Impact of Targeted Redevelopment of Central Business District on Housing Prices in the Surrounding Neighborhoods: Evidence from Oakland, California

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Abstract: Using a longitudinal data set that inventories single-family home sale transactions within 3.2 km (2 mi) of the Central District redevelopment area of Oakland, CA, this paper finds that the targeted efforts to redevelop the Central District have partially mitigated the District's negative impact on surrounding neighborhoods. The paper examined the Central District from 1992 to 2006, a period during which the District changed in character from a business district to a mixed-use vibrant area. During the period 1992 through 2000, proximity to the Central District negatively impacted housing prices up to 1.6 km (1 mi) from the District boundary. However, the magnitude of the impact reduced in the 2001–2006 period and dissipated after 0.8 km (0.5 mi) from the District boundary, indicating that the redevelopment efforts had a positive spill-over effect on surrounding property values. **DOI:** **10.1061/(ASCE)UP.1943-5444.0000112.**

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Introduction

Several major cities throughout the United States—for example, New York, Philadelphia, Los Angeles, and San Jose—have been actively redeveloping their inner core areas for the last three decades. In California, the redevelopment activities are allowed under the California Community Development Act of 1945. Under this Act, cities and counties can establish a redevelopment agency to fight blight (Dardia 1998). The law further notes that "the benefits which will result from … redevelopment of blighted areas will accrue to all the inhabitants and property owners of the communities in which they exist" (Health and Safety Code sections 33000 et seq.), construing an intention for the neighboring property owners to experience an increase in their home values as a result of the act of public intervention. The Act was amended in 1952 to allow the use of tax increment financing (TIF) to fund redevelopment activities (Dardia 1998).

California cities have made considerable use of TIF districts. In 2005, 80% of the cities and 45% of the counties in California had redevelopment agencies with nearly 800 active redevelopment project areas. Overall, TIF revenues generated approximately $3 billion for funding redevelopment activities in 2005 (California Redevelopment Association 2006). Over the years since California started using TIF, several other states in the US have used TIF as a redevelopment and/or economic development tool (Dardia 1998).

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As per the US Census Bureau, Oakland, the third largest city in the San Francisco Bay Area, had an estimated population of almost 400,000 in 2006. The City is the transportation and industrial hub of the nine-county San Francisco Bay Area, a role it has played throughout the twentieth century. Using federally supported urban renewal policies of the 1950s and 1960s, and later guided by its own redevelopment plan of 1969—Central District Urban Renewal Plan—Oakland focused its energies on redeveloping its central core. Oakland had 10 redevelopment project areas delineated as of 2006.

This study examines the spill-over effects, in the form of home value appreciation, that redevelopment activities of the oldest project area—the Central District redevelopment area (hereafter called Central District)—a redevelopment encompassing the area in and around Oakland's central business district (CBD), had on surrounding neighborhoods during the period 1992–2006. The Central District redevelopment plan specifically includes positive spill-over effects as one of the objectives of the city's redevelopment activities when it notes that the redevelopment should accrue "economic benefits to disadvantaged persons living within or near the Project Area" (Redevelopment Agency of the City of Oakland 1969).

Research Question

The specific research question raised by this study is: Did the redevelopment investments in the Central District lead to positive spill-over effects as evidenced by an increase in single-family housing prices in the surrounding neighborhoods?

Theoretical Framework

Under the hedonic analysis framework pioneered by Rosen (1974), the price of a house is the sum of the implicit prices of the components of the bundle of services provided by that house. Therefore, among others, the following impact housing prices:

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the structural attributes of a house (for example, number of bedrooms, size of living space, quality of the house); the locational attributes (such as transportation accessibility and views); and neighborhood, city and region's quality (such as walkability, safety, recreation, employment and school quality). Therefore, improvement in a home's external environment is likely to increase home prices by doing one or several of the following: reducing crime and poverty; providing a larger set of neighborhood-, city- and regional-level amenities (such as shopping and eating opportunities, cultural amenities such as theatres, and employment opportunities in the office and retail sector); and finally, by sending a positive signal to the individual home owners, who are likely to be more optimistic about their neighborhood's future, and therefore more likely to invest in their property.

If public actions such as (1) redevelopment efforts in the Central District of Oakland, CA, (2) mixed-use projects developed under the federal HOPE VI program (see Castells 2010 for an overview of studies estimating the spill-over benefits of the HOPE VI programs), or (3) projects developed in the TIF districts in Chicago, IL (see Webber et al. 2007 for details) improve the quality of a neighborhood or part of a city, they are likely to increase surrounding home prices.

Literature Review

Local governments have usually chosen between two redevelopment strategies in the US. The first strategy calls for distributing redevelopment investments as equitably as possible over the blighted areas. Byrne (2006), Ellen et al. (2001), and Weber et al. (2007) have examined the impact of this strategy on the surrounding community. Because public funding is not infinite, distributed redevelopment often results in small-scale investments sprinkled throughout the redevelopment area. The effectiveness of this strategy has been questioned by some redevelopment agencies, prompting them to adopt an alternate-targeted investment strategy.

Examining the spill-over effect of various types of redevelopment distributed over 79 districts in Chicago, Weber et al. (2007) found that while proximity to commercial and industrial TIF districts reduced prices of the surrounding homes, a mixed-use TIF district increased home prices. Ellen et al. (2001), examining the impacts of a new residential development-focused redevelopment strategy on blighted parcels distributed throughout New York City, found that the redevelopment activities had a positive spill-over effect on residential properties up to 2,000 ft (approximately 0.5 mi) from the site. The study also found the sale-price-increase rate declined over time, and the properties tended to be in low-income neighborhoods.

In contrast with the distributed development strategy studied by Ellen et al. (2001), Galster et al. (2006) examined the impact of a targeted investment strategy used by Richmond, VA. The study examined the city redevelopment program termed Neighborhoods in Bloom (NiB). Launched in 1998, the NiB program focused public and non-profit redevelopment investments "on a small number of blocks in each of seven neighborhoods [out of 49 neighborhoods originally considered for investments]." The explicit goal was to achieve a critical mass that stimulated self-sustaining private market activity (Galster et al. 2006). The study found that the $21.33 million public and non-profit funds invested in the NiB areas from 1998–2004 "increased the aggregate value of single-family homes in NiB target areas by $44.98 million more than if they had increased at the same rate as the rest of Richmond" (Galster et al. 2006). Additionally, home prices in the NiB areas "reached the citywide average for comparable homes in 2002–03" (Galster et al. 2006).

The results of Ellen et al. (2001) and Galster et al. (2006) indicate that the targeted strategy positively impacts a specific neighborhood to a greater extent than the distributed investment strategy. In contrast, more neighborhoods, and likely more residents, experience some quality of life improvements from the distributed relative to the targeted strategy (Ellen et al. 2001).

Further, the previously reviewed studies used change in residential property values to measure the temporal impact of a neighborhood characteristic, or specific changes in neighborhood characteristics. The housing market is studied because it provides an implicit measure for neighborhood desirability and residential quality of life.

Literature on enterprise/empowerment zones and other neighborhood revitalization programs also provide insights into the property value impacts of targeted development. For example, a US-wide study (Krupka and Noonan 2009) found that the empowerment zone program—a federal government's spatially targeted economic development tool—positively impacted property values. Similarly, Ding and Knapp (2002) found that targeted investment in neighborhood housing increased values of surrounding homes. Dokmeci et al. (2007) found a similar property value impact of main street revitalization in Istanbul, Turkey.

In summary, the existing literature provides strong support for targeted redevelopment approach—a strategy adopted by Oakland, CA, to revitalize its Central District.

Redevelopment Strategy Adopted by Oakland, California

Oakland, CA, along with many other large, aging cities in the US has struggled to find a successful recipe to improve its image and the quality of life for its residents. Oakland has chosen to take extensive advantage of California's redevelopment laws to further economic growth, improve public safety, and become an attractive destination for visitors and new residents. While Oakland had 10 redevelopment areas delineated in 2006, a review of the City's Redevelopment Agency budgets shows that the Central District received the lion's share of investment. This targeted redevelopment strategy implies that the City recognizes the availability of office jobs and retail services provided by a traditional CBD to be key to a viable city, but begs the question whether the focused efforts have actually improved the surrounding neighborhoods' quality of life.

Of the 10 redevelopment project areas during the period 1990–2006, only six were reported to have ongoing, public-driven physical development activity during this period. However, despite the designation of multiple project areas within the City of Oakland, extensive efforts were made to redevelop the Central District while the other areas received relatively minimal investments. In fact the only area that received comparable public investment on a per-acre basis is the Acorn Redevelopment Project Area, or Acorn, which focused on substantial rehabilitation of the Acorn public housing project and the addition of new affordable housing units to the site. While the Acorn project did receive comparable per-acre investment during the study period, the actual expenditures during this period were minuscule compared to the investments in the Central District. Based on the aforementioned observations, it can be safely concluded that Oakland's redevelopment strategy is Central-District-focused.

Empirical estimation of the spill-over effects associated with the utilization of a targeted redevelopment strategy on a mixed-use CBD is this study's primary objective. This study builds on two key findings. First, a targeted redevelopment strategy is very effective within the redevelopment neighborhood (Galster et al. 2006); and

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second, positive spill-over effects are associated with distributed, mixed-use redevelopment (Weber et al. 2007).

The remainder of the paper is divided into three sections. The first section reviews the redevelopment history of Oakland's Central District. The second section describes the empirical study. Specifically, it describes the study hypothesis, model structure, the basis for choosing the hedonic regression method for analysis, data, and study findings. The last section provides the conclusions and discusses policy implications.

History of Central District Redevelopment

Central District through the 1940s

Mapped and parceled off starting in 1850, Central District was the site of the first planned town settlement in Oakland (Bagwell 1982). An elaborate system of steam trains and electric streetcars ran throughout the region by the 1890s. Up until the 1950s, downtown Oakland was a bustling street car hub (Bagwell 1982; Modern Transit Society 2007).

However, as was happening in inner city areas throughout the US following World War II, Oakland's minority residents were abandoned in a deteriorating and economically floundering city by their White counterparts who quickly moved out to the newly developing suburbs. While the CBD in downtown Oakland was declining in the 1950s due to the outflow of residents and redistribution of industry, retail, and services to the suburbs, local businesses made decisions that ultimately intensified the problems. Many retail stores moved just north of the existing CBD to escape increasing blight; while this move may have made sense to the individual stores, the effect of physical clustering that creates an agglomeration economy for retail shopping was lost (Abrew 1973). Additionally, the City decided to permit Kaiser Industries, a large Oakland-based company, to build their new headquarters several blocks from the existing CBD. This decision paved the way for long-term decentralization of office development, creating the "bi-nodal office-financial center" that exists in the Central District today (Abrew 1973).

Early Renewal Efforts in the Central District: 1950s and 1960s

Federally-supported urban renewal policies were implemented to maintain commercial and business activities in the Central District during this period. Many vacated parcels were used to build new Alameda County agency offices and other county services, creating the Civic Center neighborhood. Significant community resources, such as a museum and a college, were added during this period.

Despite the urban renewal efforts aimed to improve the Central District and render it more accessible through an updated transportation network, private interest in the Central District did not rebound. Because none of these actions resuscitated the deteriorating area, in 1969 the Oakland Redevelopment Agency approved a new urban renewal plan that designated the majority of the Central District as a redevelopment project area.

Redevelopment under the 1969 Plan: 1970–1989

The City of Oakland approved the *Central District Urban Renewal Plan* in 1969 and the Plan was most recently updated in 2006.

Apart from the willingness of the Oakland Redevelopment Agency to acquire the necessary land to enable large-parcel and block-level redevelopment, the speculative nature of real estate investments during the 1980s supported large-scale development (Lowy 1991) that took place in the Oakland Central District. By 1989 the cumulative redevelopment in the Central District had created a supportive environment for daytime activity, but the district had lost much of its traditional appeal as a vibrant urban area. Finally, much of the housing stock within the Central District was older and in deteriorating condition. It was unable to support a heterogeneous mix of population. Despite redevelopment efforts, the Central District did not revive to its former self or bring in development projects that would attract people to the district outside of work-hours.

Redevelopment: 1990–2006

Central District redevelopment activities have continued through the present, struggling through minimal private development in the 1990s, followed by extensive private development in the first six years of the 21st century.

Redevelopment during this period was heavily influenced by two distinctive sub-periods in the real estate market: 1990–2000, and 2001–2006. The first sub-period was driven by the need to redevelop properties damaged by the 1989 Loma Prieta earthquake (Bascom and Heymen 1993) at the same time that the private development market was reeling from the fall-out of the Savings and Loan and banking scandals of the late 1980s. The tightened lending market significantly decreased the number of new, privately-funded development projects in the Central District through the 1990s and required that public agencies again become significant developers to continue to improve the area. The second sub-period saw a rebounding real estate market that enabled a strategic City policy shift toward adding new housing units to the Central District, a plan termed the "10 K Housing Initiative." This strategy was announced in 1999 with the goal to bring 10,000 new residents to the Central District in mostly market-rate housing. Private developers greeted the plan with interest as they were finally in a position to take risks in the California housing market again (Gabriel et al. 1999).

Central District of 2007

The Oakland Central District of 2007 is still not comparable to the lively picture painted by stories of the area before the 1950s. However, it is substantially more attractive than it was in 1989. The shift in the redevelopment strategy that came with the 10 K Initiative is perhaps one of the key catalysts in improving outsiders' perception of the area. A notable sub-strategy within the 10 K Initiative was to disperse projects throughout the Central District by targeting vacant or underutilized parcels (Greenwood and Lane 2002).

When compared to the previous period, the redevelopment efforts undertaken during the period 2001–2006 have made observable progress in shifting the Central District from a business district to a more vibrant urban area that provides employment opportunities, a substantial number of renovated historic amenities, as well as several new amenities. These changes have been implemented by providing housing and amenities that support residents of varied income levels while also returning to developing mixed-use residential projects that provide space for ground-floor commercial-retail services.

Empirical Study

Study Hypothesis and Model Structure

A year-by-year analysis of development trends identified three distinctive periods (1990–1991, 1992–2000, and 2001–2006) in

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which there was a significant change in the number and types of development projects completed in the Central District.

Private development activity slowed significantly after 1991, as projects that had started during the 1980s real estate boom were completed. With the private real estate market suffering during the 1990s, the Redevelopment Agency invested in capital projects in the Central District. As redevelopment activities were reliant on public-sector-driven projects, the projects were focused on adding or renovating public-sector offices and affordable housing units, and public parking garages. When private development began to rebound by end of the 1990s, Redevelopment Agency investments in capital projects decreased. The shift to private-market-led property development in the first half of the 2000–2010 decade allowed redevelopment efforts to focus on adding or renovating private-sector offices and market-rate housing.

To estimate the redevelopment activities' impact on the surrounding neighborhoods, the analysis of single-family home sales was initially divided into the previously identified three periods: 1990–1991, 1992–2000, and 2001–2006. Additionally, while the official Central District redevelopment area boundary did not change during the study period, the locations of parcel-level redevelopment activity did vary and justified that a different boundary be identified for each period for analysis purposes. Fig. 1 shows the District boundaries, the redeveloped parcels within the District, and the location of the homes included in the study data set.

After the data set was divided into the three study periods and distance to redevelopment activity was measured, only 44 sales transactions were identified within 1.6 km (1 mi) of the redevelopment activity in the 1990–1991 period. The 1990–1991 sample size and locational distribution was deemed too small to produce unbiased results. Therefore, the remainder of this study will focus on the latter two periods, 1992–2000 and 2001–2006.

The 1992–2000 period is a close approximation of the base line for estimating the impact of redevelopment efforts on surrounding residential property values. The redevelopment efforts continued during this period, albeit with limited success. The 2001–2006 period built upon the redevelopment work of the previous three decades. Neighboring properties sold during this period are more likely to benefit from the Central District redevelopment compared to the properties sold during the earlier, 1992–2000, period. The study hypothesizes that, during the period 1992–2000, controlling for other factors, the homes sold in 0–0.8 km (0–0.5 mi), 0.8–1.6 km (0.5–1 mi) and 1.6–2.4 km (1–1.5 mi) distance bands from the Central District are likely to be lower priced relative to the homes sold in the 2.4–3.2 km (1.5–2 mi) band (referent), indicating that proximity to Central District negatively impacted home prices. The homes sold in the 2.4–3.2 km (1.5–2 mi) distance band serve as the control group because this band's social, economic and housing characteristics are very similar to those of the Alameda County (Table 1). Oakland is located in Alameda County.

For the period 2001–2006, we expect to see one or a combination of the following three scenarios. In the first scenario, the proximity to the Central District would still have a net negative impact on housing price; however, the magnitude of the effect would be smaller relative to the 1992–2000 period. This scenario would indicate that the redevelopment efforts have had a positive impact on the surrounding residential neighborhoods during the period 2001–2006 relative to the 1992–2000 period, although the overall impact of the Central District is still negative. In the second scenario, the proximity to the Central District would have no impact on housing prices during the 2001–2006 period, indicating that redevelopment efforts have had a considerable positive impact on housing prices, to the extent that the previous negative impacts of the Central District have been fully mitigated. In the third scenario, the proximity to the Central District would have a net positive impact during the 2001–2006 period, indicating that the redevelopment efforts have mitigated the negative impacts associated with proximity to the Central District, and have rendered the proximate residential areas around the Central District desirable.

Choosing a Property Value Analysis Method

Two popular research methods are often used to perform property value analyses: hedonic regression and repeat-sales regression. The hedonic regression method is criticized as difficult to correctly implement and as being subject to the researcher's "ignorance of both the functional form of the relation and of the appropriate set of house characteristics to include in the analysis ... result[ing] in inconsistent estimates of the implicit prices of the attributes" (Meese and Wallace 1997).

In contrast, "the repeat-sales methodology ... control[s] for hedonic characteristics by examining only those properties that have sold more than once during the sample [period], without any change in house characteristics between sales" (Meese and Wallace 1997). Despite the relative simplicity of correctly implementing the repeat-sales technique, a study on the reliability of the repeat-sales results by Meese and Wallace (1997) found that repeat-sales results "suffer from sample selection bias and non-constancy of implicit housing characteristic prices, and they are quite sensitive to small sample problems" (Meese and Wallace 1997).

The literature review conducted for this study examined 16 research studies that performed property value analyses to measure the influence of a particular policy or externality on housing prices. Of these, 11 studies used the hedonic regression method, three used the repeat-sales regression method, one used an adjusted interrupted time series analysis method, and one employed a modified Muth model.

After weighing the pros and cons of the hedonic and repeat-sales regression methods, this study decided to use the hedonic method. The key reasons for this decision are: (1) The study area is relatively small, thus resulting in a small data set; (2) The resulting data set is expected to have a high likelihood of producing biased results if repeat-sales regression method is used. As the neighborhoods around the Central District are older and many suffer from varying levels of blight, renovations are common when property changes ownership. The data limitations do not allow capturing these changes. Additionally, the speculative nature of the urban real estate market during the study period may have introduced further bias into the results, as older single-family properties near the Central District may be located on parcels that are zoned for higher density development. Therefore, the change in sale prices may not be representative of neighborhood quality changes; (3) Extensive housing characteristics data are available.

Hedonic Regression Model Specification

The general form of the hedonic model is:

$$P_i = f(S_i, L_i, N_i, T, J) \tag{1}$$

where P_i = sale price of the ith house in the sample; S_i = structural attributes of the ith house; L_i = locational attributes of the ith house; N_i = neighborhood, jurisdictional, or regional attributes impacting the ith house; T = vector of time dummies that include the year and season of the sale; and J = vector of jurisdiction dummies. The log of sale price of the house is the dependent variable. Various transformations of the dependent and the independent

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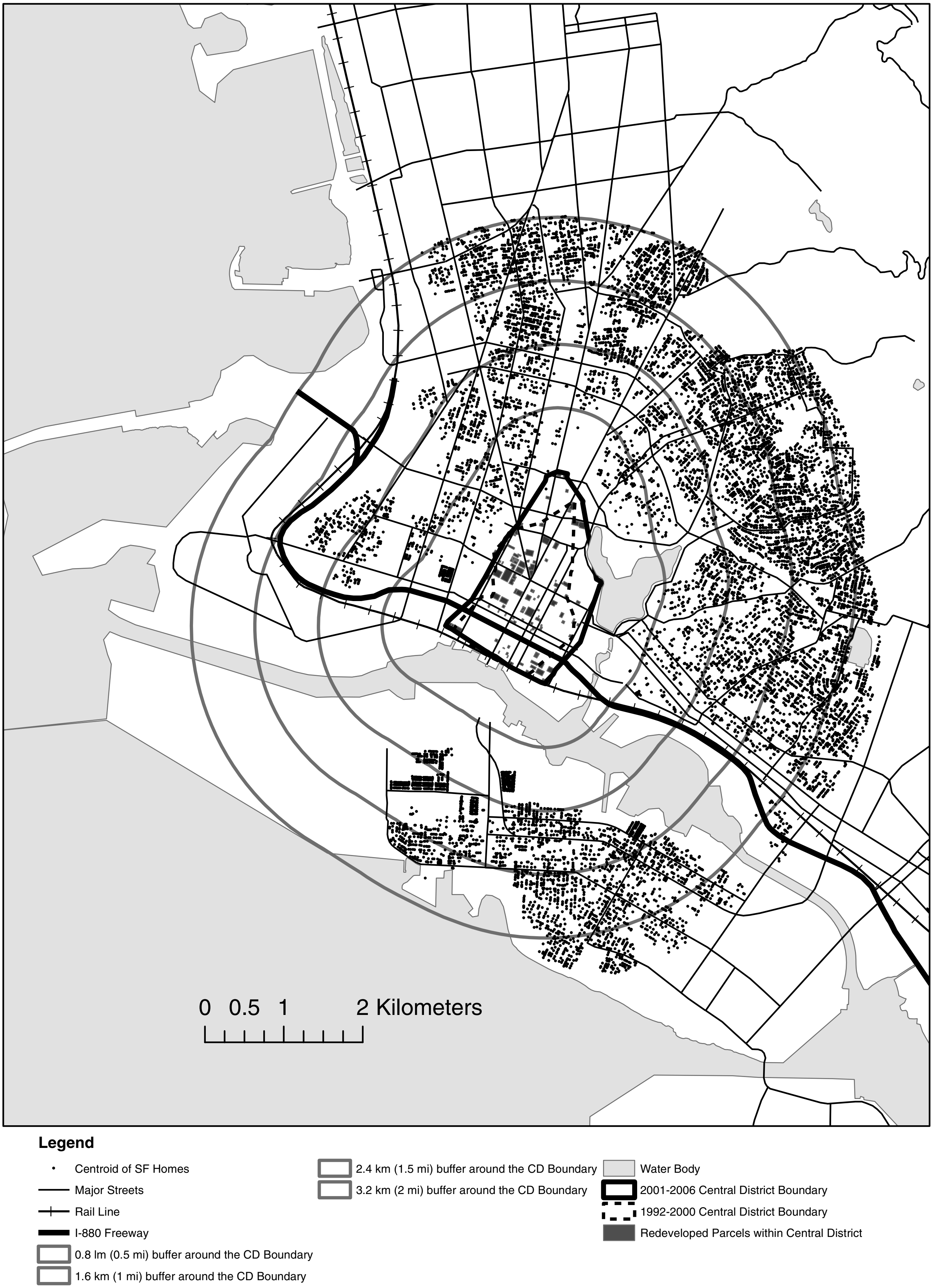

Fig. 1. Area in and around the Central District

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Table 1. Selected Social-Economic and Housing Characteristics for Alameda County and for 2.4–3.2 km (1.5–2 Mi) Distance Band

Variable	Value		
		2.4–3.2 km (1.5–2 mi) distance band[b]	
	Alameda County[a]	(1992–2000 model)	(2001–2006 model)
Median income	\$55,946	\$63,264	\$56,236
% Black population	15	18	24
% Owner-occupied housing	55	51	48
Median housing price	\$348,565	\$289,598	NA

[a]As per U.S. Census, 2000.
[b]As per study data set.

variables were tried. The functional forms resulting in the best model fit were finally adopted.

Summary of Data

The relevant property data was provided by a private vendor—CD-DATA. The CD-DATA dataset includes all available Alameda County property tax assessor data at the parcel-level that had been recorded through mid-year 2007. The data set includes the property sale price. It also includes a geographic information system (GIS) shapefile at the parcel-level that enabled spatial analysis on the properties of interest. ArcGIS software was used to create a data set of the single-family homes that were located within 3.2 km (2 mi) of the Central District, and had sold during the study period. GIS was then used to append the median income, owner occupancy rates, and racial characteristics at the 2000 census block group-level to the identified properties. In absence of more fine-grained annual data, and because the study period spanned both sides of year 2000, the year 2000 census data was used for consistency sake. The census data tables and the corresponding GIS files were obtained from the Census Bureau website.

Many properties in the data set had missing or questionably-accurate characteristics. Therefore, data was filtered to identify a suitable data set for further analysis. First, properties with "0" recorded in the bedroom, bathroom, building size, lot size, or sale price were removed. Additionally, the properties with more than six bedrooms or more than five bathrooms, as well as with building sizes or lot sizes in the top and bottom one-percentile were removed from the dataset to reduce the effect of outliers and data entry errors in the property characteristics fields. Finally, the sale prices of the homes in the data set were adjusted to 2006-constant-dollars using the Non-Housing Consumer Price Index for the San Francisco-Oakland-San Jose, CA region obtained from the U.S. Department of Labor, Bureau of Labor Statistics.

The sale price of the sample varied widely even after the previously-listed filters were applied. For example, after the data set was sorted by half-mile proximity areas and separated into the two study periods, the range of sale prices still indicated that the lower prices were unlikely to be representative of market-rate sales during the respective periods. In addition, on the higher side, sale prices were well over \$1 million (in all but one instance), while the means were in the range of \$200,000 to \$600,000, depending on period and location.

Ultimately, to ensure that the study was reflective of average, market-rate transactions during the study period, the final sample-set excluded sales that were more than one SD from the mean sale price in each model. In all cases, the mean sale price stayed relatively consistent within each model regardless of which filtering process was used, indicating that the sample-set had not been skewed toward the upper-or lower-end of the market by excluding samples with a sale price more than one SD from the mean.

If the one SD filter is not applied, several houses in the data set have sale prices as low as \$6,000, even when the assessed values for these houses are much higher. We suspect that these sale prices are either a result of non-arms length sales transactions or other extraneous factors. Most of these properties on the higher-end of the sale price spectrum (\$1 million and above) are in the neighboring high-income desirable city of Piedmont (more than 2.4 km away).

Inclusion of properties on the very low and the very high end of the price spectrum would have skewed the model results. Hence the one standard deviation filter was applied.

Further, homes built after 1997 were excluded from the 1992–2000 data set, and homes built after 2000 were excluded from the 2001–2006 period data set to ensure that the desire to live in the general area was measured over the desire for a newly built home. The majority of these homes were located in Alameda. Tables 2 and 3 provide descriptive statistics for the continuous variables in the data sets for Models 1 and 2, respectively.

Finally, data were collected for a variety of urban amenities and disamenities in and around the study area, including neighborhood commercial and office corridors, bus and rail transit, busy streets and freeways, as well as freight and elevated rail tracks and industrial operations. The locations of the commercial, office, and industrial parcels were extracted from the original CD-DATA data set using ArcGIS software. GIS data identifying the locations of city boundaries, freeways, rail right-of-way, major streets, commuter rail stations, and bus stops were obtained from the Metropolitan Transportation Commission. The locations of neighborhood-level

Table 2. Descriptive Statistics for Continuous Variables in Model 1

Variable	N	Minimum	Maximum	Mean	SD
Sale price of the house in 2006 constant dollars	2,594	\$132,613	\$543,083	\$300,333	\$108,461
Number of bathrooms	2,594	1	5	1.38	0.64
Lot area (m^2)	2,594	158	1,149	412	139
Building area (m^2)	2,594	60	362	142	45
Distance to the nearest arterial street (m)	2,594	14	1,869	475	341
Distance to the nearest collector street (m)	2,594	15	778	194	141
% Black population in the census block-group	2,594	0	89	20	21
% Asian population in the census block-group	2,594	0	71	19	15
% Hispanic population in the census block-group	2,594	0	53	9	8
Distance to I-580 (m)	2,594	54	5,528	1,877	1,636
Distance to the nearest rail line (m)	2,594	188	4,776	2,360	903
Distance to Lake Shore Ave. (m)	2,594	53	4,435	2,108	1,112

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Table 3. Descriptive Statistics for Continuous Variables in Model 2

Variable	N	Minimum	Maximum	Mean	SD
Sale price of the house in 2006 constant dollars	2,577	\$301,111	\$866,992	\$547,372	\$1462,820
Number of bathrooms	2,577	1	5	1.30	0.61
Lot area (m^2)	2,577	156	1,132	392	133
Building area (m^2)	2,577	60	356	132	41
Distance to the nearest arterial street (m)	2,577	15	1,993	438	322
Distance to the nearest collector street (m)	2,577	13	776	183	130
Distance to the nearest commercial use (m)	2,577	4	1,173	172	178
% Black population in the census block-group	2,577	0	89	27	25
% Asian population in the census block-group	2,577	0	71	18	15
% Hispanic population in the census block-group	2,577	0	73	10	9
Distance to the nearest rail line (m)	2,577	137	4,878	2,181	927

parks and two classes of major streets (arterial and collector) were merged into the GIS data sets based on a 2007 Rand McNally map of the area. Finally, the key neighborhood commercial corridors were identified through personal observations of the study area. Although the final data set contains a large number of variables measuring distance of single-family parcel from various amenities and disamenities, several of these variables had to be dropped from the final models due to multicollinearity problems.

Regression Results

Using the appropriate subset of dependent variables, ordinary least squares (OLS) linear fixed effects regression was used for the following two models:

Model 1—Single-family homes sold during 1992–2000
Model 2—Single-family homes sold during 2001–2006

The Chow F-test conducted to test the possibility of estimating a pooled regression was significant at $p = 0.001$ level. Hence, the data was not pooled. Next, the basic OLS assumptions of normality, homoscedasticity and autocorrelation were tested. Both the models display heteroscedasticity and first-order autocorrelation. Hence, White's estimator was used to estimate heteroscedasticity-consistent (HC) standard errors. Additionally, the Newey-West heteroscedasticity and autocorrelation consistent (HAC) estimator was used to control for both heteroscedasticity and autocorrelation. Results for both estimates are reported in Table 4.

Finally, spatial autocorrelation was suspected due to the data's spatial-temporal nature. First, Global Moran's I test was conducted to test for spatial autocorrelation. The test indicates that Model 1 suffers from spatial autocorrelation. Next, following Anselin (1988), Lagrange Multiplier (LM) tests were conducted to examine the type of spatial dependence exhibited by the models—spatial lag or spatial error, or both. The LM tests are: the simple LM test for error dependence (LMerr), the simple LM test for a missing spatially lagged dependent variable (LMlag), RLMerr test for error dependence in the possible presence of a missing lagged dependent variable, and RLMlag for a missing lagged dependent variable in the presence of error dependence (Bivand and Bernat n.d.). The data were weighted to take into account both the physical and the temporal proximity of the sale transactions prior to running the LM tests. Four nearest sale transactions were included in the spatial weights calculation. Further, the transactions were weighted by the sale year. The transactions in the same year were given a weight of one; two years apart, 0.5; three years apart, 0.33, and so on. The LM tests indicate that both models suffer from spatial lag autocorrelation.

Table 4 provides regression results, along with the Global Moran's I and LM test results. To economize on table length, the coefficients and standard errors for the dummy variables representing the season of sale (winter, fall, spring, with summer as referent), the year of sale and jurisdictions are not included.

Model Findings

Model 1 includes 2,594 observations with an adjusted-R^2 of 0.718, and Model 2 includes 2,577 observations with an adjusted-R^2 of 0.653. Natural log of sale price (adjusted for the year 2006) is the dependent variable. Dummy variables capturing the year and season of sale are used to control for the real estate cycles. Further, jurisdiction dummies control for the jurisdiction-specific effects not controlled by the other independent variables. Because both models suffer from spatial lag autocorrelation, further discussion will focus on the spatial lag model results.

All variables statistically significant at $p = 0.10$ featured the expected signs. For example, models show that the lot size and the building area increase housing prices. Further, homes sold in the cities of Alameda, Piedmont and Emeryville are higher priced relative to homes sold in Oakland—indicative of the three cities' relatively attractive public infrastructure service-expenditure package.

The negative coefficients for the year dummies indicate that the housing market peaked in the year 2006—accurately capturing the broader housing market forces at play during the study period. Estimating the impact of demographic characteristics, the models find that an increase in the concentration of racial (Black and Asian) and ethnic (Hispanic) minorities is negatively correlated with property values. Similarly, close proximity to major transportation infrastructure (roads and freeways) is negatively correlated with property values—perhaps indicating that once the households are ensured accessibility benefits provided by the transportation infrastructure, any further proximity to these infrastructure perhaps leads to the noise-, traffic, and pollution-associated disamenities outweighing the accessibility benefit. Finally, estimating the impact of adjoining land uses, the models find that proximity to retail uses depresses property values—indicative of the noise—and traffic-related disamenity associated with commercial land use, a finding consistent with literature (for example, see Mathur 2008; Ding and Knapp 2002).

Impact of Proximity to Central District on Property Values

Both models indicate that the Central District decreases homes prices closer to the District. However, the magnitude of the price decrease reduced during the 2001–2006 period. For example, during the period 1992–2000, housing prices within the 0–0.8 km (0–0.5 mi) distance band from the Central District were 12.1% lower relative to prices in the 2.4–3.2 km (1.5–2 mi) distance band. However, during the period 2001–2006 the magnitude reduced

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Table 4. Regression Results

Variables	Model 1 (1992–2000)			Model 2 (2001–2006)		
	OLS	LAG	ERROR	OLS	LAG	ERROR
Dummy for house sold in the 0 km–0.8 km (0.5 mi) Radius from the Central District	−0.121	−0.123	−0.121	−0.073	−0.073	−0.071
OLS	(0.030)[a]	(0.030)[a]	(0.030)[a]	(0.017)[a]	(0.017)[a]	(0.017)[a]
White HC	(0.032)[a]			(0.017)[a]		
Newey-West HAC	(0.038)[a]			(0.018)[a]		
Dummy for house sold in the 0.8 km (0.5 mi)–1.6 km (1 mi) Radius from the Central District	−0.030	−0.031	−0.030	−0.008	−0.006	−0.005
OLS	(0.015)[b]	(0.015)[b]	(0.015)[b]	(0.011)	(0.011)	(0.011)
White HC	(0.015)[b]			(0.011)		
Newey-West HAC	(0.020)			(0.012)		
Dummy for house sold in the 1.6 km (1 mi)–2.4 km (1.5 mi) Radius from the Central District	−0.009	−0.009	−0.009	0.002	0.005	0.004
OLS	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)	(0.008)
White HC	(0.009)			(0.007)		
Newey-West HAC	(0.012)			(0.009)		
Number of bathrooms	0.029	0.029	0.029	0.005	0.004	0.004
OLS	(0.007)[a]	(0.007)[a]	(0.007)[a]	(0.006)	(0.006)	(0.006)
White HC	(0.007)[a]			(0.007)		
Newey-West HAC	(0.008)[a]			(0.008)		
Natural log of lot area	0.067	0.066	0.067	0.080	0.081	0.080
OLS	(0.014)[a]	(0.014)[a]	(0.014)[a]	(0.011)[a]	(0.012)[a]	(0.011)[a]
White HC	(0.015)[a]			(0.011)[a]		
Newey-West HAC	(0.019)[a]			(0.012)[a]		
Natural log of building area	0.391	0.391	0.391	0.320	0.317	0.319
OLS	(0.018)[a]	(0.017)[a]	(0.017)[a]	(0.013)[a]	(0.013)[a]	(0.013)[a]
White HC	(0.018)[a]			(0.015)[a]		
Newey-West HAC	(0.021)[a]			(0.015)[a]		
% Black population in the census block-group	−0.627	−0.618	−0.627	−0.474	−0.460	−0.472
OLS	(0.029)[a]	(0.029)[a]	(0.029)[a]	(0.021)[a]	(0.021)[a]	(0.021)[a]
White HC	(0.030)[a]			(0.021)[a]		
Newey-West HAC	(0.047)[a]			(0.025)[a]		
% Asian population in the census block-group	−0.600	−0.590	−0.600	−0.385	−0.376	−0.380
OLS	(0.035)[a]	(0.035)[a]	(0.034)[a]	(0.027)[a]	(0.027)[a]	(0.027)[a]
White HC	(0.035)[a]			(0.026)[a]		
Newey-West HAC	(0.052)[a]			(0.033)[a]		
% Hispanic population in the census block-group	−0.714	−0.707	−0.714	−0.423	−0.414	−0.425
OLS	(0.073)[a]	(0.073)[a]	(0.073)[a]	(0.048)[a]	(0.048)[a]	(0.049)[a]
White HC	(0.074)[a]			(0.044)[a]		
Newey-West HAC	(0.095)[a]			(0.048)[a]		
Natural log of distance to the nearest Collector Street	0.012	0.012	0.012	0.021	0.020	0.020
OLS	(0.005)[b]	(0.005)[b]	(0.005)[b]	(0.004)[a]	(0.004)[a]	(0.004)[a]
White HC	(0.005)[b]			(0.004)[a]		
Newey-West HAC	(0.006)[b]			(0.004)[a]		
Natural log of distance to the nearest Arterial Street	−0.013	−0.013	−0.013	NA	NA	NA
OLS	(0.006)[b]	(0.006)[b]	(0.006)[b]			
White HC	(0.006)[b]					
Newey-West HAC	(0.008)[c]					
Natural log of distance to I-580	0.056	0.057	0.056	0.015	0.015	0.015
OLS	(0.008)[a]	(0.008)[a]	(0.008)[a]	(0.005)[a]	(0.005)[a]	(0.005)[a]
White HC	(0.009)[a]			(0.005)[a]	(0.005)	
Newey-West HAC	(0.012)[a]			(0.007)[a]		
Natural log of distance to nearest Rail line	0.140	0.139	0.140	0.084	0.084	0.086
OLS	(0.016)[a]	(0.016)	(0.016)	(0.011)[a]	(0.011)[a]	(0.011)[a]
White HC	(0.017)[a]			(0.011)[a]		
Newey-West HAC	(0.023)[a]			(0.012)[a]		
Natural log of distance to Lake Shore Avenue	−0.110	−0.109	−0.110	NA	NA	NA
OLS	(0.009)[a]	(0.009)[a]	(0.009)[a]			
White HC	(0.009)[a]					
Newey-West HAC	(0.012)[a]					
Natural log of distance to nearest commercial use	0.039	0.039	0.039	0.022	0.021	0.021
OLS	(0.005)[a]	(0.005)	(0.005)	(0.004)[a]	(0.004)[a]	(0.004)[a]
White HC	(0.005)[a]			(0.003)[a]		
Newey-West HAC	(0.006)[a]			(0.004)		
Dependent variable	Natural log of sale price of the house in constant 2006 dollars					
N	2,594	2,594	2,594	2,577	2,577	2,577

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Table 4. (*Continued.*)

Variables	Model 1 (1992–2000) OLS	Model 1 (1992–2000) LAG	Model 1 (1992–2000) ERROR	Model 2 (2001–2006) OLS	Model 2 (2001–2006) LAG	Model 2 (2001–2006) ERROR
adjusted R^2	0.724			0.653		
Log likelihood		532.5	531.6		1,075.9	1,073.2
Global Moran's I	0.048			3.499[a]		
LM-Err	0.0001			10.799[a]		
LM-Lag	2.023			14.143[a]		
RLM-Err	0.700			2.223		
RLM-Lag	2.722[c]			5.566[b]		

Note: Figures in parentheses are standard error. NA = not applicable.
[a]Significant at 1%.
[b]Significant at 5%.
[c]Significant at 10%.

almost 40% to 7.3%. Similarly, for the period 1992–2000, housing prices in the 0.8–1.6 km (0.5–1 mi) distance band were 3.1% lower relative to prices in the 2.4–3.2 km (1.5–2 mi) distance band. However, during the period 2001–2006 the negative impact of the Central District dissipated after 0.8 km (0.5 mi), as shown in the statistically insignificant coefficient values for the 0.8–1.6 km (0.5–1 mi) and the 1.6–2.4 km (1–1.5 mi) distance dummies for Model 2. The statistical insignificance of these two distance dummies could be attributable to a combination of two factors. The redevelopment efforts might have reduced the intensity of the negative impact of the Central District, which, coupled with an overall strengthening of the San Francisco Bay Area's housing market during the first half of the decade, rendered hitherto less desirable residential neighborhoods experience greater housing demand.

Conclusions

The model findings suggest that while the overall impact of proximity to the Central District on housing prices in the surrounding neighborhoods is still negative, evidence suggests that the redevelopment efforts are making a positive impact.

As discussed earlier, the Oakland Central District experienced extensive redevelopment during the 1990–2006 period. Projects during the 1990s were often driven by public-sector investment. Many projects involved construction or renovation of public agency offices and affordable housing. As the private development market improved at the turn of the century there was a shift in redevelopment strategy toward subsidizing residential-commercial mixed-use developments in the District.

As part of a larger redevelopment strategy, the Oakland Redevelopment Agency focused public resources on redevelopment of the Central District at the expense of a more distributed redevelopment strategy. As indicated previously, Galster et al. (2006) find that a targeted investment strategy is very successful for properties within the redevelopment area. However, as the targeted redevelopment is likely to serve a smaller area relative to the distributed redevelopment, it is likely to benefit a smaller population too. This limitation of the targeted strategy can be mitigated to some extent if this strategy can be shown to benefit surrounding neighborhoods.

This study finds that in the case of Oakland, CA, the Central District targeted redevelopment investments are spilling over to the surrounding neighborhoods. From a policy perspective, this finding, coupled with those from the existing literature that show that a targeted redevelopment strategy is very effective within the redevelopment neighborhood (Galster et al. 2006), and that positive spill-over effects are associated with distributed, mixed-use redevelopment (Weber et al. 2007), provide support for the effectiveness of targeted mixed-use redevelopment in rejuvenating urban areas. The study findings should be useful to the redevelopment agencies and local-, regional-, and state-level policy makers in refining redevelopment and economic development strategies.

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