonic model, which quantified the price changes relative to announcement of the development of Metrorail, an assumption is made that property value is a function of a set of locational and property characteristics. The independent variable used was the most recent selling price of the ith observation and the explanatory variables were total living area, lot size, age of property in years at the time it sold, overall index of residential property appreciation, distance of property from Metrorail, announcement dummy (1 after 1980, otherwise 0), an interactive variable set for properties selling after the rail development, and an interactive variable set for properties selling before the rail development announcement. The study segmented the data by station properties located north of Miami central business district (CBD) and those located south of the CBD. The results indicated that for stations north of the CBD, the announcement effect captured was negative and for stations south of CBD, property values increased because of the announcement. The results were in contrast to one another, which could be due to socio-economics, property types, and neighborhood characteristics (high crime vs. low crime or experiencing decline vs. growing) of areas north and south of the CBD. In summary, the study found weak evidence that there was any major affect on residential values because of the announcement of the development of the Miami Metrorail.

A study by Chen, Dueker, and Rufolo (1997) found both positive (accessibility effect) and negative effects (nuisance effect), based on proximity to light rail. Using a hedonic pricing model, the study examined the impact of the Portland light rail system (MAX) on residential property values. Sales prices of single-family homes sold from 1992 to 1994 came from two regional databases: the Regional Land Information System and MetroScan from Transamerica Intellitech, Inc. (Chen et al., 1997). In addition, the 1990 Census provided neighborhood information for each census block group and Geographic Information Systems (GIS) data provided the means to calculate four spatial variables: *distance to nearest light rail stations, shortest distance to the LRT line, distance to nearest park, and distance to CBD* (Portland City Hall) form each house

(Chen et al., 1997). The results indicated that housing price decreases when its distance to LRT station increases. At 100 meters (328 feet) away from stations, each additional meter (3.28 feet) farther away from the LRT station resulted in a $32.20 decrease in price for an average price house at $85,724 (Chen et al., 1997). The results of the nuisance effect indicated that housing prices go up with distance away from LRT line, but the effect diminishes rapidly and reaches a maximum at 215.1 meters (705.7 feet) from the LRT line (Chen et al., 1997).

Haider and Miller (2000) examined the impact of locational elements on the price of residential properties sold during 1995 in the Greater Toronto Area using spatial autoregressive (SAR) models. A SAR model consists of a spatially lagged version of the dependent variable. The study used a large dataset consisting of 27,400 freehold sales. The explanatory variables were *structural attributes of housing units, neighborhood characteristics, and derived locational values*, and the dependent variable was *housing price* (Haider & Miller, 2000). The spatial hedonic model hypothesizes that the variation in housing prices is a function of structural characteristics of housing units, neighborhood characteristics, and location variables. The study found that in the presence of other explanatory variables, location and transportation factors were not strong determinants of housing values. However, the study found that proximity to a subway line capitalizes into higher residential property value, adding approximately $4,000 to the average property value at $225,000. The study also found that the number of bathrooms and the average household income in a neighborhood were significant determinants of housing value (Haider & Miller, 2000).

Commercial Property

The effects of transit station proximity on commercial properties are important to examine, because most commercial development can have greater capitalization potential than residential land use. A study by Nelson (1999) focused on the Midtown area of Atlanta Georgia to investigate the effects that the Metropolitan Rapid Transit Authority (MARTA) had on commercial property values. The hypothesis tested whether transit stations improve the accessibility of property to all parts of an urban area, and it predicted a positive association between transit station location and property value (Nelson, 1999). It also looked at the price effects of special public interest districts (SPID), areas in midtown Atlanta where development is encouraged, in order to confirm the effectiveness of policies that are not supply-side oriented. The OLS regression equation used *sales price per square meter of commercial building* as the dependent variable and building area, floors, floor-to-area-ratio (FAR), parking-ratio, covered parking, city-center distance, MARTA station distance, and SPID location as the independent variables. Because of periodic renovations and date of construction of buildings examined, age of building, amenities, and construction quality were not included in the equation. Sales and building attribute data came from the Fulton County Assessor's Office, and a sample size of 30 sales came from office commercial property sales in the study area from 1980 to 1994.

The results of the Nelson (1999) study on MARTA station effects on property value revealed an R squared value of .561, which is acceptable given that the sample size was relatively small. The experimental variables, MARTA station distance, and SPID-locations have reasonable magnitudes and are significant at the 90% confidence level in a one-tailed t-test. The findings indicate that the price per square meter falls by $75 for each meter away from the center of transit stations and rises $433 for location within SPIDs (Nelson, 1999, p. 87). It seems predictable that this would be the case, because commercial/office spaces generally serve retail and employment purposes and require commuting to some extent, therefore accessibility to transit stations would be beneficial for these purposes and capitalized into the properties. In summary, the general findings were conclusive, indicating that even in the absence of regional planning that encourages commercial development in SPIDs, the commercial market in centralized locations are drawn to locations near transit stations.

Another study examines the effects of transit stations on commercial property in San Diego (Ryan, 2005). The study used a hedonic price analysis to decipher the importance of access to both highway and light rail transit systems in estimating office and industrial property rents. Ten years of industrial and office property data came from the Torrey Urban Research Institute (a private real estate research firm) and GIS generated the measures of access. The study used three real estate market areas, East County (n=356), South Bay (n=103) and Centre City (n=1779), in San Diego to aggregate office and industrial property data. The dependent variable in the study was *asking rents* (the typical rent quoted by the leasing agent for a building), and the independent variables were building characteristics (rentable area, stories, age), land-use type (office only), type of lease (full service and partial service), neighborhood characteristics (median income and a submarket dummy variable), and a measure of access (freeway, station, CBD) and a year dummy variable (1986-95). The three variables measuring access were straight-line distance of each property to the closest freeway on/off ramp, straight-line distance of each property to the closest light rail station, and straight-line distance of each property to the central business district (CBD).

The results indicated that, in terms of building characteristics, office space in taller buildings is more expensive than in shorter buildings and the age of building was also significant in determining rents. More importantly, of the three access variables, freeways provided the only consistent benefit for office firms across the three market areas in San Diego (Ryan, 2005). Thus, it was shown that in the South Bay market area, a 1% increase in distance of an office property from the nearest freeway corresponded with an 11% decrease in office rents, and in the East County and Centre City there were a 4% and 3% rent decrease (respectively) for every 1% increase in distance from a freeway on/off ramp. In contrast, office firms in any of the three market areas did not value proximity to transit stations. The researcher indicated that this result might have been because much of the San Diego light rail system is located on corridors that were previously freight right-of-ways (Ryan, 2005, p. 760). As for industrial properties, the study indicated that access to freeways was only significant for Centre City properties;

where a 1% increase in the distance to an industrial property from a transit station corresponded to a 4.3% decrease in rents. Access to transit stations was significant with a negative sign for South Bay properties, significant with a positive sign for Centre City properties, and not significant for East County properties.

Residential and Commercial Property

It is important examine the relationship of transit station location on both residential and commercial properties to draw accurate conclusions about proximity on property value. Furthermore, from a policy perspective, it is important to understand the role of access and the possibility of increased property value play, but also the role that noise, pollution, and crime play in the relationship. A study by Bowes and Ihlanfeldt (2001) examined the effects of MARTA rail stations on residential and commercial property values within the Atlanta region. The methodology involved estimating two sets of equations: (1) hedonic price models that study the direct impacts of improved accessibility and negative externalities and (2) neighborhood crime and retail employment equations to examine the indirect effects that stations have on property values by attracting retail development and criminal activity (Bowes & Ihlanfeldt, 2001, p. 2). The dependent variable is sales price and the explanatory variables are the number of bedrooms, number of bathrooms, size of lot, whether the house has a basement or fireplace, and the age of the house at the time of the sale. The auxiliary models include a crime model (DV: density of crimes with explanatory variables grouped into three categories) and a retail employment model (DV: density of retail with five explanatory variables: tract median income, proximity to a population, proximity to non-retail employment, a dummy variable indicating the presence of a highway in the tract, and the distance between the tract centroid and CBD).

The results suggested that rail stations might affect property values indirectly by increasing crime or retail activity within a neighborhood. The crime model indicated that over 80% of the variance in tract crime density is explained by the random effects crime model and five of the control variables were statistically significant and had the expected sign. The random effects retail model results explained approximately 70% of the variation in retail employment density and three of the control variables were statistically significant (Bowes & Ihlanfeldt, 2001). The study used results from the three estimated effects to calculate the price effects of proximity to a MARTA station using different combinations of distance from downtown, neighborhood income, and existing parking at the station (Bowes & Ihlanfeldt, 2001). The pertinent conclusions indicated that properties within a quarter-mile from a rail station were found to sell for 19% less than properties beyond three miles from a station, and crime factors (density of poverty, vacant housing, retail employment density, manufacturing density, and distance to CBD) was statistically significant at the 10% level.

Cervero and Duncan (2002) conducted another study that examined both residential and commercial property value impacts of rail transit. The study examined different transit lines of both the Metrolink Commuter Train and the Metro Rapid BRT (bus rapid transit) in Los Angeles County. The primary data source was Metroscan, which contained monthly information on all real-estate sales transactions recorded in the county assessor's office. Estimated hedonic price models gauged impacts of values-added or values-subtracted. The independent variable was the estimated *price of parcel* and vectors of variables for transportation services, property and land-use attributes, neighborhood socio-demographic characteristics, and controls were included in the models. The study also utilized municipality fixed-effect dummy variables to statistically capture the attributes of communities, such quality of schools and degree of regulatory restrictiveness (Cervero & Duncan, 2002). Using GIS, the study measured variables related to location, proximity to transit, neighborhood attributes, and accessibility.

Study results indicated that the effects of being near transit stops on the sales prices of apartments and other multi-family units were uneven, with positive and negative impacts recorded. It was shown that none of the associations with proximity to transit were statistically significant at the 5% probability level. For condominiums, the study revealed that if located near BRT stops, then they generally sold for 5.1% less. They also were worth less than multi-family housing when located near heavy-rail subway and light rail transit stations. Only with respect to Metrolink commuter rail-stops did for-sale condominiums perform better than multi-family rentals. Single-family houses mirrored the results of condominiums for the most part, but in general, relationships were statistically less robust than condominiums. Lastly, results for commercial properties were uneven and unclear, because they appeared to benefit from the presence of rapid transit in some corridors and worse off in others. Overall, most relationships were not statistically significant.

What Was Learned

Although most of these empirical studies were able to establish some level of relationship between transit station location and property value, a precise and consistent correlation between the two has yet to be established. Establishing this correlation is difficult since there are several contextual factors to consider when examining a location, including land-use and type, environment, demographics, neighborhood characteristics, and zoning policies. Furthermore, the extent of the influence of local externalities can be challenging when creating a hedonic model, because such factors as housing characteristics and value vary throughout regions. With significant policy and planning implications underlying the relationship between transit stations and property values and the variation among study findings, there is a need for further analysis to establish a higher level of conclusiveness. This thesis attempts to examine and clarify the relationship even further, by conducting an analysis of light rail station location on home value in the City of Sacramento. Since I found no specific regression study of this influence in Sacramento, the study offered here is of value for that reason alone. The next chapter discusses the methodology that I follow in conducting this study.

Chapter 3

METHODOLOGY

To analyze the effects that light rail station location has on residential property values in the City of Sacramento, the research method I employ is a hedonic regression. This chapter presents an explanation of hedonic regression, an explanation of the model, which specifies the dependent variable, the broad explanatory categories, the specific variables within each of the categories, and a representation of the regression model. This chapter also provides and explanation of the data, along with tables illustrating the expected relationship between the dependent variable and explanatory variables.

Hedonic Regression Defined

Hedonic regression, which is based on hedonic demand theory, decomposes a product into its constituent characteristics, and obtains estimates of the contributory value of each characteristic to the product's overall price. From the view of hedonic analysis, complex, highly varied products are thought of as consisting of a bundle of more fundamental attributes that consumer's value. Hedonic analysis statistically unbundles these different attributes and estimates their separate value (Cortright, 2009).

With respect to a house, which consists of an assortment of variables (e.g., number of bedrooms, number of bathrooms, house age, house size, lot size, quality of schools, etc.) that affect its value, hedonic price regression can estimate each variable's effect separately. More specifically, the analysis determines several regression coefficients that measure, at the margin, each respective characteristic's independent effect on property value (Fuguitt & Wilcox, 1999). The critical aspect to this approach is determining the non-market effects on the property value. Hedonic regression can measure the percentage change in property value for each percentage change of the environmental attribute (non-market effect), other variables held constant (Fuguitt & Wilcox, 1999). Essentially, hedonic regression can tease out the effect of non-market goods – proximity to light rail station, median income in the neighborhood, quality of schools – on the property value, holding other variables constant.

One way to estimate hedonic regression equations is by using ordinary least squares (OLS) regression analysis. OLS is a statistical method of modeling the relationships among a dependent variable and multiple causal variables. OLS attempts to find a "best fit" to a set of data by minimizing the sum of the squares of the differences (called residuals) between the fitted function and the data. Researchers use this method to predict the influence of one explanatory variable on the dependent variable, holding the values of the other explanatory variables constant. Similarly, in this analysis I use a hedonic regression model of housing sale price, which will be estimated using ordinary least squares (OLS) regression. Based on the literature review, there was not a preference for the functional form of the hedonic equation, although the majority of researchers used a log-linear or log-log form. Linear-linear (lin-lin), log-linear (log-lin), and log-log functional forms will all be tried in this regression. Using the linear-linear model, the dependent variable and the explanatory variables are in the linear form, where $Y_i = B_0 +$

$B_1X_1 + \epsilon_i$. In the log-lin model the dependent variable is in the logarithmic form but the explanatory variables are in the linear form, where $\ln Y_i = B_0 + B_1 \ln X_1 + \epsilon_i$.
In a log-log model the dependent and all explanatory variables are in the logarithmic form, where $\ln Y_i = B_0 + B_1X_1 + \epsilon_i$. In this model, the slope coefficient of an explanatory variable gives a direct estimate of the elasticity coefficient of the dependent variable with respect to the given explanatory variable.

The Model

The purpose of this thesis is to investigate the factors affecting the values of homes near light rail stations in the City of Sacramento. Subsequently, the dependent variable in this regression is *Home Value*, represented by the selling price of 3,410 homes sold within approximately two miles of a light rail station. This data focuses on particular areas within the City of Sacramento, specifically the Central City, East Sacramento, and parts of North Sacramento and South Sacramento. Neighborhoods include Del Paso Heights, East Sacramento, River Park, Tahoe Park, Elmhurst, Oak Park, Curtis Park, Land Park, Pocket, and Meadowview. I have chosen these specific areas because they represent older, more established neighborhoods with similar homes based on age and type, therefore ruling out extreme variation that would be found when compared to newer suburban track homes. Focusing on these areas, the 95816, 95817, 95818, 95819, 95820, and 95822 zip codes are included, accounting for the 3,410 observations. It is important to note that 95814, accounting for a large section of the central city, is not included in data set because sales in this zip code were not recorded in the 2008 and 2009 Multiple Listing Service data provided for this study.

In general, with hedonic regression, the variables are categorized into broad groups representing characteristics of the house, lot, neighborhood, accessibility, and non-market effect (Fuguitt & Wilcox, 1999). Using this approach, the dependant variable in this analysis is the home value, and the broad explanatory categories expected to have some effect are housing characteristics, land characteristics, location characteristics, and time related characteristics. I have selected these broad characteristics because they are most critical in determining home value. Structural, land, and location characteristics are foremost considered when a seller, real estate agent, or appraiser determines the selling price. Potential buyers also consider these characteristics in determining the value of a home. Time related characteristics are also critical in this analysis since the housing market in Sacramento experienced periods of volatility in both 2008 and 2009. Though not evenly felt throughout all sections of the City, the broad effects resulted in an average decrease in home values.

The causal model for this analysis is shown as the following function:

Home Value = *f* (Structural Characteristics, Land Characteristics, Location Characteristics, Time Related Characteristics)

The specific categories used to explain home value are as follows:

Structural Characteristics = *f* (age of home, square footage, bedrooms, full bathrooms, half bathrooms, 1 car garage, 2 car garage, 3 car garage, brick construction, central air, fireplace, raised foundation, shingle roof, tile roof)

Land Characteristics = *f* (lot square footage, pool, RV parking, horse property)

Location Characteristics = *f* (distance to nearest light rail station, within 1/10 mile of light rail station, within 1/10 to 1/4 of light rail station, within 1/4 to 1/2 of light rail station, within 1/2 to 1 mile of light rail station, zip codes, home owners association, covenants conditions and restrictions, days on market until sold, distance to nearest bus stop, API score of elementary schools, median household income of Census Block)

Time Related Characteristics = *f* (multi-month variables)

Dummy variables are coded with a one if it satisfies the title of variable, otherwise it is zero. In the case of zip codes, dummy variables are assigned for 95816, 95817, 95818, 95819, and 95822. The zip code 95822 will act a base case, and will therefore be excluded, since one less dummy variable is specified than the number of conditions (Studenmund, 2006). The omitted condition 95820 forms the basis upon which all of the included conditions (95816, 95817, 95818, 95819, and 95822) are compared. The same holds true for the quarterly time variables, which are assigned dummy variables for the January - March 2008, April – June 2008, July – September 2008, January – March 2009, and April – June 2009. October through December 2008 will form the base case upon which all the included quarterly time variables are compared.

The rationale for the choice of these specific characteristics and their expected affect on the selling price of the home are briefly described below, and further detailed in Table 3.

Structural Characteristics

As shown in the Literature Review, researchers commonly use the home size, lot size, and age of home to describe the structural attributes of the home. One would expect that as the size of the home increases, the value for that home would increase. The same is true for lot size, where an increase in the size would result in an increased value. Homes constructed during different eras have architectural styles that may or may not have current appeal. An older home, built 50+ years ago, or recently build home may be more desirable then one built 20-30 years ago. Because of these factors, I am uncertain of the effect that age of home has on the home value.

With respect to number of bedrooms and number of full and half bathrooms, I expect that the effect will be positive, so as number of bedrooms and bathrooms increase, the selling price of the home would increase. I also expect number of garage (one car, two car, three car garage) to have a positive effect on the home value, since a garage is considered an amenity that can be used for storage. A garage is also more valued than a carport because it is a completely enclosed space that can protect storage and vehicles from theft. Other key housing characteristics include brick construction, central air, fireplace, raised foundation, shingle roof, and tile roof. I expect that brick construction, central air, fireplace, raised foundation and shingle roof to have positive effects on the home value, since these are all generally considered desirable amenities. A composition shingle roof is less desirable than a tile roof, therefore I a expect it to have a negative effect on the home value.

Land Characteristics

Lot square footage, pool, RV parking, and horse property can collectively and independently result in a positive effect on the home value. The larger the square footage of a home, the higher selling price; however, it is important to note that the relationship may not be perfectly linear. This is because a small increase in size for a large home would not expect have the same value than the same size increase in a small home. For example adding 200 square feet to a 3,000 square foot home would not be as significant as adding 200 square feet to a 1,000 square foot home; the former being a 6% increase and the latter being a 20% increase.

Location Characteristics

I examine several location characteristics that can influence the selling price of a home. The zip code variables incorporate both location and neighborhood attributes. The zip codes chosen represent areas that light rail travels through, but also account for older more established neighborhoods within the City of Sacramento. As previously noted, these zip codes have been coded into dummy variables, with the zip code 95820 acting as a base case. Home Owners Association (HOA) is expected to have a negative impact on home value, because people tend to dislike the additional fees that HOA's levy on their community. Conversely, the Covenants Conditions and Restrictions (CC&Rs) are expected to have a positive impact on home value because many homebuyers like the consistency CC&Rs bring to their community.

To account for distance to nearest light rail, I have included 1/10, 1/10 to 1/4, 1/4 to 1/2, and 1/2 to 1 mile dummy variables. In doing this, I hope to extract the effects of being within a specific distance of a light rail station. Being within 1/10 of light rail is expected to have a negative impact because homes within this distance are more likely to experience nuisance effects such as noise and/or crime.

The number of days a home has been on the market could reveal a nonlinear effect. A home that has been on the market for several months could see a reduction, or several reductions, from the original price asked when first listed. However, it is possible that days on market could effect the home value in the opposite direction, especially if there is an uptick in housing market conditions (e.g., housing inventory reduction, shift to a sellers market). A home listed on the market for several months could sell for a higher price than initially expected if a buyer bids higher than the listing price to make sure that the sellers accept their offer.

Both median household income and API score are expected to have a positive effect on home value. Homes located in neighborhoods with higher median household incomes are more desirable than those with lower median household incomes. The same holds true for homes that are located within the district boundaries of a schools with higher API scores. Based on what was revealed in the literature review, proximity to light rail station is expected to have a positive affect on home value; however it is expected that homes that are located very close (within feet) of light rail will experience a slight decrease in value because of nuisance factors. The effect that distance to nearest bus stop will have on home value is unclear. While bus stops serve as a public mode of transportation and proximity is considered a desired amenity, previous studies reveal that the nuisances associated with bus stops tend to be higher than that of light rail.

Time Related Characteristics

The Sacramento housing market was extremely volatile in 2008 and 2009. Figure 7 shows a chart illustrating quarterly trends for zip codes I will examine. In order to capture these time related effects, I have created quarterly dummy variables for 2008 through 2009 mid-year. The omitted condition, October – December 2008, forms the basis upon which all of the included conditions are compared. It is important to note, however, many older neighborhoods felt the effects of the housing market much less drastically, including areas of downtown/midtown, Land Park and East Sacramento. These “bubble areas” were able to hold steady and did not experience extreme decline in value during the 2008 and 2009 mid-year.

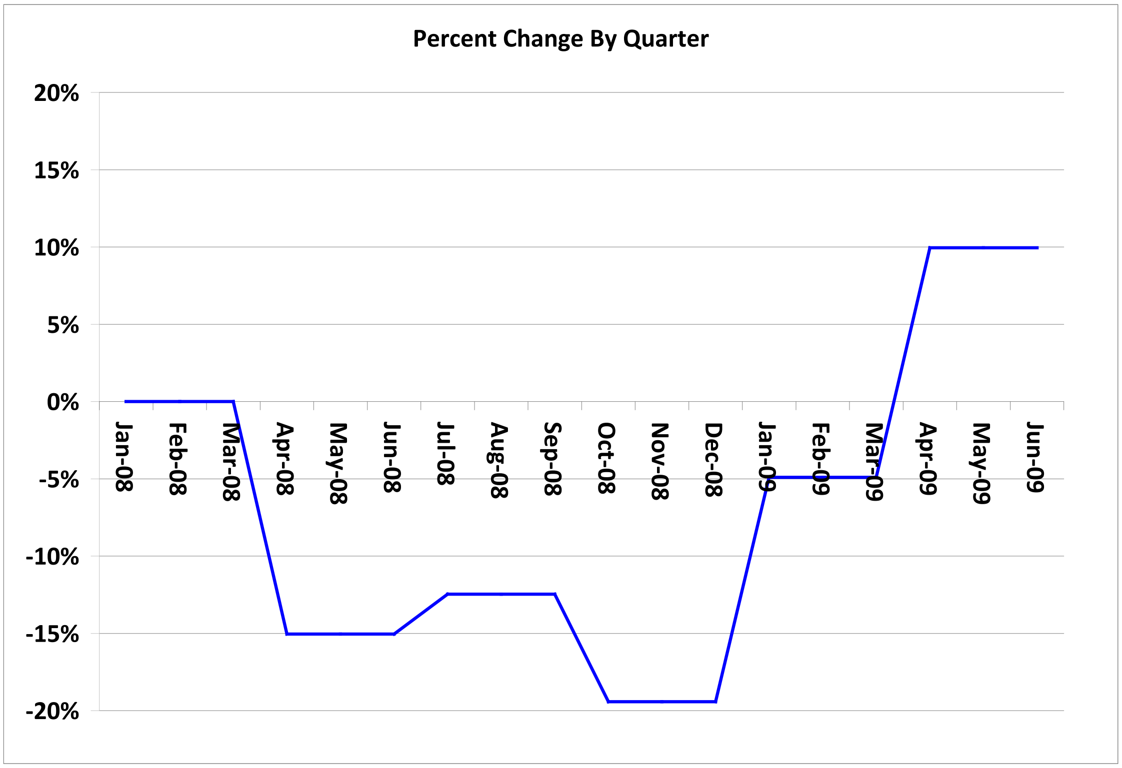

Figure 7. Changes in median home prices for select zip codes within the City of Sacramento, January 2008-June 2009.

Table 3 illustrates the expected impact (positive, negative, or uncertain) that each explanatory variable is to have on the dependent variable, along with a brief justification as to why it will have the expected impact.

Table 3

Expected Signs of Explanatory Variables

Variable	Expected Sign	Justification
3 or Greater Car Garage	+	Homes with a garage tend to be more desirable than those without a garage
Sacramento 95816	+	Homes located in midtown area are more desirable than those that aren't because of proximity and community amenities. The expected sign is based upon a comparison with the excluded zip code of 95820.
Sacramento 95817	?	Homes located in Elmhurst and Tahoe Park are desirable because of proximity and community amenities, but homes located in Oak Park are less desirable because of neighborhood. The expected sign is based upon a comparison with the excluded zip code of 95820.
Sacramento 95818	+	Homes located in East Sacramento are more desirable than those that aren't because of proximity and community amenities. The expected sign is based upon a comparison with the excluded zip code of 95820.
Sacramento 95819	+	Homes located in East Sacramento are more desirable than those that aren't because of proximity and community amenities. The expected sign is based upon a comparison with the excluded zip code of 95820.
Sacramento 95822	?	Homes located in the Pocket and South Land Park are desirable because of proximity and community amenities, but homes located in other parts of South Sacramento are less desirable because of neighborhood. The expected sign is based upon a comparison with the excluded zip code of 95820.
Age of Home in Years	?	It is unclear if the age of the home will have a positive or negative impact
Full Bathrooms	+	Homes with more full bathrooms tend to be more desirable
Half Bathrooms	+	Homes with a half bathroom tend to be more desirable

Table 3 continued

Variable	Expected Sign	Justification
Bedrooms	+	Homes with more bedrooms tend to be higher priced
Brick Exterior	+	Brick construction tends to be more desirable than non-brick construction
CCAndRs	+	Many home buyers like the that consistency CC&Rs bring to a community
Central Air	+	Homes with central air conditioning tend to be more desirable than those without
Days on Market (DOM)	–	The longer the home is on the market, the lower the price
Distance to nearest bus stop (in miles)	?	The impact of bus stop location on home value is unclear
Distance to nearest Light Rail Station (in miles)	+	Homes that are in close proximity of light rail station are more desirable. However, homes that are too close (within feet) could experience nuisance factors, such as noise or crime.
Within 1/10 mile of Light Rail Station	–	Homes that are in close proximity of light rail station are more desirable, although homes within 1/10 could experience nuisance factors, such as noise or crime.
Within 1/10 to 1/4 mile of Light Rail Station	+	Homes that are in close proximity of light rail station are more desirable.
Within 1/4 to 1/2 mile of Light Rail Station	+	Homes that are in close proximity of light rail station are more desirable.

Table 3 continued

Variable	Expected Sign	Justification
Within 1/2 to 1 mile of Light Rail Station	+	Homes that are in close proximity of light rail station are more desirable.
Fireplace	+	Homes with a fireplace tend to be more desirable
Lot Size - Sq Ft	+	Homes on larger lots tend to be more expensive
1 Car Garage	+	Homes with a garage tend to be more desirable than those without a garage
Pool	+	Homes with a pool tend to be more desirable than those without
Raised Foundation	+	Raised foundation tends to be more desirable than a concrete slab foundation
RV Parking	+	Homes with RV parking tend to be more desirable than those without
Shingle Roof	–	Composition shingle tends to be less desirable than tile or shake roofs
Home Square Footage	+	Home with more square footage tend to be higher priced
Tile Roof	+	Tile roofs are more expensive and more desirable than comp shingle roofs

Table 3 continued

Variable	Expected Sign	Justification
2 Car Garage	+	Homes with a garage tend to be more desirable than those without a garage
Home Owners Association (HOA)	–	Many home buyers dislike the additional fees HOA's levy on their community
Horse Property	+	Homes with a horse property tend to be more desirable than those without
Median Household Income 2000 Census	+	Homes located in neighborhoods with higher median household incomes are more desirable than those with lower median household incomes
2008 API Score	+	Homes located within close proximity to schools with higher API scores are more desirable
January - March 2008	–	Homes sold between January and March 2008 are expected to be negative based on chart illustrating quarterly trends and based on comparison with excluded quarter October – December 2008
April – June 2008	–	Homes sold between April and June 2008 are expected to be negative based on chart illustrating quarterly trends and based on comparison with excluded quarter October – December 2008
July – September 2008	–	Median prices of homes sold between July and September 2008 are expected to be negative based on chart illustrating quarterly trends and based on comparison with excluded quarter October – December 2008
January - March 2009	+	Median prices of homes sold between January and March 2009 are expected to be positive based on chart illustrating quarterly trends and based on comparison with excluded quarter October – December 2008
April – June 2009	+	Median prices of homes sold between April and June 2009 are expected to be positive based on chart illustrating quarterly trends and based on comparison with excluded quarter October – December 2008

The Data

Data used in this analysis came from MetroList Services, Inc. and the SACOG Mapping Center. MetroList is the official Multiple Listing Service (MLS) and computer service provider to more than 25,000 real estate brokers and agents in Sacramento, Placer, El Dorado, Yolo, San Joaquin, Stanislaus, and Merced Counties (MetroList, 2009). The MetroList data provides information on residential property transactions that indicate the sales price and pertinent house and lot characteristics. The data provided by the SACOG Mapping Center was compiled by recording the distance of the 3,414 homes used in the study to the nearest Regional Transit light rail station and nearest bus stop. The specific process involved using Geographic Information Systems (GIS). GIS uses a straight-line distance of measurement, where the shortest distance between the two points is measured. This is important to note, because distance travelled by automobile or foot from a home to the nearest light rail station or bus stop might actually differ (with distance being greater), because of roads, landmarks, and other obstructions. The SACOG Mapping Center also provided API scores and median household income originally from Census 2000 data. Figures 8 and 9 show two maps provided by the SACOG Mapping Center - one that shows ZIP code boundaries, and one that shows Census Tract and Block Group boundaries - that illustrate the data described.

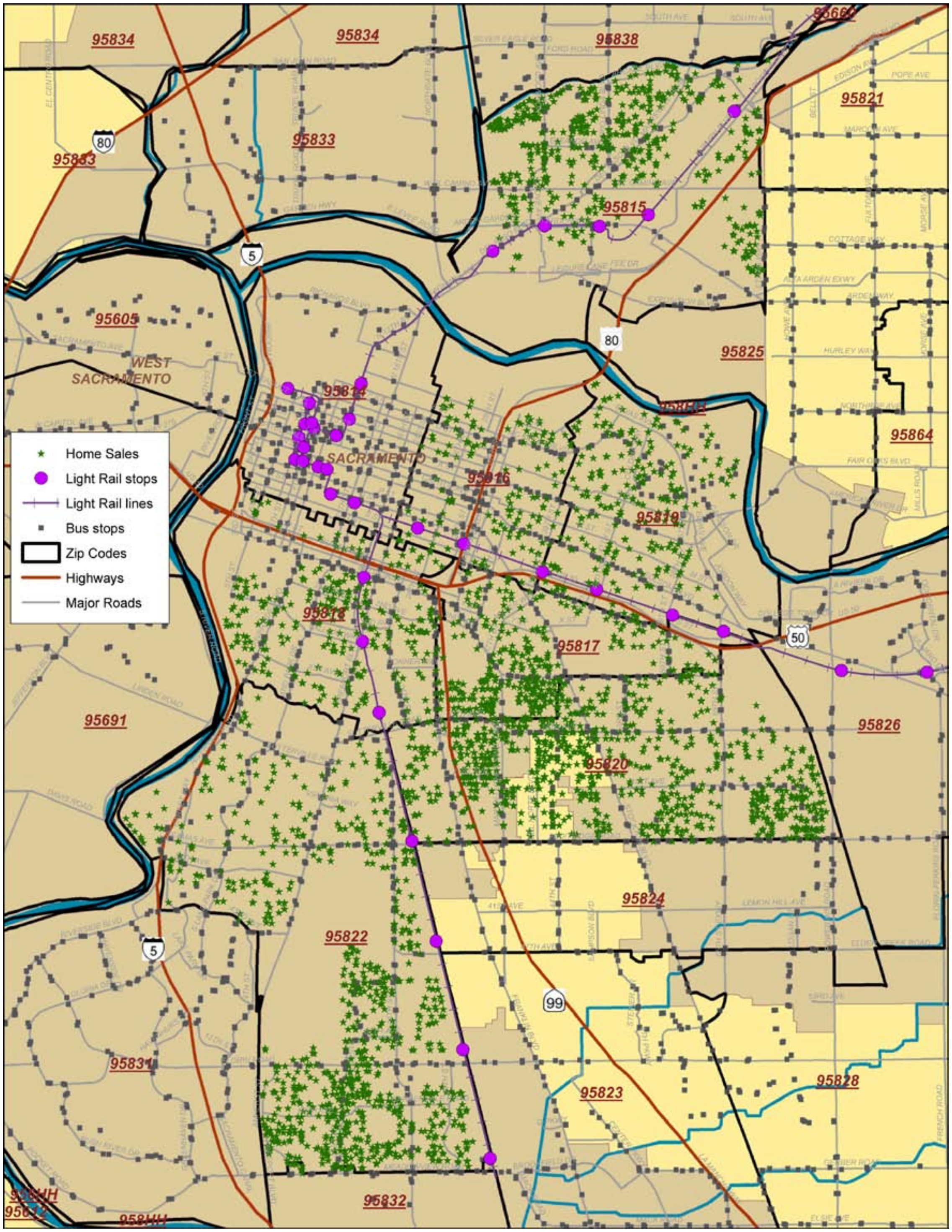

Figure 8. ZIP code boundaries (SACOG Mapping Center, 2009).

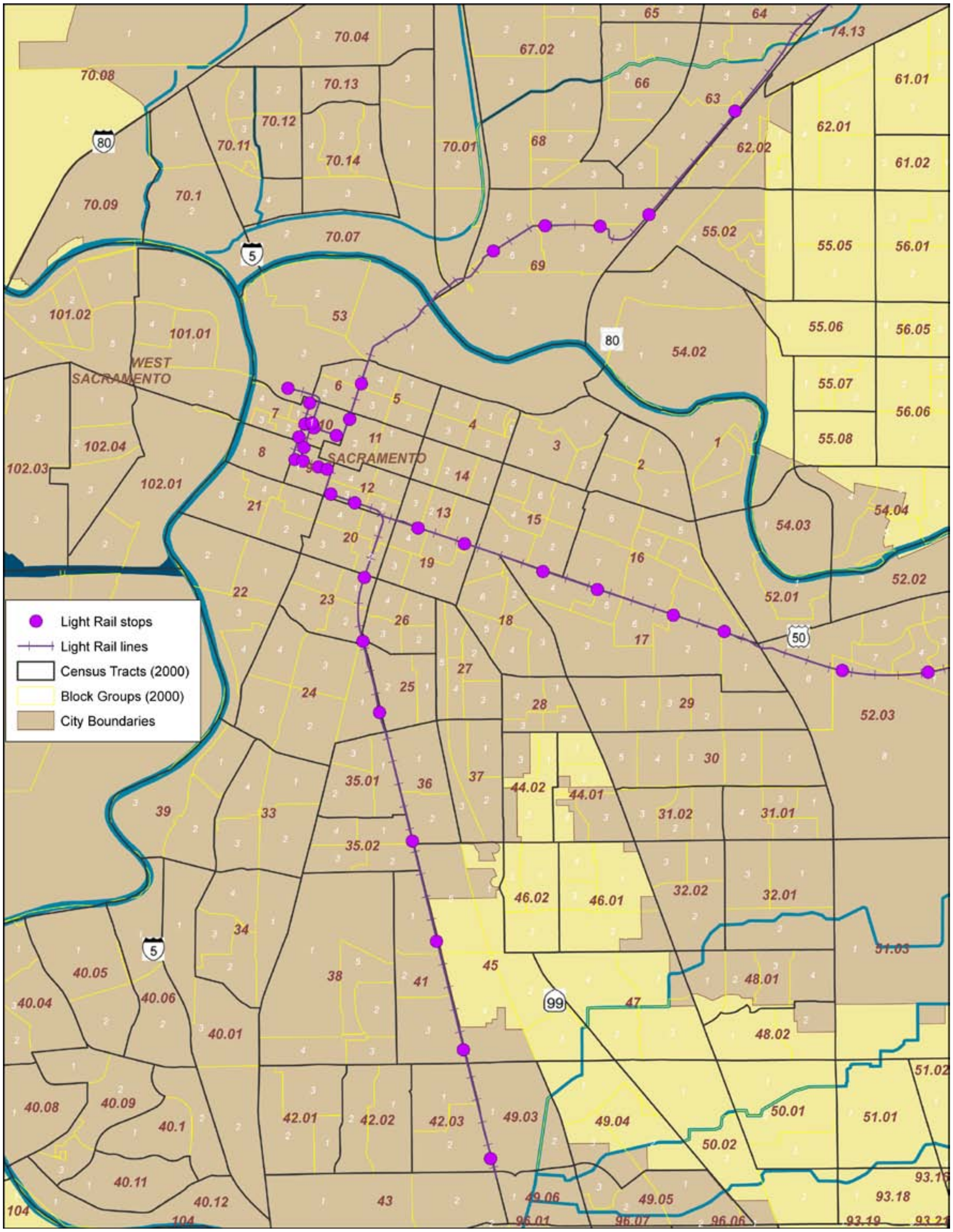

Figure 9. Census tract and block group boundaries (SACOG Mapping Center, 2009).

For this regression analysis, I used 35 independent variables and of these 35 variables, 24 were coded as dummy variables. Variables that are inherently qualitative are quantified by using dummy (or binary) variables. To do this, dummy variables take on the values of one or zero depending on whether a specified condition holds. When used in a regression analysis, one less dummy variable is constructed than conditions, and the event not explicitly represented by a dummy variable is called an omitted condition (Studenmund, 2001, p. 69). Because this study includes several variables that are qualitative in nature, such as those that describe housing characteristics, several of the variables were recoded into binary dummy variables.

Table 4 provides a brief description of each variable I used in the regression analysis, and the source from which the data was obtained. Table 5 provides descriptive statistics for all variables, which specifies the mean, standard deviation, the minimum, and the maximum. Finally, Table A1 in the appendix provides simple correlation coefficients between all independent variables. These correlations measure the strength and direction of the linear relationships between each pair of independent variables. The correlation coefficient ranges in value from −1 to +1. Each distinct increase or decrease in the independent variable is accompanied by an exactly similar increase or decrease in the dependent variable (Science Clarified, 2009). For example, a correlation coefficient of +0.75 means that a change in the independent variable will be accompanied by a comparable increase in the dependent variable a majority of the time. A correlation coefficient of 0 means that changes in the independent and dependent variable appear to be random and completely unrelated to each other, and a negative correlation coefficient (such as −0.69) means that two variables respond in opposite directions (Science Clarified, 2009). Examining this correlation is important because it reveals how closely two variables change in relationship to one another.

Table 4

Variable Description and Source

Variable	Description	Source
3 or Greater Car Garage	Dummy variable for 3 car garage or greater = 1 if the home has one and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Sacramento 95816	Dummy variable for zip code = 1 if the home is located in this zip code and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Sacramento 95817	Dummy variable for zip code = 1 if the home is located in this zip code and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Sacramento 95818	Dummy variable for zip code = 1 if the home is located in this zip code and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Sacramento 95819	Dummy variable for zip code = 1 if the home is located in this zip code and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Sacramento 95822	Dummy variable for zip code = 1 of the home is locates in this zip code and= 0 if not	Sacramento Region’s Multiple Listings Service (MLS)
Age of Home in Years	The age of the home in years	Sacramento Region's Multiple Listing Service (MLS)
Full Bathrooms	Number of full bathrooms the home has	Sacramento Region's Multiple Listing Service (MLS)
Half Bathrooms	Number of half bathrooms the home has	Sacramento Region's Multiple Listing Service (MLS)

Table 4 continued

Variable	Description	Source
Bedrooms	Number of bedrooms the home has	Sacramento Region's Multiple Listing Service (MLS)
Brick Exterior	Dummy variable for brick home exterior = 1 if the home has it and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
CCAndRs	Dummy variable for Covenants, Conditions, and Restrictions = 1 if the home has it and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Central Air	Dummy variable for central air = 1 if the home has it and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Days on Market (DOM)	The number of days the home was on the market before it sold	Sacramento Region's Multiple Listing Service (MLS)
Distance to nearest bus stop	The distance from home to the nearest bus stop (in miles)	SACOG Mapping Center
Distance to nearest Light Rail Station (in miles)	The distance from home to the nearest light rail station (in miles)	SACOG Mapping Center
Within 1/10 mile of Light Rail Station	Dummy variable within 1/10 mile of light rail station = 1 if home is and 0 if not	SACOG Mapping Center
Within 1/10 to 1/4 mile of Light Rail Station	Dummy variable within 1/10 to 1/4 mile of light rail station = 1 if home is and 0 if not	SACOG Mapping Center
Within 1/4 to 1/2 mile of Light Rail Station	Dummy variable within 1/4 to 1/2 mile of light rail station = 1 if home is and 0 if not	SACOG Mapping Center
Within 1/2 to 1 mile of Light Rail Station	Dummy variable within 1/2 to 1 mile of light rail station = 1 if home is and 0 if not	SACOG Mapping Center
Fireplace	Dummy variable for fireplace = 1 if the home has one and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)

Table 4 continued

Variable	Description	Source
Lot Size - Sq Ft	Size of lot in square feet	Sacramento Region's Multiple Listing Service (MLS)
1 Car Garage	Dummy variable for 1 car garage = 1 if the home has one and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Pool Dummy	Dummy variable for swimming pool = 1 if the home has one and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Raised Foundation	Dummy variable raised foundation = 1 if the home has it and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
RV Parking	Dummy variable for RV parking = 1 if the home has it and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Composition Shingle Roof	Dummy variable for composition shingle roof on home = 1 if the home has it and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Home Square Footage	Size of home in square feet	Sacramento Region's Multiple Listing Service (MLS)
Tile Roof	Dummy variable for tile roof = 1 if the home has it and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
2 Car Garage	Dummy variable for 2 car garage = 1 if the home has one and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
HOA	Dummy variable for Home Owner's Association = 1 if the home has one and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Horse Property	Dummy variable for horse property = 1 if the home has it and = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
Median Household Income 2000 Census	Median Household Income	SACOG Mapping Center (Original source - Census 2000)

Table 4 continued

Variable	Description	Source
2008 API Score	Academic Performance Index (API) Score	SACOG Mapping Center
January - March 2008	Dummy variable for January – March 2008 1 if the home sold during this quarter = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
April – June 2008	Dummy variable for April - June 2008 1 if the home sold during this quarter = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
July – September 2008	Dummy variable for July September 2008 1 if the home sold during this quarter = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
January - March 2009	Dummy variable for January – March 2009 1 if the home sold during this quarter = 0 if not	Sacramento Region's Multiple Listing Service (MLS)
April – June 2009	Dummy variable for April - June 2009 1 if the home sold during this quarter = 0 if not	Sacramento Region's Multiple Listing Service (MLS)

Table 5

Descriptive Statistics

Variable	Mean	Standard Deviation	Maximum	Minimum
Home Value (Selling Price)	177,771	172,356	2,450,000	6,053
3 or Greater Car Garage	0.01	0.092	1	0
Sacramento 95816	0.04	0.204	1	0
Sacramento 95817	0.11	0.307	1	0
Sacramento 95818	0.08	0.277	1	0
Sacramento 95819	0.07	0.260	1	0
Sacramento 95822	0.26	0.436	1	0
Age of Home in Years	58.43	21.796	129	0
Full Bathrooms	1.47	0.572	7	1
Half Bathrooms	0.11	0.000	2	0
Bedrooms	2.80	0.742	9	1
Brick Exterior	0.02	0.131	1	0

Table 5 continued

Variable	Mean	Standard Deviation	Maximum	Minimum
CCAndRs	0.69	0.462	1	0
Central Air	0.65	0.477	1	0
Days on Market (DOM)	53.23	66.146	509	0
Distance to nearest bus stop (in miles)	0.13	0.0815	0.5	0
Distance to nearest Light Rail Station (in miles)	0.93	0.4594	2.5	0.1
Within 1/10 mile of Light Rail Station	0.0059	0.07636	1	0
Within 1/10 to 1/4 mile of Light Rail Station	0.0569	0.23164	1	0
Within 1/4 to 1/2 mile of Light Rail Station	0.1481	0.3552	1	0
Within 1/2 to 1 mile of Light Rail Station	0.3565	0.47903	1	0
Fireplace	0.55	0.498	1	0
Lot Size - Sq Ft	6352.58	2541.404	41251	0
1 Car Garage	0.30	0.460	1	0

Table 5 continued

Variable	Mean	Standard Deviation	Maximum	Minimum
Pool Dummy	0.05	0.210	1	0
Raised Foundation	0.66	0.473	1	0
RV Parking	0.12	0.329	1	0
Shingle Roof	0.87	0.333	1	0
Home Square Footage	1222.23	438.579	9652	400
Tile Roof	0.02	0.145	1	0
2 Car Garage	0.34	0.472	1	0
HOA	0.01	0.080	1	0
Horse Property	0.00	0.024	1	0
Median Household Income 2000 Census	35084.65	15313.583	151209	12950
2008 API Score	732.07	74.082	934	523
January - March 2008 Dummy	0.10	0.305	1	0

Table 5 continued

Variable	Mean	Standard Deviation	Maximum	Minimum
April – June 2008 Dummy	0.17	0.373	1	0
July – September 2008 Dummy	0.21	0.405	1	0
January - March 2009 Dummy	0.18	0.381	1	0
April – June 2009 Dummy	0.17	0.378	1	0

The following chapter discusses the results of the regression analysis. It includes the an evaluation of the three functional forms (lin-lin, log-lin, and log-lin), an explanation of the functional form chosen, an evaluation of the results, an examination of any multicollinearity, and an assessment of heteroskedasticity.

Chapter 4

RESULTS

This chapter examines and discusses the results of the regression analysis. It includes an evaluation using three functional forms, indicating whether key variables have a statistically significant effect on price and whether the direction of the effect is as expected. It also includes an examination for any signs of multicollinearity, and an assessment of whether heteroskedasticity is present.

The regression models that I tested evaluated three basic functional forms of the hedonic model: linear-linear, log-linear, and log-log. I decided to use the Log-Log functional form for my analysis, since this form yielded the most significant variables. Table 6 provides the results of the three functional forms, with un-standardized coefficients and standard errors given in parentheses. Studenmund (2006) indicates that comparing the adjusted R squared between models is irrelevant in picking the best model, since the variables are transformed in some functional forms and not in others. Subsequently, in addition to the R squared, I have reported the variance inflation factors (VIF) and the statistical significance of the each of the coefficients at the 90, 95, and 99 percent confidence levels.

Table 6

Regression Results

Explanatory Variable	OLS Linear-Linear Results	OLS Log-Linear Results	OLS Log-Log Results	VIF for Linear-Linear Regression	VIF for Log-Linear Regression	VIF for Log-Log Regression
Constant	-261632*** (20316.603)	9.269*** (.105)	-4.565*** (.617)			
3 or Greater Car Garage	-3701.809 (14887.324)	.052 (.077)	.126* (.075)	1.083	1.083	1.066
Sacramento 95816	170002.3*** (7896.979)	.876*** (.041)	.838*** (.040)	1.501	1.501	1.509
Sacramento 95817	35912.474*** (4772.486)	.217*** (.025)	.232*** (.024)	1.247	1.247	1.268
Sacramento 95818	135127.7*** (6769.182)	.682*** (.035)	.701*** (.034)	2.034	2.034	1.972
Sacramento 95819	179539.7*** (6819.393)	.768*** (.035)	.762*** (.034)	1.818	1.818	1.773
Sacramento 95822	-11163.7*** (3841.231)	.071*** (.020)	.043*** (.019)	1.627	1.627	1.639
Age of Home in Years	-36.164 (82.301)	-.002*** (.000)	-.002*** (.000)	1.865	1.865	1.868
Bathrooms - Full	13315.028*** (3572.076)	.030 (.018)	.035 (.027)	2.423	2.423	2.242
Bathrooms - Half	20821.887*** (4580.670)	,063*** (.024)	.060*** (.023)	1.194	1.194	1.183
Bedrooms	-15091.2*** (2452.801)	-.006 (.015)	-.119*** (.035)	1.921	1.921	2.026
Brick Exterior	61032.840*** (10232.830)	.156*** (.053)	.141*** (.052)	1.049	1.049	1.049
CCAndRs D	-6736.690** (2881.955)	-.063*** (.015)	-.057*** (.015)	1.029	1.029	1.029

Table 6 continued

Explanatory Variable	OLS Linear-Linear Results	OLS Log-Linear Results	OLS Log-Log Results	VIF for Linear-Linear Regression	VIF for Log-Linear Regression	VIF for Log-Log Regression
Central Air	25112.784*** (2962.675)	.270*** (.015)	.256*** (.015)	1.157	1.157	1.161
Days on Market (DOM)	7.164 (20.218)	-4.92E-005 (.000)	-3.85E-005 (.000)	1.037	1.037	1.036
Distance to nearest bus stop (in miles)	10577.397 (16964.006)	.062 (.088)	.094 (.086)	1.107	1.107	1.108
Within 1/10 mile of Light Rail Station	-10394.6 (17631.514)	.114 (.091)	.119 (.089)	1.051	1.051	1.049
Within 1/10 to 1/4 mile of Light Rail Station	7802.059 (6176.808)	.184*** (.032)	.182*** (.031)	1.187	1.187	1.192
Within 1/4 to 1/2 mile of Light Rail Station	26085.191*** (4190.634)	.136*** (.022)	.146*** (.021)	1.284	1.284	1.286
Within 1/2 to 1 mile of Light Rail Station	17529.866*** (3061.401)	.045*** (.016)	.063*** (.016)	1.247	1.247	1.269
Fireplace	3090.214 (3139.192)	.157*** (.016)	.105*** (.016)	1.414	1.414	1.478
HOA	72087.840*** (17776.918)	.362*** (.092)	.325*** (.090)	1.174	1.174	1.173
Horse Property	12414.248 (54529.520)	.175 (.282)	.077 (.276)	1.010	1.010	1.011
Lot Size - Sq Ft	1.561*** (.593)	2.64E-006 (.000)	3.10E-006 (.000)	1.315	1.315	1.308
1 Car Garage	10183.746*** (3744.077)	.094*** (.019)	.085*** (.019)	1.722	1.722	1.726
Pool	36028.258*** (6617.618)	.067** (.034)	.082** (.033)	1.115	1.115	1.104

Table 6 continued

Explanatory Variable	OLS Linear-Linear Results	OLS Log-Linear Results	OLS Log-Log Results	VIF for Linear-Linear Regression	VIF for Log-Linear Regression	VIF for Log-Log Regression
Raised Foundation	20714.387*** (3197.398)	.095*** (.017)	.100*** (.016)	1.324	1.324	1.322
RV Parking	-438.261 (4092.316)	.095*** (.021)	.088*** (.021)	1.050	1.050	1.051
Shingle Roof	-5683.186 (4464.794)	-.009 (.023)	-.021 (.023)	1.278	1.278	1.272
Home Square Footage	154.605*** (4.961)	.000*** (.000)	.824*** (.039)	2.744	2.744	2.983
Tile Roof	-9146.518 (10080.335)	.027*** (.052)	.028 (.051)	1.234	1.234	1.234
2 Car Garage	1684.205 (4072.051)	.080 (.021)	.058*** (.021)	2.143	2.143	2.151
Median Household Income 2000 Census	2.882*** (.121)	1.14E-005*** (.000)	.458*** (.023)	1.986	1.986	1.955
2008 API Score	108.704*** (24.745)	.001*** (.000)	.801*** (.091)	1.948	1.948	1.873
January - March 2008	43949.420*** (5894.750)	.398*** (.031)	.386*** (.030)	1.878	1.878	1.879
April – June 2008	33513.711*** (4652.928)	.299*** (.024)	.290*** (.024)	1.745	1.745	1.745
July – September 2008	18878.660*** (4303.495)	.158*** (.022)	.159*** (.022)	1.759	1.759	1.759
January - March 2009	-14911.1*** (4460.385)	-.140*** (.023)	-.138*** (.023)	1.674	1.674	1.674
April – June 2009	-15590.3*** (4488.387)	-.100*** (.023)	-.106*** (.023)	1.664	1.664	1.664
R-Squared	.804	.771	.782			

Table 6 continued

Explanatory Variable	OLS Linear-Linear Results	OLS Log-Linear Results	OLS Log-Log Results	VIF for Linear-Linear Regression	VIF for Log-Linear Regression	VIF for Log-Log Regression
Adjusted R-Squared	.802	.769	.779			
Number of Observations	3,410	3,410	3,410	3,410	3,410	3,410

* Statistically significant at greater than 90% in a two-tailed test
** Statistically significant at greater than 95% in a two-tailed test
*** Statistically significant at greater than 99% in a two-tailed test

Comparison of Functional Forms in Regression Results

The results of the Linear-Linear regression show that 27 out of the 39 explanatory variables were statistically significant at a confidence level greater than 90%. The results of the Log-Linear regression also yielded a high number of statistically significant variables, showing that 29 out of the 39 explanatory variables were statistically significant at a confidence level greater than 90%. While the results from the Lin-Linear and Log-Linear regression demonstrate that being within 1/10 to 1/4, 1/4 to 1/2, and 1/2 to 1 mile has a positive effect on home value and yield statistically significant results, the premise of my analysis is based on the Log-Log regression results.

The results of the Log-Log regression show that 31 out of the 39 explanatory variables were statistically significant at a confidence level greater than 90%. Since my study is concerned with the effect of light rail station proximity on home value, the interpretation of the distance variables will be the focus of this analysis. Using the coefficients of the statistically significant distance to light rail variables, I calculated the percent change in price that distance to light rail has on property. To calculate this percent change on price, I used the following equation: % change price = 100 * (exp (coefficient of dummy) - 1) (Halvorsen & Palmquist, 1980). The following results were calculated for each distance variable:

<u>1/10 to 1/4 mile of Light Rail</u> = 100 * (exp (.182) - 1) = 100 * (1.196 - 1) = 19.6%

<u>1/4 to 1/2 mile of Light Rail</u> = 100 * (exp (.146) - 1) = 100 * (1.157 - 1) = 15.7%

<u>1/2 to 1 mile of Light Rail</u> = 100 * (exp (.063) - 1) = 100 * (1.065 - 1) = 6.5%

These results clearly indicate that the effect of light rail gets weaker as distance increases, and thus, home value (selling price) decreases as the distance from light rail station increases. However, since these percentages are quite high, it is important to note that other neighborhood amenities are also likely causing an effect, and the results are not strictly due to light rail station proximity. Other neighborhood attributes, such as parks and proximity other public amenities that are close to light rail are not accounted for in this model. The proximity of these types of amenities can also have an effect on home value and, thus, inflate the percentage change in price, as shown.

Another important factor to highlight from the results is the effects of being too close to light rail stations. The results demonstrate that a home being closer than 1/10 of a mile is not statistically different from zero. This is not too surprising because of the negative externalities associated with being too close to light rail. Specifically, noise from light rail, crime, and other nuisance factors that can lower the property value are apparent in results. The results show that the effect of negative externalities decline as distance from light rail station increases. This results show that after moving beyond 1/10 of a mile, distance become statistically significant up to the 1-mile point.

Multicollinearity

Multicollinearity occurs when the relative movements of two explanatory variables match (i.e., when one changes, the other will tend to change too), though the absolute size of the movements might differ. Consequently, the Ordinary Least Squares (OLS) estimation procedure will be incapable of distinguishing one variable from the other (Studenmund, 2006, p. 245). Variance Inflation Factor (VIF) measures the extent that a given explanatory variable is explained by all other independent variables.

In order to check for multicollinearity in my analysis, I examined the simple correlation coefficients provided in Table 4 of the Appendix and the Variance Inflation Factors (VIFs) for the Lin-Lin, Log-Lin, and Log-Log results provided in Table 5. Studenmund (2006) indicates that a simple correlation coefficient of 0.80 or greater suggests multicollinearity between the two independent variables. Studenmund (2006) also indicates that a common rule of thumb is that a VIF of greater than five (5) indicates severe multicollinearity. According to Table A1, all simple correlation coefficients were found to be less than 0.80 and according to Table 6, none of the variables had a VIF above 5.0, therefore multicollinearity was not present in my analysis.

Heteroskedasticity

Heteroskedasticity is present when the observations of the error terms do not have a constant variance (Stundemund, 2006, p. 346). This means that the scatter of the errors in the dependent variable will differ depending on the value of the explanatory variable. Though heteroskedasticity does not cause a bias in coefficient estimates, it does cause a bias in the OLS estimates of the standard errors. Heteroskedasticity often occurs in data sets in which there is a wide disparity between the largest and smallest observed value of the dependent variable. In other words, the larger the disparity between the size of observations of the dependent variable in a sample, the larger the likelihood that the error term observations associated with them will have different variances, and therefore be heteroskedastic (Studenmund, 2006, p. 349).

In order to check for heteroskedasticity, I performed a Park Test. A Park Test involves three basic steps: (1) the regression equation is estimated by OLS and the residuals are calculated, (2) the log of the squared residuals is used as the dependent variable whose only explanatory variable is the log of the proportionality factor Z, and (3) the results of the second regression are tested to see if there is any evidence of heteroskedasticity (Studenmund, 2006, p. 357). Following these steps in this analysis, I saved the unstandardized residuals from the OLS log-log regression and the log of the residuals was then regressed against the log of a chosen Z proportionality factor. According to Studenmund, a good Z is a variable that seems likely to vary with the variance of the error term (Studenmund, 2006, p. 358). Based on this recommendation, I choose the natural log of the variable Home Square Footage as the Z Factor. This variable had a calculated t-value of 1.007, which was below the critical t-value of 1398.33 at the 1% level of significance in a two-tailed test, with 3410 degrees of freedom. The results indicate that the t-value of 1.007 is not statistically significant, and therefore heteroskedasticity is not present in my model.

The final chapter provides a summary of the previous chapters, along with major findings and conclusions drawn based on the regression results. It will also include policy recommendations, as they relate to SB 375 and the SACOG Blueprint, and more specifically, transit-oriented development (TOD), and suggestions for improvements to the analysis.

Chapter 5

CONCLUSION

The final chapter of this thesis discusses the major findings based on the regression, an evaluation of how the regression results relate to the initial research question, and the policy implications related to SB 375, the SACOG Blueprint, and transit-oriented development (TOD). This chapter concludes with suggested improvements I would have made given additional time.

Evaluation of the Regression Results

My research shows that in Sacramento, proximity to light rail stations raises residential property values. The results of the Log-Log regression confirm the findings of studies in the Literature Review, which indicate that proximity to light rail has a positive effect on residential property value. The results also confirm that being too close, within 1/10 of a mile, to light rail can have a negative effect on residential property value because of negative externalities of being to close (e.g., noise and crime). However, given the magnitude of the distance results, proximity of light rail station is not the only contributing factor. Proximity to public amenities, such as parks and retail, also contribute to this effect. Thus, the correct interpretation of the results is to understand that the positive effect of light rail gets weaker as distance increases, but the magnitude of this effect is not strictly because of light rail proximity. The results argue in favor of proximity to both light rail and central locations, which bodes well for the potential of high-density TOD around central locations.

Overall, the results of the Log-Log regression show that 31 out of the 39 explanatory variables were statistically significant at a confidence level greater than 90%. Of these statistically significant variables, those that did not yield the expected sign were Home Owner's Association (HOA), Covenants, Conditions and Restrictions (CC&Rs), January – March 2008, April – June 2008, July – September 2008, January – March 2009, and April – June 2009, 2008. I expected HOA to have a negative sign because of many homebuyers dislike the additional fees that HOAs levy on their community; however, the results show that HOA had a positive sign. This outcome could be because homebuyers prefer the consistency that HOAs bring to their neighborhood more so than they dislike the fees. Conversely, based on the negative sign of CC&Rs, the effect of restrictions imposed by the CC&Rs are more apparent over the consistency that that they might bring to a neighborhood. With respect to quarterly variables, I expected negative signs for the first three quarters in 2008 and positive signs for the first two quarters in 2009 based on market trends mentioned in Chapter 3; however, the results yielded the exact opposite.

Though I indicated that I was uncertain of the effect, I expected that the zip code 95817 to have a negative effect on home value because of the neighborhood characteristics of Oak Park, such crime statistics and median household income. However, because other neighborhoods (such as Elmhurst and Tahoe Park) lie within the 95817 boundary, this expected negative effect was likely offset by positive attributes of these other neighborhoods. The results indicated the same effect for the zip code 95822, which is primarily comprised of homes in South Sacramento, yet yielded a positive sign. Another variable that I indicated uncertainty about was that of bus stop location. This variable actually yielded a positive sign, though previous studies have indicated that bus stop locations have a negative effect on residential property. The positive sign might be explained by the specific zip codes examined in the study or other public amenities near bus stop locations.

Reflecting back on the initial research question as to whether light rail station location has a positive or negative impact on residential property value; it is evident that the light rail station proximity yields a positive effect. My analysis specifically demonstrates that, within the study area, there is a positive effect from 1/10 of a mile up to 1 mile from light rail station. The benefit of accessibility to this public amenity results in a positive price effect starting with 19.6% from 1/10 to 1/4 mile, 15.7% from 1/4 to 1/2 mile, and 6.5% from 1/2 to 1 mile. Extracting the effect beyond 1 mile was not necessary because the notion of accessibility also denotes walkability, and furthermore, most research on the subject has not examined beyond this distance. These positive results argue in favor of policies currently outlined by both SB 375 and the SACOG Blueprint, specifically those related to expanding rail transit and high-density TOD in the Sacramento region.

Policy Implications

As mentioned in Chapter 1, the SACOG Blueprint is a growth plan for the Sacramento six-county region that promotes compact, mixed-use development and more transit choices as an alternative to low density development (Sacramento Regional Blueprint, 2009c). In linking land use with transportation, it also promotes TOD throughout the region. As a long-range plan for growth through 2050, it is important to understand the implications of high-density TOD and the effects that this type of land use can have on residential property value as part of the net benefit to the region. Understanding the effects of this type of land use is especially important because of the large amount of public funding needed for transportation expansion and the emphasis on high-density TOD planning objectives. The quantitative results of my analysis support this undertaking by SACOG in that it demonstrates not only the benefit of light rail station location on property value, but also the benefit of high-density development near central locations. Thus, it supports a walkable urban form of development around transit stations. In this respect, the results argue in favor of the concept of smart growth, and underscore the benefit of land-use, as outlined by the Blueprint “Preferred Scenario.” Conversely, the results also support an argument against the alternative; more land consumptive, suburban form of development that relies more heavily on automobile use.

The emphasis on linking land use and transportation planning is also a key element in SB 375. As mentioned in Chapter 1, SB 375 requires California’s 18 metropolitan planning organizations (MPOs) to show that their future planning scenarios will result in a reduction in carbon (The Planning Report, 2007). One of the goals of SB 375 is to limit the state's GHG emissions by curbing suburban sprawl (low-density development) increasing transit-based, high-density development through the adoption of sustainable community strategies (Office of the Governor, 2009). The findings of my analysis support the high-density development and TOD goals of SB 375. In turn, the findings also support the goal of reducing GHG emissions though these smart growth concepts.

By encouraging smart growth through TOD, SB 375 makes assumptions about consumer demand for this type of development. In demonstrating that there is a higher value on residential properties around transit stations and centralized locations, the question of consumer demand for this TOD is also answered, at least for now. As to whether this same demand for TOD will continue into the future is yet to be answered through future research.

In summary, my results support the land use and transportation goals of both SACOG Blueprint and SB 375. While I recommend that the Sacramento region move forward with the SACOG Blueprint “Preferred Scenario” and the required sustainable communities strategies of SB 375, further research and analysis would be necessary in the future. Given that consumer demands can change over time, especially with respect to transportation and housing, and given that the Blueprint is a long-range plan and SB 375 encourages high-density growth patterns, it is important to examine the effects over time. Future analysis could not only examine light rail effects on property value, but also public transit ridership trends, housing trends, and the effectiveness of high-density TOD with respect to GHG reduction.

Suggested Improvements

Given more time on this study, I would have made a few improvements to my model and overall analysis. I would have expanded my sample are to include all zip codes in the City, even perhaps including zip codes that are in the County of Sacramento. By enlarging my sample size, I could then isolate the effects across a variety of neighborhoods that include a variety of housing types. Adding more observations, and recording the distance to nearest light rail for these added observations would also likely help improve the analysis. Two useful variables to add to my analysis would have been crime level per zip code, based on crime statistics, and distance to freeway. Adding crime data would have perhaps helped with isolating some of the nuisance effects that affect property value, besides the nuisance effects of being too close to light rail. Adding distance to freeway would also help with either teasing out nuisance effects and/or positive effects of proximity based on a certain distances. Lastly, I would have based measurements of distance from home to light rail station on walking distance, rather than a straight-line measurement, where the shortest distance between the two points was measured (“as the crow flies”). This change would have allowed for a more accurate measurement of the key explanatory variable – distance to light rail – thus improving the accuracy of the analysis and strength of the results.

In conclusion, my analysis has demonstrated that proximity to light rail stations has a positive effect on residential properties in established neighborhoods within the City of Sacramento. This positive effect diminishes as distance to light rail increases, demonstrating that high-density transit-oriented development is currently a desirable form of land use, thus supporting the goals of the SACOG Blueprint and SB 375.

APPENDIX

Correlation Coefficients

Table A1

Correlation Coefficients

	3 or Greater Car Garage	Sacramento 95816	Sacramento 95817	Sacramento 95818	Sacramento 95819
3 or Greater Car Garage	1	0.012	-0.021	0.007	0.023
Sacramento 95816	0.012	1	-.073(**)	-.064(**)	-.060(**)
Sacramento 95817	-0.021	-.073(**)	1	-.104(**)	-.096(**)
Sacramento 95818	0.007	-.064(**)	-.104(**)	1	-.085(**)
Sacramento 95819	0.023	-.060(**)	-.096(**)	-.085(**)	1
Sacramento 95822	-0.032	-.125(**)	-.201(**)	-.177(**)	-.164(**)
Age of Home in Years	.043(*)	.145(**)	.181(**)	.214(**)	.081(**)
Bathrooms - Full	.041(*)	.042(*)	-.135(**)	0.004	.037(*)
Bathrooms - Half	-0.001	0.019	-0.026	.042(*)	.088(**)
Bedrooms	0.008	-.066(**)	-.120(**)	-.089(**)	-0.012
Brick Exterior	0.012	0.004	-0.024	.105(**)	.091(**)
CC&R's	-0.028	-.035(*)	-0.020	-0.002	-.062(**)
Central Air	0.014	.039(*)	-.116(**)	.081(**)	.104(**)
Days on Market (DOM)	-0.005	-0.024	0.022	-0.008	-0.013
Bus Stop Distance Miles	-0.002	-.064(**)	-0.024	-.094(**)	-.072(**)
Within 1/10 mile	-0.007	.040(*)	-0.026	0.032	.097(**)
Within 1/10 to 1/4 mile	0.032	.072(**)	-.047(**)	.159(**)	.043(*)
Within 1/4 to 1/2 mile	0.015	.065(**)	-0.003	.184(**)	0.030
Within 1/2 to 1 mile	-0.009	0.004	.093(**)	-0.030	-.053(**)
Fireplace	0.013	0.025	-.163(**)	.139(**)	.153(**)
HOA	-0.007	.199(**)	-0.016	-0.024	-0.023
Horse Property	-0.002	-0.005	0.031	-0.007	-0.007
Lot Size - Sq Ft	.120(**)	-.165(**)	-.183(**)	-.114(**)	-0.008
1 Car Garage	-.061(**)	.047(**)	.046(**)	0.019	0.004
Pool	0.010	-0.026	-.066(**)	.055(**)	.079(**)
Raised Foundation	0.005	.051(**)	.108(**)	.155(**)	.130(**)
RV Parking	.062(**)	-0.010	-0.024	-0.023	-0.023
Shingle Roof	-0.022	-0.031	.071(**)	-.111(**)	-.073(**)
Home Square Footage	.144(**)	.099(**)	-.106(**)	.158(**)	.189(**)
Tile Roof	0.008	-0.002	-.038(*)	-0.015	.044(**)
2 Car Garage	-.066(**)	-.084(**)	-.151(**)	-.044(*)	0.012
Median Household Income 2000 Census	0.027	.169(**)	-.204(**)	.334(**)	.384(**)
2008 API Score	-0.001	.211(**)	-.139(**)	.388(**)	.383(**)
January - March 2008	-0.032	0.012	0.020	.112(**)	.034(*)
April - June 2008	0.010	.055(**)	0.000	0.001	0.020
July - September 2008	.047(**)	-0.002	-0.010	-0.028	-0.009
January - March 2009	-0.018	-.038(*)	-0.001	-.040(*)	-0.005
April - June 2009	0.000	-0.017	0.008	0.000	0.007

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

	Sacramento 95822	Age of Home in Years	Bathrooms - Full	Bathrooms - Half	Bedrooms
3 or Greater Car Garage	-0.032	.043(*)	.041(*)	-0.001	0.008
Sacramento 95816	-.125(**)	.145(**)	.042(*)	0.019	-.066(**)
Sacramento 95817	-.201(**)	.181(**)	-.135(**)	-0.026	-.120(**)
Sacramento 95818	-.177(**)	.214(**)	0.004	.042(*)	-.089(**)
Sacramento 95819	-.164(**)	.081(**)	.037(*)	.088(**)	-0.012
Sacramento 95822	1	-.310(**)	.252(**)	.068(**)	.223(**)
Age of Home in Years	-.310(**)	1	-.374(**)	-.097(**)	-.370(**)
Bathrooms - Full	.252(**)	-.374(**)	1	-0.032	.572(**)
Bathrooms - Half	.068(**)	-.097(**)	-0.032	1	.147(**)
Bedrooms	.223(**)	-.370(**)	.572(**)	.147(**)	1
Brick Exterior	-.053(**)	.078(**)	0.011	0.025	0.009
CC&R's	.085(**)	-.077(**)	.037(*)	0.004	0.030
Central Air	.145(**)	-.201(**)	.218(**)	.067(**)	.169(**)
Days on Market (DOM)	.036(*)	0.007	0.019	0.011	-0.001
Bus Stop Distance Miles	.201(**)	-.140(**)	0.005	.058(**)	.051(**)
Within 1/10 mile	-0.019	.065(**)	-0.016	-0.002	-0.015
Within 1/10 to 1/4 mile	-0.033	.102(**)	-0.015	0.009	-.048(**)
Within 1/4 to 1/2 mile	-0.006	.069(**)	-.049(**)	-.035(*)	-.090(**)
Within 1/2 to 1 mile	-.044(**)	-0.007	0.029	0.011	0.010
Fireplace	.254(**)	-0.033	.189(**)	.086(**)	.126(**)
HOA	0.028	-.169(**)	.081(**)	-0.016	-.052(**)
Horse Property	-0.014	0.014	-0.020	0.030	0.007
Lot Size - Sq Ft	.238(**)	-.089(**)	.176(**)	.044(*)	.190(**)
1 Car Garage	-.220(**)	.072(**)	-.210(**)	-.070(**)	-.150(**)
Pool	.077(**)	-0.023	.153(**)	.072(**)	.080(**)
Raised Foundation	-.063(**)	.437(**)	-.175(**)	0.001	-.199(**)
RV Parking	.034(*)	.036(*)	0.010	0.002	-0.013
Shingle Roof	-.036(*)	.061(**)	-.107(**)	-.075(**)	-.036(*)
Home Square Footage	.107(**)	-.141(**)	.632(**)	.225(**)	.540(**)
Tile Roof	.076(**)	-.143(**)	.116(**)	.046(**)	.089(**)
2 Car Garage	.384(**)	-.293(**)	.314(**)	.094(**)	.251(**)
Median Household Income 2000 Census	-0.014	.144(**)	.152(**)	.084(**)	.047(**)
2008 API Score	-.082(**)	.143(**)	.035(*)	.061(**)	-.056(**)
January - March 2008	-0.023	.039(*)	-0.007	0.024	-0.024
April - June 2008	-.044(*)	.042(*)	-0.026	0.017	-0.025
July - September 2008	0.024	0.000	0.000	-0.015	0.009
January - March 2009	.043(*)	-.071(**)	0.018	0.001	.035(*)
April - June 2009	-0.003	-0.026	.054(**)	0.005	0.019

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

	Brick Exterior	CC&R's	Central Air	Days on Market (DOM)	Bus Stop Distance Miles
3 or Greater Car Garage	0.012	-0.028	0.014	-0.005	-0.002
Sacramento 95816	0.004	-.035(*)	.039(*)	-0.024	-.064(**)
Sacramento 95817	-0.024	-0.020	-.116(**)	0.022	-0.024
Sacramento 95818	.105(**)	-0.002	.081(**)	-0.008	-.094(**)
Sacramento 95819	.091(**)	-.062(**)	.104(**)	-0.013	-.072(**)
Sacramento 95822	-.053(**)	.085(**)	.145(**)	.036(*)	.201(**)
Age of Home in Years	.078(**)	-.077(**)	-.201(**)	0.007	-.140(**)
Bathrooms - Full	0.011	.037(*)	.218(**)	0.019	0.005
Bathrooms - Half	0.025	0.004	.067(**)	0.011	.058(**)
Bedrooms	0.009	0.030	.169(**)	-0.001	.051(**)
Brick Exterior	1	0.003	0.014	-0.002	-0.016
CC&R's	0.003	1	0.019	-.054(**)	-0.005
Central Air	0.014	0.019	1	-.040(*)	0.022
Days on Market (DOM)	-0.002	-.054(**)	-.040(*)	1	0.006
Bus Stop Distance Miles	-0.016	-0.005	0.022	0.006	1
Within 1/10 mile	.077(**)	-.040(*)	0.016	0.004	-.058(**)
Within 1/10 to 1/4 mile	0.025	-0.011	0.021	0.013	-.094(**)
Within 1/4 to 1/2 mile	0.026	-0.010	.036(*)	-0.019	0.027
Within 1/2 to 1 mile	-0.020	-0.004	-0.033	0.022	-0.013
Fireplace	.103(**)	0.020	.195(**)	-.037(*)	-0.003
HOA	-0.011	.046(**)	.051(**)	0.010	-.047(**)
Horse Property	-0.003	-0.010	-0.008	0.005	-0.004
Lot Size - Sq Ft	0.014	0.024	.053(**)	-.039(*)	.135(**)
1 Car Garage	0.013	-0.004	-.040(*)	-.091(**)	-0.032
Pool	.034(*)	-0.016	.061(**)	.041(*)	0.000
Raised Foundation	.034(*)	-0.010	-.036(*)	-0.004	-.063(**)
RV Parking	0.011	-.050(**)	-0.009	0.026	.079(**)
Shingle Roof	-0.030	0.001	-0.030	0.016	.049(**)
Home Square Footage	.107(**)	-0.003	.185(**)	0.023	-0.031
Tile Roof	0.011	0.007	.062(**)	-0.002	0.002
2 Car Garage	-0.005	.045(**)	.169(**)	-.037(*)	.083(**)
Median Household Income 2000 Census	.133(**)	-0.023	.187(**)	-0.031	-.096(**)
2008 API Score	.061(**)	-.051(**)	.144(**)	-0.021	-0.018
January - March 2008	-0.009	-0.005	0.008	.071(**)	-0.005
April - June 2008	0.024	-.036(*)	-0.010	-0.012	-0.007
July - September 2008	-0.008	-0.018	0.011	-0.005	0.008
January - March 2009	-0.015	0.005	-0.008	-0.001	.036(*)
April - June 2009	-0.008	.043(*)	0.002	-0.010	-0.003

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

	Within 1/10 mile	Within 1/10 to 1/4 mile	Within 1/4 to 1/2 mile	Within 1/2 to 1 mile	Fireplace
3 or Greater Car Garage	-0.007	0.032	0.015	-0.009	0.013
Sacramento 95816	.040(*)	.072(**)	.065(**)	0.004	0.025
Sacramento 95817	-0.026	-.047(**)	-0.003	.093(**)	-.163(**)
Sacramento 95818	0.032	.159(**)	.184(**)	-0.030	.139(**)
Sacramento 95819	.097(**)	.043(*)	0.030	-.053(**)	.153(**)
Sacramento 95822	-0.019	-0.033	-0.006	-.044(**)	.254(**)
Age of Home in Years	.065(**)	.102(**)	.069(**)	-0.007	-0.033
Bathrooms - Full	-0.016	-0.015	-.049(**)	0.029	.189(**)
Bathrooms - Half	-0.002	0.009	-.035(*)	0.011	.086(**)
Bedrooms	-0.015	-.048(**)	-.090(**)	0.010	.126(**)
Brick Exterior	.077(**)	0.025	0.026	-0.020	.103(**)
CC&R's	-.040(*)	-0.011	-0.010	-0.004	0.020
Central Air	0.016	0.021	.036(*)	-0.033	.195(**)
Days on Market (DOM)	0.004	0.013	-0.019	0.022	-.037(*)
Bus Stop Distance Miles	-.058(**)	-.094(**)	0.027	-0.013	-0.003
Within 1/10 mile	1	-0.019	-0.032	-.057(**)	0.031
Within 1/10 to 1/4 mile	-0.019	1	-.102(**)	-.183(**)	0.029
Within 1/4 to 1/2 mile	-0.032	-.102(**)	1	-.310(**)	-0.026
Within 1/2 to 1 mile	-.057(**)	-.183(**)	-.310(**)	1	-.099(**)
Fireplace	0.031	0.029	-0.026	-.099(**)	1
HOA	-0.006	-0.020	.080(**)	-.045(**)	-0.016
Horse Property	-0.002	.046(**)	0.024	-0.018	-0.002
Lot Size - Sq Ft	-0.017	-.037(*)	-0.015	0.022	.133(**)
1 Car Garage	0.008	0.019	.040(*)	0.001	-.114(**)
Pool	-0.017	-0.024	-0.025	-0.003	.165(**)
Raised Foundation	0.030	.060(**)	.079(**)	-0.032	.056(**)
RV Parking	-0.017	0.019	0.024	0.000	-0.008
Shingle Roof	-0.017	-0.013	-.047(**)	.039(*)	-.107(**)
Home Square Footage	0.012	.055(**)	0.022	0.001	.325(**)
Tile Roof	-0.011	-0.001	-0.005	0.000	.093(**)
2 Car Garage	-.046(**)	-.048(**)	-.037(*)	-0.030	.261(**)
Median Household Income 2000 Census	.081(**)	.088(**)	.086(**)	-.141(**)	.372(**)
2008 API Score	0.005	0.005	.103(**)	-0.032	.260(**)
January - March 2008	0.012	-0.001	0.012	0.003	0.022
April - June 2008	0.027	0.006	.039(*)	-0.021	-0.006
July - September 2008	-0.011	-0.031	-0.013	0.024	0.031
January - March 2009	-0.015	0.019	-0.028	0.011	-0.024
April - June 2009	-0.004	-0.008	0.018	-0.025	0.012

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

	HOA	Horse Property	Lot Size - Sq Ft	1 Car Garage	Pool
3 or Greater Car Garage	-0.007	-0.002	.120(**)	-.061(**)	0.010
Sacramento 95816	.199(**)	-0.005	-.165(**)	.047(**)	-0.026
Sacramento 95817	-0.016	0.031	-.183(**)	.046(**)	-.066(**)
Sacramento 95818	-0.024	-0.007	-.114(**)	0.019	.055(**)
Sacramento 95819	-0.023	-0.007	-0.008	0.004	.079(**)
Sacramento 95822	0.028	-0.014	.238(**)	-.220(**)	.077(**)
Age of Home in Years	-.169(**)	0.014	-.089(**)	.072(**)	-0.023
Bathrooms - Full	.081(**)	-0.020	.176(**)	-.210(**)	.153(**)
Bathrooms - Half	-0.016	0.030	.044(*)	-.070(**)	.072(**)
Bedrooms	-.052(**)	0.007	.190(**)	-.150(**)	.080(**)
Brick Exterior	-0.011	-0.003	0.014	0.013	.034(*)
CC&R's	.046(**)	-0.010	0.024	-0.004	-0.016
Central Air	.051(**)	-0.008	.053(**)	-.040(*)	.061(**)
Days on Market (DOM)	0.010	0.005	-.039(*)	-.091(**)	.041(*)
Bus Stop Distance Miles	-.047(**)	-0.004	.135(**)	-0.032	0.000
Within 1/10 mile	-0.006	-0.002	-0.017	0.008	-0.017
Within 1/10 to 1/4 mile	-0.020	.046(**)	-.037(*)	0.019	-0.024
Within 1/4 to 1/2 mile	.080(**)	0.024	-0.015	.040(*)	-0.025
Within 1/2 to 1 mile	-.045(**)	-0.018	0.022	0.001	-0.003
Fireplace	-0.016	-0.002	.133(**)	-.114(**)	.165(**)
HOA	1	-0.002	-.113(**)	.042(*)	.035(*)
Horse Property	-0.002	1	0.006	-0.016	-0.005
Lot Size - Sq Ft	-.113(**)	0.006	1	-.133(**)	.123(**)
1 Car Garage	.042(*)	-0.016	-.133(**)	1	-.048(**)
Pool	.035(*)	-0.005	.123(**)	-.048(**)	1
Raised Foundation	-.113(**)	0.017	0.005	.038(*)	0.020
RV Parking	-0.019	-0.009	.164(**)	-.047(**)	0.011
Shingle Roof	-.123(**)	0.009	-.035(*)	0.026	-.101(**)
Home Square Footage	0.022	0.009	.233(**)	-.168(**)	.222(**)
Tile Roof	-0.012	-0.004	0.032	-.067(**)	.074(**)
2 Car Garage	0.005	-0.017	.177(**)	-.470(**)	.081(**)
Median Household Income 2000 Census	-0.021	0.001	.049(**)	0.006	.215(**)
2008 API Score	.063(**)	0.005	-0.030	.036(*)	.124(**)
January - March 2008	-0.003	0.031	-.036(*)	-.221(**)	.035(*)
April - June 2008	.043(*)	0.022	0.003	-.045(**)	-.034(*)
July - September 2008	0.004	-0.012	0.008	.036(*)	.040(*)
January - March 2009	0.001	-0.011	0.002	.048(**)	0.005
April - June 2009	-0.027	-0.011	0.016	.056(**)	-0.004

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

	Raised Foundation	RV Parking	Shingle Roof	Home Square Footage	Tile Roof
3 or Greater Car Garage	0.005	.062(**)	-0.022	.144(**)	0.008
Sacramento 95816	.051(**)	-0.010	-0.031	.099(**)	-0.002
Sacramento 95817	.108(**)	-0.024	.071(**)	-.106(**)	-.038(*)
Sacramento 95818	.155(**)	-0.023	-.111(**)	.158(**)	-0.015
Sacramento 95819	.130(**)	-0.023	-.073(**)	.189(**)	.044(**)
Sacramento 95822	-.063(**)	.034(*)	-.036(*)	.107(**)	.076(**)
Age of Home in Years	.437(**)	.036(*)	.061(**)	-.141(**)	-.143(**)
Bathrooms - Full	-.175(**)	0.010	-.107(**)	.632(**)	.116(**)
Bathrooms - Half	0.001	0.002	-.075(**)	.225(**)	.046(**)
Bedrooms	-.199(**)	-0.013	-.036(*)	.540(**)	.089(**)
Brick Exterior	.034(*)	0.011	-0.030	.107(**)	0.011
CC&R's	-0.010	-.050(**)	0.001	-0.003	0.007
Central Air	-.036(*)	-0.009	-0.030	.185(**)	.062(**)
Days on Market (DOM)	-0.004	0.026	0.016	0.023	-0.002
Bus Stop Distance Miles	-.063(**)	.079(**)	.049(**)	-0.031	0.002
Within 1/10 mile	0.030	-0.017	-0.017	0.012	-0.011
Within 1/10 to 1/4 mile	.060(**)	0.019	-0.013	.055(**)	-0.001
Within 1/4 to 1/2 mile	.079(**)	0.024	-.047(**)	0.022	-0.005
Within 1/2 to 1 mile	-0.032	0.000	.039(*)	0.001	0.000
Fireplace	.056(**)	-0.008	-.107(**)	.325(**)	.093(**)
HOA	-.113(**)	-0.019	-.123(**)	0.022	-0.012
Horse Property	0.017	-0.009	0.009	0.009	-0.004
Lot Size - Sq Ft	0.005	.164(**)	-.035(*)	.233(**)	0.032
1 Car Garage	.038(*)	-.047(**)	0.026	-.168(**)	-.067(**)
Pool	0.020	0.011	-.101(**)	.222(**)	.074(**)
Raised Foundation	1	0.030	.070(**)	-0.030	-.057(**)
RV Parking	0.030	1	.036(*)	.035(*)	-.037(*)
Shingle Roof	.070(**)	.036(*)	1	-.177(**)	-.388(**)
Home Square Footage	-0.030	.035(*)	-.177(**)	1	.158(**)
Tile Roof	-.057(**)	-.037(*)	-.388(**)	.158(**)	1
2 Car Garage	-.107(**)	0.009	-.039(*)	.224(**)	.114(**)
Median Household Income 2000 Census	.180(**)	-0.004	-.174(**)	.341(**)	.061(**)
2008 API Score	.135(**)	0.004	-.142(**)	.225(**)	0.019
January - March 2008	0.032	0.012	-0.026	0.025	0.003
April - June 2008	0.006	0.009	0.010	-0.010	-0.006
July - September 2008	0.023	0.022	-0.021	-0.002	-0.010
January - March 2009	-.043(*)	0.002	0.016	-0.002	-0.021
April - June 2009	-0.023	-0.029	0.010	.041(*)	0.024

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

	2 Car Garage	Median Household Income 2000 Census	2008 API Score	January - March 2008
3 or Greater Car Garage	-.066(**)	0.027	-0.001	-0.032
Sacramento 95816	-.084(**)	.169(**)	.211(**)	0.012
Sacramento 95817	-.151(**)	-.204(**)	-.139(**)	0.020
Sacramento 95818	-.044(*)	.334(**)	.388(**)	.112(**)
Sacramento 95819	0.012	.384(**)	.383(**)	.034(*)
Sacramento 95822	.384(**)	-0.014	-.082(**)	-0.023
Age of Home in Years	-.293(**)	.144(**)	.143(**)	.039(*)
Bathrooms - Full	.314(**)	.152(**)	.035(*)	-0.007
Bathrooms - Half	.094(**)	.084(**)	.061(**)	0.024
Bedrooms	.251(**)	.047(**)	-.056(**)	-0.024
Brick Exterior	-0.005	.133(**)	.061(**)	-0.009
CC&R's	.045(**)	-0.023	-.051(**)	-0.005
Central Air	.169(**)	.187(**)	.144(**)	0.008
Days on Market (DOM)	-.037(*)	-0.031	-0.021	.071(**)
Bus Stop Distance Miles	.083(**)	-.096(**)	-0.018	-0.005
Within 1/10 mile	-.046(**)	.081(**)	0.005	0.012
Within 1/10 to 1/4 mile	-.048(**)	.088(**)	0.005	-0.001
Within 1/4 to 1/2 mile	-.037(*)	.086(**)	.103(**)	0.012
Within 1/2 to 1 mile	-0.030	-.141(**)	-0.032	0.003
Fireplace	.261(**)	.372(**)	.260(**)	0.022
HOA	0.005	-0.021	.063(**)	-0.003
Horse Property	-0.017	0.001	0.005	0.031
Lot Size - Sq Ft	.177(**)	.049(**)	-0.030	-.036(*)
1 Car Garage	-.470(**)	0.006	.036(*)	-.221(**)
Pool	.081(**)	.215(**)	.124(**)	.035(*)
Raised Foundation	-.107(**)	.180(**)	.135(**)	0.032
RV Parking	0.009	-0.004	0.004	0.012
Shingle Roof	-.039(*)	-.174(**)	-.142(**)	-0.026
Home Square Footage	.224(**)	.341(**)	.225(**)	0.025
Tile Roof	.114(**)	.061(**)	0.019	0.003
2 Car Garage	1	.071(**)	-0.008	-.242(**)
Median Household Income 2000 Census	.071(**)	1	.543(**)	.087(**)
2008 API Score	-0.008	.543(**)	1	.076(**)
January - March 2008	-.242(**)	.087(**)	.076(**)	1
April - June 2008	-.113(**)	0.032	0.025	-.153(**)
July - September 2008	.063(**)	-0.004	.038(*)	-.174(**)
January - March 2009	.095(**)	-0.033	-.061(**)	-.158(**)
April - June 2009	.079(**)	-0.023	-0.017	-.155(**)

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

	April - June 2008	July - September 2008	January - March 2009	April - June 2009
3 or Greater Car Garage	0.010	.047(**)	-0.018	0.000
Sacramento 95816	.055(**)	-0.002	-.038(*)	-0.017
Sacramento 95817	0.000	-0.010	-0.001	0.008
Sacramento 95818	0.001	-0.028	-.040(*)	0.000
Sacramento 95819	0.020	-0.009	-0.005	0.007
Sacramento 95822	-.044(*)	0.024	.043(*)	-0.003
Age of Home in Years	.042(*)	0.000	-.071(**)	-0.026
Bathrooms - Full	-0.026	0.000	0.018	.054(**)
Bathrooms - Half	0.017	-0.015	0.001	0.005
Bedrooms	-0.025	0.009	.035(*)	0.019
Brick Exterior	0.024	-0.008	-0.015	-0.008
CC&R's	-.036(*)	-0.018	0.005	.043(*)
Central Air	-0.010	0.011	-0.008	0.002
Days on Market (DOM)	-0.012	-0.005	-0.001	-0.010
Bus Stop Distance Miles	-0.007	0.008	.036(*)	-0.003
Within 1/10 mile	0.027	-0.011	-0.015	-0.004
Within 1/10 to 1/4 mile	0.006	-0.031	0.019	-0.008
Within 1/4 to 1/2 mile	.039(*)	-0.013	-0.028	0.018
Within 1/2 to 1 mile	-0.021	0.024	0.011	-0.025
Fireplace	-0.006	0.031	-0.024	0.012
HOA	.043(*)	0.004	0.001	-0.027
Horse Property	0.022	-0.012	-0.011	-0.011
Lot Size - Sq Ft	0.003	0.008	0.002	0.016
1 Car Garage	-.045(**)	.036(*)	.048(**)	.056(**)
Pool	-.034(*)	.040(*)	0.005	-0.004
Raised Foundation	0.006	0.023	-.043(*)	-0.023
RV Parking	0.009	0.022	0.002	-0.029
Shingle Roof	0.010	-0.021	0.016	0.010
Home Square Footage	-0.010	-0.002	-0.002	.041(*)
Tile Roof	-0.006	-0.010	-0.021	0.024
2 Car Garage	-.113(**)	.063(**)	.095(**)	.079(**)
Median Household Income 2000 Census	0.032	-0.004	-0.033	-0.023
2008 API Score	0.025	.038(*)	-.061(**)	-0.017
January - March 2008	-.153(**)	-.174(**)	-.158(**)	-.155(**)
April - June 2008	1	-.228(**)	-.207(**)	-.204(**)
July - September 2008	-.228(**)	1	-.236(**)	-.233(**)
January - March 2009	-.207(**)	-.236(**)	1	-.211(**)
April - June 2009	-.204(**)	-.233(**)	-.211(**)	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

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