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The Impact of LA's Fixed-Guideway Transit Stations on the Local Real Estate Market

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by

Chen Liu

Client: Southern California Association of Nonprofit Housing (SCANPH)
Faculty Chair of Committee: Joan Ling

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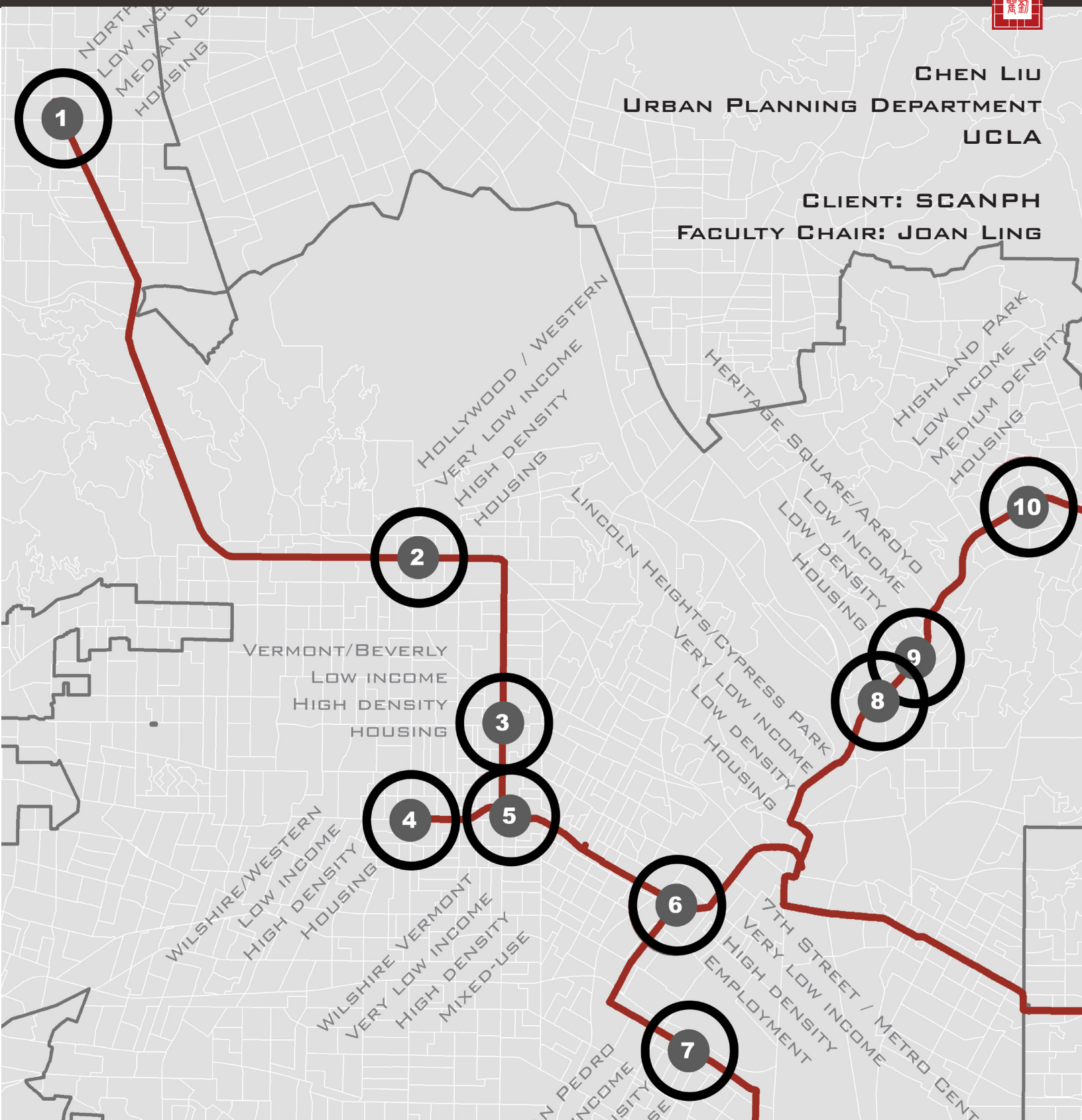
THE IMPACT

OF LA'S FIXED-GUIDEWAY TRANSIT STATIONS ON THE LOCAL REAL ESTATE MARKET

CHEN LIU
URBAN PLANNING DEPARTMENT
UCLA

CLIENT: SCANPH
FACULTY CHAIR: JOAN LING



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2012 Client Project:
The Impact of LA's Fixed-Guideway Transit Stations on the Local Real Estate market

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0 EXECUTIVE SUMMARY

There is widespread awareness that public investment in a fixed-guideway transit system (a transit facility using and occupying a separate right-of-way) affects private properties near transit stations. People enjoy the extra accessibility created by transit, but also suffer from the undesirable externalities associated with living in transit-oriented development (TOD) areas. The relationship between fixed-guideway transit stations and the local real estate market is difficult to generalize, however, and depends on the context.

To clearly determine the impact on property values is important for the following two reasons. First, there is a heated debate over whether local government should try to capture the private real estate value created by public investment in transit. Before answering the above question, we must understand the relationship between public investment and private properties in Los Angeles (LA) station areas. Second, TOD has a goal to provide sustainable and affordable transportation/housing alternatives to households at diversified income levels. More and more literature shows that displacement and gentrification is happening in TOD areas, which may undermine the original goals of TOD. Analysis of the changes in the real estate market after the stations open is necessary to understand whether residents of all income levels can benefit from existing TODs.

This study quantitatively examines the impact of Los Angeles fixed-guideway transit stations on the surrounding real estate market, especially the housing market. The findings of this research will help policy makers better understand whether and where to capture the private value created by public investment in transit system for low-income households in Los Angeles station areas.

By analyzing five real estate indicators (*number of transactions, median home value, rate of value change, median cost per square foot, and median gross rents*) for 11 selected stations in Los Angeles city, the study assesses which stations show a positive impact on the local real estate market. For a station to have a completely positive impact on the local housing market, it had to show three effects on the area surrounding the station following the station opening: one, a greater number of real estate transactions; two, a higher home value/cost per square foot; and three, a faster increase in property value and rent.

My research determined that two stations (Highland Park and Wilshire/Vermont) show ***completely positive impact*** on the local real estate market; five stations (Heritage Square/Arroyo, Hollywood/Western, Lincoln Heights/Cypress, North Hollywood &Vermont/Beverly) have ***strong positive impact*** despite one or two negative indicators; only one station (Wilshire/Western) has no impact because of mixed positive and negative indicators. Three of the stations' impact (7th Street/Metro Center, San Pedro and Westlake/MacArthur Park) is ***undetermined*** due to the lack of usable data.

The 11 selected stations nearly cover all the types of station areas based on the Los Angeles TOD's typology, and none of them display negative impact on housing market. In addition, the research indicates that existing density is a more powerful factor in high home values in station areas than is the land use pattern. This

finding is subtly different from previous studies that equally emphasize high density and land use pattern as prerequisites of building successful TODs.

According to the data analysis and findings, I highlight four conclusions and four corresponding recommendations for the government to take advantage of the positive impact on the real estate market for various purposes.

Conclusions Based on Data Analysis

- LA fixed-guideway transit stations generally positively affect the local housing market.
- Long-term impact is much stronger than the short-term.
- Displacement and gentrification are happening in station areas.
- Density is a critical factor that leads to increasing housing prices near station areas.

Suggested Actions for the Government

- Capture the value in real estate market.
- Apply progressive value capture strategies: enhance the intensity of such capture strategies over time.
- Subsidize lower-income groups in station areas.
- Implement upzoing in station areas to maximize the positive impact.

Non-government organizations such as my client Southern California Association of Non-Profit Housing (SCANPH) should collaborate with local government and related parties to establish supportive policies to capture the value for low-income households and should also help affordable housing developers obtain access to invest in station areas.

These recommendations will help the City of Los Angeles achieve a vibrant, green, and equitable TOD model by sharing the value created by public investment. As to which value capture strategy is best suitable for what kind of stations, that question remains for further research.

chapter 1

Introduction

Urgency and Necessity
LA's Advantages
Measure R & 30/10 Inititiative
Unclear Impact
Research Question

1 INTRODUCTION

As a climate action strategy and new development pattern, Transit-Oriented Development (TOD: a mixed-use residential or commercial area designed to maximize access to public transport) has drawn attention all over the United States, especially at this time of economic recession, rising oil prices, and great demographic change such as the baby boomers leaving their own nests. People have begun to rethink the strategy of suburban sprawl and car-dependent lifestyle. Cities and developers are trying to find a new development paradigm to establish walkable, creative, sustainable, and affordable neighborhoods, or at least provide an alternative for households that are not relying on automobiles. With some successful pioneer programs in U.S. cities, TOD seems to offer hope—to create vibrant, livable communities without complete dependence on automobiles for mobility.

The Urgency and Necessity of TOD

For the County and City of Los Angeles (referred to as "the County" and "the City" respectively and as "L.A." collectively), planning and constructing successful TODs is urgent and necessary. In 2010, IBM published their study findings on ranking the level of commute pain globally. The rank incorporated 10 issues, such as commuting time, time stuck in traffic, price of gas, and so on. The commute pain felt in the City of Los Angeles, a city both famous and infamous for its car culture, ranked ahead of New York and Houston (William-Ross, 2010). In addition, the City continues to be ranked as one of the most polluted cities in U.S. by the American Lung Association. Poor air quality presents a fatal threat for Angelenos. A large percentage of L.A.'s air pollutants come from the transportation sector, especially from driving. Last but not least, the task of reducing greenhouse gas emissions has come to the political forefront. In 2009, California Senate Bill 375 became effective. This new law requires California to make changes to the built environment that will reduce greenhouse gas emissions to 1990 levels by the year 2020. The transportation sector is in SB375's crosshairs since it consumes such a large share of greenhouse gas-producing gasoline. These facts provide snapshots of a few of the many factors that make it both urgent and important for Los Angeles to consider new development models to overcome the future challenges.

LA's Advantages in Constructing TOD

Fortunately, L.A. has competitive advantages that allow it to build better TODs. First, L.A. has a extensive and growing public transportation system which lays the foundation for TOD. The system includes five light-rail lines (Metro Red, Purple, Gold, Blue and Green line), local bus, rapid bus transit, and two linear bus rapid networks (Orange and Silver line). In addition, several cities within the County operate their own bus networks, such as Santa Monica's Big Blue Bus, the City of L.A.'s downtown transit system, DASH, Long Beach Transit, etc. A second TOD advantage in L.A. is the large number of Angelenos who use public transportation. The City's DASH system has over 30 million passenger boardings per year. L.A. Metro, the largest transit operator in L.A. County, has exceedingly high ridership. In January 2012, Metro busses had more than 1 million passenger boardings per weekday. Metro's rail system has over 300 thousand weekday boardings (LA Metro, 2012). Such ridership implies development opportunities in the station areas serving those

transit-dependent individuals. A third advantage for TOD in L.A. is the increasing demand for affordable transportation and housing alternatives in L.A. In 2006, the Center for Housing Policy published a report discussing the combined housing and transportation burdens of working families with income between $20,000 and $50,000 per year. The combined cost in the L.A. metropolitan area was 59% of total income, which is slightly higher than the average of 28 metropolitan areas studied (Lipman, 2006). Combined, housing and transportation costs create a heavy burden for very low and low-income households. More affordable housing and transportation alternatives should be explored to resolve this dilemma. Based on the above advantages, people could place high hopes on TOD.

Measure R and 30/10 Initiative

Another factor encouraging TOD in L.A. County is passage of Measure R in 2008. Measure R was approved by more than two-thirds of the voters, committing $40 billion to traffic relief and transportation upgrades throughout the County over the next 30 years. In addition, the County proposed the 30/10 initiative to speed up the timeline for 12 key mass transit projects to be completed in 10 years rather than 30. This would be done by borrowing against long-term revenue. The key projects are:

- Orange Line bus rapid transit extension,
- Westside subway extension,
- Expo Line light rail phase 2,
- West Santa Ana Transit Corridor,
- Gold Line Foothill light rail Extension,
- Eastside Transit Corridor phase 2,
- Crenshaw/Los Angeles International Airport (LAX) Transit Corridor,
- Green Line/LAX light rail extension,
- South Bay Green Line Extension,
- Van Nuys Boulevard Rapidway,
- Sepulveda Pass, and
- Regional Connector.

According to Metro's studies, Measure R together with the 30/10 initiative will add 77 million more transit boardings annually and reduce 10.3 million gallons of gasoline used per year (LA Metro, 2011). As more transit stations will be built in the upcoming future, they will certainly shape the future development pattern in Los Angeles.

The Unclear Impact of Transit Stations on Real Estate Market

Without doubt, before completely trusting the TOD paradigm, County and City officials and the public should understand the full impact of building transit stations. Studies show that TOD can affect many aspects of the neighborhoods near station areas. Vehicle ownership in station areas generally decreases; small households relocate to be near the transit system; and people begin to enjoy a compact lifestyle, living, working, shopping and dining in TOD areas without the need to drive.

Of course, the local real estate market is also a critical element influenced by transit stations. However, the relationship between the transit system and nearby real estate market remains unclear. Each type of station has various characteristics that may result in different impacts on the real estate market. Unfortunately, the impact of L.A.'s fixed-guideway transit (a transit facility using and occupying a separate right-of-way, e.g. light rail or bus rapid transit facilities) stations on the local real estate market has not been studied as thoroughly and systematically as have demographic impacts. The impact is valuable to understand since it determines whether TOD can achieve its expected outcomes of efficient and equitable communities.

The Research Question

Specifically, my research examines the impact of L.A. fixed-guideway transit stations on the local real

estate market. I use quantitative analyses to address the following questions:

(1) Have rail stations impacted the local housing market?
(2) If an impact exists, is it positive or negative from the perspective of real estate market?
(3) If an impact exists, how intense is it?
(4) Which kinds of stations are more likely to experience positive/negative impact?

Clarifying transit stations' real estate impact is important for two reasons. First, experiences in other cities show that displacement and gentrification may happen in TOD areas, which may weaken the original goals of TOD. Displacement refers to a pattern of change in which current residents are involuntarily forced to move out because it is too costly to stay in the area. Gentrification describes a pattern of neighborhood change in which a previously low-income neighborhood experiences reinvestment and revitalization, accompanied by increasing home values and/or rents (Pollack, Bluestone and Billingham, 2010). With the risk of displacement and gentrification in L.A.'s transit station areas, local government and advocacy organizations should increase attention to relocation of original residents and to who benefits from the reinvestment and revitalization in TOD areas. To meet our social imperatives of justice and equality, it is critical to make sure that TOD is beneficial for households of all income levels and does not discriminate against low-income, and often transit-dependent, people. Second, transit funding is declining overall nationally, and policy makers are trying to capture the private value created by public transit investment. The value capture is a type of public financing where increases in private land values generated by public investments are "captured" or recouped all or in part by the public sector. It is controversial since limited studies have been done to determine whether public investment does create private value in L.A. and how much it actually creates. The findings of this study will shed some light on the rationale of value capture.

This report will inform the work of my client, the Southern California Association of Non-Profit Housing (SCANPH), when advocating for homes affordable to low-income households in station areas. I begin with review of the literature concerning the relationship between rail stations and housing market in U.S. Then I explain the methodology used to analyze home transaction data for the eleven selected station areas. Next, I present detailed results of the data analysis. I conclude the report with conclusions drawn from the results and informed by the literature and with policy recommendations for local government officials to maximize the benefits of TOD.

CHAPTER 2

Literature Review

2 LITERATURE REVIEW

While the literature clearly demonstrates various benefits of living in TOD areas, evidence is less clear on how transit stations affect the existing housing market and how residents respond to real estate market changes caused by TOD. This literature review will focus on the new development patterns, review the definitions of TOD and its basic characteristics, present a theoretical and empirical discussion of TOD's impact on real estate markets, and examine whether those theories and empirical trends fit the case of Los Angeles.

Definitions of TOD

- ***Built Form***

Though scholars view and define TOD differently, most definitions emphasize its high-density built form and the proximity to transit stations (Lund, 2006). The Transportation Research Board considers compact, mixed-use development near transit facilities as TOD's most common trait (Transportation Research Board, 2004). Mixed-use usually refers to the diversity in the types of housing, offices and shopping. The U.S. Center for Transit-Oriented Development (CTOD) gives a similar definition, with greater emphasis on geographic proximity: TOD is higher-density mixed-use development within walking distance–or a half mile–of transit stations. The Government Accountability Office's (GAO) report on affordable housing agrees on the half-mile walking distance needed for development to be considered TOD. It highlights that most transit-oriented developments are typically near a fixed-guideway rail station, generally encompass multiple city blocks up to a half-mile from a transit station, have pedestrian-friendly environments, and include high-density and mixed-use developments (U.S. GAO, 2009). Acceptable walking distance varies from person to person, but as an approximation the consensus is that people are willing to walk a half mile to access fixed-guideway transit stations.

- ***Functional Features***

All of the above definitions focus on built form, namely the "three Ds": density, diversity, and design. However, Belzer and Autler (2002) assert that although proper built form is a necessary element for TOD that alone is not sufficient to achieve the benefits of truly transit oriented development. They recommend incorporating six additional functional features besides the three Ds: location efficiency (converting driving from a necessity into an option), value recapture, livability, financial return (investors of TOD projects expect some type of return), choice (diversified housing types that reflect the regional mix of income and family structure), and efficient regional land-use patterns (Belzer and Autler, 2002).

- ***Affordability***

Besides the built environment and functional features of TOD, some scholars define TOD from the perspective of affordability (U.S. GAO, 2009). They state that in the U.S., transit is mostly designed to serve disadvantaged groups, thus development around transit stations should increase affordability, especially providing affordable housing opportunities for low-income household who are more likely transit-dependent. In practice, TOD creates affordability through two mechanisms. One is to offer a cheaper transportation alternative. Studies show that those living in TODs own and use fewer automobiles. On average, travelling by transit can reduce driving costs by $3,000 to $5,000 per person per year (Cervero, etc., 2004). The other mechanism is

to produce and preserve affordable housing in TOD areas by offering various incentives to developers. For example, a few cities implement reduced parking requirements in exchange for the production of affordable housing after considering that residents in TOD areas tend to have lower rates of car ownership (U.S. GAO, 2009). Other incentives include density bonuses, funding support from the public sector, and joint development.

Summarizing the various definitions, TOD is not only characterized by built form (density, diversity and design), but also by its functions to create a sustainable, livable and affordable neighborhoods for all income level households, especially those relying on public transit.

Theoretical Evidence

There is widespread awareness that the introduction of transit stations will affect property values and rent in the nearby real estate market. Property value can be separated into two components: land value and improvement cost. Improvement cost can be easily calculated. It is the cost of constructing a home, mainly including the costs of materials and labor. It does not depend on where the home is located. In contrast, land value is location-related and reflects the benefits that accrue to a location based on its surroundings (Fogarty, Eaton, Belzer and Ohland, 2008, p. 14). For the real estate market, examples of beneficial surroundings include a hill with a fantastic view or an appealing neighborhood with parks.

Transit stations affect property value and rents through land value. Land value appreciation or depreciation depends on the balance between the advantages and disadvantages associated with transit facilities. On the positive side, transit can provide greater accessibility. There can also be negative externalities associated with being close to stations as well, such as noise and crowding (Kilpatrick, Throupe, Carruthers and Krause, 2007). Diaz and Allen (1999) acknowledge the potential for transit facilities to have both positive and negative impacts on property value. The ultimate impact on property value depends on the weight of each positive and negative potential.

In reality, most scholars seem to agree that the extra accessibility provided by fixed-guideway transit prevails over the undesirable externalities, and they regard transit as a valuable and desirable amenity for neighborhoods (Ohland, 2006). Planners usually acknowledge that the benefits of being well connected to the rest of the region get capitalized into the market value of land. More specifically, in an area where residents can more easily reach jobs and shops, the property value or land value should be higher than areas with limited accessibility (The Transportation Research Board, 2004). By this rule, more expansive and denser transit networks create more land value appreciation and more positive impact on properties.

However, historically the desirability of extra accessibility of transit stations in L.A., and much of the US, seems minimal, at least for households who can afford a fairly reliable car. First, access to transit is less appealing than access to highways. Americans prefer to reside near highway corridors since most U.S. cities are designed for driving. Second, driving surpasses riding transit in many aspects such as higher speed, greater punctuality, and more privacy. Additionally, in the U.S. driving costs are relatively low, which increases its appeal. Third, it is the quality of the transit service rather than its accessibility that mainly influences people's willingness to use transit. In a survey to measure transit service quality, the primary problem passengers complained about is not the availability of transit when needed. Instead they refuse to use transit because of concerns about station and vehicle cleanliness and worries about crime (Giuliano, 2005). Based on the above three

reasons, for the general public the attractiveness of being near a transit station is not as obvious as most scholars think.

To summarize, the theory concerning how fixed-guideway transit stations affect property values is straightforward. Transit stations are seen as an attribute of neighborhoods, just like household income level, ethnic composition, and educational level. If residents view fixed-guideway transit stations more as an amenity, then the market will show a positive impact on property value. If people see more shortcomings of living approximate to transit, the lower demand for properties in station areas will decrease the area property values. In short, whether transit stations positively or negatively affect the real estate market is determined by people's preferences and perceptions. Therefore, the impact is very subjective and varies according to the situation. For instance, for a neighborhood with low household income and low car ownership, a newly built or proposed station will raise land values and property values as new people that need transit for mobility move into the area; for a neighborhood with upper-middle-class residents who seldom ride transit, property values may be negatively affected by a newly built transit station because of problems associated with transit, such as noise, crowding, and crime.

Empirical Evidence

The theory is easy to comprehend, but empirically the relationship between fixed-guideway transit and the real estate market, whether positive or negative, is complicated and difficult to generalize because a variety of factors besides transit stations can affect property values and rents in a certain district. In this section I turn to some empirical cases to determine the actual impact of rail transit on real estate market.

The methodology that most empirical studies use can be organized into two main categories (Landis, Guhathakurta, Huang, Zhang, Fukuji and Sen, 1995). On one hand, there are longitudinal studies comparing land value or price changes for sites near or adjacent to newly constructed transit facilities. On the other hand, there are "hedonic" studies comparing price variations across multiple properties as a function of distance or proximity to a particular transport facility, holding constant other property attributes. Previous research prefers the second method to quantify the impact of transit on properties.

- ***Transit Lines in California***

Most empirical studies in California apply hedonic statistical models to quantitatively specify the impact of transit accessibility on property values, and, surprisingly, all reached the conclusion of positive impacts.

In 1995, the University of California at Berkeley conducted a project to measure to what extent proximity to transit stations can affect housing prices in California's five lines – BART, Caltrans, and three light-rail systems in San Diego, Sacramento, and San Jose (Landis, etc., 1995). In this comprehensive research, scholars incorporated three categories of independent variables (home attributes, neighborhood quality variables and transportation accessibility) in a regression model. The model fit the data very well, generally explaining over 60% of the variations in home prices in those studies areas. The outcomes were all positive for the market and statistically significant. For BART and Caltrans in Alameda, Contra Costa, and San Mateo County, the coefficients of proximity to transit were -2.29, -1.96, and -2.61 respectively. This means there was nearly a $2 premium value for an identical house that was one meter closer to a heavy rail station. They also found the same trend for the three light-rail lines: $2.72 premium per meter for San Diego Trolley, $2.61 per meter for San Jose, and $0.65 per meter for Sacramento City. Note that Sacramento's light-rail system

had no discernible positive or negative effect (i.e. the effect was statistically insignificant) on home prices within the city. The authors inferred that it may be because in the 1990s Sacramento's rail system served 60% fewer passengers than San Diego's Trolley although the length of both lines was the same (Landis, etc., 1995). It suggests that occupancy rate near transit systems or ridership might influence home values near station areas. But they did not confirm this assumption.

Very similar research in 2008 was conducted by another scholar, Michael Duncan, to estimate the impact of proximity to rail stations on home values in San Diego. Besides including the home and neighborhood traits of the Berkeley study, he added variable for jurisdiction characteristics into the hedonic model. One advantage of this study was that Duncan respectively estimated the impacts for single-family houses and condominiums while past research mostly focused on single-family homes. The outcome was parallel to UC Berkeley's research, indicating positive impacts for both single-family homes (SFHs) and condominiums. A condominium that was a quarter mile from a station was worth about $22,000 more than one that was one mile from the station with all else being equal; a SFH a quarter mile from a station was worth only about $12,000 more (Duncan, 2008). Duncan concludes further that proximity to a rail station had a much greater impact on condominiums that it does on SFHs. This must be due to a higher demand for condominiums than for single family homes in TOD areas.

Though the relationship between transit and property values depends on property type, in Santa Clara County the impacts of railway proximity on non-residential land values are consistent with previous studies of residential properties. Utilizing 1988 and 1999 data for commercial, office, and light industrial properties in Santa Clara County, Cervero and Duncan (2002) implemented a hedonic model that included rail and highway proximity, accessibility and location, density and land uses, and neighborhood quality proxies. Their model revealed a $25.43 per square foot value premium for land within a quarter mile of Caltrans stations. Among all the factors considered by Cervero and Duncan, rail proximity had the largest positive impact on land value, followed by accessibility to downtown San Jose ($19.18/sf premium), and professional office land use ($7.14/sf).

After reviewing some important transit systems in California, we may conclude that most transit lines positively affected the home values around station areas, except for Sacramento's light rail that had a relatively low ridership. It appears that the hedonic regression models dominate the literature, and scholars have tried to incorporate a range of variables that they believe can increase the explanatory power of their models. Moreover, the quantified impact of transit on property values varies by types of facilities, cities, and properties.

One issue with previous research is that the relationship implied by regression may be meaningful statistically but not practical. All of the models estimate the impact by keeping other related variables constant, for example home size, number of bedrooms, household income, and so on. However, there are rarely identical houses with the almost same attributes expect for the distance to nearest transit station. In other words, the premium or discount associated with the proximity to transit stations can be separated by hedonic regression models, but it is difficult to observe this directly in the real estate market, and thus is poorly understood by the public.

- ***Transit Lines Outside California***

Nearly all California transit systems show positive results on property values. Is that also true outside California? A certain amount of research has assessed the impact of proximity to fixed-guideway

stations on property values in transit-rich cities outside California. The methods used are similar but the results vary.

Adding variables representing locational amenities (straight-line distance to CBD, and nearest park) into their model, Hess and Almeida (2007) found that in Buffalo, New York, for homes located in the study area, every foot closer to a light rail station increased property values by $2.31. Consequently, a home located within a quarter mile radius of a light rail station can earn a premium of $1,300-$3,000. Model results further suggested that, rather than proximity to transit stations, three variables, the number of bathrooms, size of parcel, and location on the East Side or West side of Buffalo, had the largest influence in predicting property values. Again, these results seemed reasonable from a mathematical standpoint (i.e. they showed a negative coefficient, a significant t-value, and a large R^2), but they were not that meaningful in reality since we could hardly find two such identical homes except for in terms of their proximity to stations.

In DeKalb Atlanta, the impact is more complicated. The East Line was divided into two parts by neighborhood income level: the areas to the north of the line was comprised of predominantly middle class neighborhoods; the south side was predominantly lower income, lower middle class neighborhoods. The average housing value on the north side was more than twice the value on south side. Examination of the effects of proximity to rail transit for these two sides showed different outcomes. For the homes located on the south side, property values increased close to $1,045 for every 100 feet a property was closer to the East Line; for the relatively richer north side, property value dropped by $965 for every 100 feet a property was closer to the rail line (Diaz, etc., 1999). In this case, income level seems to be the key factor to determine whether the impact was positive or negative.

The relationship between the transit lines and property values outside California is less consistent than the relationships within California. It can contradict the opinion that proximity to fixed-guideway transit is always an amenity for urban residents. In some areas where residents rarely rely on public transit, home values around stations may be negatively affected by noise, crowdedness, and safety issues associated with transit stations.

What about Los Angeles?

What is the impact of fixed-guideway transit on property values in Los Angeles? Is it as positive as other California transit systems? The question remains open.

Some scholars believe that Angelenos should exhibit a high demand for transit access since driving in L.A. is not as desirable as in other cities. But they ignore the inferior aspects of living close to a transit. It is difficult to determine whether or not the extra accessibility provided by transit is captured by Angelenos. Furthermore, the variety of types of facilities complicate the results. L.A. has a massive transit network, and there are overlaps among the service areas of each station, which makes it difficult to differentiate the impact of a single transit station. As a result, the respective impact of heavy rail, commuter rail, light rail and bus rapid transit (BRT) are clustered and hard to generalize.

The literature discussing property value impacts of rail transit services in L.A. County is limited and quite inconsistent. Cervero and Duncan (2002) conducted research across California, including heavily populated metropolitan areas such as Los Angeles, San Francisco, San Diego and Santa Clara. In the latter three counties and cities the impacts were all positive, namely that transit increased property value around station areas. However, when they inspected L.A. transit lines using the same hedonic

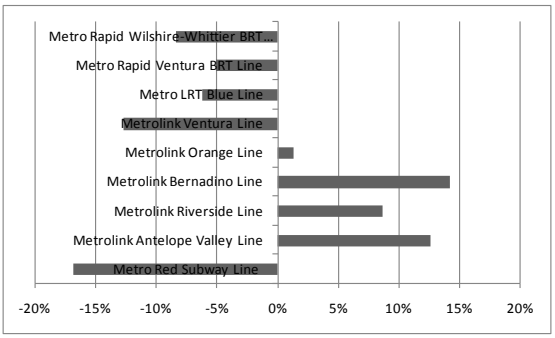
model, they found a different picture. While some evidences of land value premiums were found, overall the impacts were uneven and inconsistent. For instance, in the case of the Red Line, multi-family housing near subway stations accrued benefits; for other land uses, nearby properties tended to sell for less. Stronger premiums were found for the Metrolink commuter rail system, with the exception of the Orange and Ventura corridors. Light-rail transit services conferred the largest benefits to multi-family housing and commercial uses. Residential properties near Bus Rapid Transit stops generally sold for less, whereas commercial properties generally sold for more (Cervero and Duncan, 2002).

The following two figures (Cervero and Duncan, 2002) show the statistical results of single-family housing and condominium land value premium or discount associated with each rail line in L.A. County. For each property type, the quantified impact varies line by line, and there are lines showing negative impact on property value.

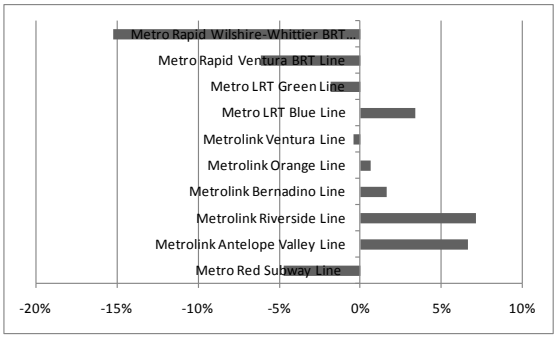
Summary of the Literature Review

- There is no single agreed-upon definition of TOD. However, most authorities emphasize its built form (high density, mixed-use, and half-mile area), functional features, and affordability.
- Rail transit stations do affect property value/rents through land value appreciation and depreciation. Positive or negative impacts on land value depend on the balance of benefits and externalities associated with stations.
- Most empirical studies have utilized hedonic regression models to quantitatively estimate the impact of proximity to transit stations on real estate market. The results are mixed, showing both positive and negative impacts.
- Limited research has been conducted to investigate L.A.'s rail stations but not other transit. What research has been done shows impacts varying by transit line.

Figure 2-1: L.A. Condominium and SFH Premium/Discount by Line



Condominiums



Single-Family Homes

Source: *Robert Cervero and Michael Duncan, Land Value Impacts of Rail Transit Services in Los Angeles County, June 2002.*

Chapter 3

Methodology

Station Selection
Data Sources
Data Analysis Plan
Limitations

3 METHODOLOGY

This study mainly utilizes covariate and multiple analyses (linear regression) to determine the impact of Los Angeles City's 11 existing rail stations on the local real estate market over the last 20 years. In this chapter I will explain the method of station selection, data sources, and the data analysis plan that was tailored towards the characteristics of two distinct datasets. At the end of the chapter I discuss the limitations of the study.

Station Selection

To select stations for this study from among the 32 existing rail stations within the City of L.A., I used three criteria based on the report titled "Creating Successful TOD in Los Angeles" (Gehrke et al., 2010) and a study on the rail line in Atlanta (Diaz, Allen and Inc, 1999). The three criteria are:

(1) intensity (the number of residents and workers in the half-mile area),
(2) land use pattern (housing, mixed-use, employment), and
(3) median household income (very low, low, medium/high) in station areas.

This selection method maximizes the different types of stations chosen while including stations of interest to my client.

In consultation with my client, SCANPH, the study originally included 13 stations, but two were eliminated early on. Grand station was dropped due to limited data availability, and the Wilshire/Normandie station because its two adjacent stations, Wilshire/Western and Wilshire/Vermont, covered the same geographic area. We finalized the selection to 11 stations listed in the Table 3-1. The selection covers the diversity of station area types, by including at least one station for every combination of the criteria above (eg. One station whose area is low-intensity, housing dominated, and very low income; one station whose area is medium-intensity, housing dominated, and very low income; etc.). However, the selection does include more stations located in housing–concentrated and high-intensity areas. There are more home transaction data in such areas so that the impact on real estate market can be quantified. Detailed station typology information is included in Appendix A.

Data Sources

Real estate markets, especially housing markets, are complex because no single indicator or attribute can represent the market condition accurately. Therefore, this study computes five indicators using data from two different data sources, the U.S. Census and DataQuick, to create an unbiased result. U.S. Census data are used to measure the rental market, and data from DataQuick provides information about the ownership market. This study uses data from 1990 to 2010.

Per the U.S. Constitution, the Census is performed by the U.S. Census Bureau every 10 years and provides reliable housing data to the public for free. For years between the decennial censuses, the Bureau issues estimates, such as American Community Survey (ACS), by surveying a sample of the population and applying statistical models. Although ACS data have a larger margin of error compared to the

Table 3-1: 11 Selected Station Area Types Within LA City

	Land Use			Intensity		
Station Area	Housing	Mixed-Use	Employ-ment	Low	Medium	High
very Low Income						
7th Street/Metro Center			x			x
Hollywood/Western	x					x
Westlake/MacArthur Park	x					x
Lincoln Heights/Cypress Park	x			x		
San Pedro		x			x	
Low Income						
North Hollywood	x				x	
Wilshire/Vermont		x				x
Vermont/Beverly	x					x
Wilshire/Western	x					x
Heritage Square/ Arroyo	x				x	
Highland Park	x				x	

Note: *1. Very low income (<$32,000/HH year), Low income ($32,000-$51,000/HH year)*
2. Housing (ratio of workers to residents <0.5), mixed-use (ratio between 0.5 to 1.5), employment (ratio>1.5)
3. High intensity (residents+workers per half-mile >21,000), medium intensity (12,000-21,000), low intensity (<12,000)
4. Station area is defined as the half-mile radius of a transit station.
Source: *CTOD, 2006-2010 ACS, Erin Coleman and Pamela Stephens' study*

comprehensive decennial Census, they are still good estimates for research purposes. This study utilizes secondary data collected from the 1990 and 2000 Censuses and from the 2006-2010 ACS (the 2010 Census did not publish housing data at the needed level of detail, the block group level). These Census Bureau data are used to calculate the median gross rent in the half-mile station areas.

This study uses a professional real estate industry dataset—DataQuick—to obtain home property values. DataQuick is based on County Assessor information and assembles records of all property transactions, including information concerning sale price, sale date, structure square feet, owner name, zoning, number of units, property type, and mortgage status, etc. The University of California-Los Angeles Young Research Library has purchased the dataset for L.A. in CD-ROM format with updated data through November 2011.

The Census Bureau data contain a variable concerning self-reported property value, but I do not think it is reliable or precise. In general property owners are not very clear about how much their properties are worth until they seek to sell the properties in the market. In addition, owners hesitate to acknowledge the value depreciation of their properties. Thus, the survey results of property value in the Census Bureau data are very subjective. In contrast, DataQuick records actual property transactions and reflects the market conditions at that time.

Data Analysis Plan

Using a two-step process of covariate analysis followed by regression analysis, I analyzed the following five real estate market indicators:

(1) number of transactions,
(2) median home value,
(3) rate of home value change,
(4) median cost per square foot, and
(5) median gross rent.

Admittedly, many factors besides rail stations can affect the five variables mentioned above. This study seeks: (1) to separate the effect of rail stations on the housing market from various potential causes through covariate analysis and linear regressions, and (2) to conclude whether L.A. fixed-guideway stations can generate positive impact and if so what kind of stations they are. *"Positive impact" in this study is based on the perspective of the real estate market. More specifically, it means a greater number of transactions, higher median home value, greater rate of value change, higher median cost per square feet, and more expensive rent.*

Covariate Analysis

In the initial stage of analysis, the covariate analysis, I applied three methods to analyze the five real estate indicators. The first method was to compare the number of transactions before and after station opening. On average, if more home transactions (including new construction and resale) occur after fixed-guideway station openings, we may assume that the fixed-guideway stations have stimulated housing construction and/or real estate transactions, which is a positive impact on real estate market. This method uses the station opening year as an anchor and compares numbers before and after this year. Although the impact of rail stations can occur long before stations open, it is hard to reach an agreement on when such effect would appear. Thus in this study, we assume that the opening date is a critical time point. From that time on, the stations undeniably start to influence the real estate market.

In this method the station itself is both the treatment and control group.

The second method compared the historical data over the last two decades for the station area with data for the same time period for the County. If median rent/value around the station increases more slowly than that in the County as a whole before station opening and more quickly than in the County after station opening, we can conclude there is a positive impact of fixed-guideway stations on the immediately surrounding real estate market. Otherwise, the station's impact is negative. Under this measure, the County average is the control group and the station area is the treatment group.

The third method of measurement examines how the real value changes over time and I use it when there is no comparable County data available. Real value is a measure of purchasing power net of any price changes over time. More specifically, if the home value adjusted by the inflation rate specified for housing is less than the current market value in the respective year, we may infer that there is an increased demand of housing in that area. This implies a positive impact for the real estate market. For the third measure, the control group is the predicted value by housing inflation rate.

Regression Analysis

In the second stage of analysis, regression analysis, the study used linear regressions to test for which kind of station areas experience a significant positive impact on home value. The dependent variable is the value difference between median home value in station areas and in the County every year. Independent variables include number of transactions, cost per square foot, square feet per structure, redevelopment area ranking (RDA), and station area types (intensity and land use pattern). If the coefficient before a specific station area type is positive and statistically significant, then such types of stations are more likely to create a positive impact on home values. The client may apply this regression model to stations that are not analyzed in this paper to forecast which ones are likely to result in positive impact on the local real estate market.

More detailed information about the data analysis plan is as follows.

5 Real Estate Indicators

- ***Rate of Median Gross Rent Change***

Gross rents were pulled from the 1990 and 2000 Censuses and the 2006-2010 ACS and assembled by using ArcMap, a software that processes and manages geographic information. The study compared the rate of gross rent change every 10 years with the County's rate of change for the same periods to determine the relationship between station opening and gross rent. If the rate of change in the station area is smaller than that in the County before the station is put into use, but greater than that in the County after the station opens, then we can conclude that the introduction of the rail station made the rental market more competitive for renters. Otherwise, the station represents a negative impact and the demand for the rental market in that station area is weak.

- ***Increase in Median Home Value***

For this variable, I calculated the average price increase per year after station opening, and compared these numbers with the County's comparable annual change. A positive impact is observed if the increase in home values in station areas is higher than the increase in the County as a whole. This analysis is divided into two time periods: (1) the short term, that is, the period encompassing the first three years after the station opened, and (2) the long term, the period from the time the station opened to the present. In this study, homes refer to both condominiums and

single-family homes.

- ***Annual Rate of Home Value Change***

Home value varies year by year, so the annual rate of change compared to the previous year is more powerful at explaining the real estate market as a dynamic system. For this variable, I added the number of years when the annual rate of change for home values in station areas were 10% higher or lower than the County's rate of change. Next, I added the number of years when the annual rate of change for home values was 0 to 10% higher or lower than the County's rate of value change. Then I compared these two numbers. If during most of the years after the station opened the station areas experienced 10% higher home value increases than those in the County, it indicates a positive impact. Again, an analysis of both the short-term and the long-term periods is included.

- ***Number of Transactions***

I calculated the yearly average number of transactions before and after the station opened. If more transactions occurred after the station opening, then we may conclude that the introduction of the stations stimulated the real estate market, another positive impact for the market.

- ***Median Home Cost per Square Foot***

In general, higher cost per square foot implies that there is a higher demand for housing in that area. First, I adjusted the median cost per square foot in the station opening year by a housing index and calculated the predicted median cost per square foot in the following years. This number shows the home cost per square feet in the years after the station opened to assess if the real estate market conditions were kept constant. The second step was to compare the predicted number with the actual cost in the corresponding year. If the predicted value is smaller than the actual cost in station areas, we may conclude that there was an increasing demand for housing in that area. Increased housing demand is viewed as a positive impact for the real estate market.

A Note on Stations That Required Alternate Analysis

Home was defined as condominiums and single-family homes. However, in four station areas (Hollywood/Western, North Hollywood, Vermont/Beverly and Westlake/MacArthur Park) there were very few home transactions during the last 20 years, which weakened the credibility of research findings when we attempted to calculate median home value. Thus, for those four stations, the study also looked at the value of multi-family homes (MFR). For MFR, it only examined the median value per unit (one apartment), rate of value change, and number of transactions.

Regression Parameters

The regression analysis helps determine which types of station areas are more likely to experience a positive impact on the real estate market.

The first regression model can be shown as:
*Value difference =c+b1*station area intensity+b2*station area land use pattern+u (1)*

In this model, the coefficient b1 and b2 inform us of the intensity (low, medium or high) and land use (housing, mixed, or employment) that contribute most to higher home value. The dependent variable is the median value difference between station areas and the County. A positive coefficient of the independent variable (b1 and b2) means that the value difference increases as the independent variables increase. A statistical hypothesis test will determine whether that coefficient is significant in explaining the change in home value.

The second regression model examines how real estate characteristics can explain the price difference.

There are four characteristics included in this model, namely the number of transactions, cost per square foot, median square feet and station area redevelopment tax increment (TI) ranking. The redevelopment TI ranking is used as a proxy for public investment. The linear function is in the following form, where "U" is the regression residual and should be a random number.

*Value difference=c+b1*number of transactions+b2*median cost per square feet+b3*square foot+b4*Redevelopment TI ranking +u (2)*

The last regression model is comprehensive by combining station type variables and real estate characteristics together.

*Value difference =c + b1*station area intensity + b2*station area land use pattern + b3*number of transactions + b4*median cost per square feet + b5*square foot + b6* Redevelopment TI ranking + u (3)*

In this model, we determine the separate impact experienced by different station areas by controlling the real estate characteristics. This model can infer whether density and land use pattern are key factors for the success of TODs, as discussed in previous studies. By using t-statistics tests it can also suggest which factor is more critical.

Based on the above covariate and regression analysis, we are able to answer the research question--whether fixed-guideway stations impose a positive impact on local real estate markets and what kinds of station areas are more likely to experience such positive impacts.

Limitations

The primary limitation of this analysis is the limited number of home transactions in some of the station areas (again, the term "home transactions" refers to for-sale home transactions). Because of the small geographic areas studied (a mile-wide circle around the transit station), the number of home transactions in some station areas is not large enough to convey the real estate market conditions over the last 20 years. For some years in certain station areas there were no home transactions. To address the short-term fluctuations and highlight the long-term trends, this study will implement a 3-year rolling average method to compute the median home value every year. The rolling average reduces the effect of limited transactions data but cannot fully eliminate it.

The second limitation is the reliability and quality of data. When analyzing gross rents, I used the 1990 and 2000 Censuses and the 2006/2010 ACS data at the block group level. The decennial Census surveys the total population and gets precise results, but the ACS is only an estimate created by sampling a smaller portion of total population. Thus the consistency of gross rents in the two datasets may be a weakness. In addition, County home values are from two sources (1990-2008 home values are from L.A. Almanac; 2009-2010 home values are from DataQuick), which may also result in inconsistency. When analyzing the cost per square foot in station areas, I applied the Federal Housing Finance Agency (FHFA) house price index to compute the predicted cost. The index is specified for average home values in Los Angele-Long Beach-Glendale MSAD and so is not directly comparable to per square foot home values in L.A. city station areas.

Furthermore, when analyzing DataQuick I found that there are some inaccurate records. For example, the record may be for a single condominium unit transaction, but the sale price represents the monetary value of the whole building. I excluded some of these records as outliers from the raw data.

Last but not least, choosing station opening year as an anchor is controversial. Many scholars believe the housing market begins to react long before the station is put into use. However, lacking an agreement on when the impact of rail stations occurs, this study used the opening year as the watershed moment.

CHAPTER 4

Data Analysis

4 DATA ANALYSIS

Based on the methodology detailed in Chapter 3, this chapter will analyze the data from DataQuick and the U.S. Census Bureau to address the two main questions:

- **What is the impact of the 11 selected fixed-guideway stations on the local real estate market surrounding the stations? More specifically, are the median gross rents and property values within a half-mile radius of the rail station positively or negatively affected by the stations' presence?**
- **In what kind of station areas are the stations most likely to result in a positive impact, namely stimulating market-rate housing development opportunities and increasing rents and property values?**

Most of the data are from DataQuick except for the median gross rents which are derived from the Census Bureau. DataQuick is a professional real estate database and based on County Assessor's information. It records every property transaction over time and reflects the real estate market conditions at the time the transaction happened. The useful variables in DataQuick for this analysis are sale value, sale date, cost per square feet, structure square foot, number of units, and use code description (property type).

The quality and reliability of the data source is acceptable, but the primary limitation of this analysis is the limited number of home transactions in a few station areas. In this study I use median numbers instead of average number. Median is described as the numerical value separating the higher half of a population from the lower half. Theoretically, the median is a measure to deal with skewed data distribution when enough observations exist. When very few data exist, the median does not show any advantages. Therefore, 3-year rolling average median is applied to reduce the short-term fluctuations. The rolling average can reduce the problem of limited transactions data, but cannot eliminate it.

The findings are organized into three parts. The first part is a descriptive analysis to introduce the general real estate market information for the 11 station areas. The second part is covariate analysis which will answer the first research question. I determined the positive or negative impact of each station on the local real estate market based on five factors: number of transactions, median home value, rate of value change, median cost per square foot, and median gross rent. According to the five real estate market attributes, we can conclude whether rail stations can create monetary value for nearby housing properties. The last part is the multivariate analysis in which linear regressions are used to determine statistically what types of station areas may lead to the positive real estate impact.

Descriptive Analysis

To give an overview of real estate market conditions over time, I combined all for-sale homes (single-family homes and condominiums) transactions within a half-mile-radius of the stations and compare them with all the home transactions in Los Angeles County.

Figure 4-1: Median Home Value

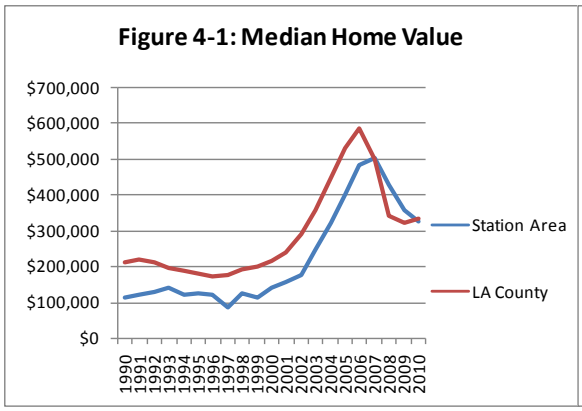


Figure 4-2: Rate of Home Value Change

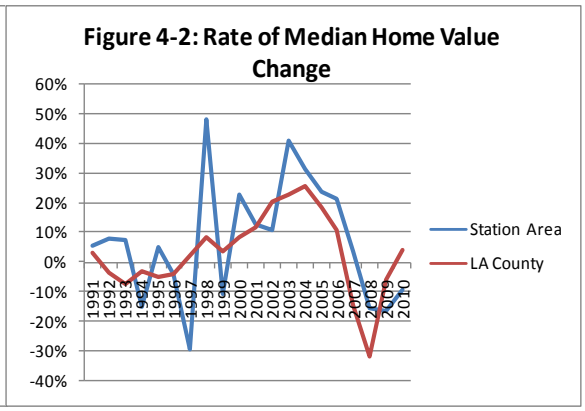


Figure 4-3: Median Square Feet

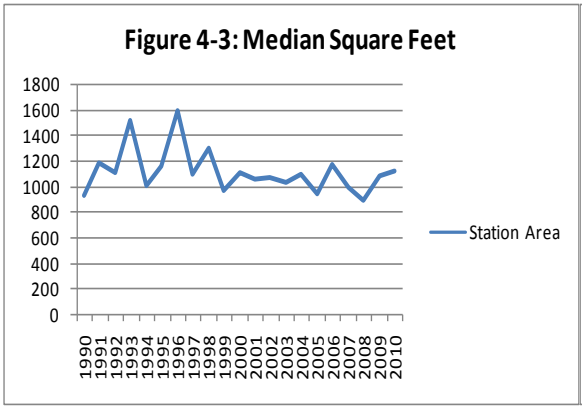
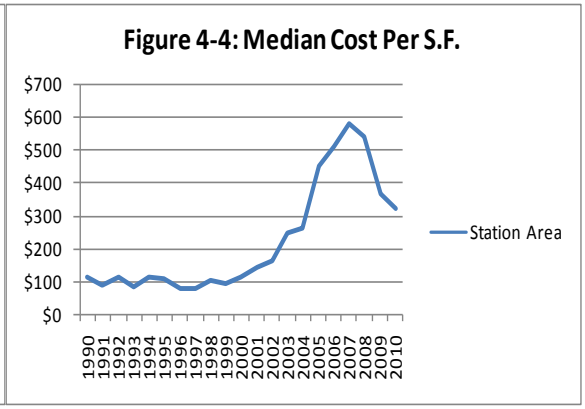


Figure 4-4: Median Cost per Square Feet



Note: *1.County median home value is pulled from L.A. Almanac for 1990-2008 and DataQuick for 2009-2010.*
2. Station area includes 11 stations within the City of L.A.: 7th Street/Metro Center, Heritage Square/ Arroyo, Highland Park, Hollywood/Western, Lincoln Heights/Cypress, North Hollywood, San Pedro, Vermont/Beverly, Wilshire/Vermont, Wilshire/Western and Westlake/MacArthur Park. Westlake/ MacArthur Park station does not have any home transactions from 1990 to 2010.

Source: *L.A. Almanac, DataQuick*

- ***Median Home Value***

The median home values in station areas are parallel with those in the County's real estate market in normal economic conditions, but it is more stable than the County's in recession periods (2008-2010).

From 1990 to 2006, the median values of all transacted homes in station areas were distinctly lower than the County median value. Surprisingly the price gap was quite constant during those periods, falling within the range of $50,000 to $100,000. However, the constant trend changed after 2006. In 2006-2007, home values in station areas kept climbing (even as those in the County as a whole were falling). In 2007, the median home value in station area equaled that of the County – about $500,000 per unit - and then prevailed over the median County home value in 2008 and 2009. Although the dollar amount of the median home value in station areas actually decreased due to the economic recession during 2008 and 2009, the decrease was at a slower rate than that of the County as a whole during those years. Thus, home values in station areas were certainly affected by the current economic condition, but not as much as homes located in the rest of the County. There are multiple potential explanations about this phenomenon. One possible reason is that as more households decide to reside near public transit during the recession period, the trend increases the demand for housing in station areas, thus protecting home values from dropping dramatically like the County. The other reason is the expansion of L.A. transit system and the approval of Measure R. The benefits of living in station areas accrue significantly, which also increases the housing demand.

- ***Rate of Median Home Value Change***

The rate of change is another way to examine the home value trend. Shown in the Figure 4-2, we can see that during most years, the rate of change in station areas fluctuated widely within a large range from -29.2% to 48.2%, which is much wider than the County. In other words, the station area displayed a higher rate of change when there was an increase in home value in that year, but also a greater rate of decrease when there was a value decrease.

According to this indicator, the real estate market in station areas is not as stable as we thought earlier. It may be due to the limited number of transactions every year in the small geographic area. In these small areas, even one or a small number of transactions can affect the median home value to some degree.

An interesting finding is the difference in home value change after 2004 when all the selected stations were already in use. During years where there were positive value changes station area saw higher increases. Whereas, during the years where there were negative value changes, station areas saw lower decreases. However, the County and station areas shared similar trends.

- ***Median Square Feet***

The median number of square feet in the structure of transacted homes around transit stations was very constant over last two decades, although there were small variations in the middle 1990s. The median size of homes remains at approximately 1,000 square feet. The fact that over the last two decades in station areas nearly 81% of homes sold are condominiums, but the home size is small. It implies that small footage condos are likely to be constructed and transacted in station areas. By reason of the small size, these homes are meant for the singles and couples, not for large families.

- ***Median Cost per Square Foot***

The trend of median cost per square foot is quite similar to home value since the square footage does not change too much. The median cost per square foot continued to increase until 2007, reaching the peak at $583 per square foot. There is an interesting finding that before 2000 the cost was fixed at around

$100, but increased dramatically after that year. It suggests that after 2000 the demand of housing in station area began to increase. Eight of the eleven selected stations started to operate after 2000. It may imply that the build-out of the fixed-guideway transit system fed demand for living around stations.

- ***Housing Mix***

Over the last 20 years, there were 1138 condominiums and 258 single-family homes transactions in the 11 station areas. The condominium market is much more dynamic than SFH in station areas. In addition, a majority of these transactions happened in the last sixyears (from 2005 to 2010), due to several large housing development projects, including big conversions of office t space to residential uses at 7th Street/Metro Center, the new Puerta Del Sol development at the Lincoln Heights/Cypress Station, the Solair near the Wilshire/Western station and Gerding Edlen studios near Wilshire/Vermont.

Covariate Analysis

After the overview of the 11 stations, this part will separately review the real estate impact in each station area. The housing markets are so complex and dynamic that no single indicator can provide a reliable and unbiased picture. Thus, this study will synthesize the five most common indicators mentioned earlier to provide a comprehensive idea as to whether L.A. fixed-guideway stations create a positive or negative impact on property value and rent.

Before examining the five real estate indicators, there are three stations that each has particular characteristics that make my approach to them different from that to the rest of the stations —7th Street/Metro Center, San Pedro and Westlake/MacArthur Park. There were no home transactions near 7th Street/Metro Center station until an adaptive reuse ordinance passed in 1999. This ordinance facilitated the conversions of dozens of historically under-utilized structures into new housing units. Thus home transactions just began to recently occur around the 7th Street/Metro Center station area. The San Pedro station opened in 1990 and this study only utilizes transactions between 1990 and 2010. Therefore I lack data before the San Pedro station opened. Westlake/MacArthur Park is a rental apartment-rich area that had almost no home transactions during the last 20 years. Thus for this station, I only examined transactions of multifamily buildings. For these reasons, some real estate indicators for these three stations cannot be quantified, creates difficulties to determine the positive or negative impact of station opening in the areas. For the remaining stations, we do not have such data issue.

Also, in order to differentiate between short-term and long-term effects of rail stations, this research calculates the indicators within a 3-year period and all-years period (from 1990 to 2010). The rationale behind why we selected three years as a short term period is twofold. Primarily, the real estate market needs a certain duration of time to respond to the introduction of rail stations. New housing development takes time to be built, and the public needs time to realize the extra accessibility produced by the rail system. Additionally, the manifestation of real estate effect also depends on when the transit system as a whole moves to scale. The more developed the transit network is, the bigger effect on housing market. In this study, I assumed that three years can approximately reflect the short-term effect. Secondly for some stations, we only have data back to three years before the station opened. The choice of three years allows us to use all available data in DataQuick.

Next we examined the five indicators one by one to analyze the impact on the real estate market within a ½ mile radius around the station.

- ***Number of Unit Transactions***

The method of comparing the number of unit

Table 4-1: Annual Number of Unit Transactions

	3-year Period			1990-2010		
Station Area (Open Year)	Before	After	Short-Term Impact	Before	After	Long-Term Impact
7th Street/Metro Center (1993)	0.0	0.0	No	0.0	20.8	Positive
Heritage Square/Arroyo (2003)	4.0	6.3	Positive	2.6	6.0	Positive
Highland Park (2003)	5.0	6.3	Positive	3.5	6.3	Positive
Hollywood/Western (1999)	0.7	3.3	Positive	0.6	2.7	Positive
Lincoln Heights/Cypress (2003)	1.0	6.7	Positive	0.5	19.3	Positive
North Hollywood (2000)	0.7	0.7	No	0.5	0.9	Positive
San Pedro (1990)	NA	0.7	NA	NA	1.4	NA
Vermont/Beverly (1999)	0.3	1.7	Positive	0.2	1.3	Positive
Wilshire/Vermont (1996)	0.3	1.3	Positive	0.2	11.1	Positive
Wilshire/Western (1996)	2.0	2.3	Positive	1.5	32.9	Positive

Note: *1. Positive impact means that the transaction number increases after station opened.*
2. Unit is a condominium or a single-family home.
Source: *DataQuick, L.A. Metro*

transactions before and after the station opened is straightforward and persuasive. In addition, for differentiating the immediate impact and long-term impact, I respectively calculated the annual average number of transactions within a three year-period around station opening year and all-years period from 1990 to 2010.

In the short-term, a total of seven stations showed a positive impact, which means more transactions occurred after the station was opened, and two stations had no impact. one station (San Pedro) was undetermined since there were no transaction data before the station opening year that can be used for comparison. One item worthy of noting again is that there were no for-sale home transactions either before or after 7th street/Metro center station opened. Because there were many historical buildings around the 7th Street/Metro station, the presence of the station did not promote housing development in that area until after 1999 when adaptive reuse ordinance was originally approved for downtown Los Angeles and later resulted in several large real estate conversions from offices to residential buildings. Although there were positive impacts within three years immediately after most stations opened, the increase was not that large except for the Lincoln Heights/Cypress Park station where the number grew up from 1 to 6.7 per year.

However, in the long run, station areas displayed much stronger positive impacts in terms of the number of transactions. All nine stations with transaction data show positive impacts in the surrounding area. Indeed, the annual number of transactions at least doubled in every station area, except for that around the Highland Park station where the annual number of transactions only rose slightly. Dramatic increases were found for the 7th street/Metro Center, Lincoln Heights/Cypress Park, Wilshire/Vermont and Wilshire/Western station. It complied with some of the changes known in these areas. One can easily find visible evidence of this positive impact: large real estate conversions of buildings from offices to residential homes occurred in the 7th Street/Metro Center station area; Puerta Del Sol was located adjacent to Lincoln Heights/Cypress station; large condominium projects were constructed around Wilshire/Vermont and Wilshire/Western station; new developments were constructed in station areas to take advantage of the L.A. rail system. Though many factors can result in large development in station area, like real estate cycle, we can conclude here that to some degree the introduction of rail stations does facilitate the construction and selling of homes if appropriate land-use policy is applied.

- ***Median Home Value***

Table 4-2 describes the annual home value change for both station areas and the County in terms of whole dollar and percentage change. It is divided into two categories—the 3-years and all-years period after the station was put into use.

In the short term, station areas did not have any advantage over the County in whole dollar change. The property values of for-sale homes in half of the station areas increased at a lower rate than they did in the County. The Wilshire/Western station area even showed a value loss after the station opened. Also, a lack of data made findings about the impact of the San Pedro and 7th Street/Metro Center stations inconclusive. In fact the whole dollar change is skewed by the relatively higher County median home values. The percentage change was more positive. The number of negative stations with a negative impact decreased to 2. Three stations that had a negative impact in terms of the change in whole dollar median-home value had a positive impact in terms of percentage change in value. The highest percentage change appeared in the Highland Park station are (33%), followed by the Lincoln Heights/Cypress Park station area (22%) and the Heritage Square/Arroyo station area (20%). The three stations are on the

Table 4-2A: 3-Year Period Median Home Value (3-year rolling average)

Station Area (Open Year)	3-year Period					
	Station After (Dollar)	Station After (%)	County After (Dollar)	County After (%)	Short-term Impact (Dollar)	Short-Term Impact (%)
7th Street/Metro Center (1993)	NA	NA	NA	NA	**NA**	**NA**
Heritage Square/ Arroyo (2003)	$37,667	20%	$56,121	19%	Negative	Positive
Highland Park (2003)	$61,292	33%	$56,121	19%	Positive	Positive
Hollywood/Western (1999)	$14,064	14%	$15,009	8%	Negative	Positive
Lincoln Heights/Cypress (2003)	$39,750	22%	$56,121	19%	Negative	Positive
North Hollywood (2000)	$12,167	8%	$23,347	12%	Negative	Negative
San Pedro (1990)	NA	NA	NA	NA	NA	NA
Vermont/Beverly (1999)	$33,438	19%	$15,009	8%	Positive	Positive
Wilshire/Vermont (1996)	$4,944	5%	$4,210	2%	Positive	Positive
Wilshire/Western (1996)	$(9,979)	-10%	$2,103	1%	Negative	Negative

Note: *1. County median home value is pulled from L.A. Almanac for 1990 -2008 and DataQuick for 2009-2010.*

2. Station area median home value is pulled from DataQuick. Home refers to condominium and single family home.

3. All values shown above are based on 3-year rolling average median value to compensate for limited transactions in some years in certain station areas.

Source: *DataQuick, L.A. Almanac, CA Realtors Association, L.A. Metro*

Table 4-2B: 1990-2010 Median Home Value (3-year rolling average)

Station Area (Open Year)	1990-2010					
	Station After (Dollar)	Station After (%)	County After (Dollar)	County After (%)	Long-Term Impact (Dollar)	Long-Term Impact (%)
7th Street/Metro Center (1993)	$(77,556)	-12%	$(47,867)	-10%	Negative	Negative
Heritage Square/ Arroyo (2003)	$9,567	5%	$4,428	1%	Positive	Positive
Highland Park (2003)	$11,156	6%	$4,428	1%	Positive	Positive
Hollywood/Western (1999)	$52,803	51%	$17,933	9%	Positive	Positive
Lincoln Heights/Cypress (2003)	$14,979	8%	$4,428	1%	Positive	Positive
North Hollywood (2000)	$20,174	13%	$11,710	6%	Positive	Positive
San Pedro (1990)	$7,670	9%	$7,796	4%	Negative	Positive
Vermont/Beverly (1999)	$46,151	27%	$11,828	6%	Positive	Positive
Wilshire/Vermont (1996)	$23,488	26%	$11,040	6%	Positive	Positive
Wilshire/Western (1996)	$17,444	17%	$10,023	6%	Positive	Positive

Note: *1. County median home value is pulled from L.A. Almanac for 1990 -2008 and DataQuick for 2009-2010.*
2. Station area median home value is pulled from DataQuick. Home refers to condominium and single family home.
3. All values shown above are based on 3-year rolling average median value to compensate for limited transactions in some years in certain station areas.
Source: *DataQuick, L.A. Almanac, CA Realtors Association, L.A. Metro*

Metro Gold Line and opened last among the 11 stations I selected.

Similar to the stations' impact on the number of transactions in the surrounding area, the positive impact (increasing median home value faster against County values) is stronger at the long run. For whole dollar changes, eight stations produced distinctly higher increase than the County. For example, the highest annual value increase occurred in Hollywood/Western station and it was three times more than County's corresponding change. The second highest occurred in Vermont/Beverly station, which is four times more than the County. In addition, we determined that all five stations with negative impacts in 3-year time period had strong positive impacts over time. The only two stations with negative long-term effects were also the two stations that were inconclusive due to lack of data in the short run. We can reach similar results by computing the percentage change. Only 7th Street/Metro Center station decreased 2% faster than the County, and the rest of the stations all displayed positive impacts, namely growing faster than the County.

- ***Rate of Median Home Value change***

Median value is just one side of the coin. It is not conclusive to just compare median home values between station areas and the County. Therefore, we calculated the annual rate of change in each station area and compare these rates with the County's rates. If during most years after the station opened, the station area's rate of change is greater than the County, we can assume it is due to the fixed-guideway station's positive impact on the housing market.

According to Table 4-3, a total of eight out of the 10 station areas, the station had a positive impact, which means that at least half of the time, the rate of value change was higher than that of the County. More specifically, four stations (Hollywood/Western, Lincoln Heights/Cypress Park, Vermont/Beverly and Wilshire/Western) revealed strong positive impacts. Here strong positive impacts mean that during the majority of the time the rate in the station area was more than10% higher than that in the County as a whole. Only San Pedro and 7th Street/Metro stations displayed negative impacts. But I am not confident about the result concerning 7th Street/Metro Center station since there were only limited years of data that could be compared with the County. The data were from the recession years when real estate markets behave abnormally.

In order to explore the differences between station areas and the County, in the above table, I also computed the percentage of years that either a 10% higher or 10% lower rate change than the County. It reflects the frequency of value change divergent from the County. Again, eight of the ten stations diverged from the County during more than 30% of time. Among these eight stations, Wilshire/Western ranks No.1 with 69% of the time divergent from the County's real estate market as a whole, followed by Heritage Square/Arroyo and Hollywood/Western. It proves that in general the performance of station area real estate markets differ from that of the County average.

- ***Median Cost per Square Foot***

From the descriptive analysis we know that condominiums were more likely than single-family homes to be built and sold in station areas. In general condominiums are smaller in size and cheaper in absolute value than single-family homes, so the median home value in the station area tends to be lower than County's median. In order to eliminate this bias, it is necessary to look at the cost per square foot. It is widely acknowledged that a higher cost per square foot refers to a higher demand for housing in that area.

The methodology of examining cost per square foot is a little complicated. First, I extracted data

Table 4-3: 1990-2010Rate of Median Value Change

Station Area (Open Year)	Compare to County's rate of change					Impact
	# of years >10% higher	# of years 0~10% higher	# of years 0~10% lower	# of years >10% lower	% of years >10% higher or lower	
7th Street/Metro Center (1993)	0	0	2	0	**0%**	Negative
Heritage Square/ Arroyo (2003)	2	3	0	2	**57%**	Positive
Highland Park (2003)	1	4	2	0	**14%**	Positive
Hollywood/Western (1999)	5	1	4	0	**50%**	Positive
Lincoln Heights/Cypress (2003)	3	2	2	0	**43%**	Positive
North Hollywood (2000)	3	5	1	1	**40%**	Positive
San Pedro (1990)	3	4	7	2	**31%**	Negative
Vermont/Beverly (1999)	4	4	2	1	**45%**	Positive
Wilshire/Vermont (1996)	3	10	0	0	**30%**	Positive
Wilshire/Western (1996)	6	3	1	3	**69%**	Positive

Note: *1. County median home value is pulled from L.A. Almanac for 1990 -2008 and DataQuick for 2009-2010.*
2. Station area median home value is pulled from DataQuick
3. All rates of change shown above are based on 3-year rolling average median value to compensate for limited transactions in some years in certain station areas.
Source: *DataQuick, L.A. Almanac, CA Realtors Association, L.A. Metro*

Table 4-4: 1990-2010 Median Cost per Square Foot

	3-year Period		1990-2010		
Station Area (Open Year)	# of years > predicted value	Short-Term Impact	# of years > predicted value	# of years < predicted value	Long-Term Impact
7th Street/Metro Center (1993)	NA	NA	0	2	Negative
Heritage Square/Arroyo (2003)	1	No	5	2	Positive
Highland Park (2003)	3	Positive	7	0	Positive
Hollywood/Western (1999)	3	Positive	10	0	Positive
Lincoln Heights/Cypress (2003)	2	No	6	1	Positive
North Hollywood (2000)	3	Positive	10	1	Positive
San Pedro (1990)	NA	NA	12	4	Positive
Vermont/Beverly (1999)	0	Negative	4	7	Negative
Wilshire/Vermont (1996)	1	No	11	2	Positive
Wilshire/Western (1996)	0	Negative	5	9	Negative

Note: *1 Housing Price Index is used to predict what the cost per square foot would have been if there was no demand or supply change of housing in station area.*
2. The index is specified for Los Angeles-Long Beach-Glendale MSAD, quarter 4 to quarter 4.
Source: *DataQuick, Federal Housing Finance Agency, L.A. Metro*

from DataQuick and computed the median cost per square foot in each year. These values are the actual cost which is captured by real estate market. Then I calculated the predicted value by using Housing Price Index (HPI). The predicted value informs us what the cost per square foot should be if there is no change in appreciation or depreciation in the local real estate market. HPI is very similar to Consumer Price Index, which adjusts for inflation to allow prices among different years to be comparable. For instance, the median cost in Heritage Square/Arroyo station in the opening year (2003) was $192. Suppose the demand and supply were not changed, the $192 in 2003 should equal to $241 in 2004. If the actual cost was higher than $241, it could indicate that there was an increased demand of housing in that station area.

The table lists the number of years with higher/lower cost per square foot than the predicted value. In the short-term (during the three years from station opening), three stations were positive, two were negative and three observed no impact. Two stations (7th Street/Metro Center and San Pedro) were not determined for lack of data. In this scenario, no impact does not mean that there is no relationship between station and cost per square foot. Instead, it is too difficult to generalize a conclusion since for some years those station areas show a positive impact, and for other years a negative impact.

Now we examined the long-term effects. A total of seven stations experienced positive impacts and the number doubled from the three stations found to have positive impacts in the short-term. Two stations with short-tem negative impacts remained negative in the long run, but they appeared to be turning positive during the last two years of the analysis. We can use Vermont/Beverly station as an example. Looking at the eleven years after the station opened, during four, homes in the station area had a higher cost per square foot than those in the County as a whole, and during seven, station-area homes had a lower cost per square foot than that in the County. But the four positive years were all distributed in the most recent time period, namely 2007 to 2010 (See the Appendix). The five positive years in the Wilshire/Western station are from 2006 to 2010. We believe that in the future, those station areas will be showing more positive impacts from the transit stations.

- ***Median Gross Rent***

The rental markets are another important aspect of the local housing markets. Theoretically, the existence of fixed-guideway stations would attract transit-dependent people to reside in station areas. The increased demand should make the rental market competitive for those home-seekers. Thus the median gross rent in station areas should increase faster than other places, which is regarded as a positive impact in this study. Table 4-5 lists the median gross rent in 11 station areas sequentially from 1990 to 2010. Generally, the rents in the Los Angeles City station areas were lower than the County median rent. This makes sense, since transit-area residents have been lower income people for decades, Los Angeles City had a rent-control ordinance, and affordable apartments are typically concentrated in station areas.

However, the median gross rents increased faster than the County in most station areas after opening. It suggests that apartments in station areas are decreasing in affordability. For stations that were put into operation around 2000, we assumed they had a positive impact on gross rent if the rate of change in the surrounding area was lower than in the County before the station opened but higher than in the County after the station opened. For stations that started operating around 1990, because of data availability we simply considered they were positive as long as the rate of change after station opened was higher than the County. The overall results are strikingly positive. Of the 11 selected stations,

Table 4-5: 1990-2010 Median Gross Rent

	Median Rent in Dollars			Rate of Rent Change				
Station Area (Open Year)	1990 Rent	2000 Rent	2006-2010 rent	1990-2000	2000-2006/2010	1990-2006/2010	Impact 1	Impact 2
7th Street/Metro Center (1993)	324	318	709			118.6%		Positive
Heritage Square/Arroyo (2003)	512	613	916	19.7%	49.4%		Negative	
Highland Park (2003)	524	592	959	13.0%	61.9%		Positive	
Hollywood/Western(1999)	529	578	920	9.1%	59.3%		Positive	
Lincoln Heights/Cypress (2003)	464	559	866	20.6%	54.7%		Negative	
North Hollywood (2000)	588	647	1118	10.0%	72.9%		Positive	
San Pedro (1990)	431	529	859			99.5%		Positive
Vermont/Beverly (1999)	535	577	919	7.7%	59.4%		Positive	
Westlake/MacArthur Park (1993)	420	415	746			77.7%		Negative
Wilshire/Vermont (1996)	504	559	924	11.0%	65.2%		Positive	
Wilshire/Western (1996)	565	618	999	9.4%	61.7%		Positive	
County Median Gross Rent	**600**	**704**	**1117**	**17.3%**	**58.7%**	**86.2%**		
U.S. CPI				**32%**	**25%**	**65%**		

Note: *1. For stations that were opened around 2000, impact 1 is applied. Positive impact 1 means lower rate of change than the County in the first 10 years (before station opened), and higher rate of change than the County in the 2nd 10 years (after station opened).*

2. For stations that were opened around 1990, impact 2 is applied. Positive impact 2 means higher rate of change than the County over 20 years from 1990 to 2010.

Source: *1990, 2000 Census, 2006-2010 ACS, L.A. Metro, Bureau of Labor Statistics*

eight stations showed positive impact, only three had negative impact. We may reasonably forecast a continuing increase of median gross rent in station areas in excess of the County's trend if policy makers do nothing to prevent gentrification and to ensure housing affordability.

As explained in the chapter of methodology, due to limited home (condominium and single-family) transactions in some stations I also examine the multifamily property market (rental apartment) in these four stations (Hollywood/Western, North Hollywood, Vermont/Beverly and Westlake/MacArthur Park) to reach more reliable conclusions. For multifamily apartments I only assessed median price per unit, rate of value change, and number of unit transactions.

- ***Multifamily Number of Unit Transactions***

In the 3-year period, the North Hollywood station revealed negative impact, the annual number of unit transactions decreased from 11.3 to 1.7. The other three stations had positive impacts. In the all-years long run, annual transactions grew dramatically. For example, the transactions in Hollywood/Western station doubled. North Hollywood and Vermont/Beverly increased more than four times than the annual transactions before the station opened. Westlake/MacArthur experienced the highest increase from 0 to 77.4 annually. The rental market became very active after the station opened. This is a positive result for landlord by reducing the affordability for lower income households.

- ***Multifamily Median Price per Unit***

The Hollywood/Western station area showed negative impact in the short-run, but positive in the long run. The North Hollywood and Vermont/Beverly were positive in the short and long term. Westlake/MacArthur was undetermined since there were no transactions before the station opening year.

Table 4-6: 1990-2010 MFR Annual Number of Unit Transactions

	3-year Period			1990-2010		
Station Area (Open Year)	Before	After	Short-Term Impact	Before	After	Long-Term Impact
Hollywood/Western (1999)	45.0	77.0	Positive	46.0	95.1	Positive
North Hollywood (2000)	11.3	1.7	Negative	5.5	46.7	Positive
Vermont/Beverly (1999)	18.3	42.0	Positive	8.1	57.4	Positive
Westlake/MacArthur Park (1993)	0.0	30.3	Positive	0.0	77.4	Positive

Source: *DataQuick, L.A. Metro*

Table 4-7: 1990-2010 MFR Median Price Per Unit

	3-year Period			1990-2010		
Station Area (Open Year)	Before	After	Short-Term Impact	Before	After	Long-Term Impact
Hollywood/Western (1999)	$3,217	$2,166	Negative	$(1,418)	$7,667	Positive
North Hollywood (2000)	$(193)	$12,764	Positive	$ (837)	$7,800	Positive
Vermont/Beverly (1999)	$(496)	$6,231	Positive	$ (496)	$10,433	Positive
Westlake/MacArthur Park (1993)	NA	NA	NA	NA	$4,165	NA

Note: *1. Station area median multifamily home value is pulled from DataQuick.*
2. All values shown above are based on 3-year rolling average median value to compensate for limited transactions in some years in certain station areas.
Source: *DataQuick, L.A. Metro*

Table 4-8: 1990-2010 MFR Rate of Price Per Change

	1990-2010		
Station Area (Open Year)	Before	After	Long-Term Impact
Hollywood/Western (1999)	-3.3%	12.9%	Positive
North Hollywood (2000)	-6.7%	17.4%	Positive
Vermont/Beverly (1999)	-2.8%	18.2%	Positive
Westlake/MacArthur Park (1993)	NA	12.9%	NA

Note: *All values shown above are based on 3-year rolling average median value to compensate for limited transactions in some years in certain station areas.*
Source: *DataQuick, L.A. Metro*

I want to make a note that in the all-years period for the three determined stations, they suffered value loss before the station opened but had an absolute gain after the station opened. This suggests that in these station areas, the revitalization is closely associated with the introduction of rail stations.

- ***Multifamily Rate of Price Change***

The positive impacts were more obvious when we compare annual rate of change before and after the stations opened. The rate of price change for all stations areas except Westlake/ MacArthur Park decreased in the beginning but started to increase after building the stations, and the annual rates of price change were higher than 10%. Westlake/MacArthur station is still undetermined for lack of transactions data in the years before the station opened.

Summary of Covariate Analysis

Table 4-9 summarizes all the results of covariate analysis. There are 11 stations included in my study focused on the for-sale home market for 10 stations and on the rental market for four stations. This analysis allows us to see to what degree these stations are positive/negative in terms of the five real estate indicators.

- The Highland Park and Wilshire/Vermont stations were the only two stations that showed completely positive impacts. All of the real estate indicators listed in the table were positive for these two stations.
- The majority of the indicators for five stations (Heritage Square/Arroyo, Hollywood/Western, Lincoln Heights/Cypress Park, North Hollywood, Vermont/ Beverly) were positive. Each of these stations only had one or two negative indicators.
- The real estate indicators have no impact in the Wilshire/Western station area since it had mixed results with four negative impacts and sixpositive ones.
- The 7th street/ Metro Center, San Pedro and Westlake/MacArthur Park stations had quite a few undetermined indicators due to a lack of transaction data. The San Pedro station was opened in 1990, and this study did not collect data before 1990. 7th Street/Metro Center lacked transaction data due to land use regulation. Westlake/MacArthur Park had no for-sale home transactions over the last twenty years.

Table 4-9: Summary of Covariate Analysis

✓ : Positive Blank Cell: Negative

Station Area (Open Year)	Short-Term Impact				Long-Term Impact					
	# of Trans-actions	Me-dian Home Value (Dollar)	Me-dian Home Value (%)	Mdian Cost per S.F.	# of Trans-actions	Me-dian Home Value (Dollar)	Me-dian Home Value (%)	Mdian Cost per S.F.	Rate of Value Change	Median Gross Rent
Highland Park (2003)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wilshire/Vermont (1996)	✓	✓	✓	NO	✓	✓	✓	✓	✓	✓
Heritage Square/Arroyo (2003)	✓		✓	NO	✓	✓	✓	✓	✓	
Hollywood/Western(1999)	✓		✓	✓	✓	✓	✓	✓	✓	✓
Lincoln Heights/Cypress (2003)	✓		✓	NO	✓	✓	✓	✓	✓	
North Hollywood (2000)	NO			✓	✓	✓	✓	✓	✓	✓
Vermont/Beverly (1999)	✓	✓	✓		✓	✓	✓		✓	✓
Wilshire/Western (1996)	✓				✓	✓	✓		✓	✓
7th Street/Metro Center (1993)	✓	NA	NA	NA	✓					✓
San Pedro (1990)	✓	NA	NA	NA	NA		✓	✓		✓

Note: 1. The table summarizes the attributes of 10 stations with home transactions.
2. 7th Street/Metro Center station shows anomaly negative indicators uncertain since it does not have transaction data until 2006 when housing bubble started to burst.
Source: DataQuick, L.A. Metro, L.A. Almanac, CA Realtors Association, Federal Housing Finance Agency, 1990 Census, 2000 Census, 2006-2010 ACS

Multivariate Analysis

After studying the impact of fixed-guideway stations on the real estate market by reviewing various real estate market indicators, the next step was to analyze what kind of station areas are more likely to generate positive impact, especially from the perspective of intensity and land use pattern, the most common factors discussed in previous research. Linear regressions assist in answering the above question.

The dependent variable (Y) is the difference of median home value between station areas and the whole County. Mathematically it is to use station area's median home value minus County home value in the corresponding year. Higher Y denotes a positive impact happening in the station areas during last 20 years. The independent variables (X) include actual intensity (density) and land use pattern based on L.A. TOD's report, number of unit transactions, cost per square foot, median square feet and redevelopment area (RDA) ranking based on incremental tax for 2011 fiscal year.

Three dummy variables are included in the regressions. Intensity has three categories, namely low (number of residents and workers per half mile is less than 12,000), medium (the number is between 12,000 and 21,000) and high (the number is greater than 21, 000), which is denoted as 1, 2, 3 respectively. Land use pattern also has three classifications--employment center (ratio of workers to residents is greater than 1.5), mixed use (the ratio is between 0.5 and 1.5), and housing concentration (the ratio is smaller than 0.5), also respectively signed as 1, 2, 3. Note that there is only one station area (7^{th} Street/ Metro Center) that is an employment center. The third dummy variable is the station area Redevelopment TI ranking. It reflects the amount of local funding that was used for redevelopment. People assume the funding collected from local property owners can stimulate the community and protect local property value from depreciating. Station area Redevelopment TI has four ranking levels, namely none, low, medium and high, sequentially denoted using 0, 1, 2, 3. For details of the ranking methodology see Erin Coleman and Pamela Stephens' report.

Three regression models are conducted to determine how density and land use pattern affects home values. The first model is to simply examine the effect of these two attributes—land use and density. The second model examines the effect of real estate characteristics on value difference. The last comprehensive model is used to analyze the impact of density and land use by controlling for real estate characteristics.

This section discusses the regression results one by one. Note that the "u" in the three models is unobserved random variable.

- Regression model with intensity and land use pattern variables

*Value_Difference=c+ b1*Intensity+b2* Land_Use+u (1)*

The first regression consists of two independent variables which are intensity and land use. The R^2 is smaller than 0.20 since the two variables have limited ability to explain the dependent variable—real estate value difference. The coefficients of the two variables are both positive. Numerically, higher value of intensity and land_use will lead to higher value_difference. In my assumption, the greatest value for these two variables is both 3, which represents high density and housing. It means that high density and housing-concentrated station area lead to higher median home value but are not the only factors. The value of t-statistics for the coefficient of intensity is significant, but the land use is not statistically significant.

- Regression with number of transactions, cost per square foot, median square feet, and Redevelopment TI ranking variables

Table 4-10: Regression Results (10 stations)

	Coefficient	Standard Error	t-statistics	Significance
Model 1: Intensity and Land Use				
Intercept	-238,730.9	64,448.2	-3.7	0.000
Intensity	66,246.9	14,106.6	4.7	0.000
Land Use	13,559.6	18,709.8	0.72	0.470
R2=0.1852, N=100				
Model 2: # of Transactions, Cost/s.f., S.F., Redevelopment TI ranking				
Intercept	-356,913.5	37,517.6	-9.51	0.000
Number of Transactions	7.6	357.7	0.02	0.983
Cost per S.F.	399.5	64	6.24	0.000
Square Feet	131.6	21.4	6.15	0.000
Redevelopment TI Ranking	22,553.6	7,575.2	2.98	0.004
R2=0.4552, N=100				
Model 3: All variables above				
Intercept	-398,670	53,730	-7.42	0.000
Intensity	69,329.5	16,324.1	4.25	0.000
Land Use	-7,502.4	14,769.2	-0.51	0.613
Number of Transactions	-175.2	334	-0.52	0.601
Cost per S.F.	385.6	59.5	6.49	0.000
Square Feet	106.4	20.8	5.12	0.000
Redevelopment TI Ranking	-11,801	10,719	-1.10	0.274
R2=0.5444, N=100				

Note: *1. R2 explains how an dependent variable can be explained by the independent variables included in the right-hand side of the regression function. R2 is between 0 and 1, and higher value indicates higher explanatory level.*

2. The coefficient refers to the numerical relationship between independent variables and dependent variable. The standard error of the coefficient estimates the statistical distribution of the coefficient. Large standard error implies a wide possible range of the coefficient.

3. T-statistics is calculated by dividing coefficient over its standard error. Significance is derived by looking up the T-distribution table. Lower significance level means the coefficient is more distinctive from zero, which implies a stronger relationship between this variable and dependent variable.

4. Y=median home value in station areas – median home value within the whole County

Value_Difference=
*c+ b1*Transactions+b2*cost_per_SF+b3*Square_*
Feet+b4 Redevelopment TI +u (2)*

There are four independent variables in the second regression. The coefficient of transactions is positive but not significant. It suggests that where there are high transaction activities, there is also a trend of prices increasing faster than the County. These two observations combined illustrate that the demand for market-rate housing exceeds the supply, notwithstanding that new construction activities took place in the station areas. The coefficients of cost per square foot and structure square feet are both positive and significant. These results are intuitive since Y (value difference) is the product of these two variables. In this model, station area Redevelopment TI also has significantly positive impact on home value since higher Redevelopment TI funding suggests higher local community investment which can create greater value for private properties.

- Regression model with all variables

*Value_Difference=c+ b1*Intensity+b2* Land_Use+*
*b3*Transactions+b4*cost_per_SF+b5*Square_*
Feet+b6 Redevelopment TI +u (3)*

The comprehensive model combines the variables in the previous models. The R^2 is over 0.5. After controlling for the number of transactions, cost per square foot, structure square feet and station area Redevelopment TI ranking, higher density and non-housing station areas are more likely to generate higher home value. This regression result is different from the first model in that it reveals that high density and housing-concentrated station areas are positive. The difference may be because that in the comprehensive model we control some real estate characteristics, which can reduce the bias of omitted variables from the perspective of statistics. Thus the comprehensive model is more accurate in explaining the difference in value between station areas and the County. In the 100 observations, only one station is an employment center, so we can further conclude that an identical home will be sold at a higher price if it is located in a high-density and mixed-use station area.

The coefficient of land use is positive in the first simple model, but turns negative in the comprehensive model. It illustrates that the other independent variables included in the model can affect the influence of land use on home prices. It also suggests that the impact of land use pattern is hard to generalize and based on the context.

In contrast, density is much more consistent in affecting home prices. It seems that under various situations, higher density (of residents and workers) can always lead to higher home values. In addition, through the value of t-statistic tests we know that intensity has significantly positive impacts, but land use pattern does not. Intensity plays a relatively more important role in creating higher home value.

Through comparing the coefficients in the table 4-10, we are surprised to determine that the sign of coefficients for land use, number of transactions and station area Redevelopment TI ranking changed. There may be possible distortion in the data because of the extraordinary numbers of transactions in certain stations in recent years. The previous findings might not be generalized since the results could be distorted by the large number. Thus, in order to get an unbiased result, I deleted the all the data in 7th Street/Metro Center, Lincoln Heights/Cypress Park and Wilshire/Western station, which had a large number of home transactions, and rerun the models.

Table 4-11 shows more consistent results. In the first model, both coefficients for density and land use remain positive, but land use becomes significant too. The second model is consistent with the 10 station

Table 4-11: Regression Results (7 stations)

	Coefficient	Standard Error	t-statistics	Significance
Model 1: Intensity and Land Use				
Intercept	-453,936.9	72,713	-6.24	0.000
Intensity	92,706.7	16,532.2	5.61	0.000
Land Use	75,942.4	21,720.6	3.5	0.001
R2=0.3536, N=76				
Model 2: # of Transactions, Cost/s.f., S.F., Redevelopment TI ranking				
Intercept	-363,581	44,047.9	-8.25	0.000
Number of Transactions	486.8	1,081.7	0.45	0.654
Cost per S.F.	420.4	77.1	5.45	0.000
Square Feet	130.6	23.7	5.51	0.000
Redevelopment TI Ranking	24,527.9	9,578.4	2.56	0.013
R2=0.4655, N=76				
Model 3: All variables above				
Intercept	-499,328.9	65,645.1	-7.61	0.000
Intensity	73,418.6	18,308.2	4.01	0.000
Land Use	26,873	22,193.3	1.21	0.230
Number of Transactions	326.3	1,002.9	0.33	0.746
Cost per S.F.	379.8	75.2	5.05	0.000
Square Feet	90.2	23.2	3.89	0.000
Redevelopment TI Ranking	1,604.8	12,081.4	0.13	0.895
R2=0.5824, N=76				

Note: *1. R2 explains how an dependent variable can be explained by the independent variables included in the right-hand side of the regression function. R2 is between 0 and 1, and higher value indicates higher explanatory level.*

2. The coefficient refers to the numerical relationship between independent variables and dependent variable. The standard error of the coefficient estimates the statistical distribution of the coefficient. Large standard error implies a wide possible range of the coefficient.

3. T-statistics is calculated by dividing coefficient over its standard error. Significance is derived by looking up the T-distribution table. Lower significance level means the coefficient is more distinctive from zero, which implies a stronger relationship between this variable and dependent variable.

4. Y=median home value in station areas – median home value within the whole County

regression. In the comprehensive model, the sign of the coefficients are now consistent with model #1and model #2. Housing-concentrated land use patterns, number of transactions, and station area Redevelopment TI ranking contribute to high home values. The new set of regression models, with the three stations deleted, were more intuitively reasonable, and revealed consistently that use density is still the key factor that impacts housing price. Land use also has an impact, but not as significantly as density.

Lastly, I need to emphasize the limitation of this multiple regression analysis. In the comprehensive model, real estate characteristics of station areas are controlled to examine the effect of density and land use patterns. However, only limited characteristics are included, which may result in omitted-variable bias. We should be very careful in interpreting the regression results. A better model should contain some other important features of the real estate market, such as number of bedrooms, bathrooms, and built year.

chapter 5

Conclusions & Policy Recommendations

5 CONCLUSIONS AND POLICY RECOMMENDATIONS

Although this study has some data limitations, it still provides an insight into some trends and patterns in the station area real estate market after reviewing the five real estate indicators and three types of analysis in the previous chapter. From these findings, I will draw conclusions on the impact of Los Angeles' fixed-guideway transit stations on the local real estate market, and propose some policy recommendations to local government and related non-government organizations to understand the impacts of fixed-guideway transit stations on local housing market, and to create a successful and equitable TOD in Los Angeles.

Conclusions

1. The local housing market around Los Angeles fixed-guideway transit stations was generally positively affected.

Although the urban form of L.A. City is designed for driving, some Angelenos rely on public transit. Access to public transit is enhanced when these users reside near the station areas. The extra accessibility created by rail stations is fully reflected and captured by the local housing markets.

Before going further to the reasoning of this conclusion, I want to clarify the definition of positive impact. Concerning the five real estate indicators, positive impact refers to greater number of transactions, larger median home value, higher rate of change, rents rising and increasing cost per square foot. These positive impacts are the features of the real estate market and do not necessarily benefit the local residents. For example, median home value in station areas increased steadily, which would benefit the original property owners, but it also made homes less affordable for those who wanted to go from renting to owning within the station area or move within the area for some other reason, as well as for those who wanted to move into station areas. There may also be increased pressure from landlords in rent-controlled buildings to encourage their current tenants to move out so that rents can be raised to the new market levels.

Now let's look at the positive impact. Housing supply dramatically increased after the stations opened. More than half of the real estate transactions were due to new developments near the stations. New development is especially visible in large condominium projects such as Solair and Puerta Del Sol. Housing construction and increases in transactions are found in the 11 selected stations. Before the selected stations opened, the surrounding station areas were generally underutilized and undeveloped. This can be proven by the minimal number of transactions and the decreasing home value before the stations were brought into operation. However, after government investment in building the stations (and operating the transit) was fully realized by the start of fixed-route transit service, the surrounding areas began to revitalize, and the real estate market started to prosper.

Despite the increase in housing supply, housing demand increased in excess of supply in station areas.

Cost per square foot kept increasing and home value continued appreciating. The demand increased much faster than the supply which resulted in home prices rising. In terms of the five indicators, after the station opened, the majority of the 11 station areas had more transactions, higher median home value, greater rate of change, higher rents, and cost per square foot. From a real estate viewpoint, the role of Transit Oriented Development appears by all the evidence to have indeed succeeded to stimulate market rate housing in these station areas. However, from the point of view of the local residents and proponents of affordable housing, the results above may be interpreted as having less positive consequences.

As discussed before, the positive impact is for the local real estate market, especially private parties such as developers and property owners. As a non-government organization dedicated to promoting affordable housing throughout Southern California, SCANPH should keep an eye on how the local real estate market changes after stations opening, and try to track the original residents' response to such change. Also, SCANPH should be clear about who are affected by the positive impact and by how much, especially whether the low-income households benefit or suffer from such positive impact in terms of revitalization and development.

2. The long-term impacts are stronger than the short-term (3-year period) impacts.

The real estate market needs a certain period of time to respond to the introduction of rail stations. Therefore, over the long run the positive impact in station areas is revealed gradually.

Concerning the five indicators, the long-term impact was always more encouraging than the short-term. For instance, five stations displayed value increase slower than the County in terms of median home value in the short run, but the number decreased to two in the long run. The market needed time for people to discover the benefits of living close to transit stations, and the impact waited to be visible until the transit network reached a certain level. After people experienced the convenience of the rail system and the new lifestyle in station areas, more and more residents started to purchase homes in station areas thus increased the demand of local real estate market. Then developers saw these development opportunities and produced more housing to satisfy the increasing demand. All of above changes are not an instant process. Thus only in the long run the impact of rail stations can be captured and reflected in the market at a large scale.

Another reason why the housing market is more positively impacted in the long run is the effect created by new development. The added accessibility brings in more development opportunities. Office, commercial, retail buildings and parking structures begin to locate in the station area, which drives up the demand of housing at the same time. In fact, it is an interactive process. More people choose to live in station area, which attracts retail companies, employers, medical centers, and so on to locate in station area to serve such new residents. After these infrastructure and facilities come in, the neighborhood starts to revitalize and then attract more people in return. A repeated process as such accumulates positive impacts over time.

For SCANPH, protecting low-income households from negative impacts from the revitalization and reinvestment in TOD areas is a long process. The transaction data convey that the long-term impact on the housing market is much stronger than the short-term. Over time, home values and rents keep increasing in station areas, thus housing becomes less and less affordable.

3. Displacement and gentrification are happening in station areas.

A large number of home transactions together with increasing home values point to displacement and gentrification.

Station areas were under-utilized areas and the original residents were generally not high income. After station opened, median home size in station areas was kept constant but median home prices increased dramatically. The housing in station areas became less and less affordable. Especially the growing rents added a heavy burden on renters in station areas. Consequently, living in station areas became more and more expensive.

Two other phenomena in the real estate market may prove that displacement and gentrification is happening in many of the L.A. station areas. One is the increasing number of transactions. Transaction occurs due to new construction and resale. DataQuick showed that a certain amount of transactions was not due to new development, which means some original residents sold their homes and moved to a new place after station opened. The second indicator is the increasing home value and gross rent. Among 11 selected stations, eight stations displayed striking increases of home value or rents compared with the County. Some former property owners sold their homes to new higher buyers, and new renters who pay higher rent, replaced former ones. We can assume that the new owners/renters are more affluent than the former owners/renters since housing price/rents increased notably. To determine what scale displacement and gentrification is happening in L.A. station areas requires further research.

SCANPH has concerns about displacement and gentrification in TOD areas, and this research validates their concerns. L.A. TODs are gentrified because of the increasing home values and rents in previously low-income neighborhoods. Displacement also occurs through a large number of home transactions in the half-mile TOD areas. Therefore, TODs need more attention from such non-government organizations, like SCANPH, to advocate for equitable neighborhoods and from governmental entities to implement policies that ensure them.

4. Density is a critical factor that can facilitate development and contribute to high home values in station areas.

Successful TOD usually requires high density. Density not only provides development opportunities, but also drives up home values. This conclusion seems contradictory, but is verified by many studies.

In previous research, scholars reach an agreement that land use and density both critically determine the features of TOD. They suggest a mixed-use and high-density developmental pattern should be applied in station areas. Mixed-use can attract outside travelers with various trip purposes. They can work, shop, and eat in the half-mile station areas. Mixed-use can also incentivize people to live inside the station areas to enjoy the convenience of the concentrated neighborhood facilities. Concerning high density, it creates profit for developers, thus it captures more development opportunities. In addition, higher density in station area can help attract more choice riders to take transit, which is very important for the operation of public transit.

My research comes up with very similar conclusions that high density and land use patterns can lead to high home values in station areas, but density is more critical and influential than use mix. According to the linear regression models, high density can positively affect home values and the impact was

statistically significant. A mixed-use and housing-concentrated pattern can also lead to home value appreciation but the impact is not as obvious in this study.

There is a heated debate over the effect of density on home values. Some argue that higher density means increasing housing supply, and finally lead to lower housing cost. This argument is true in Economics only when the demand for housing does not increase proportionally together with the supply. In Los Angeles famous for its traffic congestion and high density, the demand for housing in station areas is still very high after constructing several new developments like Puerta Del Sol at Lincoln Heights Station. In the foreseeable future, we may predict that the housing demand in station area will continue to increase and push up housing prices.

Of course, density has its limits. It is not recommended that the density be as high as possible. Home value may decrease if the station area becomes over crowded making proximity to stations a disamenity. In that case, TOD is unable to achieve its goal of providing convenient and comfortable living environment.

High home values are likely to increase faster in high-density station areas, so SCANPH should take extra efforts to support the production, preservation and management of affordable homes in high density TODs. Within the city of L.A., high-density TODs include all the stations along the red line, Pico station on the blue line, and Chinatown station on the gold line.

Policy Recommendations for the Government

The data analysis has highlighted several policy strategies that can be used to take advantages of the positive impact of L.A. rail stations on the local real estate market. The first four recommendations are proposed to the local government, and the latter two are for my client SCANPH.

- **Capture the real estate value created by public investment in transit stations.**

As discussed before, many fixed-guideway stations do affect the local real estate market and most of the impacts are positive for the real estate and developers. Among 11 selected stations, only one station has no impact, three stations have undetermined impact, and seven stations show strong positive impact. None of the 11 L.A. stations I examined have a negative impact on the housing market. This study justifies the rationale and possibility of value capture, which is to capture the value that transit confers to surrounding properties to fund transit infrastructure or related improvements in station areas (CTOD report). It also proves that public investment can have a magnified effect that brings in private investment and can produce monetary value for private parties. Policy makers must seek ways to capture the value of this growth and development.

There are a variety of value capture strategies, such as assessment districts, tax-increment financing, joint development, development impact fees, etc. Each strategy works well in different contexts. So policy makers should pay attention to which strategy is suitable for what kind of stations and make the wisest decision.

Furthermore, this study suggests that different stations enjoy different levels of positive impacts, thus value capture should be implemented to different degrees. For example, Highland Park and Wilshire/Vermont had completely positive real estate indicators, compared with Wilshire/Vermont, which had 40% of negative indicators. The capture amount for these two kinds of stations should be different. Cap-

tured value should be done in a manner that will not deter new developments. Consequently, capture strategy and capture amount should be specified according to how positively such stations are impacting the local real estate market.

- **Apply value capture strategies when the station opens, but increase the intensity of such strategies as the benefits of the transit station are increasingly reflected in the real estate market.**

The data results imply that the real estate market needs time to respond after building of the transit station system. Over the long run, the benefits created by transit, mainly the added accessibility, are more prominently reflected in the real estate market. Therefore, in order to maximize the potential value, capture strategies should be in place at the beginning of station opened, and increase as the real estate market reflects the extra benefits of living close in station areas. For example, a graduated inclusionary requirement linked to property value increase may be appropriate.

Progressively increasing value capture strategies over time could include a property tax increment set as a percentage of marginal value increase. In that way, the value capture will increase as property value increase. Officials should consider the timing when intensifying those value capture strategies. Further research needs to be done to determine when the optimal time to implement value capture strategies is. Obviously, the choice of timing should maximize the development potentials in station areas and the possible values that can be captured by the local government at the same time.

- **Subsidize lower-income groups in station areas by sharing the captured value with them.**

Lower-income households in station areas are the group most vulnerable to being negatively affected by the changing housing market around a fixed-guideway transit station.

Constructing transit stations can revitalize the surrounding community, and governments should ensure that the poor residents who are transit dependent (many of whom currently live around the transit stations) have the opportunity to enjoy the benefits together with the general public. The rising real estate market, however, makes it difficult for transit-dependent residents to either continue to love around fixed-guideway stations or to move into them.

Housing subsidies are necessary to provide homes affordable to core transit riders and many workers and may be provided in several ways. For instance, require more affordable housing units in new housing projects in station areas, subsidies for transit users, density bonus, provide discounted public land to affordable developers, etc. Only by ensuring there are sufficient homes for transit riders and most workers to live around fixed-guideway transit stops, along with the other people who will move into the area, can we say the total impact is really "positive" for the entire community.

- **Implement upzoing in station areas to stimulate the positive potential of fixed-guideway transit system.**

There is a controversial argument about upzoning and downzoning in U.S. cities. However, specifically for TODs, upzoning is always a better choice. Upzoning means higher density or land use intensity.

In this study, we determine that controlling for land use pattern, increasing density can significantly increase area home values. In housing-concentrated

area, employment center or mixed-use area, allowing more residents and workers to stay in the half-mile station areas will actually increase the home value rather than lower it. Upzoning is very beneficial for market-rate developers. It means they can get a density bonus in station area, which will definitely improve their profits and encourage them to invest in station areas. Upzoning is also good for the residents who can affordable to live in the transit area, since there are increasing opportunities for them to reside and work in station areas and enjoy the convenience of public transit. In addition, upzoning can increase the value that can possibly be captured by the local neighborhood since both home value and number of home units are increasing.

Based on the above explanations, city officials should consider relaxing the zoning constraints in station areas coupled with value capture strategies to contribute to the positive impact of rail station.

Recommendations for SCANPH

- **Collaborate with the local government to establish policy to capture the value for low-income households in fixed-guideway station areas.**

SCANPH should work with private corporations, local communities and governments to justify the rationale and necessity of value capture. The policy can and should be implemented in L.A. since public investment in transit does create monetary value for private sector and previous land owners in TOD areas. SCANPH should warn the government of the urgency of applying some policies to establish a diversified and equitable TODs in L.A..

In addition, SCANPH should advocate that a portion of the increased property value be captured to be set aside for low-income households. First, the goal of TOD is to create a vibrant community with less dependence on vehicles. Low-income individuals make up the largest group to use transit for mobility. Thus keeping them living in TOD areas is the only way to achieve a high ridership of public transportation. Second, low-income households are the most vulnerable group in station areas suffering from the increase of home values and rents. As this research verified, displacement and gentrification is happening in many L.A. station areas. So, part of the value captured by the government should be used to promote affordable housing for low-income households. SCANPH should advocate along with low-income residents to ensure the TOD pattern is equitable.

- **Help the members, especially affordable housing developers, to better access the sites and development opportunities in TOD areas.**

As the transaction data shown, home values in the 11 existing station areas increased dramatically over the last 20 years. When property value increases, it become more difficult with nonprofit affordable developers to compete with market-rate developers to acquire property on which to build. SCANPH should help its members, especially nonprofit housing developers, gain access to these development opportunities, and invest in the newly constructed and proposed station areas covered in Measure R.

SCANPH should lobby the government to designate a certain percentage of building permits in TOD areas to affordable housing developers. Only in this way can we achieve a successful TOD to accommodate households at diversified income level in Los Angeles.

Chapter A

Appendix A-1

A. Station Selection Typology (all stations within the L.A. City)

	Very Low Income			Low Income			Medium Income		
Land Use	Housing	Mixed-Use	Employment	Housing	Mixed-Use	Employ-ment	Hous-ing	Mixed-Use	Employment
Low Intensity									Universal City
Medium Intensity				North Hollywood					
High Intensity	Hollywood/Western, Vermont/Santa Monica, Westlake/McArthur Park	Hollywood/ Vine, Wilshire/ Vermont	7th street/Metro Center, Pershing Square, Union Station, Civic Center	Wilshire/Western, Vermont/Beverly	Hollywood/Highland, Vermont/Sunset, Wilshire/Normandie				
Low Intensity	103rd Street								
Medium Intensity	Vernon, Slauson	San Pedro	Grand, Washington						
High Intensity			Pico						
Low Intensity	Harbor Freeway			Avalon		Aviation			
Medium Intensity	Vermont								
High Intensity									
Low Intensity	Lincoln Heights/Cypress Park			Heritage Square/Arroyo, Southwest Museum					
Medium Intensity				Highland Park					
High Intensity			Chinatown						

B. Number of Usable Transaction Data in This Study

Station Area (Open Year)	Home Transactions				MFR Transactions			
	Raw Data	Usable Data	Deleted Data (Outlier)	Valid Data	Raw Data	Usable Data	Deleted Data (Outlier)	Valid Data
7th Street/Metro Center (1993)	374	356	2	***354***				
Heritage Square/Arroyo (2003)	102	80	0	***80***				
Highland Park (2003)	127	103	5	***98***				
Hollywood/Western(1999)	41	35	0	***35***	131	72	0	***72***
Lincoln Heights/Cypress (2003)	163	153	9	***144***				
North Hollywood (2000)	191	14	0	***14***	37	25	2	***23***
San Pedro (1990)	47	30	2	***28***				
Vermont/Beverly (1999)	22	17	0	***17***	79	51	2	***49***
Westlake/MacArthur Park (1993)					70	36	2	***34***
Wilshire/Vermont (1996)	167	159	2	***157***				
Wilshire/Western (1996)	634	481	12	***469***				

Note: *1. Raw data is pulled from DataQuick without any changes.*
2. Usable data means there is a complete record of transaction information in DataQuick. Information includes sale date, sale value, structure square feet, property type.
3. Outliers are transactions with inappropriate recording.
4. Valid data is what I use in this study.

Source: *DataQuick*

C-1. Number of Unit Transactions (Home)

Station Area	7th Street / Metro Center	Heritage Square / Arroyo	Highland Park	Hollywood / Western	Lincoln Heights / Cypress	North Hollywood	San Pedro	Vermont / Beverly	Wilshire / Vermont	Wilshire / Western
1990	0	1	2	2	0	0	0	0	0	3
1991	0	0	3	1	1	0	0	0	0	0
1992	0	2	4	0	0	0	1	0	0	0
1993	0	0	3	0	1	0	1	1	0	0
1994	0	2	3	0	0	0	0	0	0	4
1995	0	2	0	0	0	2	0	0	1	2
1996	0	0	2	0	1	1	1	0	1	0
1997	0	5	3	1	0	1	1	1	2	1
1998	0	5	7	1	1	0	0	0	1	0
1999	0	5	3	0	0	1	1	1	1	6
2000	0	1	2	7	1	0	2	0	2	8

C-2. Number of Unit Transactions (Home)

Station Area	7th Street / Metro Center	Heritage Square / Arroyo	Highland Park	Hollywood / Western	Lincoln Heights / Cypress	North Hollywood	San Pedro	Vermont / Beverly	Wilshire / Vermont	Wilshire / Western
2001	0	7	7	3	1	1	2	2	4	2
2002	0	4	6	0	1	0	0	3	1	5
2003	0	4	9	4	2	1	1	1	5	13
2004	0	7	12	4	3	1	5	0	3	9
2005	0	9	5	7	2	1	6	3	21	77
2006	23	3	2	0	15	0	3	1	2	16
2007	166	2	4	3	88	0	0	0	1	28
2008	31	3	0	1	6	0	0	2	12	44
2009	49	11	13	1	11	2	1	1	28	187
2010	85	7	8	0	10	3	3	1	72	64

Note: *Dash line denotes station opening year*
Source: *DataQuick, L.A. Metro*

D-1. Median Home Value (3-year rolling average)

Station Area	7th Street / Metro Center	Heritage Square / Arroyo	High-land Park	Holly-wood / Western	Lincoln Heights / Cypress	North Holly-wood	San Pe-dro	Vermont / Beverly	Wilshire / Vermont	Wilshire / Western	County Median
1990											
1991											
1992		153,200	130,667								213,833
1993		137,567	124,167		155,000						208,267
1994		120,500	137,167		160,000		87,667				198,463
1995		113,500	139,417		157,000		80,000				188,167
1996		105,000	139,250		146,000		75,000			104,167	180,652
1997		95,000	139,417		180,600	126,817	82,833		91,500	86,000	176,434
1998		94,000	140,333		260,800	150,000	100,417		98,833	69,250	180,368
1999		100,000	160,500	104,167	305,567	133,333	127,750	172,500	106,333	64,250	189,066
2000		134,333	144,667	127,500	269,300	151,833	136,583	207,917	132,833	90,083	202,193

D-2. Median Home Value (3-year rolling average)

Station Area	7th Street / Metro Center	Heritage Square / Arroyo	Highland Park	Holly-wood / Western	Lincoln Heights / Cypress	North Holly-wood	San Pe-dro	Vermont / Beverly	Wilshire / Vermont	Wilshire / Western	County Median
2001		152,333	141,500	132,833	193,767	140,500	142,583	256,250	153,833	115,000	218,750
2002		166,167	139,833	162,583	161,667	169,000	143,542	306,250	176,333	144,667	249,100
2003		189,333	183,333	216,750	178,833	200,500	154,875	330,833	219,333	176,333	295,580
2004		208,000	258,500	318,083	205,500	273,500	189,625	384,167	274,000	236,667	363,917
2005		288,167	331,833	374,167	250,333	367,833	251,333	477,500	400,667	305,000	443,577
2006		340,000	428,500	410,000	337,833	443,250	356,667	700,500	520,500	350,000	520,063
2007		422,667	460,000	415,000	394,083	461,250	400,944	781,742	585,167	439,500	537,603
2008	633,333	401,200	439,583	736,667	419,417	439,000	382,833	721,225	540,500	462,000	474,600
2009	475,000	353,533	333,750	685,000	347,417	416,750	285,666	554,892	450,000	462,000	386,333
2010	400,667	265,867	272,583		298,667	373,750	218,055	726,317	420,333	365,833	331,000

Note: *1. All of the values are 3- year rolling average to compensate for limited transactions in some years in certain station areas.*
2. Dash line denotes station opening year
Source: *DataQuick, L.A. Almanac, CA Realtors Association, L.A. Metro*

E-1. Rate of Median Value Change (Homes)

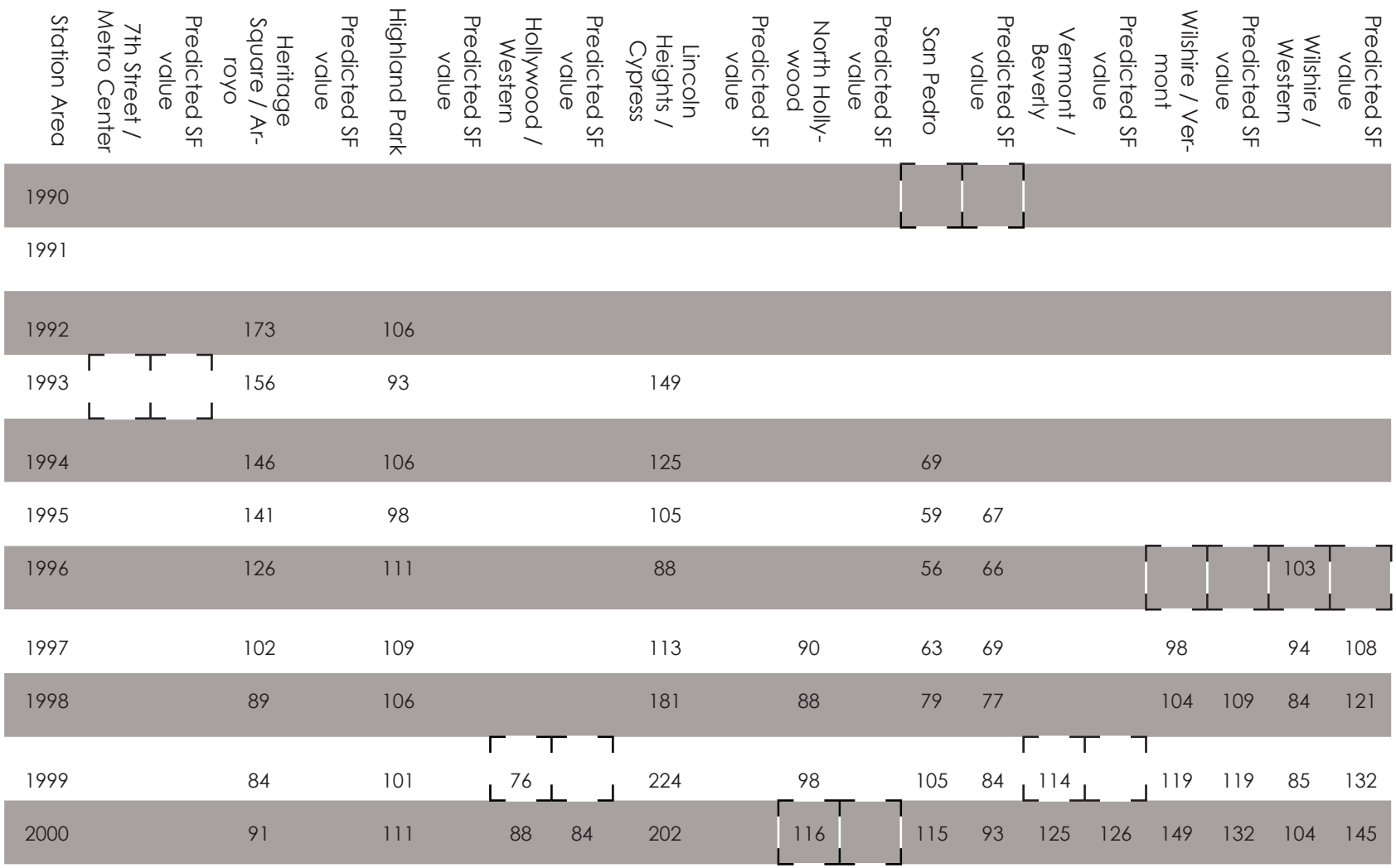
Station Area	7th Street / Metro Center	Heritage Square / Arroyo	High-land Park	Holly-wood / Western	Lincoln Heights / Cypress	North Holly-wood	San Pe-dro	Vermont / Beverly	Wilshire / Vermont	Wilshire / Western	County Median
1990											
1991											
1992											
1993		-10.2%	-5.0%								-2.6%
1994		-12.4%	10.5%		3.2%						-4.7%
1995		-5.8%	1.6%		-1.9%		-8.7%				-5.2%
1996		-7.5%	-0.1%		-7.0%		-6.3%				-4.0%
1997		-9.5%	0.1%		23.7%		10.4%			-17.4%	-2.3%
1998		-1.1%	0.7%		44.4%	18.3%	21.2%		8.0%	-19.5%	2.2%
1999		6.4%	14.4%		17.2%	-11.1%	27.2%		7.6%	-7.2%	4.8%
2000		34.3%	-9.9%	22.4%	-11.9%	13.9%	6.9%	20.5%	24.9%	40.2%	6.9%

E-2. Rate of Median Value Change (Homes)

Station Area	7th Street / Metro Center	Heritage Square / Arroyo	Highland Park	Holly-wood / Western	Lincoln Heights / Cypress	North Holly-wood	San Pe-dro	Vermont / Beverly	Wilshire / Vermont	Wilshire / Western	County Median
2001		13.4%	-2.2%	4.2%	-28.0%	-7.5%	4.4%	23.2%	15.8%	27.7%	8.2%
2002		9.1%	-1.2%	22.4%	-16.6%	20.3%	0.7%	19.5%	14.6%	25.8%	13.9%
2003		13.9%	31.1%	33.3%	10.6%	18.6%	7.9%	8.0%	24.4%	21.9%	18.7%
2004		9.9%	41.0%	46.8%	14.9%	36.4%	22.4%	16.1%	24.9%	34.2%	23.1%
2005		38.5%	28.4%	17.6%	21.8%	34.5%	32.5%	24.3%	46.2%	28.9%	21.9%
2006		18.0%	29.1%	9.6%	35.0%	20.5%	41.9%	46.7%	29.9%	14.8%	17.2%
2007		24.3%	7.4%	1.2%	16.7%	4.1%	12.4%	11.6%	12.4%	25.6%	3.4%
2008		-5.1%	-4.4%	77.5%	6.4%	-4.8%	-4.5%	-7.7%	-7.6%	5.1%	-11.7%
2009	-25.0%	-11.9%	-24.1%	-7.0%	-17.2%	-5.1%	-25.4%	-23.1%	-16.7%	0.0%	-18.6%
2010	-15.6%	-24.8%	-18.3%		-14.0%	-10.3%	-23.7%	30.9%	-6.6%	-20.8%	-14.3%

Note: *1. All the rates are based on 3-year rolling average median value.*
2. Dash line denotes station opening year
Source: *DataQuick, L.A. Almanac, CA Realtors Association, L.A. Metro*

F-1. Cost per Square Foot (Home)



F-2. Cost per Square Foot (Home)

Station Area	7th Street / Metro Center	Predicted SF value	Heritage Square / Arroyo	Predicted SF value	Highland Park	Predicted SF value	Hollywood / Western	Predicted SF value	Lincoln Heights / Cypress	Predicted SF value	North Hollywood	Predicted SF value	San Pedro	Predicted SF value	Vermont / Beverly	Predicted SF value	Wilshire / Vermont	Predicted SF value	Wilshire / Western	Predicted SF value
2001			104		125		101	94	156		144	131	120	104	127	142	167	148	125	163
2002			139		144		124	112	121		184	155	139	124	145	168	192	176	156	194
2003			192		161		156	137	152		225	189	184	151	159	205	232	214	199	237
2004			221	241	203	202	219	171	176	190	284	237	218	189	197	257	304	268	253	296
2005			283	294	260	247	280	209	238	233	382	290	269	232	233	314	378	328	354	362
2006			369	303	325	254	333	216	287	240	454	299	286	239	279	324	435	339	445	374
2007			419	270	350	227	362	192	348	214	478	266	294	213	302	288	449	302	521	333
2008	634		388	204	344	171	637	145	373	161	437	201	246	161	302	217	414	227	535	251
2009	547	629	297	202	304	170	592	144	322	160	396	199	193	159	298	216	356	226	485	249
2010	466	608	257	195	263	164			257	155	343	192	149	154	494	208	313	218	411	241

Note: *1. The predicted value is based on Housing Price Index specified for Los Angeles-Long Beach-Glendale MSAD, quarter 4 to quarter 4.*
2. Dash line denotes station opening year.
Source: *DataQuick, Federal Housing Finance Agency, L.A. Metro*

G-1. Number of Transactions, Median Value per Unit, Rate of Value Change (MFR)

	No. of Unit Transactions				Median Value per Unit				Rate of Value Change			
Station Area	Holly-wood/ Western	North Holly-wood	Ver-mont/ Beverly	West-lake/Ma-cArthur	Holly-wood/ Western	North Holly-wood	Ver-mont/ Beverly	West-lake/Ma-cArthur	Holly-wood/ Western	North Holly-wood	Ver-mont/ Beverly	West-lake/Ma-cArthur
1990	0	0	0	0								
1991	44	0	0	0								
1992	16	9	0	0								
1993	89	0	0	0	46,911							
1994	113	0	10	80	43,518	39,074			-7.2%			
1995	17	12	8	0	23,631	43,704			-45.7%	11.8%		
1996	29	0	13	11	24,113	42,007	30,359	21,377	2.0%	-3.9%		
1997	73	34	26	32	24,735	33,984	27,051	16,932	2.6%	-19.1%	-10.9%	-20.8%
1998	33	0	16	96	32,611	26,681	28,489	12,410	31.8%	-21.5%	5.3%	-26.7%
1999	75	0	90	204	36,982	26,424	28,375	8,963	13.4%	-1.0%	-0.4%	-27.8%
2000	88	5	11	0	35,962	33,212	38,752	13,393	-2.8%	25.7%	36.6%	49.4%

G-2. Number of Transactions, Median Value per Unit, Rate of Value Change (MFR)

	No. of Unit Transactions				Median Value per Unit				Rate of Value Change			
Station Area	Holly-wood/ Western	North Holly-wood	Ver-mont/ Beverly	West-lake/Ma-cArthur	Holly-wood/ Western	North Holly-wood	Ver-mont/ Beverly	West-lake/Ma-cArthur	Holly-wood/ Western	North Holly-wood	Ver-mont/ Beverly	West-lake/Ma-cArthur
2001	88	0	65	0	42,314	45,115	42,731	19,072	17.7%	35.8%	10.3%	42.4%
2002	55	0	50	57	45,647	62,133	53,301	24,848	7.9%	37.7%	24.7%	30.3%
2003	190	5	134	9	64,392	84,266	59,981	29,602	41.1%	35.6%	12.5%	19.1%
2004	106	30	22	64	77,341	89,037	76,898	33,396	20.1%	5.7%	28.2%	12.8%
2005	42	21	119	0	101,786	101,781	91,250	39,189	31.6%	14.3%	18.7%	17.3%
2006	50	39	58	91	113,810	111,242	101,431	48,006	11.8%	9.3%	11.2%	22.5%
2007	236	292	71	332	135,540	191,354	97,222	57,512	19.1%	72.0%	-4.1%	19.8%
2008	71	41	22	130	133,596	202,142	101,151	70,236	-1.4%	5.6%	4.0%	22.1%
2009	71	13	48	187	129,509	194,654	91,220	88,040	-3.1%	-3.7%	-9.8%	25.3%
2010	49	26	31	23	128,990	119,013	153,571	83,848	-0.4%	-38.9%	68.4%	-4.8%

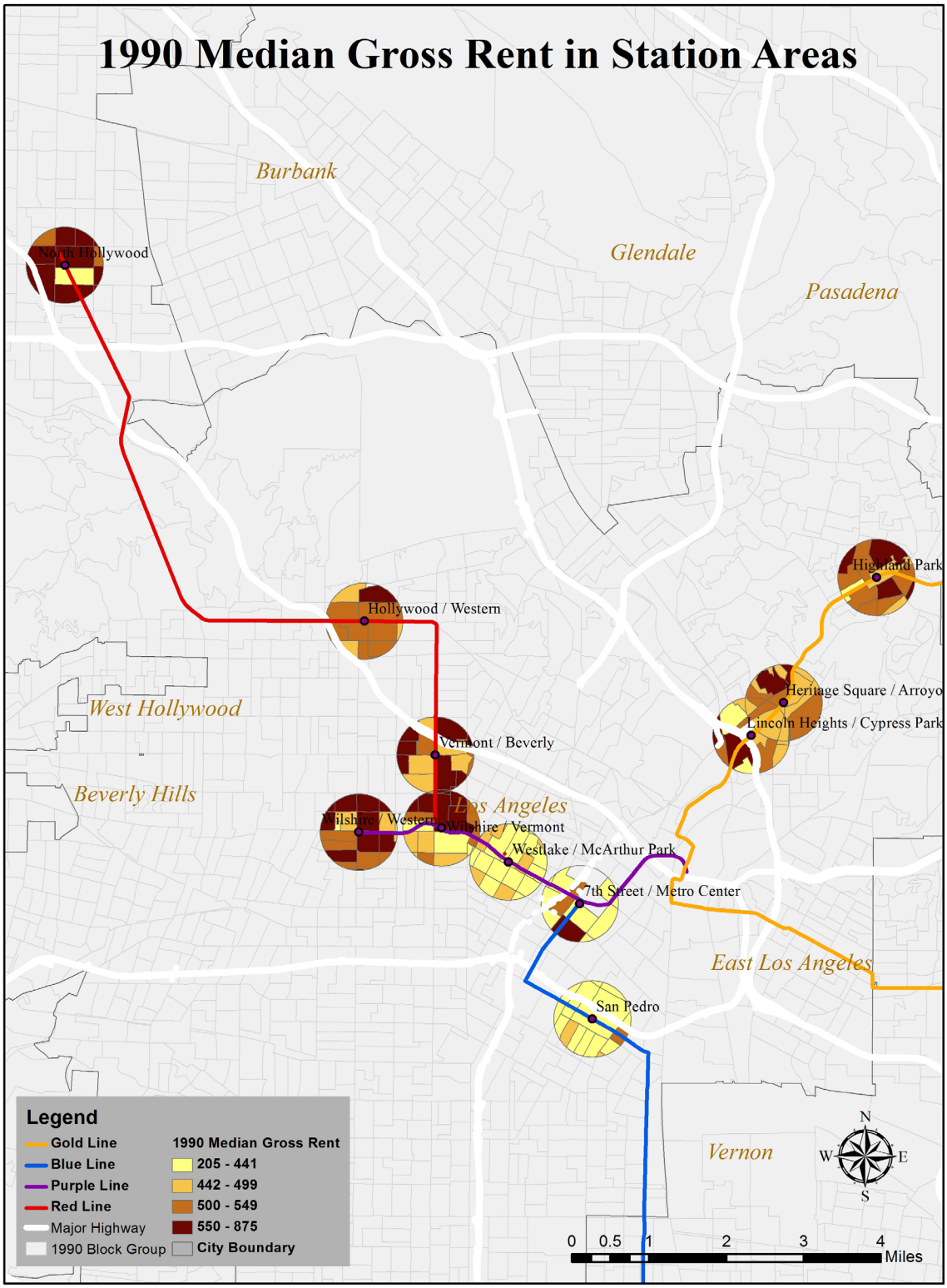
Note: *1. Median value per unit is 3-year rolling average to compensate for limited transactions in some years in certain station area.*
2. Dashed line denotes station opening year.
Source: *DataQuick, L.A. Metro*

H. Station Area Ranking by Redevelopment Tax Increment

Station Area (Open Year)	Ranking	Description
7th Street/Metro Center (1993)	Medium	35% in Medium RTI; 11% in High RTI
Heritage Square/Arroyo (2003)	None	None
Highland Park (2003)	None	None
Hollywood/Western(1999)	Medium	35% High RTI; 24% Medium RTI
Lincoln Heights/Cypress (2003)	None	None
North Hollywood (2000)	High	75% High RTI; 1% Low RTI
San Pedro (1990)	Medium	64% Medium RTI; 11% Low RTI
Vermont/Beverly (1999)	Medium	23% Medium RTI; 20% High RTI
Westlake/MacArthur Park (1993)	High	89% Medium RTI; 4% Low RTI
Wilshire/Vermont (1996)	High	63% High RTI; 5% Medium RTI
Wilshire/Western (1996)	High	66% High RTI

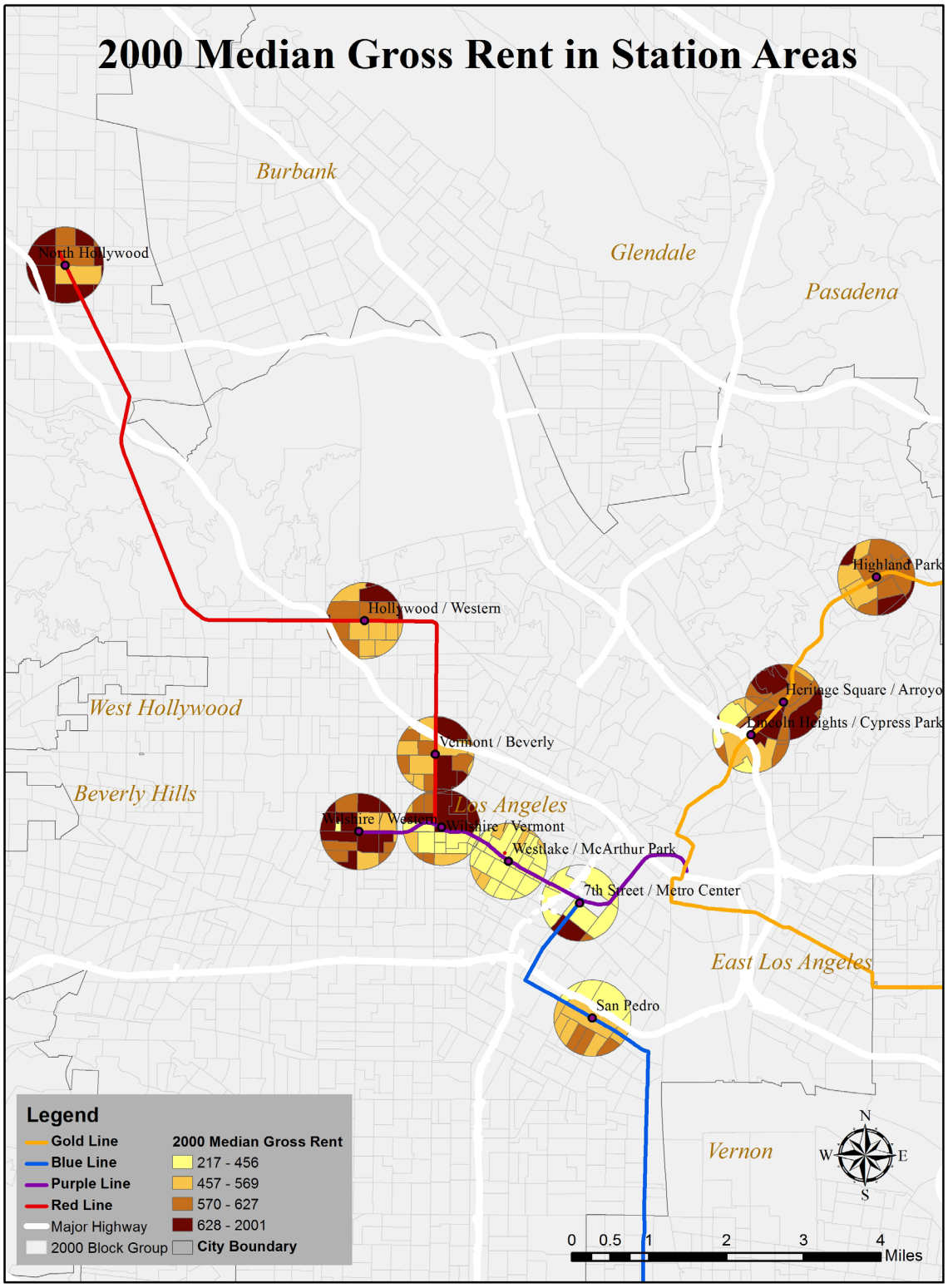
Note: *Redevelopment TI ranking is based on tax incremental amount in 2011 fiscal year*
Source*: Erin Coleman and Pamela Stephens' report on demographic change in L.A. station areas.*

I-1. Station Area Median Gross Rent (3 maps)



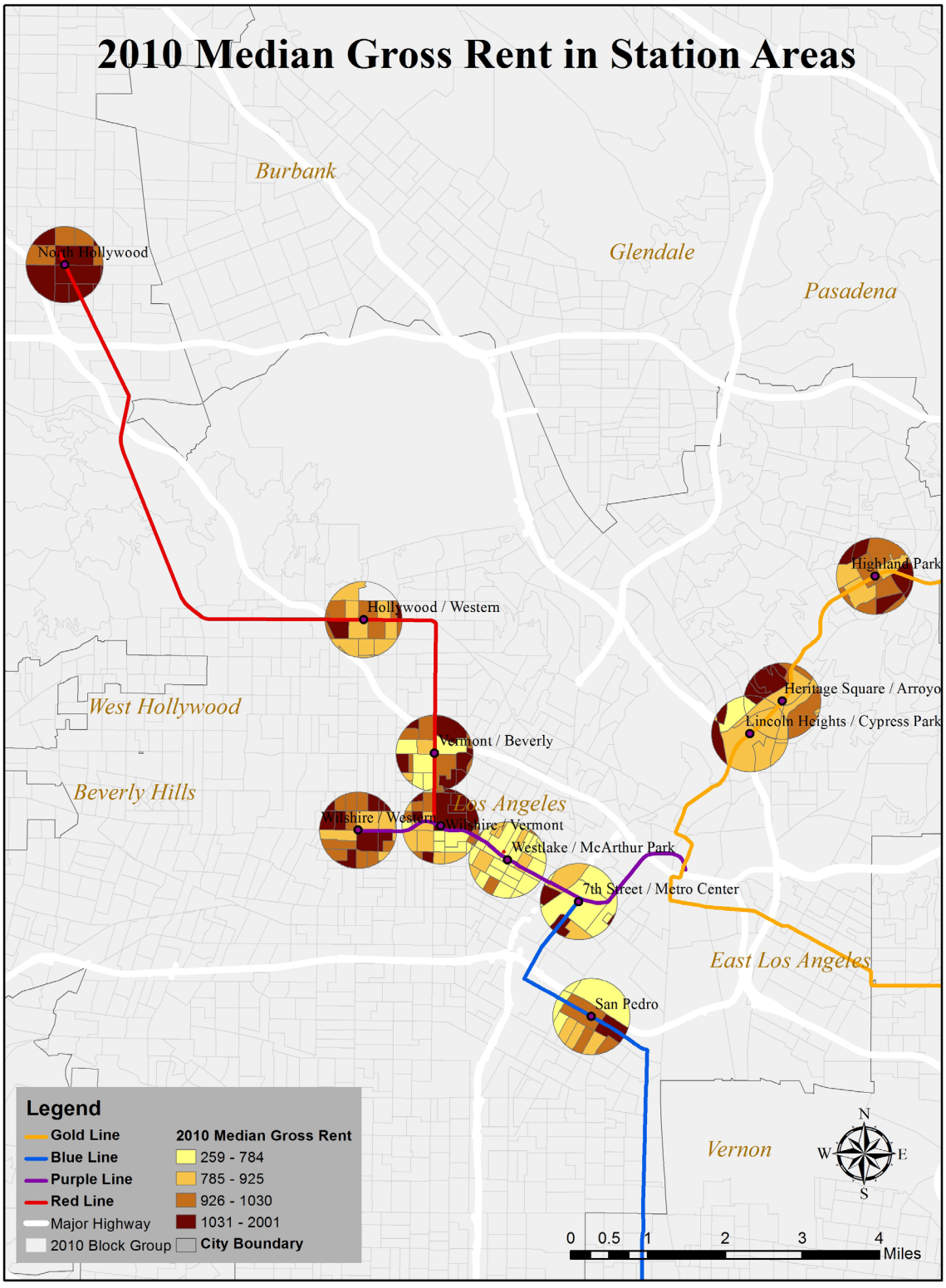
Source: *U.S. Census Bureau, Tiger/Line, L.A. Metro*

I-2. Station Area Median Gross Rent (3 maps)



Source: *U.S. Census Bureau, Tiger/Line, L.A. Metro*

I-3. Station Area Median Gross Rent (3 maps)



Source: *U.S. Census Bureau, Tiger/Line, L.A. Metro*

Chapter B

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