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Los Angeles

Do Land Use Regulations Matter? Why and How?

A dissertation submitted in partial satisfaction of the requirements for the degree

Doctor of Philosophy in Urban Planning

by

Charles Joshua Gabbe

2016

ABSTRACT OF THE DISSERTATION

Do Land Use Regulations Matter? Why and How?

by

Charles Joshua Gabbe

Doctor of Philosophy in Urban Planning

University of California, Los Angeles, 2016

Professor Randall D. Crane, Chair

American cities face tremendous challenges including housing affordability, rising economic inequality, and climate change. Land use regulatory reform can play an important role in addressing these issues. But, the evolution, determinants, and effects of land use regulations remain unclear. I use Los Angeles as a case study to answer important questions about why and how land use regulations matter. I organize the dissertation as three related but independent papers.

The first paper characterizes how land use regulations change. In Los Angeles, zoning designations were largely static between 2002 and 2014; the city rezoned only about two percent of its parcel land area during this period. While rezonings were uncommon, the city adopted new land use regulations or expanded existing regulations, including several transit-oriented development plans, a density bonus ordinance, an adaptive reuse ordinance, and the expansion of historic preservation overlays. In general, this illustrates a bifurcated evolution of regulations.

Single-family neighborhoods remain protected, while significant changes occur in downtown Los Angeles and some high-density neighborhoods near transit.

The second paper examines why zoning is changed. I use logistic regression models to analyze the relationship between parcel-scale "upzoning" and housing demand factors, supply constraints, the influence of interest groups, and municipal policy drivers. I find that upzoning in Los Angeles follows the path of biggest opportunity and least political resistance. My research supports the "homevoter hypothesis," meaning that concentrations of homeowners deter zoning changes to allow higher densities.

The third paper explains how regulations matter for housing production. Using negative binomial regression models, I find strong associations between high-density zoning and multifamily housing production across Los Angeles. In the city's oldest transit-oriented development (TOD) plan area, the average multifamily development was built at 132% of the baseline allowable residential density, 107% of the allowable floor area ratio, and 102% of the allowable height. The regression results and the TOD analysis provide evidence that developers would build more densely, in neighborhoods with housing demand, if land use regulations were more permissive.

The dissertation of Charles Joshua Gabbe is approved.

Michael C. Lens

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Introduction

American cities face tremendous challenges including worsening housing affordability, rising economic inequality, and climate change. Urban planning can, and hopefully will, play a central role in addressing these challenges. To do so, urban planners and policymakers must focus on both proposing *and* implementing solutions. Visionary plans without supportive policies and regulations are destined to sit on the shelf. Zoning codes and other land use regulations are central to implementing urban policy goals. While zoning alone certainly cannot ensure a just and sustainable city, it is impossible without a zoning code aligned with these aspirations. Land use regulations are powerful, affecting each of us in countless hidden ways as we go about our daily lives. Zoning shapes what our neighborhoods look like and where we can afford to live, our commutes to school or work, and the quality of our natural environment. But, insomuch as zoning is influential, the status quo is commonly accepted as a given. Zoning reform is politically challenging and land use regulations have been adapted to changing times at a molasses-like pace.

Zoning matters – perhaps now more than ever – and yet zoning is understudied by scholars. This dissertation heeds Boarnet's (2011) call for planners to "study the relationship between plans, land use regulations, development patterns, and individual preferences; and the interplay between markets and governance processes more closely" (p. 208). This dissertation fills gaps in the literature by (1) adding a longitudinal perspective of land use regulations that has been sparsely addressed, (2) providing new evidence about the determinants of zoning change, and (3) extending our understanding of how some regulations constrain housing production.

This dissertation is organized as an introductory essay and three papers related to the determinants and effects of local land use regulations. In this introduction, I first describe the context for my central questions about why regulations are adopted, and how regulations matter. I describe the case of Los Angeles, and explain my particular focus on regulations near rail transit and bus rapid transit. Lastly, I summarize the three papers that compose this dissertation.

Why are regulations adopted?

Leading (and sometimes overlapping) explanations for why municipalities adopt and change land use regulations include protecting homeowners' financial interests, supporting real estate developers' interests, and municipal fiscal motivations (Been, Madar, & McDonnell, 2014; Fischel, 2005b; Gyourko & Molloy, 2014; Molotch, 1976). First, Fischel (2004, p. 317) argued that exclusionary regulations represent the "dominance of home-owners and their touchiness about their main asset." Existing homeowners have an incentive to increase the value of their homes, and they do not internalize the price increases for renters or future residents (Glaeser, Gyourko, & Saks, 2005a). Second, the city may serve as a "growth machine," meaning that municipal policies support pro-growth elites involved with the development process (Molotch, 1976). Third, land use interventions may be motivated by municipal fiscal interests. Cities may perceive that commercial development generates a fiscal surplus, transit-based employment is a desirable economic development strategy, or public service provision is more efficient in higher density neighborhoods (Boarnet & Crane, 1997; Carruthers & Úlfarsson, 2008; Lewis, 2001). Municipalities may also aim to maximize the use of existing infrastructure and public facilities, including public transit, parks, and schools (Been et al., 2014). There is limited empirical

evidence supporting or refuting these motivations, and there has been particularly little research on land use regulatory *changes*, which is a focus of this dissertation.

How do regulations matter?

Economic theory and empirical evidence show that regulations affect how much housing is produced and the price of that housing. Zoning requirements can particularly hinder affordable housing production (Downs, 1992). Additionally, there are often widespread disconnects between local regulations and broad regional policy goals (Barbour & Deakin, 2012; Boarnet & Crane, 2001). This is important because for real estate development to occur, it must be both marketable and permissible (Boarnet & Crane, 2001; J. Levine, 2006). While some argue that density restrictions limit housing production near transit (J. Levine, 2006), there has been little research showing which regulations are most problematic in different settings (Schill, 2005). An important set of under-studied hypotheses relate to whether developers would build more densely in the absence of restrictive land use regulations (J. Levine, 2006). I analyze regulations and transit-oriented housing to, in Rolf Pendall's words, "provide knowledge about differences within regions in the finer points of regulations and demonstrate how regulations are implemented and which ones matter" (Burchell & Lahr, 2008, p. 76).

Los Angeles and its transit-oriented development

Los Angeles is a useful case study because, like many cities, it is predominantly auto-oriented, is investing heavily in transit infrastructure, has a long-standing Euclidean zoning code, and has an increasing population. Los Angeles is the largest city in America's most populous state, with more than 3.9 million residents spread across 469 square miles. It is the center of a

growing five-county combined metropolitan statistical area of over 18.5 million people (United States Census Bureau, 2014b). For decades, Los Angeles has been an epicenter of contentious growth politics. Whittemore (2012), for example, argued that Los Angeles has undergone four political regimes with different balances of homeowner and developer power, and that today's local land use policy is dominated by suburban homeowners who oppose growth. Regulatory issues have been at the forefront of power struggles about future housing development in the city. Through piecemeal policy changes, Los Angeles's zoning code has become a 600-page document with "layers of new plans, overlays, and property specific development limitations," and the city is in the midst of the largest code review since 1946 (City of Los Angeles, 2014d, p. 1). This ad hoc approach to policymaking allows me to examine the causes and effects of the different layers of overlapping, and sometimes conflicting, regulation.

As America's cities focus renewed attention on public transit, and scholars examine the effects of this transit spending, Los Angeles is a particularly relevant subject. While Los Angeles is often perceived as the "ultimate automobile city" (Boarnet & Crane, 1997, p. 189), Southern California was originally developed around an extensive metropolitan streetcar network with downtown Los Angeles as a hub (Elkind, 2014). These early streetcar routes have continued to shape land development patterns in Southern California (Brooks & Lutz, 2013). Although this streetcar system was completely dismantled by 1961, in the 1970s political leaders began taking the first steps to rebuild a rail transit network (Elkind, 2014). Since then, the Los Angeles Metro agency has spent billions of dollars building the region's transit network. Today the Metro Rail system has six lines and 91 stations serving over 333,000 passenger boardings per weekday (Elkind, 2014; Los Angeles Metro, 2016a, 2016c). Los Angeles Metro's extensions of the Gold and Purple lines are in progress, and the agency broke ground in 2014 on the Crenshaw/LAX rail

line, which will connect the Exposition Line, Los Angeles International Airport (LAX) and the Green Line (Los Angeles Metro, 2014). Additionally, Metro has the Orange Line bus rapid transit (BRT) and more than a dozen rapid bus lines along major arterials (Los Angeles Metro, 2011, 2016b).

For Los Angeles, transit-oriented development is a strategy for addressing road congestion, reducing air pollution, and mitigating shortages of affordable housing (Cervero, Ferrell, & Murphy, 2002; Loukaitou-Sideris, 2010). While the implementation of transit-oriented development around rail stations has been inconsistent and has commonly fallen short of planners' aspirations (Boarnet & Crane, 1997, 2001; Cervero & Landis, 1997; Loukaitou-Sideris & Banerjee, 2000), there is recent evidence of increased building construction activity along some rail lines (Loukaitou-Sideris, 2010). Land use regulations are viewed as a barrier to transit-oriented development; as Los Angeles evaluates its zoning code, revising the city's regulatory approach to transit-oriented development is a central priority (City of Los Angeles, 2014d).

The influence of California's greenhouse gas reduction strategies

Statewide greenhouse gas reduction efforts have also boosted interest in transit-oriented development, and injected hundreds of millions of dollars of new funding for affordable housing near public transit. In the past decade, California passed two landmark laws to reduce the state's greenhouse gas (GHG) emissions. The California Global Warming Solutions Act of 2006 (AB 32) requires the state to reduce GHG emissions to 1990 levels by 2020 through strategies related to energy, transportation, fuels, land use, water, agriculture, and green buildings (Brown, Rodriquez, Nichols, & Corey, 2014; California Air Resources Board, 2014a). The Sustainable Communities and Climate Protection Act of 2008 (Senate Bill 375) focuses on lowering GHG

emissions from automobiles and light trucks in California's metropolitan regions through coordinated land use and transportation (California Air Resources Board, 2012). Southern California's Sustainable Communities Strategy, a requirement of SB 375, encourages affordable and market-rate housing development near high-quality transit as a core GHG reduction strategy (Southern California Association of Governments, 2012a).

A cap-and-trade program is a centerpiece of California's overall GHG reduction strategy (California Air Resources Board, 2014b), and the cap-and-trade auction is projected to raise $1.7 billion in new revenue for the state in 2015-16 (California Air Resources Board, 2016). The proceeds of this auction are intended to fund strategies to reduce GHG emissions, including affordable housing development near transit. In 2015-16, about $480 million of cap-and-trade revenue was appropriated for the California Strategic Growth Council's Affordable Housing and Sustainable Communities program, and this revenue source is expected to grow in coming years (California Air Resources Board, 2016; Taylor, 2014). These new laws, and potentially billions of dollars of associated funding, mean that California's policymakers must examine how local land use regulations near transit support or hinder the state's GHG reduction goals.

Overview of chapters

The three papers in this dissertation, summarized below, examine the evolution, causes, and consequences of local land use regulations in Los Angeles, with a particular focus on areas best served by public transit.

Chapter 1 overview

In the first chapter, I examine how land use regulations are changing. My framework for categorizing and quantifying regulations is based on the type of policy and its geographic extent. I start by comparing each Los Angeles parcel's zoning designation in 2002 and 2014. I find that the underlying zoning designations in Los Angeles are largely static. The city, on average, "upzoned" 225 acres and "downzoned" 216 acres per year between 2002 and 2014. In other words, Los Angeles rezoned less than two-tenths of one percent of its parcel land area every year. And some of these changes, particularly the downzonings, were more administrative than substantial changes to the city's development capacity.

In general, there was a bifurcated evolution of land use regulations in Los Angeles. Single-family neighborhoods remained protected, at least in regulatory terms. Significant regulatory changes occurred in downtown Los Angeles and a handful of high-density neighborhoods near transit. In these areas, city leaders adopted some density-increasing policies that included a mix of regulatory and deregulatory components. The Los Angeles case supports the idea that cities are adopting an evolving mix of regulations, rather than deregulating land use.

Chapter 2 overview

In the second chapter, I examine why regulations are changed. Specifically, I analyze the determinants of "upzoning," referring to zoning changes to allow higher development intensities. While upzoning is often a subject of lively debate amongst planners, elected officials, and neighborhood groups, there is little empirical evidence about why allowable residential density is increased in some areas and not others. I conceptualize a parcel's likelihood of upzoning to be a function of housing demand factors, existing supply constraints, the influence of local interest

groups, and municipal policy drivers. I specify logistic regression models to analyze the relationship between parcel upzoning and potential determinants.

I find that upzoning, when it occurs, follows the path of biggest opportunity and least political resistance. Upzoning was most likely on well-located parcels near freeways, and those zoned for low-intensity uses like agriculture, manufacturing, and parking. Meanwhile, upzoning was least likely in neighborhoods with average or above-average shares of homeowners coupled with desirable amenities like proximity to the beach and high-performing schools. There is also strong evidence supporting the "homevoter hypothesis," meaning that concentrations of homeowners deter zoning changes that allow higher density development.

Chapter 3 overview

In the third chapter, I explain how regulations matter. I investigate if land use regulations constrain multifamily housing production, and which regulations shape new transit-oriented housing in Los Angeles. I combine a regression approach with a case study of residential development near four rail transit stations. I specify negative binomial regression models of multifamily housing production citywide, in neighborhoods within a half-mile of a transit station, and in neighborhoods farther away from a transit station. I find strong positive associations between high-density zoning and multifamily production. There is also a positive relationship between upzoning and multifamily production. These relationships may exist because zoning is a constraint on development or simply because many areas suited for multifamily housing already have the highest density allowances.

I examine these possible explanations by analyzing recent multifamily residential development approvals in the Vermont/Western specific plan area, which is Los Angeles's oldest

adopted transit-oriented development plan (circa 2001). I analyze land use entitlements in the Vermont/Western specific plan area, and I conduct expert interviews with planners and developers. I find that the average multifamily development was built at 132% of the baseline allowable residential density, 107% of the allowable floor area ratio, and 102% of the allowable height. The average development included the minimum number of parking spaces, and one percent more open space than was required. Developers primarily used state-mandated density bonus incentives to exceed the baseline zoning parameters. The regression results and the Vermont/Western analysis provide evidence that developers would build more densely in areas with housing demand if land use regulations were more permissive.

Chapter 1: Mostly "More or Different": The Evolution of Land Use Regulations

Scholars have blamed high housing prices on restrictive local land use regulations (Fischel, 2004; Glaeser & Gyourko, 2002; Glaeser et al., 2005a; Quigley & Raphael, 2005). Urban mayors have increasingly talked about easing urban zoning requirements and streamlining development processes (T. Logan, 2014; Yglesias, 2015). Developers want these same things (Talen, 2013). Meanwhile, local land use regulation may be moving in the opposite direction; Pendall, Puentes and Martin (2006, p. 32) observed that while land use regulation is in a long-term process of reform, nowhere is the "discussion a choice between regulation and no regulation. Rather, they [state and local governments] are choosing either more or different regulation." However, we lack a good empirical understanding of how land use regulations are changing and this paper fills that gap. I propose a framework for categorizing and quantifying local land use regulations based on the stated purpose and geographic scale of changes. I apply this framework to Los Angeles to answer the question: How is local land use regulation changing?

I create a citywide dataset of parcel characteristics and municipal zoning classifications in 2002 and 2014. Using this dataset, I find that regulations in Los Angeles have been largely static. The city, on average, "upzoned" 226 acres and "downzoned" 214 acres per year during my study period. In other words, Los Angeles rezoned less than two-tenths of one percent of its parcel land area every year. Single-family neighborhoods, true to city policy (City of Los Angeles, 2001a) and common national practices (Hirt, 2014) were large islands of remarkable regulatory stability. The most significant regulatory changes occurred in downtown Los Angeles and a handful of

high-density neighborhoods near transit.[1] Some of these initiatives eased density restrictions while adding new requirements – particularly design standards and review – in the same areas. In general, this illustrates a bifurcated evolution of land use regulations. Single-family neighborhoods remained protected in regulatory terms. Meanwhile, the city adopted density-increasing policies – with a mix of regulatory and deregulatory components – in the downtown and some areas near rail transit stations. The Los Angeles case supports the idea that cities are adopting an evolving mix of regulations, rather than easing land use requirements.

Surprisingly little is known about how residential land use regulations are changing

Modern land use regulations, notably zoning, emerged in the early twentieth century to separate seemingly incompatible uses, particularly single-family homes, apartments, and industry (Fischel, 2004). In this paper, I focus on residential land use regulations, which have been shown to affect housing production and prices (Glaeser & Gyourko, 2002; Glaeser et al., 2005a; Quigley & Raphael, 2005; Saiz, 2010). Despite keen interest by scholars and policymakers in better-understanding land use regulations, most research has been cross-sectional; we know relatively little about how regulations are changing over time (Been et al., 2014; Burchell & Lahr, 2008; Glaeser & Ward, 2009; Schill, 2005; A. H. Whittemore, 2012). Rolf Pendall suggested a need for in-depth analyses that "provide knowledge about differences within regions in the finer points of regulations and demonstrate how regulations are implemented and which ones matter" (Burchell & Lahr, 2008, p. 76). Whittemore (2012, p. 394) wrote that "there is a

[1] One large-scale initiative near transit, the Hollywood Community Plan update, was unsuccessful (Zahniser, 2013).

[2] Additionally, the city has plans for the Los Angeles International Airport and the Port of Los Angeles.

[3] Some of these parcels are on the same site because each condominium unit has a unique parcel identifier.

[4] For example, within the R1 zone, there are parcels designated R1-1, R1-1-0, R1-1XL, and R1-1-HPOZ.

limited understanding of how land-use regulation changes over time or the full breadth of its historical and contemporary consequences."

Broadly, regulatory changes may increase allowable residential density ("upzoning"), reduce allowable residential density ("downzoning"), or change something unrelated to residential density (Been et al., 2014). The existing literature provides just a few empirical insights about rezonings within cities. In New York City, between 2002 and 2009, during a period of "rapid" rezoning activity, the city made zoning changes that affected over 20% of the city's land area (Been et al., 2014, p. 241). But within these areas of change, there was considerable variation, with changes increasing or decreasing allowable development intensities, changing allowable land uses, or revising "other restrictions applicable to new development" (Been et al., 2014, p. 241).

Evidence from Los Angeles suggests that cities can go through periods of large-scale regulatory change, along with periods of relative stasis. Los Angeles's pro-growth 1940s and 1950s were followed by anti-growth policies in the mid-1960s through the 1990s (Morrow, 2013; A. H. Whittemore, 2012). Most notably, through large-scale reductions in allowable density in Los Angeles's community plans, the city reduced its population capacity from 10 million in 1960 to about 3.9 million in 1990 (Morrow, 2013). The New York City and Los Angeles data beg the question of what is a "normal" amount of zoning change. If zoning is the main implementation tool of urban planning (Hoch, Dalton, & So, 2000) – and something that affects the vast majority of Americans (Rolf Pendall et al., 2006) – we know surprisingly little about how its practice is evolving.

Regulations can be organized by purpose and geographic scale

I create a framework for categorizing and quantifying land use regulations. I adapt some of Deakin's (1989) growth management framework to local land use regulation. Deakin (1989) wrote that growth management policies can limit where development occurs and the density of that development, add standards for lots and buildings, shift costs from the municipality to the developer, and create other direct and indirect controls on growth. I supplement Deakin's approach with regulatory topics from two national surveys. Gyourko et al. (2008) categorized local land use regulations in terms of supply restrictions, density restrictions, open space requirements, and exactions. Pendall et al. (2006) organized land use regulations in terms of zoning code provisions, comprehensive planning, urban containment, infrastructure regulation, growth control, and affordable housing programs.

Within the general categories, I focus on six key dimensions of local land use regulations that may vary within cities: (1) allowable land uses, (2) allowable density, (3) parking standards, (4) design requirements, (5) development impact fees, and (6) affordable housing incentives and requirements. These areas of regulation, and related reforms, may be applied at different geographic scales. Zoning reforms may occur citywide (Hirt, 2014) or in specific neighborhoods (Manville, 2013; Morrow, 2013; A. H. Whittemore, 2012), and cities may change zoning to apply to master-planned developments and individual developments (Been et al., 2014; Inam, Levine, & Werbel, 2004). My framework for identifying regulatory changes combines the stated purpose of the regulation and geographic scale to which it is applied.

The case of Los Angeles

Metropolitan California is a lively and relevant place to study land use planning and regulation. Scholars have shown the state's strong housing demand in coastal areas coupled with restrictive land use regulations have raised housing prices (Kok, Monkkonen, & Quigley, 2014; Quigley & Raphael, 2005). I focus on California's largest city, Los Angeles, with nearly 3.9 million residents spread across 469 square miles, and the central city of a combined metropolitan statistical area of over 18.3 million people (United States Census Bureau, 2013b). Los Angeles has an array of regulations which have largely been adopted in a piecemeal fashion since 1946 (City of Los Angeles, 2014d). As such, Los Angeles's zoning code has become a 600-page document with "layers of new plans, overlays, and property specific development limitations," and the city is in the midst of a major code overhaul (City of Los Angeles, 2014d, p. 1).

Housing affordability is a major political issue in Los Angeles, and metropolitan California more generally. Los Angeles's housing production has not kept up with its population growth; while more than 10,000 new units are needed per year to keep up with growth, only about 6,000 units are being produced per year (City of Los Angeles, 2013d). To address fast-rising housing prices, Los Angeles Mayor Eric Garcetti announced plans to expand the city's housing supply by 100,000 units by 2021 (Hsu, 2014) and zoning reform is a key strategy (City of Los Angeles, 2015g).

The main components of Los Angeles's planning and land use regulatory regime are the city's general plan, 35 community plans,[2] 54 specific plans, and the zoning code. The general plan is the city's overarching comprehensive plan, which aims to focus growth in areas with

[2] Additionally, the city has plans for the Los Angeles International Airport and the Port of Los Angeles.

adequate infrastructure capacity and preserve single family neighborhoods (City of Los Angeles, 2001a). The general plan is implemented through 37 more detailed community plans (City of Los Angeles, 2015d). Zoning is required to be consistent with the city's general plan and communities, and cities are limited in the number of plan amendments they may make in each year (W. B. Fulton, 2005). The community plan areas are shown in below in Figure 1.

Specific plans are a type of implementation plan in California, frequently with land use regulatory authority that overrides the underlying zoning designation (W. B. Fulton, 2005). Specific plans may initiated by the city, a private developer or a neighborhood organization (Governor's Office of Planning and Research, 2001). Los Angeles adopted its first specific plan in 1978 in the San Fernando Valley. In the 1980s, 16 specific plans were adopted, including two for Century City, three for Playa Vista, and four encompassing Westwood (City of Los Angeles, 2015b). In the 1990s, 21 specific plans were adopted, ranging from the downtown development-focused Central City West Specific Plan to the hillside Hollywoodland Specific Plan. Since 2000, the City of Los Angeles adopted 16 specific plans (City of Los Angeles, 2015b), and these are a focus on my analysis (Figure 2).

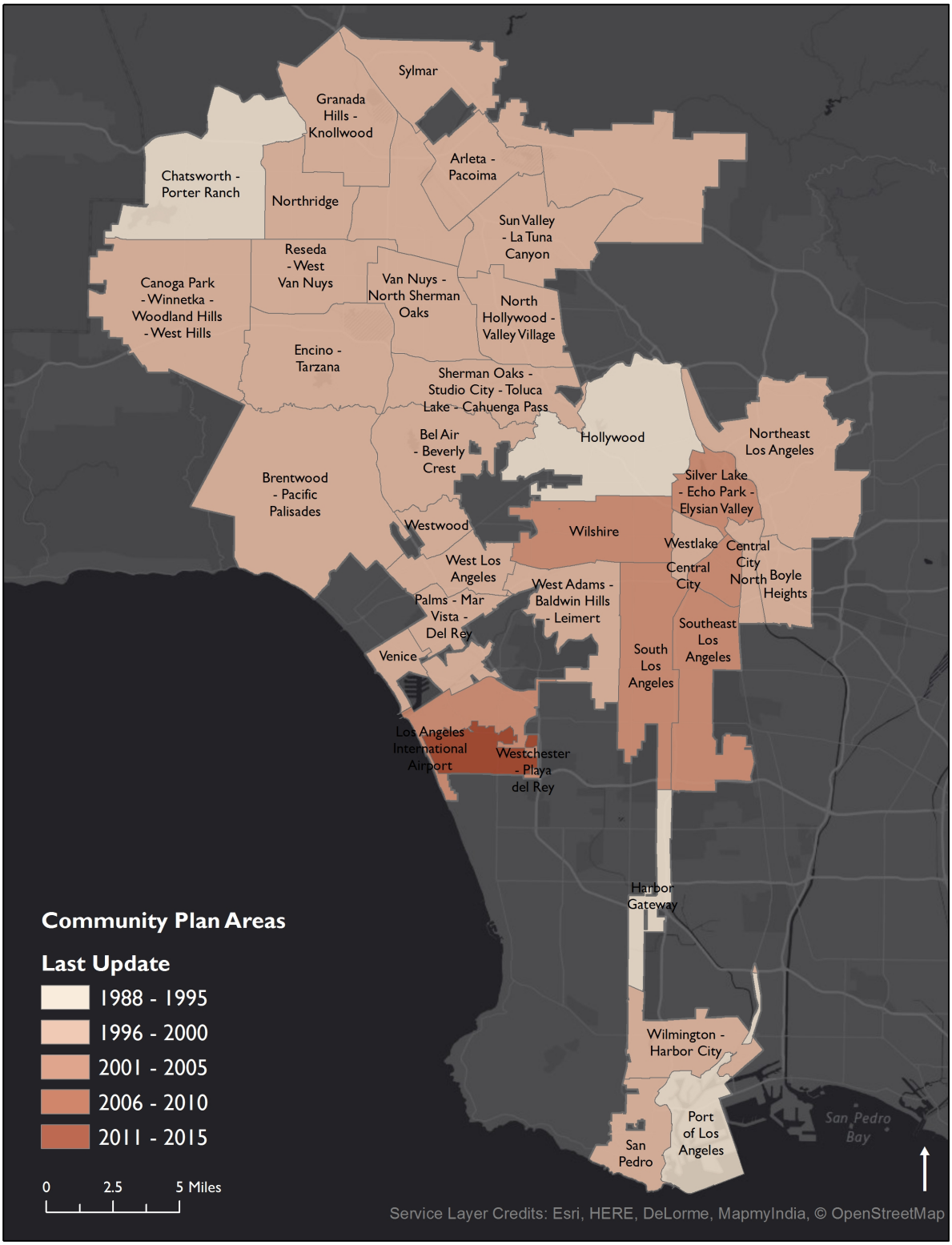


Figure 1. Community Plan Areas by year of last update

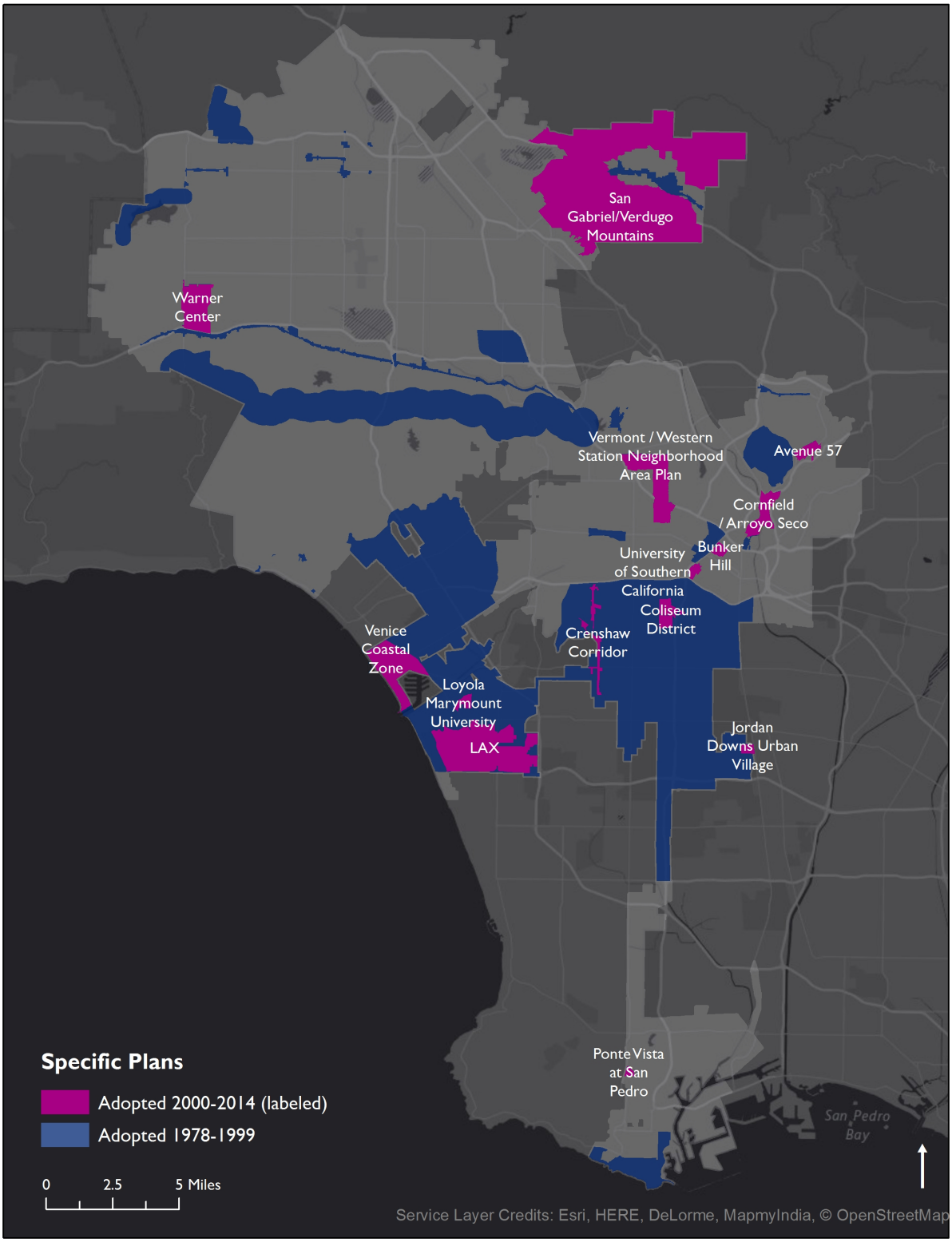


Figure 2. Adopted Specific Plans in Los Angeles

Data

To quantify zoning changes, I create a detailed dataset of parcel and regulatory characteristics in Los Angeles. Beginning with the Los Angeles County Assessor 2011-2012 parcel boundary shapefile, I use ArcGIS to clip the dataset to the city of Los Angeles boundaries, leaving approximately 788,000 parcels in my analysis.[3] Parcel boundaries can change over time – lots can be subdivided or assembled – and to standardize locations over the study period, I calculate the geographic centroid of each parcel using ArcGIS. I then spatially join the parcel centroids to each of the regulatory and administrative boundaries described below.

Two city zoning shapefiles are central to my regulatory dataset. The oldest available digital zoning file for Los Angeles is from July 2002 (Butcher, 2015) and presents the starting point for my analysis. The 2002 shapefile includes 65 zoning classes. These include common zones like "R1" (single family residential), "C2" (commercial), and "M2" (manufacturing), and a smaller number of uncommon zoning classes associated with certain neighborhoods. The shapefile includes 953 unique complete zoning classifications that add more detail related to allowable height, supplemental use districts, and other zoning designations (City of Los Angeles, 2006).[4] The 2014 zoning shapefile includes 85 unique zoning classes, a 31% increase from 2002, and 1,218 unique complete zoning classifications, a 28% increase from 2002.

[3] Some of these parcels are on the same site because each condominium unit has a unique parcel identifier.

[4] For example, within the R1 zone, there are parcels designated R1-1, R1-1-0, R1-1XL, and R1-1-HPOZ. Additionally, some of these detailed zoning classifications include "T", "Q" or "D" prefixes, meaning a parcel has site-specific regulatory requirements (City of Los Angeles, 2006). The "T" prefixes are "City Council requirements for public improvements as a result of a zone change"; the "Q" prefixes are "restrictions on property as a result of a zone change, to ensure compatibility with surrounding property"; and the "D" prefixes restrict "heights, floor area ratio, percent of lot coverage, building setbacks" (City of Los Angeles, 2006, p. 6).

For each of the generalized zoning classes in 2002 and 2014, I assign new variables that I create by analyzing the municipal code and adopted specific plans (City of Los Angeles, 2015f). I create indicator variables representing whether any kind of residential development (single-family and/or multifamily) or multifamily development is allowed by-right within the zoning class. I then assign each zoning class with its minimum allowable lot size per unit.[5] For example, in the C2 (commercial) zone, the minimum lot size per unit is 400 square feet, which translates to about 109 dwelling units per acre.[6] To the main parcel dataset, I join spatial data of other land use regulatory overlays. I identify parcels in Historic Preservation Overlay Zones (HPOZ) in 2002 and 2014. I also identify parcels covered by the two phases of the city's Adaptive Reuse Ordinance.[7]

I also add variables related to fixed-guideway transit, which are the product of large capital investments, relatively permanent, and the subject of much urban planning focus today. Fixed-use guideway transit in Los Angeles includes Metrorail (subway and light rail), bus rapid transit (BRT), Metrolink (commuter rail), and Amtrak (commuter and long-distance rail). I begin with the Center for Transit-Oriented Development's national TOD database (Center for Transit-Oriented Development, 2011) and update the station data for completions between December

[5] If residential uses are not permitted in a zone, I assign this variable with the value of 0. I next use the minimum lot size per unit to calculate maximum residential density in units per acre for each zoning class. The Cornfield Arroyo Specific Plan area reports maximum residential density in terms of floor area ratio (FAR) and I translate the FAR limits into the units per acre metric by assuming that the average net square footage of each residential unit is 1,000 square feet.

[6] In 1986, Los Angeles voters approved Proposition U, which limits development in commercial zones in Height District 1 to a floor area ratio of 1.5 across much of the city (City of Los Angeles, 2013d). Given Proposition U, maximum dwelling unit densities are difficult or impossible to develop on affected parcels, except perhaps in buildings composed of small studio apartments.

[7] The first phase included the Central City and Figueroa Corridor, and the second phase included Chinatown, Lincoln Heights, Hollywood, and Wilshire Center/Koreatown (City of Los Angeles, n.d.).

2011 and 2014.[8] I calculate the Euclidean distance from each parcel to the closest rail transit or bus rapid transit station. Lastly, for each parcel I assign an indicator variable representing if the parcel is within a half mile of a transit station. In my analysis below, I focus on the half mile distance, which is the dominant definition of "transit-oriented" in the literature because it typically represents about a ten-minute walk (Guerra, Cervero, & Tischler, 2012).

Methods

I first summarize parcel-level changes in terms of allowable residential uses and allowable residential density. To analyze how allowable uses changed between 2002 and 2014, I compare the parcel-level "residential allowed" and "multifamily residential allowed" indicator variables for each parcel in both years. For instance, a parcel might change from "residential not allowed" in 2002 to "residential allowed" in 2014. This would occur if, for example, a parcel that was previously zoned for industrial uses is rezoned to allow mixed-use commercial and residential uses. I follow the same process to assess if multifamily capacity was added or eliminated for each parcel.[9] To identify parcels that the city upzoned or downzoned, I compare each parcel's allowable residential density in 2002 and 2014.

Second, I analyze adopted plans and ordinances that regulate land use. I focus on the 2000 to 2014 period because it overlaps with the parcel/regulatory dataset and includes the Vermont/Western Transit Oriented Development Specific Plan, the city's first rail-oriented neighborhood plan. For analysis of the specific plans, I obtain the sixteen specific plan

[8] The locations of stations that were completed between December 2011 and 2014 were in the database, but were categorized as "planned transit" rather than "existing transit."

[9] The residential added and multifamily added categories generally overlap, except in instances where single-family residential zones are rezoned to allow multifamily housing.

documents adopted since 2000 from the city's website (City of Los Angeles, 2015b). Given that land use regulations in specific plans supersede the base zoning, I create an inventory of regulations in each plan, organized in terms of the framework shown in Figure 3. I supplement the document analysis with keyword searches of local media and real estate development blogs.

		Geographic extent of regulation or regulatory change			
		Citywide	**Downtown**	**Non-downtown neighborhood**	**Master planned development or individual parcel**
Type of regulation or regulatory change	Allowable land uses				
	Residential density				
	Parking				
	Design				
	Impact fees				
	Affordable housing				

Figure 3. Sample regulatory inventory matrix

Results

The results below are organized in terms of allowable residential land uses and density, parking requirements, design standards, development impact fees, and affordable housing provisions. Within each category, I describe changes citywide, in downtown Los Angeles, non-downtown neighborhoods, and for individual parcels. Changes to allowable land use and density came in the form of upzoning, downzoning, and issue-focused ordinances, as described below.

Upzoning

At the study baseline (2002), single-family housing was allowed in most of Los Angeles, while multifamily housing was not. Housing of some kind was allowed on 69% of the city's

acreage, while multifamily dwellings were only permitted in 16.5% of the city.[10] That is, on about 52% of land citywide, single-family housing (and in limited cases duplexes) were the only allowable land use. This changed very little by 2014. The city began allowing some type of housing on over 1,237 acres, while it removed residential allowances on 1,398 acres. The net result was a 161-acre reduction in residential land, equivalent to 0.07% of the city's parcel land area. During this same period, the city began allowing multifamily housing on 1,241 acres, while it removed multifamily housing as a permitted use on 671 acres. The net result was 570 additional acres of multifamily residential capacity or 0.2% of Los Angeles's parcel land area. Overall, the city's capacity for new housing grew. The rezoning of some agricultural and low-density single-family areas to open space was more than offset by the new multifamily housing potential of the upzoned areas. The changes to residential land capacity are summarized in Table 1 and Table 2, the zoning changes are mapped in Figure 4.

The city most significantly expanded its residential development capacity by rezoning industrial land in and near downtown Los Angeles. The most common changes included rezoning industrial parcels to allow mixed-use commercial and residential development (about 664 acres or 54% of the new residential acreage) and rezoning open space to agricultural zones that allow low-density residential development (about 271 acres or 22% of the new residential acreage). Over 100 acres of residential allowances were added in four community plan areas: 255 acres in Northeast Los Angeles, 166 acres in Sylmar, 125 acres in Central City North, and 115 acres in Brentwood-Pacific Palisades. The area in the Sylmar and Brentwood-Pacific Palisades community plans was mostly new low-density single-family residential zoning while

[10] Throughout this paper, land area refers to the city's parcels and excludes public rights-of-way. The city has about 243,000 acres of land area in parcels.

the area in Northeast Los Angeles and Central City North allowed medium- and high-density multifamily housing. Overall, the city began allowing multifamily housing on 1,241 acres, most notably in Northeast Los Angeles (242 acres), Central City North (125 acres), Westchester-Playa del Rey (115 acres), and Sylmar (107 acres). About 42% of this new multifamily acreage was rezoned from industrial/manufacturing and 14% from parking-related zones. About 10% of the new multifamily eligible land came from upzoning R1 parcels (the city's most widely used single-family zone).

Los Angeles upzoned 2,712 acres by an average of 43 units per acre. This upzoning occurred across the city, from downtown to the San Fernando Valley. In and around downtown Los Angeles, and in the Wilshire community plan area, there are clusters of upzoned parcels that followed plan updates or new specific plan adoption. In the San Fernando Valley and other parts of the city, there tended to be more property-owner initiated and parcel-by-parcel upzoning. A share of this upzoning occurred proximate to transit infrastructure. About 16% of the upzoned acreage was within a half-mile of a rail or bus rapid transit station, and 57% was within two miles of a station. This upzoning was not evenly distributed across stations. For instance, about two-thirds of the upzoned transit-proximate acreage was within a half-mile of just five stations: Lincoln Heights/Cypress Park, Chinatown, Universal City, Little Tokyo/Arts District, and Wilshire/Western. The most significant transit-oriented upzoning was the result of the city's Cornfield Arroyo Seco Specific Plan, described below, which includes the first two of these stations.

The most significant upzoning in specific plan areas – in terms of number of added units and its stated intention to promote residential development – was the Cornfield Arroyo Seco plan. This specific plan includes part of Los Angeles's Chinatown and spans the Northeast Los

Angeles and Central City North community plan areas. The Cornfield Arroyo Seco plan added about one-fifth of the city's new residential acreage in an area that was previously zoned for mostly industrial land uses (City of Los Angeles, 2013b). There were several other specific plans with residential components. The Avenue 57 Specific Plan included development incentives for live-work units and mixed-use buildings (City of Los Angeles, 2002a). The Jordan Downs Specific Plan incorporated residential and mixed-use development in many parts of the public housing redevelopment site (City of Los Angeles, 2013c). The Los Angeles Sports and Entertainment District Specific Plan in downtown Los Angeles allowed up to 1,797 units (City of Los Angeles, 2001b). The University of Southern California University Park Campus Specific Plan allowed 5,400 beds of student housing and 250 units of faculty/staff housing (City of Los Angeles, 2012b).

Outside specific plan areas, in the Wilshire neighborhood – centered along Wilshire Boulevard west of downtown Los Angeles – there were several large parcels rezoned from a parking designation to a high-density commercial or residential designation. In the outlying Chatsworth-Porter Ranch area, located in the northwestern part of the San Fernando Valley, there were several sizable parcels rezoned to C2 zoning, which allows up to about 109 dwelling units per acre.[11] Lastly, in 2002, the city introduced two new zones ("RAS3" and "RAS4") that permitted higher densities for residential development in commercial zones affected by Proposition U (City of Los Angeles, 2013d). Between 2002 and 2014, this zone was designated for 351 parcels.

[11] The Wilshire and Chatsworth/Porter Ranch examples show that there may be more multifamily capacity on paper in some areas than is likely to be redeveloped in the near term. For instance, on one 11-acre parcel, rezoned to C2, one could build nearly 1,200 units at the maximum density in the zoning. However, on this site a developer built a new conventional shopping center, with a grocery store, pharmacy and bank.

The city also expanded housing supply by deregulating the adaptive reuse of existing buildings. The Adaptive Reuse Ordinance (ARO) for the central city was adopted in 1999 and became effective in late 2001. Then, effective in early 2003, the ARO was expanded to include other centrally located neighborhoods, including Chinatown, Lincoln Heights, the Hollywood Community Redevelopment Project Area, and the Wilshire Center/Koreatown Community Redevelopment Project Area (City of Los Angeles, n.d.). The ARO allowed a change in building use from commercial or industrial to residential without a variance, and removed these properties from minimum parking requirements, as long as the redevelopment did not remove parking (Manville, 2013). This ordinance increased the city's housing supply through redevelopment of existing buildings; Manville (2013) identified 7,300 adaptive reuse housing units produced through 2008.

Another regulatory change that increased flexibility but did not involve rezoning was the 2005 citywide "small lot subdivision" ordinance. This ordinance was adopted to increase production of fee-simple ownership options by allowing detached small-lot single family homes in multifamily and commercial zones where single-family housing would otherwise not be allowed (City of Los Angeles, 2014c). The ordinance included new standards and design guidelines; for instance, lots must be at least 600 square feet in size and 16 feet wide, and parking could be provided in a tandem configuration anywhere on the development site (City of Los Angeles, 2004c).

Downzoning

The city reduced its residential land supply largely through environmental conservation plans and the Los Angeles International Airport specific plan. Most downzoning occurred in

neighborhoods that were also upzoned, so the net effect for nearly all community plan areas was positive. Between 2002 and 2014, the city removed housing as an allowable use from 1,398 acres. Over 40% of this land area (603 acres) was A1 and A2 (agricultural) zoned parcels rezoned as open space in the San Gabriel/Verdugo Mountains Scenic Preservation Specific Plan. About 173 acres of R1 (single-family residential) land was converted to non-housing zones, largely to open space or LAX designations. The Los Angeles International Airport plan created a buffer between the airport and the adjacent Westchester neighborhood to "provide for the redevelopment of land previously used for residential purposes with uses that are consistent with airport needs and neighborhood conditions" (City of Los Angeles, 2004b, p. 17).

The city downzoned 2,570 acres and removed 671 acres of multifamily capacity, though much of this was a "paper" reduction rather than a functional decrease. More than 250 acres of the reduced multifamily capacity was in and near downtown Los Angeles, which is explained by the rezoning of parcels with public buildings from commercial zones to the public facilities designation;[12] the adoption of the Convention and Event Center Specific Plan (City of Los Angeles, 2012a); and the creation of several parks, including downtown's Grand Park. The first two reflect a numerical reduction in residential land supply because the sites or specific plan areas already had public buildings on them and the rezoning codified the existing land uses.

[12] An example is the headquarters for Los Angeles Department of Water and Power, which was zoned C4 (commercial) in 2002 and PF (public facilities) in the 2014 zoning data. Theoretically the 13-acre site can now accommodate about 1,400 fewer housing units, but this probably had little or no practical effect on the housing market. The Central City Community Plan map footnote states that the "Public Facility (PF) planning land use designation is premised on the ownership and use of the property by a government agency. The designation of the PF Zone as a corresponding zone is based on the same premise. The Plan also intends that when a board or governing body of a government agency officially determines that a property zone PF is surplus, and no other public agency has indicated an intent to acquire, and the City is notified that the agency intends to offer the property for sale to a private purchaser, then the property may be rezoned to the zone(s) most consistent within 500 feet of the property boundary and still be considered consistent with the adopted Plan" (City of Los Angeles, 2009, p. 1).

Table 1. Zoning changes affecting residential development (2002-14, in acres)

	Any Residential		*Multifamily**	
Community Plan Area	**Added**	**Removed**	**Added**	**Removed**
Arleta - Pacoima	2	13	25	11
Bel Air - Beverly Crest	0	0	0	0
Boyle Heights	2	0	2	2
Brentwood - Pacific Palisades	115	0	5	0
Canoga Park - Winnetka - Woodland Hills - West Hills	36	56	47	18
Central City	0	217	0	217
Central City North	125	21	125	21
Chatsworth - Porter Ranch	71	63	94	5
Encino - Tarzana	8	12	13	14
Granada Hills - Knollwood	2	3	7	9
Harbor Gateway	1	0	0	0
Hollywood	5	27	19	1
Los Angeles International Airport	0	168	0	131
Mission Hills - Panorama City - North Hills	13	3	48	29
North Hollywood - Valley Village	3	0	7	9
Northeast Los Angeles	255	138	242	29
Northridge	2	3	16	5
Palms - Mar Vista - Del Rey	9	0	9	0
Port of Los Angeles	0	0	0	0
Reseda - West Van Nuys	10	0	28	4
San Pedro	13	17	14	0
Sherman Oaks - Studio City - Toluca Lake - Cahuenga Pass	11	3	89	8
Silver Lake - Echo Park - Elysian Valley	52	21	58	22
South Los Angeles	56	1	3	1
Southeast Los Angeles	33	28	28	30
Sun Valley - La Tuna Canyon	85	246	29	4
Sunland - Tujunga - Lake View Terrace - Shadow Hills - East La Tuna Canyon	21	278	29	3
Sylmar	166	0	107	1
Van Nuys - North Sherman Oaks	11	3	27	5
Venice	1	0	1	0
West Adams - Baldwin Hills - Leimert	9	12	9	13
West Los Angeles	8	0	9	0
Westchester - Playa del Rey	80	52	115	51
Westlake	0	0	0	0
Westwood	0	0	0	0
Wilmington - Harbor City	9	0	9	1
Wilshire	26	14	26	26
Total	**1,237**	**1,398**	**1,241**	**671**

* Land area converted from non-residential or single-family zoning to a designation allowing multifamily.

Table 2. Zoning changes affecting allowable residential density (2002-14, in acres)

	Zoning Change	
Community Plan Area	**Upzoning**	**Downzoning**
Arleta - Pacoima	37	16
Bel Air - Beverly Crest	1	3
Boyle Heights	2	2
Brentwood - Pacific Palisades	120	298
Canoga Park - Winnetka - Woodland Hills - West Hills	66	172
Central City	0	261
Central City North	134	21
Chatsworth - Porter Ranch	272	125
Encino - Tarzana	29	71
Granada Hills - Knollwood	68	56
Harbor Gateway	4	0
Hollywood	29	44
Los Angeles International Airport	0	168
Mission Hills - Panorama City - North Hills	63	39
North Hollywood - Valley Village	11	11
Northeast Los Angeles	292	216
Northridge	41	15
Palms - Mar Vista - Del Rey	10	3
Port of Los Angeles	0	0
Reseda - West Van Nuys	46	17
San Pedro	18	17
Sherman Oaks - Studio City - Toluca Lake - Cahuenga Pass	103	18
Silver Lake - Echo Park - Elysian Valley	125	48
South Los Angeles	57	9
Southeast Los Angeles	48	33
Sun Valley - La Tuna Canyon	120	266
Sunland - Tujunga - Lake View Terrace - Shadow Hills - East La Tuna Canyon	302	456
Sylmar	269	12
Van Nuys - North Sherman Oaks	39	26
Venice	1	1
West Adams - Baldwin Hills - Leimert	25	13
West Los Angeles	9	5
Westchester - Playa del Rey	136	63
Westlake	4	0
Westwood	1	2
Wilmington - Harbor City	11	7
Wilshire	218	52
Total	**2,712**	**2,570**

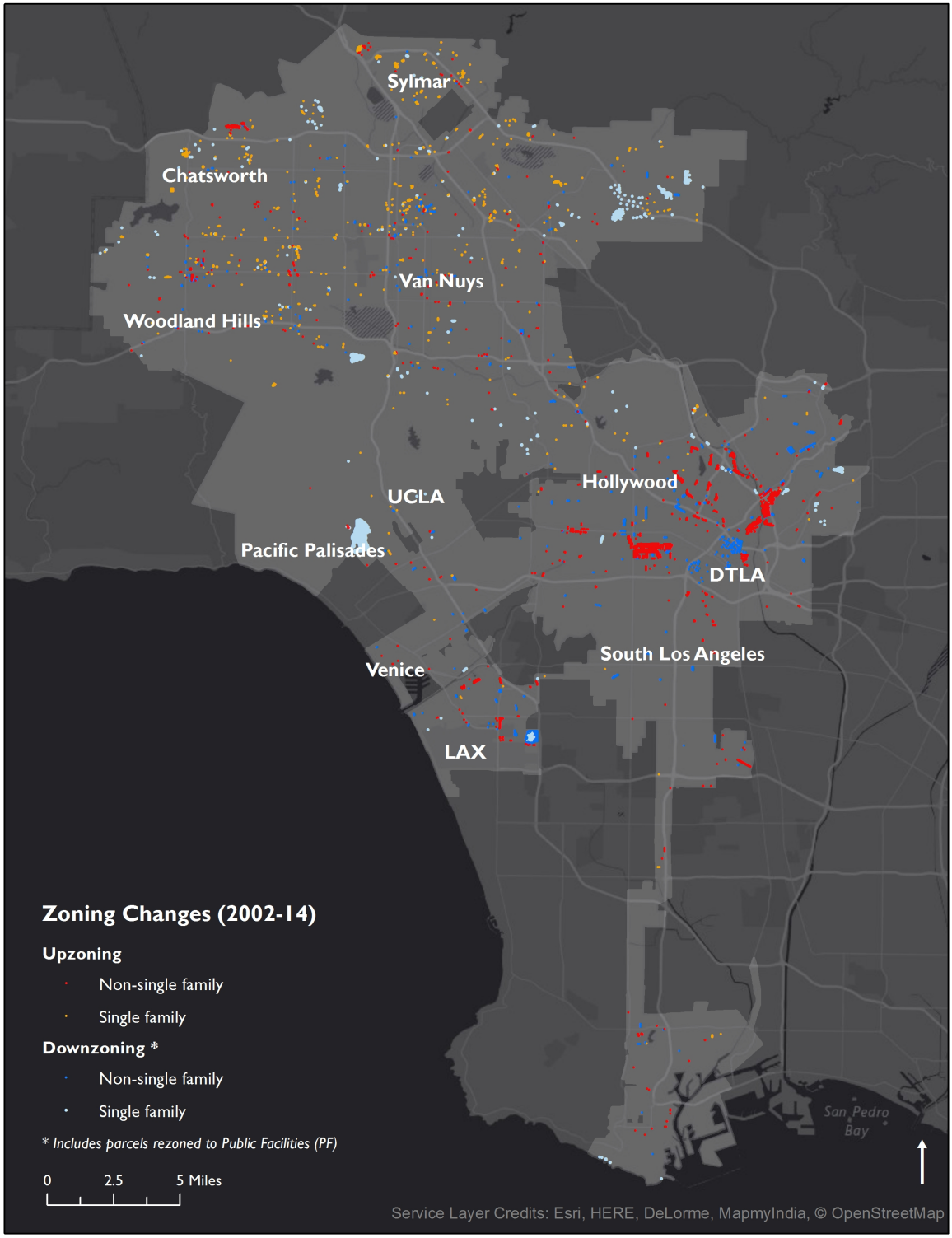


Figure 4. Zoning changes affecting allowable residential density (2002-14)

Parking

Los Angeles has standardized minimum parking requirements across most of the city. The zoning code requires a minimum of two covered parking spaces for each single-family unit (City of Los Angeles, 2002c, 2013d). Apartment requirements vary depending on the size of the unit; typically two-bedroom or larger units require two parking spaces, one-bedroom units require 1.5 spaces, and studios require one space (City of Los Angeles, 2002c).[13] There are lower parking requirements downtown, where the city generally requires one parking space per apartment, except in buildings with more than six units of two-bedrooms or larger, where 1.25 spaces per unit are required (City of Los Angeles, 2002c; Manville, 2013). There is another set of standards for downtown condominiums, and these requirements were eased during the study period. Prior to 2005, a special condominium advisory board required 2.25 to 2.5 spaces per condominium unit, but after 2005 this board generally only requires 1.5 to 2 spaces per unit (Manville, 2013).

The city adopted multi-neighborhood or citywide ordinances that reduced or removed minimum parking requirements. The Adaptive Reuse Ordinance, described in the previous section, allows for a change of use without requiring additional parking spaces (Manville, 2013). The Vermont/Western and Avenue 57 transit-oriented specific plans have similar provisions (City of Los Angeles, 2001d, 2002a). In 2012, the city council adopted a Modified Parking District Ordinance, which gives the city more flexibility to reduce or increase parking requirements in areas with strong local support; the ordinance requires 75% of the signatures of

[13] The city standards are based on the number of "habitable rooms." Habitable rooms include kitchens, living rooms and bedroom(s); a unit with 3 habitable rooms is a 1-bedroom. I translate these standards to the nomenclature of commonly-used bedroom counts.

property owners within the proposed district (City of Los Angeles, 2014d). While this ordinance enables the type of district (Brasuell, 2012), none were implemented as of 2014.

The most radical regulatory change was the elimination of minimum parking requirements and bundled parking in the Cornfield Arroyo Seco Specific Plan (City of Los Angeles, 2013b). This was the first plan in the city that does not require parking for new residential development (City of Los Angeles, 2014d). If developers elect to provide on-site parking, they are required to provide electric vehicle charging stations and scooter/motorcycle parking, and are encouraged to provide spaces for car-sharing vehicles (City of Los Angeles, 2013b). Additionally, the plan requires parking to be rented or sold separately from the unit ("unbundled") (City of Los Angeles, 2013b).

Three specific plans – Vermont/Western, Jordan Downs, and Warner Center 2035 – adjusted minimum parking requirements *and* introduced parking maximums. The Jordan Downs Urban Village Specific Plan, which covers the redevelopment of a public housing complex, requires parking minimums of 0.75 parking spaces per multifamily unit with shared parking, one space per single-family unit with private parking, and 0.5 spaces for senior housing (City of Los Angeles, 2013c). This plan introduced parking maximums of one parking space per unit for studio apartments, 1.5 spaces per unit for one-bedroom apartments, and two spaces per unit for two-bedroom and larger apartments (City of Los Angeles, 2013c). The Vermont/Western specific plan includes a variety of parking reforms, including parking reductions near rail transit stations and parking minimums and maximums (City of Los Angeles, 2001d). Somewhat counter intuitively, for some housing types there is no difference between the minimum and maximum requirements. The minimum resident and guest parking standards are 1.25 parking spaces per studio, 1.75 spaces per one-bedroom unit, and 1.75 spaces per unit that has two bedrooms or

more. The maximum parking is 1.25 spaces per studio unit, 1.75 spaces per one-bedroom unit, and 2.25 spaces per unit that has two bedrooms or more. The studio and one-bedroom minimums are higher than the citywide standards, but for larger units, the minimum standards are lower than the citywide ones. Lastly, the plan allows for a 15% reduction in required parking within 1,500 feet of Metro Rail Red Line station (City of Los Angeles, 2001d).

The current specific plan for Warner Center, adopted in 2013, includes parking minimums and maximums. This area is a large regional employment and mixed-use center in the mostly suburban San Fernando Valley. Housing developments must include at least one space and no more than two spaces per unit. For projects with fewer than 100 units, 0.25 guest spaces per housing unit are required, but for projects with 100 or more units, no guest parking is required (City of Los Angeles, 2013e). Additionally, any parking in excess of one space per unit must be unbundled from the unit's rent or sales prices (City of Los Angeles, 2013e).

Three specific plans adjusted minimum parking requirements, without imposing maximums. The Bunker Hill specific plan in northwestern downtown Los Angeles reduced minimum parking requirements to 0.5 spaces per housing unit for studios and one space per unit for all other housing units in the plan area. Additionally, within 1,500 feet of rail transit, the plan requires 0.25 spaces per studio unit and 0.5 spaces for units of one-bedroom or larger (City of Los Angeles, 2013a). The Los Angeles Sports and Entertainment District Specific Plan in the downtown area – anchored by the L.A. Live entertainment complex and Staples Center sports arena – introduced minimum parking requirements of 1.25 spaces per unit, and allows parking provision to be reduced by 10% at the discretion of the city's planning director (City of Los Angeles, 2001b). The University of Southern California Specific Plan required a minimum of

one space and 0.15 guest spaces per unit of faculty/staff housing, and bases student parking requirements on the university's enrollment (City of Los Angeles, 2012b).

While specific plans were generally used to reduce parking requirements, the Ponte Vista at San Pedro specific plan increased parking requirements for this new master planned development: studios and one-bedroom apartments must have at least one covered parking space, and housing units with two bedrooms or more must have at least two parking spaces (one of which must be covered). Additionally, one guest parking space is required for every four residential units (City of Los Angeles, 2014b). The parking plan for Ponte Vista at San Pedro includes a total of 1,887 parking spaces, or the equivalent of nearly 2.8 spaces per unit (City of Los Angeles, 2014b).

Design standards

The city's regulations pertain to design in terms of building massing, site placement, architectural details, and the adjacent public realm. The city applied new design-related regulations through (1) specific plans, (2) the expansion of historic preservation districts, and (3) the adoption of an anti-"mansionization" ordinance. The specific plans were primarily focused on commercial or mixed-use building design, and nearby streetscapes. The historic preservation districts and the mansionization ordinance were focused on single-family neighborhood preservation.

Of the specific plans adopted in the study period, 9 of 13 include design guidelines, design standards, and/or design review board requirements for residential development. As described below, these specific plans exhibit considerable variety in how they address design aspects of new development. The city adopted five neighborhood-scale specific plans that

regulate residential design. The downtown Bunker Hill plan includes design standards focused on setbacks, ground floor uses, and massing along designated "retail streets" (City of Los Angeles, 2013a). The Cornfield Arroyo Seco plan includes design standards for building entrance locations, ground floor uses, ground floor transparency, facades, windows and glazing, exterior lighting, and a set of parking structure design standards related to exterior materials and ground floor uses (City of Los Angeles, 2013b). The Crenshaw Corridor plan requires design review by an appointed seven member design review board (City of Los Angeles, 2004a). The Vermont/Western plan includes development standards and design guidelines related to building setbacks, open space, ground floor transparency, façade design, and parking structure design (City of Los Angeles, 2001c, 2001d). The Warner Center 2035 plan includes design guidelines related to block size, sidewalks, setbacks, street frontage, ground floor design and uses, parking, architecture, landscaping, and streetscapes (City of Los Angeles, 2013e).

The city also adopted four specific plans for master-planned developments with design requirements. The Jordan Downs Urban Village plan requires LEED-Neighborhood Development (LEED-ND) standards, and design standards related to height transitions between different parts of the plan area, massing, building entrance frequency, setbacks, ground floor uses and entry locations, roof design, and building corner design (City of Los Angeles, 2013c). The Los Angeles Sports and Entertainment District plan includes a streetscape plan and building design guidelines related to street walls, setbacks, curb cuts, entrance locations, ground floor uses and design, and architectural features (City of Los Angeles, 2001b). The Ponte Vista at San Pedro Plan designates four permitted four architectural styles: Mediterranean, Mediterranean Eclectic, Early California Modern, and California Modern. The plan does not include detailed design guidelines and specifies that design guidelines must be created before any development is

approved (City of Los Angeles, 2014b). The University of Southern California University Park Campus plan presents general urban design principles related to mixed land uses, pedestrian-oriented design, connections to rail transit and context sensitivity; the plan also requires urban design guidelines based on these principles to be adopted prior to any development in the plan area (City of Los Angeles, 2012b).

The city expanded regulations intended to preserve existing single-family neighborhoods through historic preservation and a "mansionization" ordinance. Los Angeles has 30 historic preservation overlay zones (HPOZ) covering about 4,800 acres (City of Los Angeles, 2015e). Twenty-one of the city's HPOZ, covering two-thirds of the total historic preservation land area, were adopted between 2000 and 2014. In HPOZ areas, a five-member board must review and make recommendations to the Planning Department prior to any exterior changes to existing buildings and new development (City of Los Angeles, 2015e). Second, the city made it more difficult to build a large single-family house in existing neighborhoods by adopting a "Baseline Mansionization Ordinance" with size and design limitations for new development in most single-family neighborhoods (City of Los Angeles, 2008a). The ordinance caps the floor area of new housing at 25% of the lot area, up to 5,000 square feet, and allows new housing meeting certain criteria a 20% floor area bonus (City of Los Angeles, 2008a).

Development impact fees

The city assesses administrative processing fees and infrastructure fees on new development to fund parks and schools, and these have been in place since the mid-1980s (City of Los Angeles, 2013d). Impact fees were a small or non-existent part of the specific plans adopted since 2000. Most of the plans do not mention impact fees, with two exceptions. The

Vermont/Western plan includes a special $4,300 per housing unit fee to fund park development in the area (City of Los Angeles, 2001d). The Bunker Hill plan gives the city the option to charge an impact fee for transferring floor area rights between sites (City of Los Angeles, 2013a). Impact fees are commonly subject to negotiations between municipalities and developers (Altshuler & Gomez-Ibanez, 1993), but Los Angeles's system is particularly improvised. A recent audit of Los Angeles's impact fee practices concluded that the city has "favored an ad-hoc approach to mitigating the impacts of new developments, imposing mandatory conditions of approval and/or negotiating case-specific deals […]" (City of Los Angeles, 2015a, p. i). As a result, Los Angeles may have undercharged developers by as much as $91 million annually (City of Los Angeles, 2015a).

Affordable housing requirements and incentives

The most notable policy change related to affordable housing provision was the density bonus incentives.[14] First, Los Angeles adopted a density bonus ordinance in 2008 to implement state law for affordable housing provision (City of Los Angeles, 2008b). The ordinance allows developers that meet certain affordable housing thresholds to build up to 35% more densely, reduce parking requirements, and receive up to three incentives related to setbacks, lot coverage, lot width, building height, floor area ratio, and open space (City of Los Angeles, 2008b). To receive a minimum density bonus of 20%, lowered parking requirements, and one other incentive, a development proposal must include at least 5% of units for very low-income

[14] The city does not have a mandatory inclusionary zoning ordinance (Mukhija, Regus, Slovin, & Das, 2010). There were some mandatory affordable housing provisions in two specific plans, but these were removed due to legal issues (City of Los Angeles, 2013d).

households or 10% of units for low-income households (City of Los Angeles, 2008b). To receive the maximum density bonus of 35%, lowered parking requirements, and three incentives, a development proposal must include at least 15% of units for very low-income households or 30% of units for low-income households. The city's planning commission may also grant developers additional incentives ("off-menu" incentives), if the developer sufficiently justifies that the incentive is necessary for the affordable units to be "economically feasible" (City of Los Angeles, 2008b, p. 14).

There were additional affordable housing provisions in several specific plans. The Cornfield Arroyo Seco plan grants floor area bonuses if units are set aside for affordable housing (City of Los Angeles, 2013b). Unlike the citywide density bonus, which allows additional residential density, the Cornfield Arroyo Seco bonuses allow additional residential *or* non-residential floor area and other development incentives (City of Los Angeles, 2008b, 2013b). The Venice Coastal Zone plan allows additional housing development on-site if a developer replaces units that are removed with new income-restricted affordable housing (Los Angeles Department of City Planning, 2004).

Discussion

The four most important findings are: (1) land use regulations were remarkably stable in most of the city; (2) Los Angeles tightened regulations in some single-family neighborhoods; (3) the city adopted several policy experiments, particularly in the downtown and densest neighborhoods; and (4) density and parking deregulation were also commonly accompanied by new or expanded design standards. On the whole, when there were changes, the city became

more or differently regulated between 2002 and 2014, and there was little deregulation of new residential construction.

Land use regulations were largely stable, particularly in single-family neighborhoods. In contrast with the more extensive rezoning of New York City during the early 2000s (Been et al., 2014), Los Angeles adopted fewer regulatory changes. During the 12-year study period, the city changed the allowable density on about 5,300 acres of land, or 2% of the city's parcel land area. Little rezoning involved upzoning single-family zones; only 120 acres of single-family zoned land were rezoned to allow multifamily development and nearly all of this land was in the San Fernando Valley. Once a parcel was zoned for single-family, it was unlikely to be rezoned for denser uses. Some single-family neighborhoods, if anything, became more regulated through the expansion of historic preservation overlays and the baseline mansionization ordinance. There were some zoning changes adjacent to single-family zones, particularly to preserve open space or rezone to allow commercial uses. However, the largest area of upzoning – the Cornfield Arroyo Seco plan area – was in the central city and not proximate to residential neighborhoods.

Los Angeles tended to change its land use regulations for one of six reasons: (1) to increase density or encourage new development around rail transit (e.g., Vermont/Western, Cornfield Arroyo Seco); (2) to conserve open space and environmental areas (e.g., San Gabriel/Verdugo Mountains Scenic Preservation); (3) to promote redevelopment of existing commercial buildings (e.g., Adaptive Reuse Ordinance); (4) to preserve single-family neighborhoods (e.g., historic preservation and baseline mansionization ordinance); (5) to facilitate large-scale projects (e.g., the convention center, Los Angeles Sports and Entertainment District); and (6) to allow development on individual parcels or groups of parcels.

Regulatory changes were often confined to relatively small geographic areas or specific land use topics. There were few changes to parking requirements, although there was some modification of standards in about half of the recent specific plans and through the Adaptive Reuse Ordinance. Planning interventions that loosened density requirements were generally accomplished through specific plans or new density bonus incentives. There was a rise in new design standards. Some of these design standards were coupled with increases to allowable density (primarily in specific plans), while other design standards (e.g., HPOZ and anti-"mansionization" policies) were not.

Density deregulation was often accompanied by new or increased design standards. This may reflect the political reality of densification. That is, if density-increasing initiatives have a chance of making it through the adoption process, they must provide increased certainty for existing residents as to the nature and design of this new development.[15] Although it is clear that additional design standards have been imposed on development in some areas, it is unclear whether these requirements are onerous. It seems possible that if the standards introduce more certainty in the development approval process that they could be perceived neutrally or even positively by developers. This is analogous to Burge and Ihlanfeldt's observation that impact fees may increase housing supply by "indirectly reducing project approval costs and by relaxing implicit limits on the percentage of permit applications that receive local government approval" (2006, p. 285).

[15] A counterexample, however, is the Hollywood Community Plan, which included design guidelines and requirements, and was opposed by several neighborhood groups and successfully challenged in court (City of Los Angeles, 2012c; Zahniser, 2013).

Although zoning classifications were generally stable, the city adopted some land use regulatory reforms on a piecemeal basis in the form of specific plans or multi-neighborhood topical policy initiatives. A common thread throughout the city's plans, including those near rail transit stations, is the preservation of single-family neighborhoods. Many plans have unique provisions, like a requirement in the Vermont/Western plan that large mixed-use and commercial developments provide on-site childcare for employees. More broadly, the Cornfield Arroyo Seco plan is notable because it is Los Angeles' first hybrid of use-based and form-based codes. Outside of specific plans, the biggest regulatory changes were the Adaptive Reuse Ordinance and related parking reforms. Initially adopted just for the downtown, the Adaptive Reuse Ordinance was expanded to other dense neighborhoods, and seems to have permitted new housing that otherwise would not have been permissible to build (Manville, 2013).

Written land use regulations are just one part of the puzzle. Beyond characterizing regulations that are "on the books," it is crucial to understand how regulations are being applied (May, 2005). Neighborhood opposition can affect the way regulations are applied (Rolf Pendall, 1999). A city may adopt a "business-friendly" or "by-the-book" approach, meaning that the same regulation can be implemented differently depending on the time and place (May, 2005; Warner & Molotch, 2000). There are several possible approaches to better understanding how regulations are being applied. We can compare the characteristics of actual developments with the baseline zoning requirements, and examine the approval processes. We can compare the number of development projects that allowed by-right under the zoning code versus those requiring a variance or other discretionary review.[16] Lastly, we can analyze average development

[16] In Los Angeles every development project of at least 50 residential units is subject to discretionary review.

approval periods for different types of development projects. Since developers seek to minimize risk, we could examine explanations for the variance in approval timelines to better understand the uncertainty a developer may face.

Conclusions

The Los Angeles case supports Pendall et al.'s (2006) observation about the trend toward more and different regulations, rather than deregulation. Between 2000 and 2014, Los Angeles restricted residential development by enacting new protections for single-family neighborhoods and through environmental land preservation. But, during the same period, the city enabled multifamily development by allowing it in new parts of the city and by easing density limits and parking standards in a handful of rail transit station areas. On the whole, the areas in which some zoning restrictions were eased also often became subject to additional design and development standards. Los Angeles's regulatory changes suggest rich opportunities for further research related to the motivations for regulation and deregulation, and the effects of these regulatory changes on housing production.

Chapter 2: Why Are Regulations Changed? The Determinants of "Upzoning"

Urban economists and planners have made strong arguments for easing residential density limits based on housing price (Fischel, 2005b; Glaeser & Gyourko, 2002), environmental (Calthorpe & Fulton, 2001), equity (R. Pendall, 2000), and consumer choice (J. Levine, 2006) rationales. "Upzoning" is a common colloquial term used to describe land use regulatory changes that allow higher development intensity (Bartke & Lamb, 1975). While planners, politicians, and neighborhood groups often discuss upzoning, its actual occurrence is more rare. New York City, during a period of "rapid" rezoning activity, upzoned about 5% of its lots between 2003 and 2009 (Been et al., 2014). Los Angeles, by contrast, upzoned about 1% of its land area between 2002 and 2014, as described in the previous chapter. There is limited empirical evidence about how and why land use regulations are changed. This paper uses the case of Los Angeles to analyze the parcel-level determinants of municipal upzoning.

I conceptualize the upzoning of a specific parcel to be a function of housing demand factors, existing supply constraints, the influence of interest groups, and other policy drivers. The parcel is important because it is the smallest geographic scale at which development decisions are made. To examine upzoning, I create a parcel dataset with Los Angeles regulatory, site, and neighborhood characteristics between 2002 and 2014. I specify logistic regression models to analyze the relationship between parcel upzoning and the potential determinants mentioned above, citywide and in three sub-areas of Los Angeles. I find that upzoning follows the path of opportunity combined with least political resistance, and there is strong evidence supporting the "homevoter hypothesis" in Los Angeles. Specifically, upzoning was least likely in areas with concentrations of homeowners coupled with desirable amenities like proximity to the beach and

high-performing schools. Upzoning was most likely for parcels near freeways, and those zoned for agricultural or manufacturing land uses. There was no significant difference in the likelihood of upzoning for parcels located within a half mile of rail or bus rapid transit.

The determinants of zoning changes

Zoning codes emerged in the early twentieth century to separate single-family residences from industrial land uses, commercial areas, and apartments (Fischel, 2004; Hirt, 2007). Today, zoning codes typically prescribe what land uses are allowed by-right and as conditional uses, and the maximum development densities that are permitted (Hirt, 2007; Hoch et al., 2000). Residential development is permitted in some zones, while not in others. Maximum residential densities vary considerably across a city.[17] Changes to the zoning designation of a property must be adopted by the municipal government, and can be initiated by either a property owner or the local government (Hoch et al., 2000). Zoning changes may be applied at scales ranging from a single parcel to parcels across many neighborhoods. Below I assess the potential determinants of zoning changes.

Demand and supply factors

Housing demand within a metropolitan area is influenced by natural amenities and human-created locational advantages (Anas, Arnott, & Small, 1998; DiPasquale & Wheaton, 1996). Examples of natural amenities include the ocean or a location with a view. Human-created locational advantages include access to employment and cultural amenities (DiPasquale

[17] In Los Angeles, for example, residential density may be capped at less than one unit per acre in some agricultural zones, while in the densest zones over 200 housing units per acre may be permitted (City of Los Angeles, 2015f).

& Wheaton, 1996). Job accessibility was historically measured in terms of proximity to a central business district (Alonso, 1964; Muth, 1969), and this later gave way to a polycentric view of employment across a city (Anas et al., 1998; Small & Song, 1994). Transportation factors, like access to freeways and public transit, affect workers' access to job centers (Shen, 2001).

Supply constraints may be natural or human-made (Saiz, 2010). Natural features that constrain housing supply include water bodies, mountains, and wetlands (DiPasquale & Wheaton, 1996; Saiz, 2010). Natural features limit and direct the urban footprint relative to a featureless plane. Some constraints may also have an amenity dimension, if a parcel with a view (an amenity) is also on a steep slope (natural development constraint). The primary human-created constraints are land use regulations. Land use regulations constrain supply by limiting locations and densities of new development, adding standards for lots and buildings, and shifting costs from a municipality to a developer (Deakin, 1989). Regulations that constrain housing supply in major American metropolitan areas, particularly coastal ones, have contributed to the rise in housing prices (Glaeser, Gyourko, & Saks, 2005b; Glaeser & Ward, 2009; Kok et al., 2014; Quigley & Raphael, 2005). Lot size is also a constraint since small lots – particularly lots under 5,000 square feet – are more difficult to develop or redevelop (Landis, Hood, Li, Rogers, & Warren, 2006).

Homeowners and other interest groups

Interest groups influence the regulations that are adopted. Regulation is a product of competing interests seeking to rationally forward their self-interest, and this competition plays out through the political process (Posner, 1974; Stigler, 1971, p. 3). A handful of powerful interests are most active in proposing and influencing land use decisions, particularly the

development industry (Babcock, 1966; Fischel, 2005b; J. R. Logan & Molotch, 1987; Molotch, 1976; Stigler, 1971; Warner & Molotch, 2000), business associations (Cooper, Nownes, & Roberts, 2005; Heberlig, Leland, & Read, 2014), neighborhood organizations (Babcock, 1966; Fischel, 2005b; Frieden, 1979; Warner & Molotch, 2000), and environmental groups (Frieden, 1979; W. B. Fulton, 2001). Interest groups use votes and/or campaign contributions to influence politicians (Downs, 1957; Glaeser et al., 2005a; J. R. Logan & Molotch, 1987; Purcell, 2000; Schone, Koch, & Baumont, 2011). Homeowners, environmental groups, and owners of developed land are generalized as opposing growth, while owners of vacant land and the real estate development industry are viewed as pro-growth.

Homeowners and neighborhood associations are powerful interests in most cities, with an apparent economic rationale for opposing upzoning. Fischel (2004) argued that exclusionary regulations represent the "dominance of home-owners and their touchiness about their main asset" (p. 317). Existing homeowners have an incentive to increase the value of their homes, and they do not internalize the price increases for renters or future residents (Glaeser et al., 2005a). Locational characteristics affect the value of a home, and there are few mechanisms through which homeowners can protect their home equity (Fischel, 2005a). A home's value can be "reduced by changes in nearby land use, increases in neighborhood traffic, increases in local taxes, and decreases in the local school's test scores" (Fischel, 2005a, p. 400). Thus, the tendency for homeowners to become hyper-involved in local land uses issues. Homeowners have been very successful at protecting their interests, and preserving single-family neighborhoods is a central part of American land use regulation (Hirt, 2014; A. H. Whittemore, 2012).

Although land use debates are commonly portrayed as homeowner interests versus real estate development interests, scholars have operationalized the clash between interest groups

over land use and development in different ways. This has included vacant landowners versus neighboring owners of developed land (Hilber & Robert-Nicoud, 2013); homeowners versus developers (Been et al., 2014); the median voter and farmers versus developers (Chanel, Delattre, & Napoléone, 2014); homeowners and environmental groups versus developers (Hawkins, 2014); and voters versus non-voting interest groups (Schone et al., 2011). The median voter model, sometimes characterized as the median income household, represents the aim of elected officials to meet the needs of the electorate (Chanel et al., 2014; Fischel, 2005a; Romer & Rosenthal, 1979).

All of the studies above, with the exception of Been et al. (2014), took a cross-sectional view of zoning and development. There has been little research on the determinants of regulatory *change*. In the most relevant research on this topic, Been et al. (2014) assessed four aspects of the "growth machine" and "homevoter" theories: the presence and quality of public services, including schools, parks and transit; neighborhood market growth; neighborhood demographics, and voter turnout. The authors used multinomial logistic regression models and found empirical evidence of the homevoter explanation of zoning changes in New York City. In particular, neighborhood homeownership rates were associated with a higher probability of a parcel being downzoned and a lower probability of a parcel being upzoned. However, other relationships, including those related to city infrastructure capacity, were more ambiguous.

Modeling the strength of interest groups can be complicated because the political process is noisy and sometimes strong-willed minority groups can overcome weak-willed majorities: "The system is calculated to implement all strongly felt preferences of majorities and many strongly felt preferences of minorities but to disregard the lesser preferences of majorities and minorities" (Stigler, 1971, p. 12). Relatedly, Bishin (2009, p. 159) wrote that "[…] it is the

diverse nature of peoples' identities and preferences and the variation of intensities to which they correspond that make it possible for minorities to defeat majorities." In the case of land use and housing development policies, small but strong-willed groups often have disproportionate influence if they are more likely to vote and/or have financial resources.

Fiscal and environmental policy motivations

Scholars have studied local government motivations for exclusionary zoning (Fischel, 2004; Glaeser & Ward, 2009; Hamilton, 1978; Ihlanfeldt, 2004), with relatively little analysis about why municipalities might adopt more permissive regulations. Large central cities' motivations might include mitigating negative externalities from growth, increasing tax revenue, and reducing public service costs. Proponents of upzoning in transit-accessible areas argue that residential infill development will result in higher public transit ridership and consequently less road congestion, better air quality, and fewer greenhouse gas emissions (Cervero, 2004; Landis et al., 2006). This is the basis for climate change mitigation strategies, like California's Senate Bill 375, with a central strategy of increasing density near frequent-service public transit (Barbour & Deakin, 2012).

Municipal land use decision-making intended to generate property and/or sales tax revenues in excess of public service costs has been characterized as the "fiscalization of land use" (Chapman, 1998; Misczynski, 1986; Wassmer, 2002). Municipalities have economic and fiscal incentives to zone land for non-residential uses, for example (Boarnet & Crane, 1998). Cities should be motivated to maximize the use of available infrastructure and public facilities, including rail transit with additional capacity, parks, and high-performing schools (Been et al., 2014). Cities may believe that higher density neighborhoods facilitate more efficient public

service provision. Some scholars have found higher densities to be associated with lower per capita costs for some services (Carruthers & Úlfarsson, 2008; Carruthers & Ulfarsson, 2003), while others have found positive or non-linear relationships (Ladd, 1992, 1994). Recent practice-oriented publications, which may influence policymakers more than the sparse academic literature, report public service costs to be lower in smart growth areas (EPA Office of Sustainable Communities, 2012; W. Fulton, Preuss, Dodds, Absetz, & Hirsch, 2013; Litman, 2012).

The case of Los Angeles

Los Angeles, California is the second largest American city, with nearly 3.9 million residents spread across 469 square miles (United States Census Bureau, 2013b). It is a growing city within an expanding metropolitan region; in 1980, Los Angeles had less than 3 million residents, and in 2035, it is projected to have 4.3 million residents (Southern California Association of Governments, 2012b; United States Census Bureau, 1980). The city has residents and neighborhoods ranging from impoverished to some of the wealthiest in the world. The city is also an immigrant gateway, and more than 38% of the city's residents were born outside the United States (United States Census Bureau, 2013b). While Los Angeles is sometimes portrayed as a city of sprawling suburban single-family housing (Ewing, 1997), only about 38% of its housing units are detached single-family, and 64% of the city's households rent their housing (United States Census Bureau, 2013b).

Land use regulations and residential growth politics have been particularly contentious in Los Angeles (W. B. Fulton, 2001; Morrow, 2013; A. H. Whittemore, 2012). A well-known national regulatory survey, the Wharton Residential Land Use Regulatory Index, found Los

Angeles to be more than two standard deviations above the national mean on a measure of local political pressure related to development (Gyourko et al., 2008). Morrow (2013), studying the period between 1965 and 1992, wrote that Los Angeles "communities with time, money, and resources (including social capital) can resist change while those unable to mobilize bear the burden of future growth" (p. 4). Los Angeles has undergone several political regimes with different balances of homeowner and developer power, and today's local land use policy is dominated by "suburban anti-growth interests" (A. H. Whittemore, 2012, p. 404). There is some consensus that the historical Southern California "growth machine" has been severely weakened, and single-family homeowners now have the upper hand (W. B. Fulton, 2001; Purcell, 2000; A. Whittemore, 2010). As evidence, local and regional plans preserve single-family neighborhoods (City of Los Angeles, 2014e; Southern California Association of Governments, 2012a). For example, Southern California's regional sustainable communities strategy protects "stable existing single-family neighborhoods as future growth and a more diverse housing stock are accommodated in infill locations near transit stations" (Southern California Association of Governments, 2012a, p. 119).

Political dynamics do seem to be more favorable towards growth in rail and bus rapid transit (BRT) station areas, which tend to have higher shares of renters and multifamily development. A broad spectrum of interests has generally united to support transit and transit-oriented development (TOD). For instance, political support for Los Angeles's Measure R sales tax increase for transit came from a coalition of environmental, business, and labor interests, (Elkind, 2014). Despite a prominent coalition of supporters, there have been debates about transit and TOD. Controversies have centered on the region's emphasis on rail transit instead of buses, the neighborhood impacts of new higher-density development, and general issues of social

equity and TOD (Gehrke et al., 2010; Grengs, 2002; Zahniser, 2013). Most recently, a litigious neighborhood group successfully halted the transit-oriented Hollywood Community Plan and thwarted new development proposals in the area (Zahniser, 2014a, 2014b).

Data

To analyze the determinants of municipal upzoning, I create a detailed dataset of Los Angeles parcel and neighborhood characteristics. I begin with the approximately 788,000 parcels located in the city of Los Angeles based on county assessor data (Los Angeles County Assessor, 2012).

Regulations

I obtain Los Angeles municipal zoning spatial data from 2002 and 2014. The 2002 zoning data, the oldest available digitally (Butcher, 2015), provides the baseline for this analysis. The 2014 zoning data, the most recent available at the time of writing, represents the other bookend of my analysis. I use ArcGIS software to spatially join the geographic centroids of each parcel to the 2002 and 2014 Los Angeles zoning data.[18] For each zoning class in the city,[19] I calculate the maximum allowable residential density based on the minimum lot size per residential unit defined in the municipal code and adopted specific plans (City of Los Angeles, 2015f). For example, in the R3 (multiple dwelling residential) zone, the minimum lot size is 800

[18] Using centroids standardizes locations over my study period since parcels can be split or combined over time.

[19] Zoning classes represent the most general categories of zoning designation. The 2002 shapefile includes 65 zoning classes and the 2014 zoning shapefile includes 85 zoning classes. Zoning classes include common designations like "R1" (single-family residential), "C2" (commercial), and "M2" (manufacturing). The city's zoning data also include a smaller number of uncommon zoning classes associated with specialized land uses or adopted specific plans.

square feet per unit, which translates to about 54 dwelling units per acre.[20] I assign these allowable density attributes to each parcel and calculate each parcel's maximum residential "capacity" in 2002 and 2014 by multiplying the parcel's lot size by its allowable residential density.[21] I assign an indicator variable to each parcel representing where residential capacity increased – these are upzoned parcels.

[20] The calculation is 43,560 square feet per acre ÷ 800 square feet per unit = 54.45 allowable dwelling units per acre.

[21] In 1986, Los Angeles voters approved Proposition U, which limited development in commercial zones in Height District 1 to a floor area ratio of 1.5 across much of the city (City of Los Angeles, 2013d). Given Proposition U, high dwelling unit densities would be difficult or impossible to develop in affected zones, except perhaps in buildings composed of small studio apartments. However, since my focus here is on *changes* to regulations, I retain the base dwelling per acre allowances to compare 2002 and 2014 regulations.

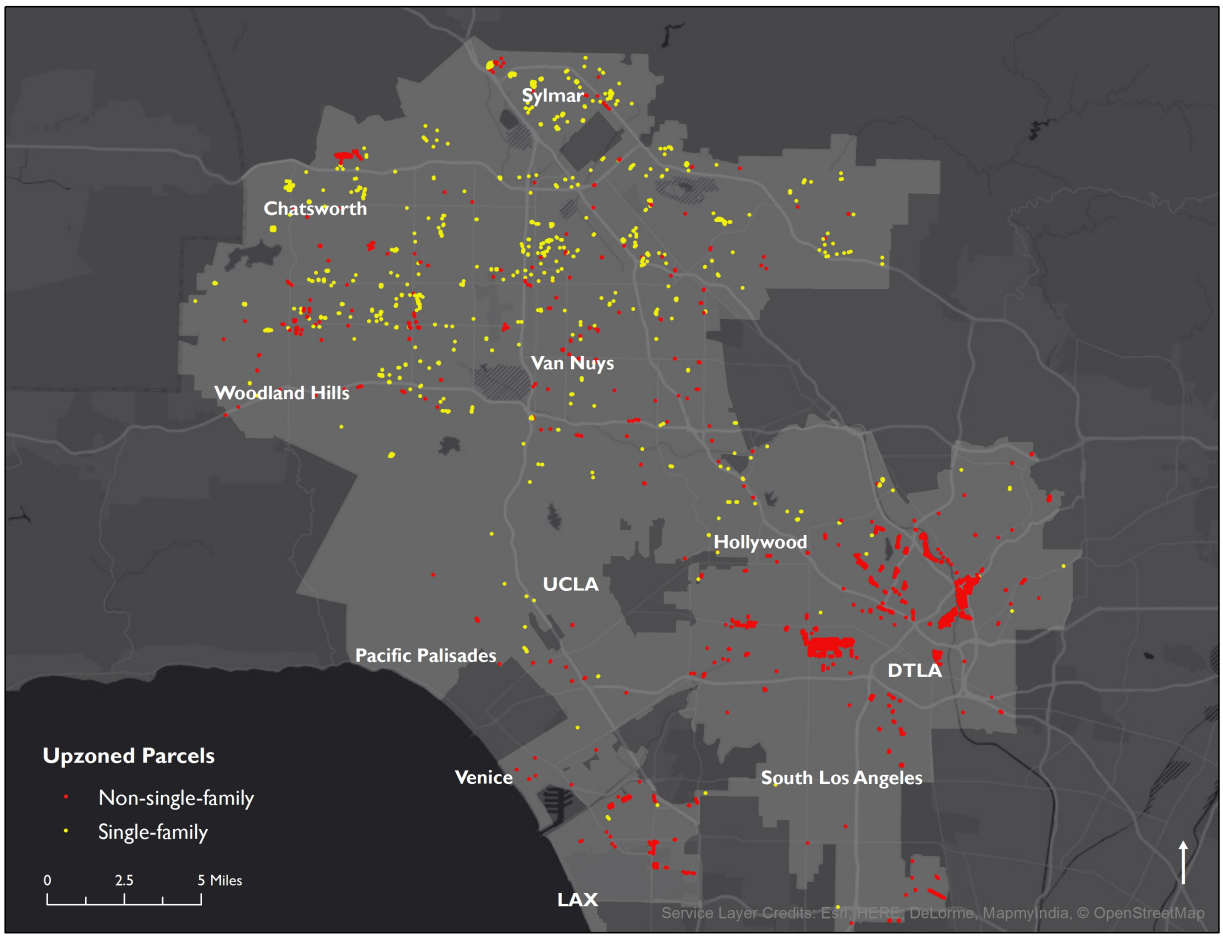


Figure 5. Upzoned parcels (2002-2014)

Housing and demographic characteristics

Most variables related to neighborhood characteristics and demographics are from the United States Census Bureau. I obtain 1990 and 2000 tract-level data related to population, housing, income, and race/ethnicity, and use the Longitudinal Tract Database (LTDB) crosswalk to adjust the older tract boundaries to 2010 tract boundaries (J. R. Logan, Xu, & Stults, 2014). I combine these data with 2009-2013 American Community Survey estimates (United States Census Bureau, 2013a). For the homeownership measure, I assign tracts to one of three ordered

categories: *low* for tracts in the bottom quartile of the city's neighborhoods, *average* for tracts in the middle two quartiles, and *high* for tracts in the top quartile.

Infrastructure and public services

Infrastructure and public services variables relate to rail transit and bus rapid transit (BRT), parks and open space, and school performance. First, rail and BRT station locations are based on the Center for Transit-Oriented Development's TOD database (Center for Transit-Oriented Development, 2011). I calculate the Euclidean distance from each parcel to the nearest rail transit or BRT station using ArcGIS. I create an indicator variable representing if a parcel is within a half mile of a transit station. For parks and open space, I use 2014 General Plan Land Use spatial data (Los Angeles City Planning Department, 2014) to calculate the Euclidean distance from each parcel to the nearest park of at least a quarter acre in size, consistent with Been et al. (2014).

School quality can be measured in terms of school inputs, school outputs or other related factors (Nguyen-Hoang & Yinger, 2011). I focus on standardized test scores, as measured by California's Academic Performance Index (API) 2013 Growth data (California Department of Education, 2015). Since API is the most widely available metric on California schools, it likely represents an influential factor in households' school quality assessments. However, standardized test scores may be an invalid measure of school quality because scores are influenced by students' in school *and* outside school experiences (Downey, Hippel, & Hughes, 2008). Despite this caveat, I proceed using API scores and concentrate on elementary schools because they are most closely tied to neighborhoods. However, open enrollment policies, on a space-available basis, mean that near one-third of children attend schools outside their attendance zone (Ledwith,

2010). Given this issue, I create an inverse distance-weighted measure of neighborhood API score, with the scores of schools closest to each parcel weighted more than the scores of schools farther away.[22]

Other measures of accessibility, amenities, and natural features

Other variables are related to employment density, job accessibility, distance to the nearest freeway ramp, distance to the ocean, elevation, and slope. Employment density per acre is calculated using 2000 Census Transportation Planning Package (CTPP) tract-level data (United States Department of Transportation, 2000). The inverse distance-weighted employment accessibility measure is from Lens (2014) based on 2000 CTPP data (United States Department of Transportation, 2000). The Euclidean distance from each parcel to the nearest freeway ramp is calculated using CalTrans Enhanced National Highway System data (California Department of Transportation, 2013). The Euclidean distance from each parcel to the ocean is calculated using USGS California shoreline data (Hapke, Reid, & Borrelli, 2008). The elevation of each parcel centroid is calculated using the United States Geological Survey's ten foot digital elevation model for Los Angeles County (United States Geological Survey, 2006). Lastly, the slope in degrees of every parcel is calculated using the same digital elevation model and ArcGIS Slope tool (Esri, 2011; United States Geological Survey, 2006).

[22] I set an outer distance for this measure at 5,000 meters (about 3.1 miles), which is a reasonable buffer for capturing alternative neighborhood school options that are relatively convenient given open enrollment policies.

Table 3. Descriptive statistics of parcel variables

	Non-single-family parcels			*Single-family/residential estate/agricultural parcels*		
Variable	**Obs**	**Mean**	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**
Upzoned parcels	350,866	0.02	0.13	437,472	0.01	0.07
Distance to freeway ramp (miles)	350,866	0.82	0.70	437,472	1.12	0.85
Employment accessibility measure (2000)	350,866	617.31	190.36	437,472	473.27	177.67
Half mile to rail or BRT station (indicator)	350,866	0.19	0.39	437,472	0.06	0.23
Distance to beach (miles)	350,866	10.23	4.42	437,472	11.36	4.97
Neighborhood API score in tens)	350,866	80.79	5.32	437,472	83.08	5.64
Distance to quarter-acre park (miles)	350,866	0.29	0.22	437,472	0.31	0.24
Elevation (in 100s of feet)	350,866	3.91	3.27	437,472	6.80	4.00
Slope above 25% (indicator)	350,866	0.15	0.36	437,472	0.21	0.41
Lot size (acres)	350,866	1.21	7.21	437,472	0.32	2.64
Historic Preservation Overlay Zone (2002, indicator))	350,866	0.02	0.13	437,472	0.01	0.08
Residential development allowed (2002, indicator)	350,866	0.90	0.30	437,472	1.00	0.00
Over 100 units/acre allowed (2002, indicator)	350,866	0.20	0.40	437,472	0.00	0.00
Adaptive Reuse Ordinance area (2002)	350,866	1.06	0.23	437,472	1.00	0.01
Years since last Community Plan update (based on 2014)	350,865	15.18	3.40	437,471	16.08	2.90
Population density (2000, in 1000s of persons/sq. mi.)	350,705	13.37	10.24	435,827	7.05	4.73
Employment density (2000, in 1000s of jobs/sq. mi.)	350,866	7.30	14.70	437,472	2.31	3.68
Percent owner-occupied housing units (2000)	350,705	0.34	0.21	435,827	0.63	0.21
Median household income (2000, in 1000s of $US)	350,705	38.19	19.70	435,827	60.43	31.25
Percent Hispanic (2000)	350,705	0.44	0.28	435,827	0.31	0.26

Methods

My conceptual model is that parcel upzoning is a function of housing demand and supply factors, the influence of local homeowners, and municipal fiscal policy goals. Table 4 summarizes the expected relationships between upzoning and each category of predictor. In general, demand factors and municipal policy objectives would be expected to lead to upzoning. Strong homeowner interests, in contrast, would most likely hinder upzoning proposals. The expected relationships are more ambiguous for natural features and baseline regulations.

Table 4. Expected relationships between categories of determinants and upzoning

Category of determinant	Expected relationship with upzoning
Accessibility	Positive
Amenities	Positive
Natural features	Ambiguous, depending on the relative degree to which the feature acts as an amenity or supply constraint.
Existing regulations	Ambiguous, depending on the regulations at baseline. Generally parcels with most restrictive zoning are expected to be unlikely to be upzoned. Meanwhile, parcels with the most permissive zoning are unlikely to be further upzoned.
Municipal fiscal interests	Positive
Homeowner interests	Negative

Logistic regression models are appropriate for analyzing relationships between a binary dependent variable and a set of covariates (Hosmer, Lemeshow, & Sturdivant, 2013). One of the assumptions of logistic regression, however, is that observations are independent (Hosmer et al., 2013). In my dataset, this assumption is violated because parcels are clustered into neighborhoods. Not addressing clustered data increases the risk of incorrectly concluding that a covariate is statistically significant and/or specifying a poorly fitted model (Hosmer et al., 2013; Neuhaus, 1992). The two primary modeling strategies for addressing clustered data include population-average models and mixed-effects models (Gibbons, Hedeker, & DuToit, 2010;

Hosmer et al., 2013; Neuhaus, 1992). Population-average models are fixed-effects models that apply generalized estimating equations to adjust estimates of the variance (Gibbons et al., 2010; Hosmer et al., 2013). The population-average model "is likely to be the best model for correlated data when the objective of the study is to describe, in broad terms, the effects of the covariates" (Hosmer et al., 2013, p. 326).[23]

I specify population-average logistic regression models in the general form of Equation 1. The dependent variable in my models is a binary measure of whether a parcel was upzoned between 2002 and 2014. Model predictors relate to amenities, accessibility, natural features, land use regulations, infrastructure, population and employment density, and demographics (Table 5). I include City Council district fixed effects to control for unobservable within-city variation related to geographic and political factors. I cluster standard errors by Census tract using the VCE cluster option with the 'logistic' command in Stata 13 (StataCorp, 2013).

Equation 1. Logistic regression model of parcel upzoning

$$Upzoning_i = \alpha + \beta_1 Accessibility_i + \beta_2 Amenities_i + \beta_3 Natural_i + \beta_4 Regulations_i + \beta_5 Municipal_i + \beta_6 Homeowner_i + \beta_8 OtherControls_i + \beta_9 CityCouncil_i + \varepsilon_i$$

[23] As a robustness check, I specify a mixed-effects model, but it failed to converge in the Stata or R software packages. Mixed-effects models may be more feasible using a smaller dataset with fewer second-level units and covariates.

Table 5. Covariates in logistic regression models

Category	Variable Description
Accessibility	Distance to freeway ramp (miles)
	Employment accessibility measure (2000)
	Half mile to rail or BRT station (indicator)
Amenities	Distance to beach (miles)
	Elementary school API score (2013, in hundreds)
	Distance to quarter-acre park (miles)
	Elevation (in 100s of feet)
Natural features	Slope above 25% (indicator)
Regulations and human-made constraints	Lot size (acres)
	Historic Preservation Overlay Zone (2002, indicator)
	Residential development allowed (2002, indicator)
	Over 100 units/acre allowed (2002, indicator)
	Adaptive Reuse Ordinance area (2002)
	Years since last Community Plan update (based on 2014)
Municipal fiscal interests	Population density (2000, in 1000s of persons/sq. mi.)
	Employment density (2000, in 1000s of jobs/sq. mi.)
Homeowner interests	Percent owner-occupied housing units (2000)
Other neighborhood demographics	Median household income (2000, in 1000s of $US)
	Percent black (2000)
	Percent Hispanic (2000)

I specify separate models for parcels that were zoned for single-family housing ("SF" parcels) and those that were not ("non-SF" parcels).[24] I split these two general types of parcels because the literature and a review of Los Angeles-specific policies indicate different decision processes given strong single-family neighborhood protections in local land use policy. I also stratify my data by three subareas within Los Angeles, based on the city's Area Planning Commission (APC) boundaries, shown in figures 6 and 7. The first is the San Fernando Valley, composed of the North Valley APC and the South Valley APC. The second is what I call central

[24] Single-family parcels include parcels zoned for agricultural uses (A1 and A2 zoning designations).

Los Angeles, composed of the Central APC, East Los Angeles APC, South Los Angeles APC, and the Harbor APC. The third is west Los Angeles, which includes the entirety of the West Los Angeles APC. In these models, I also include City Council district fixed effects and cluster standard errors by Census tract.

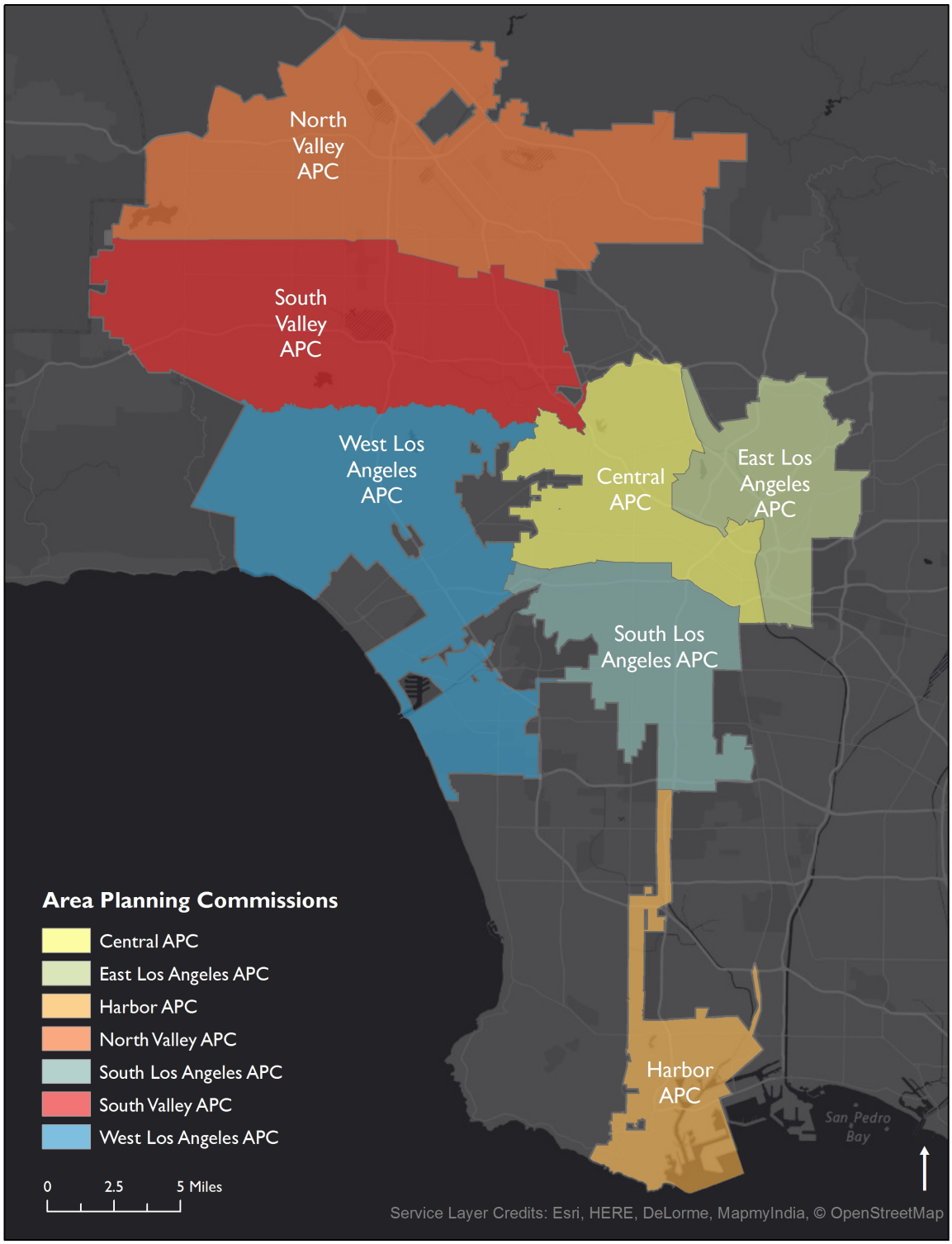


Figure 6. Area Planning Commissions defined by the city of Los Angeles

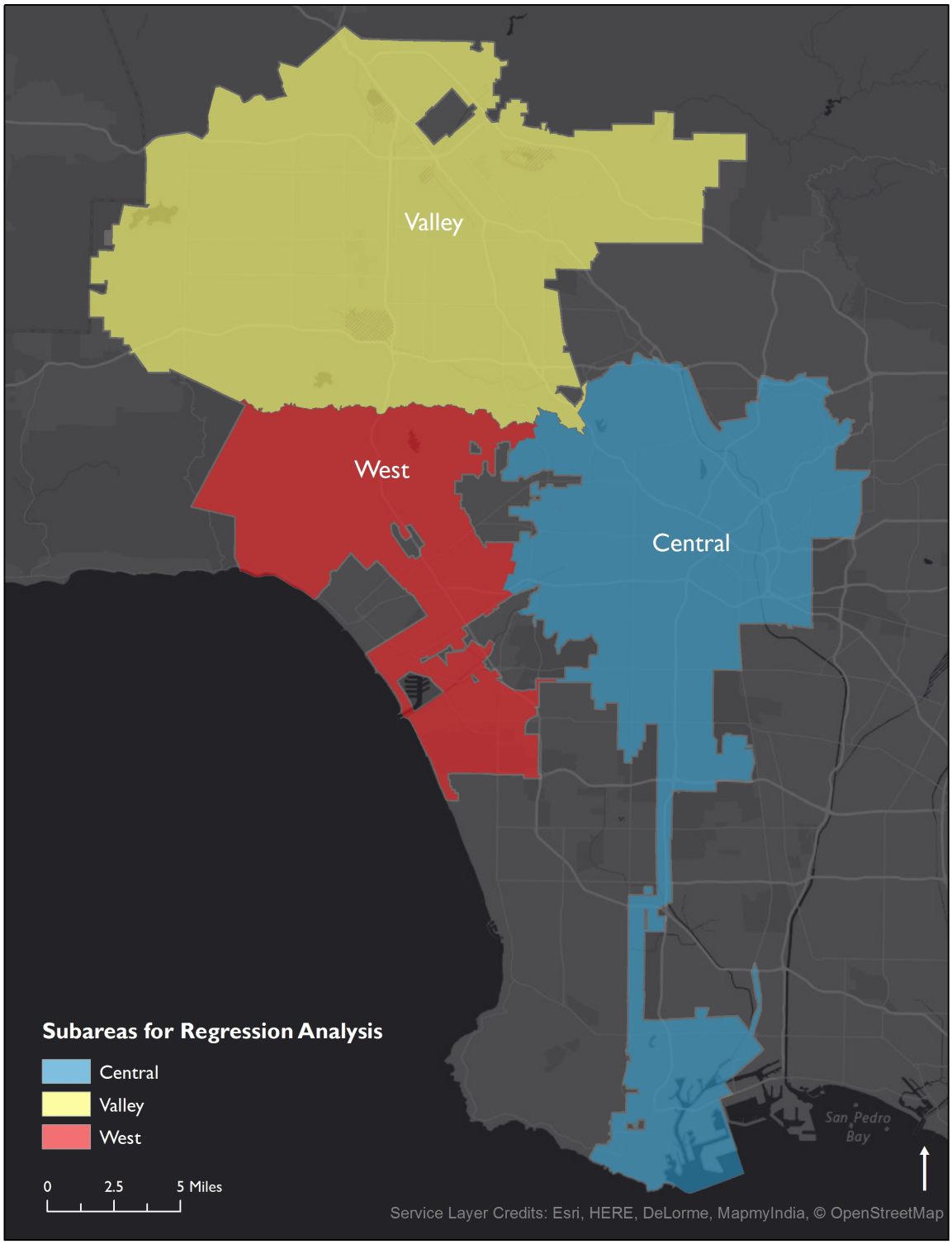


Figure 7. Three subareas for regression analysis

Endogeneity is a methodological issue in most of the literature on land use regulations and housing markets (Quigley & Rosenthal, 2005). At issue is the simultaneity of influences; neighborhood characteristics affect zoning, and zoning affects neighborhood characteristics (Pogodzinski & Sass, 1994; Quigley & Rosenthal, 2005). I address endogeneity in two ways. First, I incorporate a dependent variable that represents zoning change, rather than cross-sectional characteristic of zoning. Second, given that zoning decisions are related to existing land uses and demographics, I control for each parcel's baseline characteristics.

Logistic regression results are commonly reported as the natural log of odds (Hosmer et al., 2013). These can be difficult to interpret, so I report odds ratios. The odds ratios in this paper represent the odds of a parcel being upzoning compared with the odds of a parcel not being upzoned. Statistically significant values greater than one mean that as the predictor variable increases, so do the odds of a parcel being upzoned. Values lower than one mean that as a predictor increases, the odds of a parcel being upzoned decrease.

Results and discussion

Upzoning was a relatively rare event in Los Angeles, with about 1% of the city's land area upzoned in the twelve-year study period. But, while the overall degree of change is low, I find considerable variation within baseline zoning categories: the city upzoned 17% of parcels zoned for parking, 5.9% of those zoned for manufacturing, and 4.6% of those zoned for agricultural uses. By contrast, only 0.2% of lots zoned for single-family were upzoned. These figures are shown in Table 6.

Table 6. Upzoned parcels by zoning category (2002-2014)

	Upzoned Parcels	Total Parcels	Percent Upzoned
Agricultural	1,465	32,081	4.6%
Residential Estate	212	117,347	0.2%
Single-Family Residential	537	288,060	0.2%
Multiple Residential	2,546	264,900	1.0%
Commercial	1,054	54,519	1.9%
Manufacturing	1,424	24,025	5.9%
Parking	224	1,307	17.1%
Open Space	59	2,978	2.0%
Public Facilities	324	3,121	10.4%
Total	**7,845**	**788,338**	**1.0%**

Below, Table 7 summarizes the regression results from the citywide models. The non-single-family model fits better than the single-family model. The McFadden's R-squared statistic for the non-SF model was 0.37 compared with 0.16 for the single-family model. Many of the upzoned single-family parcels were in the San Fernando Valley, and it was more difficult to predict where these would be located. As described below, the parcels with the highest likelihood of being upzoned were near downtown or located at the urban fringe, zoned for employment uses (e.g., industrial, warehousing etc.), and in neighborhoods with larger shares of renters. Upzoning was less likely in beach-accessible areas, and in neighborhoods with higher concentrations of homeowners. The results by large area were mostly similar, with an exception related to homeownership in west Los Angeles, described and shown below (Table 8).

Table 7. Logistic regression results for upzoning (odds ratios)

Variables	(1) All Parcels Odds Ratio	(2) Non-SF Parcels Odds Ratio	(3) SF Parcels Odds Ratio
Distance to freeway ramp (miles)	0.723	0.543*	0.964
	(0.152)	(0.160)	(0.152)
Employment accessibility measure (2000)	1.000	1.001	0.996
	(0.00334)	(0.00431)	(0.00321)
Half mile to rail or BRT station (indicator)	0.948	0.919	1.125
	(0.359)	(0.393)	(0.404)
Distance to beach (miles)	1.389***	1.563**	1.167
	(0.129)	(0.217)	(0.113)
Neighborhood API score	0.897*	0.848**	1.041
	(0.0453)	(0.0489)	(0.0684)
Distance to quarter-acre park (miles)	0.528	1.110	0.484
	(0.398)	(1.097)	(0.279)
Elevation (in 100s of feet)	0.854	0.788	0.839*
	(0.0963)	(0.136)	(0.0574)
Slope above 25% (indicator)	1.314	1.089	2.878***
	(0.499)	(0.550)	(0.776)
Lot size (acres)	1.001	0.989	1.016**
	(0.00284)	(0.0154)	(0.00496)
Historic Preservation Overlay Zone (2002, indicator)	0.0465***	0.0321***	
	(0.0345)	(0.0247)	
Residential development allowed (2002, indicator)	0.130***	0.149***	
	(0.0532)	(0.0736)	
Over 100 units/acre allowed (2002, indicator)	0.00832***	0.00552***	
	(0.00975)	(0.00672)	
Adaptive Reuse Ordinance area (2002)	1.997	2.134	
	(1.817)	(1.913)	
Years since last Community Plan update (based on 2014)	0.923	0.866**	1.003
	(0.0412)	(0.0412)	(0.0571)
Population density (2000, in 1000s of persons/sq. mi.)	1.028	1.037	0.892**
	(0.0221)	(0.0250)	(0.0309)
Employment density (2000, in 1000s of jobs/sq. mi.)	0.966	0.959	0.980
	(0.0368)	(0.0393)	(0.0502)
Average homeownership vs. low homeownership (tract)	0.165***	0.170**	0.194**
	(0.0896)	(0.114)	(0.100)
High homeownership vs. low homeownership (tract)	0.0564***	0.0356***	0.0803***
	(0.0426)	(0.0347)	(0.0479)
Median household income (2000, in 1000s of $US)	1.023*	1.061**	0.985
	(0.0116)	(0.0206)	(0.0114)

Percent black (2000)	0.000316***	2.34e-05***	10.28
	(0.000770)	(7.35e-05)	(29.79)
Percent Hispanic (2000)	0.112**	0.120*	0.510
	(0.0868)	(0.109)	(0.739)
Observations	786,510	350,688	431,198
City Council District FE	YES	YES	YES

Robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05

Table 8. Logistic regression results for upzoning by area (odds ratios)

Variables	(1) Valley Odds Ratio	(2) Central Odds Ratio	(3) West Odds Ratio
Distance to freeway ramp (miles)	0.816	0.925	0.115
	(0.190)	(0.335)	(0.197)
Employment accessibility measure (2000)	0.992	0.998	0.976
	(0.00444)	(0.00440)	(0.0128)
Half mile to rail or BRT station (indicator)	0.829	1.103	
	(0.253)	(0.531)	
Distance to beach (miles)	1.086	1.665**	2.162*
	(0.108)	(0.280)	(0.822)
Neighborhood API score	1.000	0.871*	0.863
	(0.0591)	(0.0608)	(0.104)
Distance to quarter-acre park (miles)	2.423	0.0390**	0.711
	(2.520)	(0.0471)	(0.544)
Elevation (in 100s of feet)	0.860*	0.282*	0.790
	(0.0624)	(0.143)	(0.130)
Slope above 25% (indicator)	1.578	2.056	1.891
	(0.509)	(1.216)	(1.310)
Lot size (acres)	0.997	1.014	0.994
	(0.00599)	(0.00912)	(0.00643)
Historic Preservation Overlay Zone (2002, indicator)		0.0877**	
		(0.0682)	
Residential development allowed (2002, indicator)	0.172***	0.146**	0.0520**
	(0.0613)	(0.0992)	(0.0468)
Over 100 units/acre allowed (2002, indicator)		0.00520***	
		(0.00663)	
Adaptive Reuse Ordinance area (2002)		1.788	
		(1.323)	
Years since last Community Plan	1.166	0.857*	0.986

update (based on 2014)	(0.155)	(0.0599)	(0.0716)
Population density (2000, in 1000s of persons/sq. mi.)	0.882**	1.031	0.913
	(0.0358)	(0.0264)	(0.164)
Employment density (2000, in 1000s of jobs/sq. mi.)	0.908	0.932	1.089**
	(0.0651)	(0.0385)	(0.0355)
Average homeownership vs. low homeownership (tract)	0.142***	0.195*	1.319
	(0.0724)	(0.138)	(1.903)
High homeownership vs. low homeownership (tract)	0.0296***	0.169	1.092
	(0.0248)	(0.219)	(2.204)
Median household income (2000, in 1000s of $US)	1.018	0.964	0.995
	(0.0131)	(0.0370)	(0.0109)
Percent black (2000)	10.99	6.38e-06***	0.0253
	(45.99)	(1.64e-05)	(0.0711)
Percent Hispanic (2000)	0.983	0.0266***	0.000941
	(1.245)	(0.0293)	(0.00402)
Observations	322,643	334,715	105,470
City Council District FE	YES	YES	YES

Robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05

Accessibility

Freeway access, rail and BRT proximity, and employment proximity are measures of a parcel's accessibility. First, freeway access is positively associated with upzoning for non-SF parcels; for every mile increase in distance from a freeway ramp, the odds of a parcel being upzoned are nearly halved. For single-family parcels, there is no significant association between freeway access and upzoning. Second, there is no significant association between location in a rail or BRT station area and upzoning for either set of parcels. Third, there is no significant association between employment proximity and the odds of upzoning.

The positive relationship between freeway proximity and upzoning highlights the continued value placed on auto accessibility in Los Angeles. Although the city is becoming more transit-oriented, the large majority of commuters still travel by car (United States Census Bureau, 2013b). This may explain why proximity to a rail or Bus Rapid Transit station is not a significant

determinant of upzoning. There are several other reasons why Los Angeles's increasing transit-orientation is not indicated in the regression results. One is that the city's rail and BRT lines run through some areas that already had permissive zoning, including downtown Los Angeles. Another is that some upzoning around stations was approved prior to 2002, such as the Vermont/Western specific plan for four station areas near Hollywood (City of Los Angeles, 2001d). Additionally, some recent transit-oriented policy initiatives are still tentative, including the draft transit neighborhood plans around ten rail stations (City of Los Angeles, 2013b; Los Angeles Department of City Planning, 2015a). Lastly, some of the proposed plans to upzone near transit were not successful, like the Hollywood Community Plan (Zahniser, 2013). It is reasonable to expect different results if this study was repeated in five or ten years.

Amenities

Parcels nearer to the beach, higher performing schools, and/or in hillier areas are generally associated with lower odds of upzoning. For all parcels, proximity to the ocean is associated with reduced odds of upzoning. For non-SF parcels, for every mile farther from the beach, the odds of a parcel being upzoned increase by 56%. For single-family parcels, there is no significant association. Higher performing schools are associated with lower odds of upzoning non-SF parcels. For every one hundred-point increase in neighborhood API score, the odds of a non-SF parcel being upzoned decrease by 15%. There is no significant association between school performance and single-family parcel upzoning. In general, parcels in central Los Angeles with higher test scores are associated with lower odds of upzoning, while the relationships are not significant in the San Fernando Valley or in west Los Angeles.

In terms of open space, there is no significant association citywide between proximity to a park and upzoning. General park proximity may be so common that it is not a major driver of demand. Over 80% of parcels in the city are within a half-mile of a moderately sized park. But, in central Los Angeles, parcels nearest to parks were much less likely to be upzoned. These neighborhoods tended to have fewer parks than other parts of the city, and there was little or no upzoning near some of the biggest open spaces, including Griffith Park, Exposition Park, and MacArthur Park. Lastly, for every one hundred feet in elevation gain, single-family parcels have 16% lower odds of being upzoned. Higher elevation parcels in central Los Angeles are even less likely to be upzoned, largely explained by the dearth of upzoning in the Hollywood Hills. This seems reasonable if higher elevation single-family sites are more likely to have good views or more difficult transportation access. There are no significant associations between elevation and upzoning for non-SF parcels.

Steep slopes

I measure whether a parcel is on a steep slope, defined as a slope of 25% or higher. There is no significant association between steep slopes and upzoning for non-SF parcels. However, somewhat surprisingly, single-family parcels on steep slopes have more two times higher odds of being upzoned. There are several possible explanations. First, 25% slopes may not represent a major development constraint.[25] Second, steep slopes may, in addition to being a development constraint, represent a view, which drives demand and increases the likelihood of upzoning.

[25] A 25% slope is equivalent to 14 degrees. I note that Saiz (2010) defined steep slopes as those above 15% or less than 9 degrees.

Third, single-family sites with slopes may have been historically overlooked for development, and now are being viewed as a building opportunity.

Regulations and lot characteristics

I considered a handful of other human-created characteristics that could affect whether a parcel was upzoned. First, historic preservation overlay zones (HPOZ) effectively stop subsequent zoning changes. A non-SF parcel located in a HPOZ is associated with 97% lower odds of upzoning. There were only about a dozen such HPOZ parcels modestly upzoned between residential categories in the Angelino Heights and Highland Park areas. There were no single-family parcels in HPOZs upzoned between 2002 and 2014 (thus the empty coefficient in the regression results). Again, historic preservation overlays seem to fulfill their mission by stopping zoning changes. This is of policy interest as Los Angeles has expanded its HPOZ coverage considerably since 2000. Between 2000 and 2015, the city adopted 21 of its 29 HPOZ and another four historic preservation zones have been proposed and are in the adoption process (City of Los Angeles, 2015e).

Second, parking, manufacturing, and agricultural zoned parcels are much more likely to be upzoned than multifamily or commercial zoned parcels. Overall, lower-intensity land uses are more likely to be upzoned than higher intensity ones. Relatedly, parcels where allowable densities exceed 100 dwelling units per acre in 2002 are unlikely to be further upzoned. That is, upzoning is less likely in the highest density zones, demonstrating the ceiling to the city's baseline density (before any density bonuses or variances). Third, there is no significant relationship between a parcel being located in an adaptive reuse ordinance (ARO) area and being upzoned. The ARO makes it easier to convert existing buildings from commercial or industrial uses to a residential use without a variance, and removes these properties from minimum parking

requirements, as long as the redevelopment did not remove parking (Manville, 2013). A likely explanation is that these areas already tend to have permissive density allowances, which limits the extent to which there is further upzoning.

Lastly, I analyze the relationship between community plan updates and zoning decisions. Community plans are the city's district-level plans to implement the citywide general plan (City of Los Angeles, 2015d). For non-SF parcels, for every year since a community plan is last updated, there are about 13% lower odds of a parcel being upzoned.[26] There is no significant association between plan age and upzoning in single-family neighborhoods. In central Los Angeles, every additional year of plan age reduces the likelihood of a parcel being upzoned by about 14%. This supports the idea that zoning is an implementation tool of planning, and that upzoning is less likely without prior planning. Lastly, I looked at lot size. For non-SF parcels, there is no significant relationship between lot size and the likelihood of upzoning a parcel. One explanation is that large-scale city-initiated upzonings, like specific plans, include parcels of a variety of sizes. For single-family parcels, there is a small positive relationship between parcel size and upzoning.

Homeowners

The "homevoter" hypothesis predicts and explains homeowner opposition to upzoning and new residential development (Fischel, 2005a). The results from both models strongly support this hypothesis. All else equal, a parcel in a neighborhood with a higher share of homeowners is much less likely to be upzoned than one where there is a larger share of renters. This holds true

[26] The age of each community plan is calculated as 2014 minus the year of last update.

for both non-SF and single-family parcels, and is the most consistent result across both sets of models. For non-SF parcels, the odds of upzoning in an area with average homeownership is about 83% lower than one in a neighborhood with low homeownership. The odds of upzoning a parcel in a high ownership neighborhood is about 96% lower than in a low ownership neighborhood. For single-family neighborhoods, the odds lower by 80% and 92% respectively. Figure 8 shows the homeownership rate of Census tracts where parcels were upzoned.

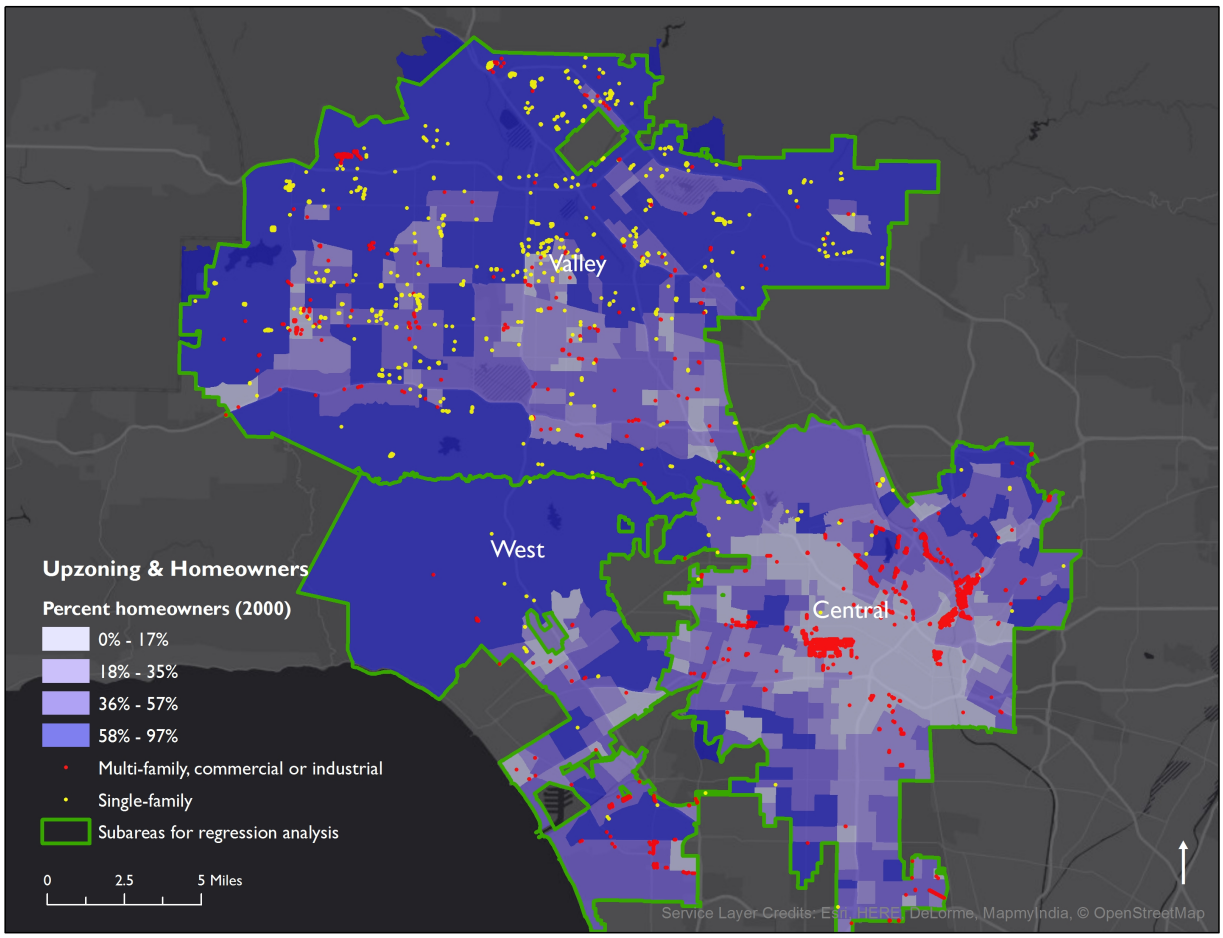


Figure 8. Upzoned parcels (2002-14) and Census tract homeownership rates (2000)

There is some variation in the relationship between homeownership rates and upzoning in the three subareas of Los Angeles. In the San Fernando Valley, upzoning is much less likely for parcels in neighborhoods with average or high homeownership rates compared with neighborhoods with few homeowners. In central Los Angeles, neighborhoods with average homeownership rates are less likely to be upzoned, but there was no statistically significant difference between low and high ownership neighborhoods in terms of upzoning. Here neighborhoods with average homeownership rates are less likely to be upzoned than neighborhoods with low or high homeownership rates.

The most unexpected result comes from west Los Angeles – which has been notoriously anti-growth since the 1960s (A. H. Whittemore, 2012) – and where there is no statistically significant association between homeownership and the likelihood of upzoning. How could this be? First, upzoning was disproportionately rare in west Los Angeles altogether; the city upzoned only about 278 acres (less than 0.5% of the land area) between 2002 and 2014. About half of this was in the Westchester/Playa Vista area, where the city entitled new large-scale mixed-use developments and the area gained a reputation as Los Angeles's "Silicon Beach" technology hub. This area had moderate to high homeownership rates coupled with wide swathes of undeveloped or low-intensity land uses that were ripe for redevelopment. Beyond this, there was little other notable systematic upzoning in west Los Angeles, regardless of neighborhood homeownership rates.

Population and employment density

There are no significant associations between population density and the odds of upzoning a non-SF parcel, but there are higher odds of upzoning single-family parcels in lower

density neighborhoods. This is reasonable since many of the upzoned single-family parcels were originally zoned for agricultural uses, and located at the edge of the city. This is affirmed by the significant negative relationship between population density and the likelihood of upzoning in the San Fernando Valley. Citywide, there are no significant associations between employment density and the odds of upzoning a parcel. Only for west Los Angeles is there a positive association between employment density and upzoning. These results do not support the idea that achieving density-related public service efficiencies is a major municipal determinant of upzoning.

Conclusions and policy implications

This research supports the homevoter hypothesis, and adds empirical evidence to past scholarship about powerful homeowner influence in Los Angeles (Morrow, 2013; A. H. Whittemore, 2012). Homeowners – and more specifically homeowners with access to valuable amenities – are associated with regulatory stasis. Valuable amenities include beach proximity, better performing schools, and hillier neighborhoods. The current political dynamic in Los Angeles, and undoubtedly many other American cities, is one in which the most desirable areas are also the most difficult to upzone. This presents a major barrier to using infill development to focus urban growth, as envisioned by local, regional, and state policymakers. But, we need to further explore why and how some homeowners oppose growth. In particular, a tiny vocal minority of homeowners can fight a development, so it is entirely possible for neighborhoods with moderate or even low homeownership rates to successfully oppose growth. Additionally, there may be opposition from commercial property owners or other stakeholders. A good example is the Hollywood neighborhood, where a small group of litigious local property owners

has fought growth despite neighborhood homeownership rates well below the citywide average. Future research should explore the interaction between existing residents, the existing built environment, and development proposals.

Upzoning is most likely on sites with lower-intensity land uses, like parking, agriculture, and manufacturing. This is consistent with basic economic theory about the transition of land uses to the highest and best use in a growing city. Upzoning these types of parcels usually represents a sizable increase in allowable density. For parking and manufacturing zoned parcels, residential development was not even allowed at the outset of my study period, and upzoning enabled higher-density residential development where it was previously forbidden. Parking, agriculture, and manufacturing parcels also tend to be located nearer fewer residents (and homeowners). This helps explain why upzoning takes the path of least resistance in terms of proximity to existing residents. But, this could be problematic over the long-term, because there is a limited supply of such land in higher-demand locations, and redevelopment for residential uses may have adverse impacts on local employment.

This paper has several limitations that provide opportunities for future research. First, I use a binary measure of zoning change. The planning and development process is much more nuanced than this, and future research could involve shadowing planners and developers as they evaluate the existing zoning code and navigate the development approval process. If much of the development approval process is negotiated, this would provide insights into the circumstances under which higher density allowances can be successfully brokered. Second, my analysis does not include parcels that were proposed for upzoning, but for which upzoning was not approved or adopted. These data were not available in any systematic form. Third, my model does not address property owners' endogenous knowledge of where zoning changes are likely to be

approved (Quigley & Rosenthal, 2005). Property owners who thought that an upzoning approval was unlikely – due to expected neighborhood opposition or other factors – may have chosen to forgo the time and expense of attempting to change their zoning.

The Los Angeles case expands our understanding of barriers to density-increasing land use regulatory changes. For scholars, there was previously sparse empirical evidence about the magnitude and characteristics of zoning change within cities. My contribution is quantifying the degree to which upzoning occurred and identifying the primary determinants of this upzoning. For planners and policymakers aspiring to increase residential densities, this paper shows where upzoning is most likely today, and the types of neighborhoods where roadblocks may necessitate more aggressive policy approaches.

Conflicts over zoning are as old as zoning itself. William Munro, the vice president of the National Municipal League in 1931, observed that rezoning is not usually approached "from the standpoint of what the city needs, but of what the private owners desire and what their immediate neighbors feel disinclined to let them have" (Babcock, 1966, p. 12). To overcome this dynamic, planners will need to tailor neighborhood and citywide solutions to increase density. If local residents are concerned about protecting their access to amenities and existing neighborhood character, planners can partially mitigate these concerns through clearly written and predictably applied urban design standards, and linking new development with public improvements. Additionally, some consistent citywide policy changes may be more politically feasible than ad hoc neighborhood-scale policy changes. For example, the city could change accessory dwelling unit standards citywide (rather than in a few areas), or minimum parking standards near all of the city's rail transit stations. In short, upzoning is possible, but will take a nuanced approach at both the neighborhood and citywide scales.

Chapter 3: Do Regulations Constrain Housing Production? An Analysis of Zoning and Transit-Oriented Development

Economists, urban planners, and environmentalists often argue for urban densification based on efficiency, equity, and/or environmental rationales. Certain land use regulations, however, may stand in the way of achieving these goals. While there is evidence that regulations hinder housing production in a general sense (Glaeser & Ward, 2009; Quigley & Raphael, 2005), there are gaps in the scholarly literature about how specific zoning provisions affect the rate of new housing development within cities. Some zoning requirements may be major barriers to new housing construction while other provisions may be largely symbolic. There is particularly little empirical evidence about developments approved "by-right" versus through a discretionary process. By exploring associations between regulatory and housing market variables, and examining the regulations that developers commonly propose to exceed, I provide evidence about which regulations are most constraining. These are issues important to scholars of land use, and to planners and policymakers as they adapt land use regulations to the challenges of environmental sustainability and housing affordability.

Economists and urban planners approach the study of regulations and residential development from different, though largely complementary perspectives. Economists most often analyze within-metro and between-metro variation in land use regulations and broadly quantify their effects on housing production and prices (Glaeser & Ward, 2009; Ihlanfeldt, 2007; Kok et al., 2014; Quigley & Raphael, 2005). Urban planning scholars use a mix of methods to examine how land use regulations enable or obstruct desired outcomes, including development near transit, affordable housing, efficient public service provision, and racial and economic

integration (Boarnet & Crane, 1997; Landis et al., 2006; J. Levine, 2006; R. Pendall, 2000). In this paper, I bridge these perspectives by analyzing whether land use regulations constrain multifamily housing production.

Los Angeles – with its large size, diversity of land use regulations, and growing transit network – presents a good case for studying these questions. To examine regulations and multifamily housing in Los Angeles, I combine a regression approach with an analysis of recent residential development near four rail stations. I specify negative binomial regression models of multifamily housing production citywide, in neighborhoods within a half-mile of a transit station, and in neighborhoods farther away from a transit station. I then pilot a detailed comparison of regulations and actual building characteristics for recent residential developments in Los Angeles's oldest transit-oriented development planning area.

Citywide, I find a strong positive association between initial high-density zoning and multifamily production. There is also a positive relationship between density-increasing zoning changes ("upzoning") and multifamily production. More housing is built in neighborhoods with permissive zoning and where upzoning is more likely. I use the Vermont/Western neighborhood analysis to examine how regulatory variables are related to the characteristics of new multifamily housing. In the four Vermont/Western rail station areas, most recent developments met or exceeded the baseline zoning limits. The average development was built at 132% of the baseline allowable residential density, 107% of the allowable floor area ratio, and 102% of the allowable height. The average development included the minimum number of parking spaces, and slightly more open space than required. To exceed the baseline limits, developers primarily used state-enabled density bonus incentives. This is evidence that a handful of zoning provisions constrain multifamily housing production, and that developers would build more densely if land use

regulations were more permissive. If densification near transit is the goal of policymakers, I recommend that cities ease baseline density limits in these areas, and state governments adopt policies, if needed, to supersede exclusionary local regulations.

Land use regulations and housing markets

Municipalities regulate many dimensions of the built environment, including land use, density, height, parking, and design (Deakin, 1989; Downs, 1992). One problem with restrictive regulations is that they make it more difficult for housing supply to adjust to demand (Quigley & Raphael, 2005). Scholars have largely tied restrictive land use regulations to lower housing production and increased housing prices (Glaeser et al., 2005a; Glaeser & Ward, 2009; Ihlanfeldt, 2007; R. Pendall, 2000; Saks, 2008). In California – a state known for its expensive housing and extensive system of land use and environmental regulations – restrictive regulations have been associated with higher land prices (Kok et al., 2014), home prices (Kok et al., 2014; N. Levine, 1999; Quigley & Raphael, 2005), and rents (N. Levine, 1999).

Some regulations, however, are "symbolic, ineffectual, or only weakly enforced" and seem to have little effect on housing production or prices (Quigley & Rosenthal, 2005, p. 69). Landis (1992, 2006), for example, matched pairs of California communities and concluded that local growth control and management programs had modest or no effects. A regulation in one jurisdiction may have a smaller effect than a similar regulation in another jurisdiction because of local market conditions and how it is implemented (Pendall et al., 2006). Regulatory interpretation and implementation can vary widely, and it is important to recognize how approvals involve some administrative discretion (May, 2005).

An important and under-studied hypothesis is that developers prefer to build more densely than regulations allow (J. Levine, 2006). Testing this hypothesis requires us to examine if a regulation is a supply constraint or merely symbolic. Each specific regulation, like floor area or height restrictions, can be viewed as an "upper limit" imposed by the government (Bertaud & Brueckner, 2005). But, depending on local conditions and where these limits are set, regulations can have varying influence real estate developers' behavior. Alonso (1964) pointed out that zoning is only binding if it mandates minimum lot sizes, for example, that are larger than the market would otherwise produce. A simple way to examine regulations is by comparing the ratio of actual density of a site to the allowable density (Cai, Wang, & Zhang, 2016; Kopits, McConnell, & Miles, 2012). If regulations are a constraint, we would expect to see developers building right up to – or when possible beyond – the legal limit.

Some developments are permitted to deviate from the baseline written regulations through discretionary approvals. Types of discretionary approvals include incentives, conditional use permits, variances, zoning code amendments, and design review (Hoch et al., 2000; Punter, 2007). The discretionary approval process itself can indicate existing regulations are a constraint – otherwise a developer would be able to build "by-right."[27] Incentive zoning refers to additional density that is granted by the city in exchange for a public contribution from the developer (J. Levine, 2006). Levine (2006) wrote that the "use of incentive zoning itself is additional evidence of the extent to which the private development market desires to develop more densely than conventional zoning allows" (pp. 115-116).

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[27] It is beyond the scope of this paper, but worthwhile to consider, whether and which developers, planners and policymakers may actually benefit from some discretionary processes. Developers may see their ability to navigate discretionary processes as a source of competitive advantage that will help them to maximize profits (Booth, 1995). Planners and policymakers may use their discretion as a demonstration of power (Booth, 1995) and/or to apply their values (Forsyth, 1999).

There are conceptual and methodological challenges to overcome when studying land use regulations and housing markets. In particular, there have been issues with endogeneity, relatively crude measurements of housing prices, weak or indirect measures of regulations, and lack of attention to the market setting (Ihlanfeldt, 2007; Quigley & Rosenthal, 2005). Endogeneity refers to unmeasured factors that influence both regulations and housing market outcomes (Pogodzinski & Sass, 1994). For example, simple associations between high housing prices and regulations "do not take into account feedback effects between prices and regulations. Homeowners have stronger incentives to protect their housing investments where land values are high initially" (Saiz, 2010, pp. 1254–1255). To address feedback effects and the simultaneity of factors through statistical means, some scholars have used instrumental variables, although finding valid instruments has been problematic (Brueckner, Fu, Gu, & Zhang, 2015; Glaeser & Ward, 2009; Saiz, 2010).

While we can assess the degree to which developments deviate from the base zoning, we do not know much about a developer's prior knowledge about the likelihood of a development approval (Quigley & Rosenthal, 2005). We do not know how a developer's prior knowledge of the likelihood of a deviation being approved affects a development proposal. The approval of a deviation may indicate that a given regulation was the biggest constraint, or it could show that this was the most politically feasible deviation from the baseline requirements. With a precise model of the housing market and developer decision-making, we might be able to infer these locations, but it is not directly observable.

There are at least four measurable and two unobservable symptoms of zoning as a supply constraint: (1) multifamily housing is prohibited in areas with demand for multifamily; (2) development is built close to, or exactly at, the zoning requirements; (3) development exceeds

the zoning requirements through discretionary approvals; (4) developers seek to exceed zoning requirements but their requests for zoning relief are not approved. Additionally, unobservable symptoms include: (5) developers prefer to build more densely than allowed by the zoning, but do not propose it because they perceive the odds of approval to be too low; and (6) developers choose not to buy a property because they perceive difficulties in getting projects approved. For many of these indicators, there is little systematic data, and several would need to be inferred using models of the housing market or studied using qualitative methods. In general, this illustrates a major gap in our understanding of the "relationship between plans, land use regulations, development patterns, and individual preferences; and the interplay between markets and governance processes" (Boarnet, 2011, p. 208).

Planning, zoning, and transit-oriented development

We do not know which regulations matter in different contexts (Schill, 2005), including transit areas. Transit-oriented development ("TOD") has been the subject of considerable research (Cervero et al., 2002; Guerra et al., 2012).[28] Most scholars have focused on how TOD affects travel behavior, particularly whether transit proximity reduces auto travel (Boarnet, 2011; Ewing & Cervero, 2010). A smaller body of literature examines the conditions necessary to build TOD.

There is widespread agreement that the presence of rail transit alone will not automatically translate into development near local stations (Bartholomew & Ewing, 2011; Bernick & Cervero, 1997). A combination of conditions are necessary for new TOD, and the

[28] Transit-oriented development has been broadly defined as mixed-use development within walking distance of a major public transit facility.

importance of land use regulation relative to other factors is not completely clear. Supportive regulations are necessary, along with a strong regional economy, population growth, developable land, and favorable station area locational characteristics (Bernick & Cervero, 1997; Cervero, 1984; Gomez-Ibanez, 1985; Knight & Trygg, 1977; Loukaitou-Sideris, 2010). For example, Boarnet and Compin (1999), studying San Diego, concluded that "no single barrier was overwhelmingly important in explaining the limits of TOD" (p. 92).

While cities and regions increasingly aspire to focus growth around public transit, there are often widespread disconnects between broad policy goals and local regulations (Barbour & Deakin, 2012; Boarnet & Crane, 2001). In the 1990s, for instance, the majority of rail station areas in southern California did not even allow residential uses (Boarnet & Crane, 1997). Some municipalities have adopted policies intended to encourage TOD construction including mixed-use zoning, allowing higher densities by-right, density bonus incentives, performance zoning, interim zoning, floating zones, minimum density classifications, planned unit developments, specific plans, and transfer of development rights (Cervero et al., 2002; White & McDaniel, 1999). Some cities have allowed unbundled parking, reduced minimum parking requirements, instituted parking maximums, permitted shared parking, and allowed parking requirements to be met off-site (Loukaitou-Sideris, 2010). Local governments may also subsidize transit-oriented development through infrastructure investments, assist with land assembly or become equity partners in development projects (Cervero & Landis, 1997). But, again, we do not know how these regulations and incentives affect residential development near transit.

Los Angeles and its Vermont/Western transit-oriented development plan

This paper includes citywide and neighborhood scale analyses of Los Angeles. The United States's second largest city, Los Angeles has more than 3.9 million residents spread over 469 square miles, and is the center of a metropolitan region of over 18 million residents (United States Census Bureau, 2014b). In contrast to the cultural stereotype of a city of sprawling single-family homeowners, over 60% of Los Angeles's 1.3 million households live in attached housing, and about 63% are renters (United States Census Bureau, 2014b). Los Angeles is a growing city with significant new housing construction. Between 2000 and 2014, developers in Los Angeles built more than 92,000 new housing units, of which 71% was multifamily and 68% was rental housing, as shown in Table 9 (United States Census Bureau, 2014b). Much of this new housing was near a transit station; about 43% of new multifamily housing units were built in TOD neighborhoods.[29]

Table 9. New housing by type of unit and tenure (2000-2014)

	Owner-occupied	Renter-occupied	Total
Single-family (attached or detached)	17,968	7,087	25,055
Multifamily	10,271	55,556	65,827
Mobile home or other	861	484	1,345
Total	**29,100**	**63,127**	**92,227**

Source: American Community Survey 2014 1-year estimates for the city of Los Angeles

Since Los Angeles's growth is projected to continue, local and regional policymakers have adopted plans that further focus higher-density residential growth near transit (Barbour & Deakin, 2012; City of Los Angeles, 2015g; Southern California Association of Governments,

[29] I define TOD tracts as a tract with any overlap with a half-mile station area buffer.

2012a). Within Los Angeles, the Vermont/Western Transit Oriented District Specific Plan ("VWSP") was adopted in 2001 as Los Angeles's first modern neighborhood-scale transit-oriented development plan.[30] The plan covers four Metro Rail Red Line transit stations between downtown Los Angeles and Hollywood. The plan's specific requirements are described in further depth later in this paper.

I use citywide and Vermont/Western area analyses to test the hypotheses that (1) developers would build denser apartment buildings if not for land use regulations, and (2) the biggest regulatory constraints on transit-oriented development are direct density limits. I first present the citywide analysis, followed by the Vermont/Western case study.

Citywide analysis of multifamily housing production

Data

The data described here pertain to housing construction and land use regulations. Descriptions of data related to amenities, accessibility, geographic features, and other neighborhood characteristics are provided in the appendix. Descriptive statistics for all data are in Table 10.

Citywide housing production data are from the U.S. Census American Community Survey. New multifamily housing counts are based on American Community Survey 2010-2014 estimates (United States Census Bureau, 2014a), which I refer to as 2012 estimates.[31] I define

[30] The VWSP plan is also commonly referred to as "the SNAP" because of its subtitle as the Station Neighborhood Area Plan.

[31] 2012 is the mid-point of the Census Bureau's five-year data collection cycle

"new" construction as housing units built in the year 2000 or later.[32] I aggregate six Census categories of "units in structure" into three categories: single-family, multifamily, and other (Bennefield & Bonnette, 2003).[33] I use "multifamily housing" and "apartments" interchangeably in the remainder of this paper; this is not intended to characterize whether a unit is renter- or owner-occupied, but rather that a housing unit is attached to others.

[32] This is the most recent Census Bureau category for housing unit year of construction.

[33] The "single-family" category includes attached and detached units. The "multifamily" category includes residential buildings with 2-4, 5-19, 20-49, and 50+ units. The "other" category includes mobile homes and recreational vehicles.

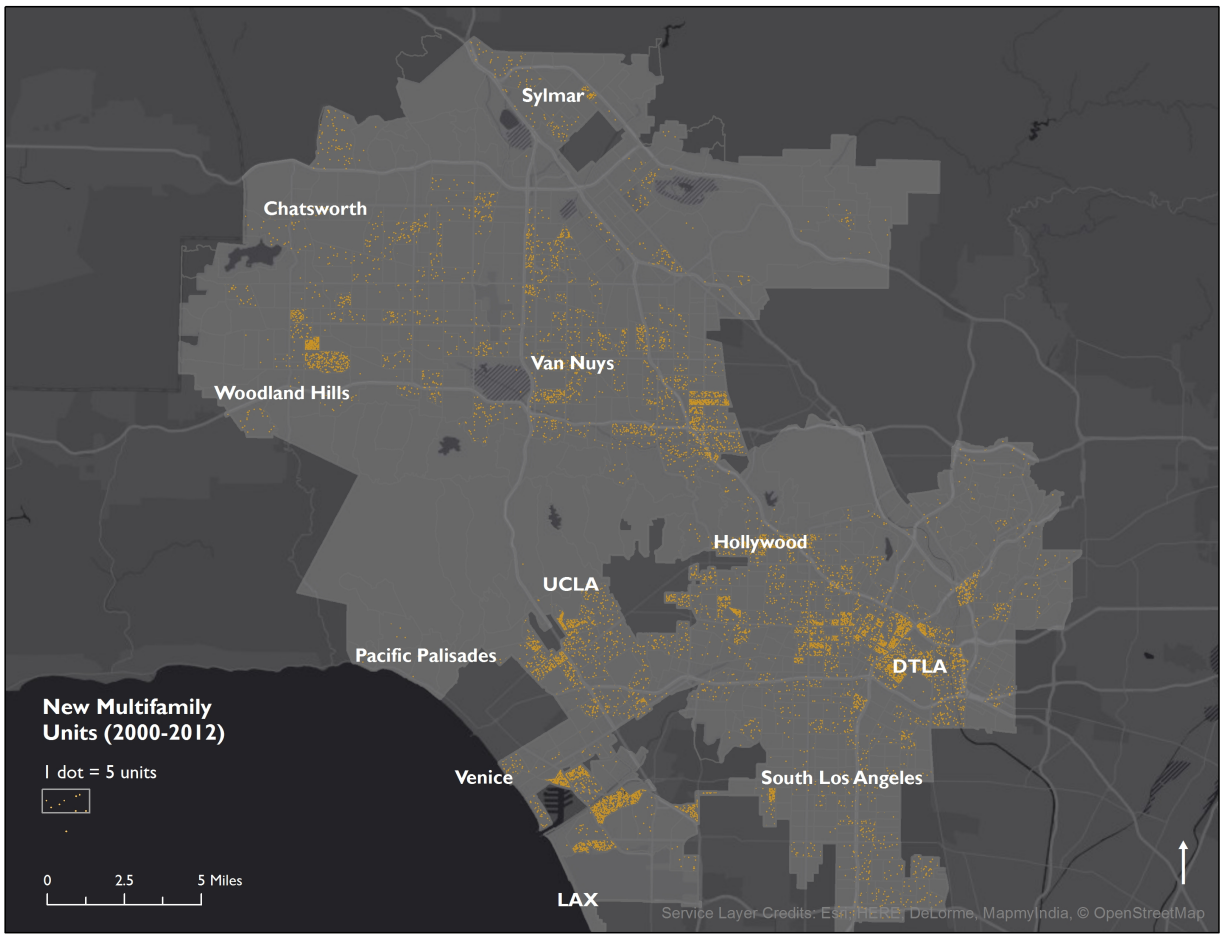


Figure 9. Multifamily housing production by Census tract (2000-2012)

To quantify land use regulations by Census tract, I first create a detailed dataset of Los Angeles parcel characteristics. I use ArcGIS to connect each of the city's approximately 788,000 parcels with its zoning attributes in 2002 and 2014 (City of Los Angeles, 2002b, 2014a; Los Angeles County Assessor, 2012).[34] I focus on municipal *zoning class* attributes, which are the most general categories of zoning. In 2002, Los Angeles had 65 zoning classes (City of Los

[34] The 2002 zoning data was the oldest available digitally for the city of Los Angeles (Butcher, 2015).

Angeles, 2002b). By 2014, the city had 85 zoning classes (City of Los Angeles, 2014a).[35] I assign each zoning class with its maximum allowable residential density based on the zoning code (City of Los Angeles, 2015f). I assign indicator variables representing whether the zoning allowed single-family housing only, allowed multifamily housing, and allowed high-density housing (e.g., at least 100 units per acre). I identify parcels where the underlying zoning changed between 2002 and 2014, and I assign an indicator variable representing whether a parcel was "upzoned" in that time period.[36] I then aggregate the parcel data to Census tracts by land area. For example, Figure 10 maps high-density zoning by Census tract. Additionally, I assign each tract to its primary city-designated community plan area.[37]

[35] Zoning classes include common designations like "R1" (single-family residential), "C2" (commercial), and "M2" (manufacturing). The city's zoning data also include a smaller number of uncommon zoning classes associated with specialized land uses or adopted specific plans.

[36] "Upzoning" refers to a zoning change that allows higher development intensity.

[37] The city implements its general plan through 37 more detailed community plans (City of Los Angeles, 2015d). Most Census tracts fell entirely within one community plan area, but for those that did not, I assigned it to the area where the majority of the tract's acreage fell.

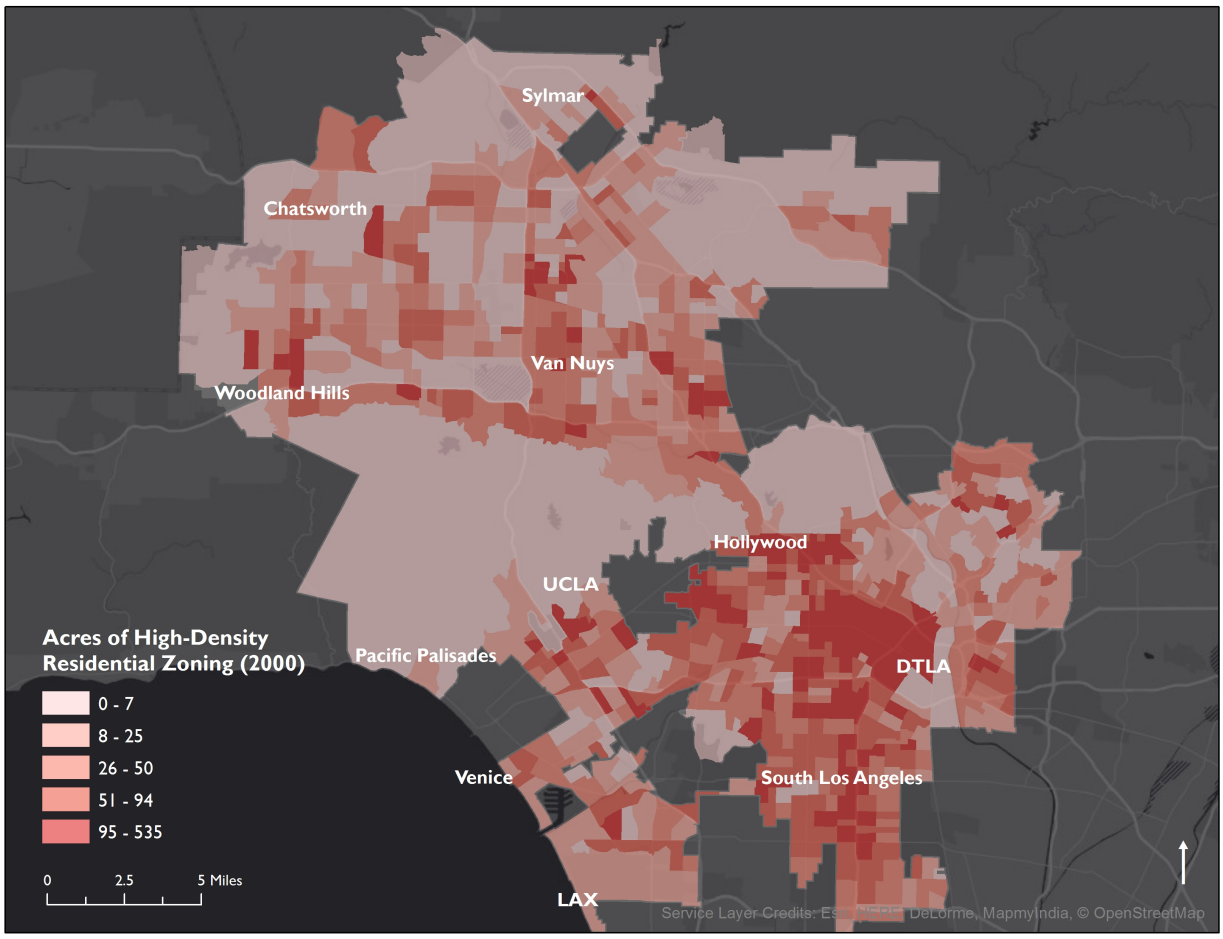


Figure 10. High-density residential zoning by tract

Table 10. Descriptive statistics of Census tract variables

Variable	Obs	Mean	Std. Dev.	Min	Max
New multifamily units (2000-2012)	1000	63.80	155.40	0.00	2749.00
Neighborhood API score (2013, in tens)	1000	80.78	5.23	64.44	95.19
Distance to beach (miles)	1000	11.15	4.34	0.19	21.59
Elevation (in feet)	1000	493.64	375.53	8.60	2794.34
Area within 1/2 mile of transit station (2012, acres)	1000	20.56	44.92	0.00	358.26
Distance to freeway ramp (miles)	1000	0.86	0.72	0.02	4.49
Employment per square mile (2000, in thousands)	1000	5.52	11.21	0.04	121.95
Employment accessibility measure (2000, in thousands)	1000	583.04	203.12	189.17	880.96
Area upzoned between 2002 and 2014 (acres)	1000	2.71	13.27	0.00	230.40
Over 100 dwelling units/acre allowed (2002, acres)	1000	15.04	19.45	0.00	187.35
Slopes of at least 25% (acres)	1000	84.58	441.07	0.00	10622.32
Water (indicator variable)	1000	0.22	0.41	0.00	1.00
Summary of homeownership categories					
Low homeownership rate	250	0.08	0.05	0.00	0.17
Average ownership	500	0.36	0.11	0.17	0.57
High ownership	250	0.76	0.12	0.57	0.97
Tract size (in hundreds of acres)	1000	0.31	0.55	0.02	10.91
Multifamily housing units (2000, in hundreds)	1000	0.72	0.56	0.00	2.99
Population per square mile (2000, in thousands)	1000	13.41	12.17	0.03	92.16
Percent black (2000)	1000	0.10	0.16	0.00	0.91
Percent Hispanic (2000)	1000	0.46	0.29	0.03	0.98

Regression models of housing production

My conceptual model is that real estate developers build apartments in neighborhoods where there is strong demand and reasonably limited supply constraints compared with existing supply (DiPasquale & Wheaton, 1996). Within a city, housing demand is driven by amenities and accessibility (Anas et al., 1998; DiPasquale & Wheaton, 1996). Local supply constraints include geographic features, written land use regulations, and neighborhood opposition to growth (DiPasquale & Wheaton, 1996; Fischel, 2005b; Saiz, 2010).

I create reduced form models of housing production. The dependent variable is the number of apartment units built in a neighborhood between 2000 and 2012. This outcome variable is a count and the most common regression models for count data are Poisson and negative binomial (Hilbe, 2014). The Poisson model assumes that the conditional mean is equal to the conditional variance; if the conditional variance is greater than the conditional mean, then the model may be "overdispersed" (Greene, 1994). Overdispersion is a problem because it can result in the underestimation of standard errors in a model, and lead to conclusions that variables are statistically significant predictors when they are not (Hilbe, 2014). There are several indicators of overdispersion. The first warning sign here is that the unconditional mean number of new multifamily units per tract is 64 while the unconditional variance of more than 24,000. This large variance is partially explained by the large number of zero values in my data; about 39% of tracts did not have any new multifamily housing. Overdispersion is indicated in my model by the Likelihood Ratio Test showing alpha to be significantly different than zero. The negative binomial regression is a special form of the Poisson distribution with an extra dispersion parameter (Hilbe, 2014). But, some scholars have cautioned that the negative binomial models

cannot be expected to "fix" an incorrect model specification, including models with omitted variables and dependence between observations (Berk & MacDonald, 2008).

I specify a negative binomial regression model for the entire tract dataset, and then stratify my dataset based on transit proximity. "TOD tracts" are those with some area within a half-mile of rail transit or BRT, and "non-TOD tracts" are those more than a half-mile away from rail and BRT. Two regulatory characteristics are the primary predictors of interest in the regression models. The first represents the land area of the tract where multifamily housing of at least 100 units per acre is allowed in the baseline zoning ("100 dwelling units/acre allowed" variable). The second is a variable representing the land area of the tract that was upzoned between 2002 and 2014 ("area upzoned between 2002 and 2014" variable). Other independent variables represent demand drivers, land use regulations, geographic features, and neighborhood characteristics. In order to address the dependence of observations that are geographically proximate, I cluster standard errors by Los Angeles's 37 community plan areas.[38] The models take the form of Equation 2. The coefficients from the models are reported as incident risk ratios. Risk ratios can be interpreted as the rate of a change in the outcome variable given a one-unit change in the independent variable (Hilbe, 2008).

Equation 2: Negative binomial regression model of Census tract housing production

$$NewHousing_i = \alpha + \beta_1 Accessibility_i + \beta_2 Amenities_i + \beta_3 Geographic_i + \beta_4 Regulations_i + \beta_5 Homeowner_i + \beta_6 OtherControls_i + \varepsilon_i$$

[38] Los Angeles has 35 community plans, and individual plans for Los Angeles International Airport and the Port of Los Angeles.

One methodological issue, mentioned earlier, is accounting for the "endogenous" relationship between land use regulations and housing production (Pogodzinski & Sass, 1994; Quigley & Rosenthal, 2005). That is, the housing market, regulatory, and demographic variables are entangled; these factors may simultaneously influence each other and result in feedback loops. Reverse causality is possible, for example, from "growing prices to higher regulations" in addition to the intuitive explanation that more regulations lead to higher prices (Saiz, 2010, pp. 1282–1286). This is a particular challenge with cross-sectional models. I use measures of multifamily housing *change* between 2000 and 2012, baseline zoning in 2002, and zoning *change* between 2002 and 2014 in the model. This allows me to correlate new housing construction with baseline regulations and changes in regulations.

Citywide results

The primary land use regulatory variables in my models – high-density multifamily zoning ("100 dwelling units/acre allowed") and upzoning ("area upzoned between 2002 and 2014") – are generally associated with apartment production. The regression results from the citywide, TOD, and non-TOD models are summarized in Table 11. Across the three models, apartments are more likely to be built in tracts with more high-density zoning. For every additional acre in which high-density apartments are allowed, there is between 2.1% (TOD tracts) and 3.3% (non-TOD tracts) more multifamily built. Citywide and in non-TOD tracts, for every additional acre upzoned, multifamily production rises by 2.4% and 2.7% respectively.

Table 11. Results of models of multifamily housing production

Categories	Variables	(1) All Tracts	(2) TOD	(3) Non-TOD
Amenities	Neighborhood API score (2013, in tens)	0.987	0.992	0.991
		(0.0234)	(0.0378)	(0.0265)
	Distance to beach (miles)	0.878***	0.899	0.877***
		(0.0248)	(0.0842)	(0.0330)
	Elevation (in hundreds of feet)	1.001**	1.004*	1.001*
		(0.000439)	(0.00183)	(0.000589)
Accessibility	Area within 1/2 mile of transit station (2012, acres)	1.005**	1.005	
		(0.00177)	(0.00271)	
	Distance to freeway ramp (miles)	1.050	1.076	1.105
		(0.0824)	(0.178)	(0.107)
	Employment per square mile (2000, in thousands)	1.002	0.998	1.002
		(0.00706)	(0.00775)	(0.0214)
	Employment accessibility measure (2000, in thousands)	1.001	1.004	1.001
		(0.000611)	(0.00229)	(0.000893)
Planning and zoning	Area upzoned between 2002 and 2014 (acres)	1.024***	1.011	1.027***
		(0.00597)	(0.00655)	(0.00706)
	Over 100 dwelling units/acre allowed (2002, acres)	1.027***	1.021**	1.033***
		(0.00484)	(0.00723)	(0.00701)
Geographic features	Slopes of at least 25% (acres)	0.998**	0.997	0.999
		(0.000740)	(0.00208)	(0.000940)
	Water (indicator variable)	1.275	1.354	1.198
		(0.218)	(0.284)	(0.258)
Home-ownership	Homeownership: average vs. low tract	0.867	0.517*	1.094
		(0.152)	(0.148)	(0.243)
	Homeownership: high vs. low tract	0.568	0.172**	0.856
		(0.184)	(0.102)	(0.356)
Other tract characteristics	Tract size (in hundreds of acres)	0.539	1.137	0.265
		(0.323)	(1.117)	(0.187)
	Multifamily housing units (2000, in hundreds)	2.079***	1.033	2.858***
		(0.407)	(0.239)	(0.806)
	Population per square mile (2000, in thousands)	0.980***	0.994	0.971**
		(0.00527)	(0.00777)	(0.0106)
	Percent black (2000)	0.368	2.910	0.380
		(0.228)	(3.411)	(0.236)
	Percent Hispanic (2000)	1.273	0.934	1.866
		(0.561)	(0.559)	(1.153)
	Observations	1,000	310	690

Robust clustered standard errors by Community Plan Area
*** p<0.001, ** p<0.01, * p<0.05

Two of the three amenity variables are associated with apartment production. For all tracts and non-TOD tracts, for every mile farther from the beach, multifamily housing production drops by about 12%. There is marginally more multifamily production at higher elevations. Across the three models, for every one hundred foot increase in elevation, there is between a 0.1% and 0.4% increase in multifamily production. There is, however, no significant relationship between school performance and apartment production. Steep slopes and water bodies have limited associations with multifamily development. Citywide, every acre of steep slope in a tract is associated with about 0.002% fewer apartments built. There are no significant relationships between water in the tract and multifamily production.

The accessibility variable that is significantly associated with multifamily housing development is the tract's land area within a half mile of a rail or BRT station. Citywide, for every additional acre of the tract that was within a half mile of a transit station, there is 0.5% more multifamily production. However, in the TOD model, the land area near the stations is not a significant determinant of new apartment construction. The other accessibility variables – freeway access, job proximity and employment density – have no significant association with apartment production.

In terms of neighborhood characteristics, higher homeownership rates are associated with less multifamily production in TOD tracts. Multifamily production is about 48% lower in tracts with average homeownership compared with those with low homeownership, and multifamily production is about 82% lower in tracts with high homeownership compared with low ownership rates. Citywide and for non-TOD tracts, there is no significant relationship between homeownership rates and new multifamily housing. Several characteristics of the built environment in 2000 are related to subsequent multifamily production. Citywide, for every one

hundred multifamily units that were in existence in a tract in 2000, about 107% more new multifamily housing is produced. This means that neighborhoods with a sizable number of apartments are likely to get more apartments. This may indicate that there is demand in these neighborhoods for multifamily, there are already services to support additional residents in apartments, and there is less opposition to growth from multifamily than single-family dwellers. But, this becomes problematic if some neighborhoods experience disproportionate costs from this multifamily housing growth. The next finding seems contradictory, but it is not: apartments are more likely to be built in areas with *lower* population density; for every increase of one thousand residents per square mile, there is about 2% less multifamily housing produced citywide and in non-TOD tracts. This is likely a function of new multifamily being built in neighborhoods with a mix of land uses, including commercial uses, and not just residential density. There is no significant relationship between population density and multifamily production in TOD tracts. Lastly, there is no significant association between black or Hispanic population share and apartment production.

Analysis of new multifamily housing in the Vermont/Western rail station areas

The Vermont/Western Transit Oriented District Specific Plan ("VWSP") was adopted in 2001 as Los Angeles's first modern neighborhood-scale transit-oriented development plan. The plan covers four Metro Rail Red Line transit stations between downtown Los Angeles and Hollywood: Vermont and Beverly, Vermont and Santa Monica, Vermont and Sunset, and Hollywood and Western (Los Angeles Metro, 2016a). The 2.2 square mile plan area has about 55,000 residents and 29,000 employees (Chatman et al., 2016). The neighborhood is home to

several hospitals and the main campus of Los Angeles City College, among other employers (Chatman et al., 2016).

Among other goals, the VWSP aims to "promote increased flexibility in the regulation of the height and bulk of buildings as well as the design of sites" (City of Los Angeles, 2001d, p. 2). The plan eases density limits in some areas; reduces minimum parking requirements and imposes parking maximums on new construction; makes it easier to adaptively reuse existing buildings without providing additional parking; and incentivizes mixed-use buildings on commercial streets (City of Los Angeles, 2001d). It also adds new development impact fees for parks, transitional height requirements, pedestrian throughway standards, and design guidelines (City of Los Angeles, 2001d).

The VWSP is a useful case study for several reasons. First, the plan was adopted in 2001, providing adequate time to examine its implementation. Second, the plan area includes some of the city's common baseline zoning requirements along with an overlay of additional or different land use stipulations from the VWSP. Third, the built environment in the plan area exhibits considerable variety, with neighborhoods ranging from single-family to high-density mixed-use corridors. Fourth, the area experienced a moderate amount of new housing development since 2000, with at least 1,400 new housing units constructed between 2000 and 2010 (Chatman et al., 2016; City of Los Angeles, 2015c).

My approach to studying the effects of regulations in the Vermont/Western plan area includes reviewing the Los Angeles municipal zoning code and applicable neighborhood plans; creating an inventory of the characteristics of recently permitted building projects; and interviewing local experts.

Development analysis approach

I analyze the six multifamily and mixed-use residential developments that had building permits approved between January 1, 2013 and December 31, 2015 in the Vermont/Western specific plan area (City of Los Angeles, 2015c). All six developments, totaling 475 housing units, are all within a half-mile of a Metro rail station. The developments range in size from a two-story apartment building with seven housing units to a seven-story mixed-use residential building with 280 housing units.[39] Three of the developments are exclusively affordable housing, two developments are primarily market-rate housing with some affordable housing units, and one development is exclusively market-rate housing. These residential developments are summarized in Table 12 and mapped in Figure 11.

For each residential development, I review approval letters from the planning department and planning commission, environmental review documents, site plans, elevation plans, floor plans, parking plans, and landscape plans. I compare the actual characteristics of each development with the site's baseline land use regulations in terms of allowable uses, density (e.g., floor area ratio and dwelling units), height, parking, and open space.[40] I note any conditional uses that were permitted. For the density, height, parking, and open space characteristics, I calculate a percentage variable based on how the actual building corresponded with the limits in the zoning code. For example, if the baseline zoning allows 100 units on a site, but 125 units are actually approved, the development has 125% of the site's allowable density.

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[39] By comparison, the mean multifamily development permitted in Los Angeles between 2013 and 2015 had 50 units, but the median multifamily development permitted had only 14 units. The 5550 Hollywood Boulevard development, with 280 units, is in the top 5% of the city's new developments by unit count.

[40] Some regulations were minimums, like the number of parking spaces per unit. Other regulations were maximums, like the number of housing units that could be built.

Table 12. Summary of VWSP multifamily and mixed-use development permits (2013-2015)

Project Name	Lot Size (SF)	FAR	Market-Rate Housing Units*	Affordable Housing Units	Total Housing Units	Height (Feet)	Parking Spaces	Open Space (SF)
5550 Hollywood Boulevard	82,801	3.42	257	23	280	86	414	30,920
The Meridian Apartments	42,930	2.31	1	99	100	55	102	13,175
5400 Hollywood Family Apartments	16,000	2.9	0	40	40	65	54	6,560
Beverly Terrace	19,750	1.93	1	39	40	61	32	3,460
536 N. Westmoreland	7,505	N/A	8	0	8	23	10	800
5107 W. Harold	8,973	N/A	5	2	7	30	16	1,231

* In affordable housing developments, the building manager's unit is generally classified as a market-rate housing unit.

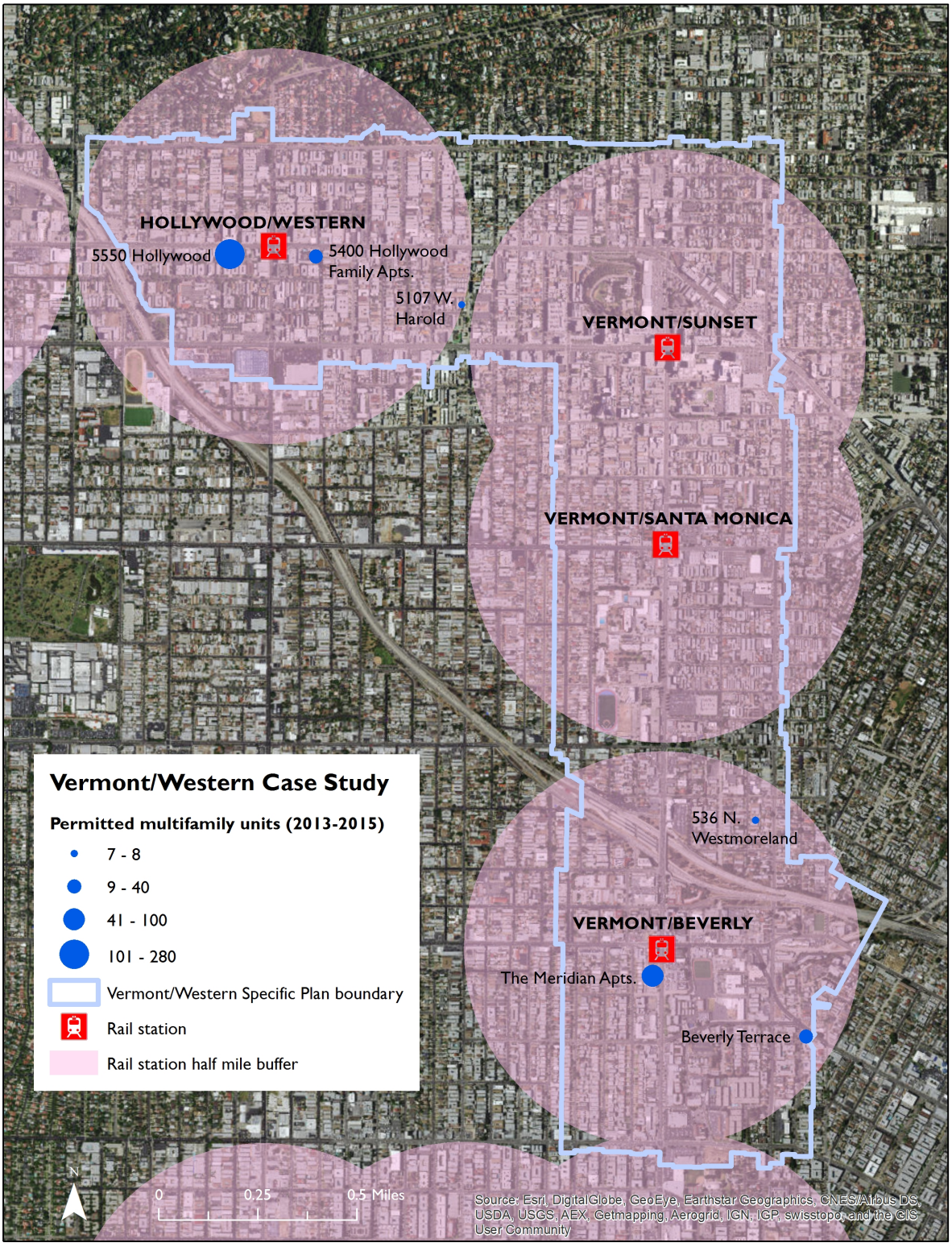


Figure 11. Vermont/Western Transit Oriented Development Specific Plan area building permits (2013-2015)

Development analysis results

Below I describe the results organized by density bonus incentives, floor area ratio, total residential units, affordable housing, height, parking, and open space. The relationships between the actual characteristics of each development and the baseline zoning requirements (before any density bonuses or discretionary approvals) are summarized in Table 13.

Table 13. Actual development characteristics as a percentage of the baseline zoning allowance, by category

Project Name	Density Bonus Incentives	FAR	Housing Units	Height	Minimum Parking	Open Space
5550 Hollywood Boulevard	X	114%	135%	115%	105%	102%
The Meridian Apartments	X	116%	189%	110%	100%	101%
5400 Hollywood Family Apartments		97%	100%	87%	92%	124%
Beverly Terrace	X	103%	138%	122%	73%	80%
536 N. Westmoreland		N/A	89%	79%	100%	100%
5107 W. Harold	X	N/A	140%	100%	128%	100%
Average (Mean)		**107%**	**132%**	**102%**	**100%**	**101%**

California enacted a state law in 1979 requiring cities to provide density bonuses and other incentives for developers that provide affordable housing; the city of Los Angeles adopted an ordinance to implement this law in 2008 (City of Los Angeles, 2008b; State of California, 1979). Density bonuses of up to 35% are granted based on how much affordable housing is provided and the targeted income groups.[41] Density bonus developments automatically qualify for reduced parking requirements. Additionally, developers may choose from one to three "on-

[41] The state sets the income limits for affordable housing based on county median income and household size. In 2015 in Los Angeles County, a "low-income" household of four people earned less than $68,300. A "very low-income" household of four people earned less than $42,700 (Bates, 2015).

menu" incentives. On-menu incentives relate to yards/setbacks, lot coverage, lot width, floor area ratio, height, and open space (City of Los Angeles, 2008b). To qualify for a density bonus of 20%, a parking reduction, and one on-menu incentive, a developer must ensure that at least 5% of units are affordable to very low-income households or 10% of units are affordable to low-income households (City of Los Angeles, 2008b). For a density bonus of 35%, a parking reduction, and three on-menu incentives, a developer must ensure that at least 15% of units are affordable to very low-income households or 30% of units are affordable to low-income households. The city's planning commission may also grant developers "off-menu" incentives that go beyond the on-menu ones. To justify a request for an off-menu incentive, a developer must provide a project proforma spreadsheet showing the incentive is necessary to make the affordable units "economically feasible" (City of Los Angeles, 2008b, p. 14).

Again, state law enables these on- and off-menu incentives, which were codified in Los Angeles's 2008 ordinance (City of Los Angeles, 2008b; State of California, 1979). Density bonus incentives were commonly used in Vermont/Western plan area. Four of the six developments were granted "on-menu" incentives through the city's density bonus ordinance. Only one development, the Meridian Apartments, received off-menu incentives related to transitional height and loading space (Los Angeles City Planning Commission, 2015).

Floor area ratio (FAR) is the ratio of building size to site size. For commercial and mixed-use residential buildings, the allowable FAR in the VWSP area ranged from 1.5 to 3.0, depending on the subarea, and this was an upzoning for many parcels. This FAR range is comparable to, or greater than, most of the high density zones outside downtown Los Angeles. Residential-only buildings were not subject to FAR limits. Four mixed-use residential developments were approved at 97% to 116% of the baseline maximum FAR. Three of these

four projects used density bonuses to exceed the baseline VWSP requirements.[42] Only one project (5400 Hollywood Family Apartments) was below the baseline maximum, with an FAR of 2.9 in a zone that allows 3.0 FAR.

The developments in the VWSP area were approved at 89% to 189% of baseline allowable residential density. The four developments that received a density bonus were built between 135% and 189% of the baseline allowable density. The Meridian Apartments project received a conditional use permit to achieve 189% of the baseline density, justified in part because it would contribute "to the widespread need for [affordable] housing close to a major transit stop" (Los Angeles City Planning Commission, 2015, p. F–1). The two developments (Westmoreland and 5400 Hollywood Family Apartments) that did not pursue a density bonus were built at 89% and 100% of allowable density respectively.

The heights of the six projects ranged from 23 feet to 86 feet. The maximum allowable height, depending on the VWSP subarea, ranged from 29 feet to 75 feet. Two developments (Westmoreland and 5400 Hollywood Family Apartments) were under the maximum height limits by 6 and 10 feet respectively. One project (Harold) was permitted at exactly the baseline height limit. Three developers (5550 Hollywood, Vermont and Beverly Terrace) used the density bonus program to build to between 110% and 122% of the baseline height allowance, equivalent to between 5 and 11 feet taller than otherwise allowed. Several of the developments also received relief from the VWSP's transitional height requirements, which are based on the heights of neighboring buildings.

[42] An anecdote that illustrates some nuances of the density bonus program and the VWSP: the Beverly Terrace apartment development straddles the VWSP boundary, with about three-quarters of the site falling in the VWSP area and the other one-quarter just outside of it. The VWSP part was subject to a 2.0 FAR limit, while the non-VWSP part had a 1.5 FAR limit. The developer received a 15% density bonus for the non-VWSP component. The project was then approved with an overall FAR of 1.91 on two sites that would have allowed a weighted average 1.88 FAR.

The VWSP included parking minimums and maximums (Table 14). The requirements were tied to the number of habitable rooms in each residential unit. For studios and one-bedroom apartments, the minimums and maximums were the same, at 1.25 parking spaces per housing unit. Additionally, developments within 1,500 feet of a Metro Rail Red Line station entrance were allowed to reduce required parking by 15% (City of Los Angeles, 2001d).

Table 14. Citywide and VWSP area parking standards

	Typical unit type	**Citywide standards**			**Minimums - VWSP**			**Maximums - VWSP**		
		Resident	Guest	Total	Resident	Guest*	Total	Resident	Guest*	Total
<3 habitable rooms	**Studio**	1	0	1	1	0.25	1.25	1	0.25	1.25
3 habitable rooms	**1 bedroom**	1.5	0	1.5	1.5	0.25	1.75	1.5	0.25	1.75
4+ habitable rooms	**2+ bedrooms**	2	0	2	1.5	0.25	1.75	2	0.25	2.25

Sources: Los Angeles Municipal Code and Vermont Western TOD Specific Plan
Note: Habitable rooms include kitchen.
* In mixed-use developments, guest parking may be fulfilled through shared parking with commercial uses.

There was some variation across the six developments, which included from 73% to 128% of the *minimum* parking required. Two developers used the density bonus to build less parking than required under the baseline zoning. Two developers built the exact number of minimum spaces required. Two developers built more than the minimum number of spaces required. The two developments with more than the minimum required were predominantly market-rate developments. In terms of *maximum* parking standards, the developments ranged from 52% to 100%. Two developments included the maximum number of spaces, although in one case this also equated to the minimum number of spaces, since the minimum and maximums were the same for units with three or fewer habitable units (Table 14 above).

All of the developments were subject to minimum open space requirements. One development (Beverly Terrace) used the density bonus program to reduce its required open space from 4,325 square feet to 3,460 square feet. Four developments provided between the exact amount required and 2% above that amount. One development (5400 Hollywood Family Apartments) provided 124% of the required open space.

Expert interviews

There were questions that I could not answer through the building analysis, so I talked with six experts about zoning and development approvals in Vermont/Western and across Los Angeles. I interviewed three staff members from the city's planning department (including the two planners most involved with development approvals in the plan area), and three real estate developers active in the Vermont/Western area or their consultants. I essentially interviewed every planner or developer in this small area who would talk with me. I describe the experts' perspectives in terms of (1) the development approval process, (2) whether and how zoning constrains residential development, and (3) developers' strategies for deviating from the baseline zoning.

Developers and planners walked me through sample development processes. Developers and consultants explained that the baseline zoning is generally the starting point for exploring development options, and part of the initial feasibility analysis is assessing the viability of regulatory deviations. One consultant likened this to "peeling back the layers of an onion." Developers lay groundwork before any official proposal is submitted. Early on, a developer may pitch their proposal to the local city council member to build early political support. A developer

may meet with city planning staff to vet the draft proposal. Developers also begin reaching out to neighbors and neighborhood groups.

Zoning generally constrains multifamily development in the Vermont/Western plan area, but not always, according to the experts. Some smaller multifamily developments are proposed within the baseline zoning requirements and trigger no discretionary review by city officials. However, these projects that are allowed "by-right" are the exception in Los Angeles. The bulk of the city's new multifamily units are in medium and large developments, and these commonly necessitate deviations from the baseline zoning requirements, and tend to be subject to more complicated approvals.

Interviewees found different land use regulations to be most constraining. One developer found the biggest constraints to be floor area ratio limits, residential density limits, minimum parking requirements, and sometimes setbacks. One planning consultant thought floor area ratio caps are the biggest constraint, particularly in commercial zones in "Height District 1," where parcels were downzoned to a floor area ratio of 1.5 in the 1986 voter-approved Proposition U (A. H. Whittemore, 2012).[43] Another consultant explained that it is usually a combination of the regulations mentioned above. There was variation in whether planners and developers viewed parking requirements as a barrier, mainly because the Vermont/Western standards are generally lower than the citywide average, and further reductions are possible for projects within 1,500 feet of a Metro rail station and through density bonus incentives. Overall, density and floor area ratio limits were the most commonly mentioned constraints, and these regulations are fairly similar inside and outside the VWSP area.

[43] Allowable floor area ratios were halved by this ballot measure in Height District 1, which covered about 85% of the city's commercially zoned areas in 1986 (A. H. Whittemore, 2012).

Some regulatory constraints were Vermont/Western area specific. Several interviewees found that the Vermont/Western plan made development more complicated than in other Los Angeles neighborhoods. One interviewee described the plan as the strictest specific plan in the city, and another said the VWSP was "very very onerous." One planner, however, thought it was more of a mixed situation, with most requirements in the VWSP comparable to zoning requirements elsewhere, some requirements less restrictive (e.g., parking), and some requirements more restrictive (e.g., transitional height and mixed-use incentives). Several planners and developers mentioned that transitional height requirements can challenge a development depending on the site layout and neighboring properties. One consultant found that lot assembly is sometimes a problem, particularly if part of the site is in the most restrictive subarea of the VWSP.

Several interviewees thought that a fundamental problem with land use regulation in Los Angeles is that little development can be approved "by-right." The two main reasons are that the Los Angeles code requires a discretionary review ("site plan review") for any development with at least 50 residential units, and it is challenging to build without any relief from the baseline zoning requirements. Three paths for deviating from the zoning include a project permit adjustment, project permit exception, and density bonus application. An adjustment can be approved by the city's planning director for smaller deviations. An exception must be approved by the Area Planning Commission, and is typically reserved for larger deviations. But, most commonly, developers used state-enabled density bonus incentives to deviate from baseline land use regulations.

Interviewees concurred that for developers seeking to stray from the baseline zoning, the density bonus was the most streamlined route and was least susceptible to appeals. One private

sector interviewee called the density bonus "the best incentive out there." The density bonus can be used as a strategy for getting the on-menu incentives (e.g., build taller, denser or with less parking), even if the developer does not end up maxing out the full density on a site. A developer may not maximize the full allowable density on a site, for example, if doing so would necessitate using steel construction instead of less expensive wood-frame construction. One developer who works citywide explained that they use the density bonus program on most projects, although they will not apply if they are able to make the project work without it. They aim to "fly under the radar" as much as possible. If they go down to the density bonus route, they use on-menu incentives if they can, and off-menu incentives only if necessary.[44]

Public and private sector interviewees generally agreed that development approvals, particularly for large or complicated projects, had a core political dimension. This was an advantage for some; one interviewee explained that "most sophisticated developers know the game." Part of the so-called game involves avoiding appeals and lawsuits, if possible. One interviewee characterized the neighborhood council in which the VWSP falls as being particularly "active," which I interpreted to mean that one or more local residents are likely to challenge or appeal projects that they do not like.[45] For density bonus applications, only the abutting property owners can appeal, while for other deviations, anyone in the city can appeal. The likelihood of an appeal depends on the proposed project and its location. Several interviewees mentioned that appeals were more likely in Hollywood and west Los Angeles than

[44] The off-menu incentives are rarer, go to the city planning commission for approval, and are non-appealable.

[45] Neighborhood councils cannot appeal proposed projects, but individuals can.

downtown Los Angeles, for example. The threat of appeals looms over planners and developers, according to the interviewees, but actual appeals are less likely.

Discussion

The evidence from the regression models, Vermont/Western development analysis, and expert interviews suggest that zoning is commonly a constraint on apartment construction. My three main findings are (1) apartments were built in neighborhoods where regulations were more permissive; (2) floor area ratio and residential density limits were the most prominent direct constraints on development; and (3) in an increasingly litigious planning environment, reducing risk in the development approval process matters to multifamily developers.

Apartments were built where regulations were more permissive

First, the high-density zoning coefficient shows that apartments were built in neighborhoods where regulations were more permissive. There are a few possible explanations. Apartments could have been built in neighborhoods with high-density zoning *because* regulations constrained development in other neighborhoods. A complementary explanation is that a large share of the city's new housing comes from a small number of large residential developments, which are usually built on parcels with high-density zoning. For instance, from 2013 to 2015, about 7% of the multifamily and mixed-use residential development projects that the city approved contained 50% of the city's multifamily units, and 18% of the approved projects contained 75% of the new multifamily units (City of Los Angeles, 2015c). But, it is also possible that the neighborhoods zoned for more high density residential are simply best suited to multifamily development in terms of location, accessibility, and more community support/less

community opposition. Mostly likely it is a combination of these factors. Additionally, the positive association between upzoning and new apartment construction is reasonable since much of the upzoning was property-owner initiated to facilitate new residential development. Upzoning would be unnecessary if zoning was not a constraint.

The results of the Vermont/Western case study support the hypothesis that developers would build more densely if the zoning allowed it. Developers' close conformance to the zoning limits – and common requests to deviate from the baseline zoning using density bonus incentives – is strong evidence of this. The citywide increase in density bonus uptake suggests that this is not isolated to the Vermont/Western area. It seems reasonable to conclude that more housing would be built in many Los Angeles neighborhoods if baseline density restrictions were loosened. The regression results are also consistent with the city's own assessment of zoning, and uncertainty in the approval process, as a supply constraint:

> The result of relatively low zoning capacities and high land costs is that most significant multi-family housing requires at least one kind of discretionary review to be built. Discretionary reviews require public hearings, findings, appeals and mandatory CEQA compliance - all of which introduce considerable uncertainty and risk for a developer (Los Angeles Department of City Planning, 2015b, pp. 3–4).

FAR and residential density limits were the most prominent regulatory constraints

Floor area ratio and residential density limits were the most prominent – but not the only – constraints on development, based on the building analysis and the expert interviews. Four of the developments were subject to FAR limits (the two residential-only developments were not), and three of these developments were approved at 101% to 116% of maximum FAR. The developers built from 89% to 189% of the baseline housing units allowed on each site. Five of the six developments were at or above 100% of the allowable zoning in terms of housing units. The density bonus program was used to build more housing units; in this way it truly acted as an

incentive for housing production. The density bonus enabled 50 market-rate units and 83 affordable units that would not have been built without the program. This equates to about 39% more housing units than under the baseline requirements. The density bonus program provided a mechanism through which the city can encourage developers to build affordable housing.

Other development constraints included height limits, minimum parking requirements, and open space requirements. These requirements should be considered in relation to density changes, but these are not the primary zoning constraints in Vermont/Western. Four of six developments met or exceeded the baseline height limit. Interviewees concurred that these requirements could be an impediment, depending on the site and development scenario. Several interviewees mentioned transitional height limits – the VWSP included additional stipulations based on the heights of neighboring properties – as challenging for some development proposals. Specifically, even in the two highest density subareas of the VWSP, height was restricted to two stories within 49 feet of a "neighborhood conservation" (predominantly single-family) area and three stories within 99 feet of a neighborhood conservation area.

Parking regulations were a barrier for some developers, while others provided more than the minimum. The three affordable housing developments were all at or below the minimum parking requirements. The three predominantly or exclusively market rate developments all met or exceeded the minimum requirements. This was a function of developers acting conservatively, perceiving market demand for more parking and/or stringent lending requirements, as has been reported in other transit station areas (Cervero, 2004). Open space standards shaped development programs in that developers generally provided close to the minimum required.

Certainty in the approval process matters

The Vermont/Western case shows that in an increasingly discretionary system, there are also more opportunities for local stakeholders to oppose development proposals and thus proven pathways to development approval are highly valued. Developers are increasingly using the density bonus incentives to exceed the zoning in the surest way possible. An important dimension of the density bonus program is that it limits appeals to the nearest neighbors, rather than anyone in the city. This closes to the door to serial litigants. The city grants deviations and a clearer approval path in exchange for income-restricted affordable housing provided by developers. For an increasing share of developers in the Vermont/Western area, and seemingly elsewhere in the city, this is a worthwhile trade. But, fundamentally this only works if zoning acts as a ceiling on development intensities.

The Vermont/Western results help explain the weak or non-significant associations in the citywide regression results between homeownership rates and new multifamily housing production. That is to say, opposition to development is possible in places with low homeownership rates. Homeownership rates in the VWSP plan area were very low, around 11% (Chatman et al., 2016), but the local neighborhood council was actively involved with development issues. One of the recently approved developments, the 5550 Hollywood Boulevard project, was subject to an unsuccessful appeal by a litigious group tied with other appeals and lawsuits in Hollywood (Los Angeles City Planning Commission, 2014). While high homeownership rates increase the odds that a neighborhood will have a cohort of litigious stakeholders, one dissatisfied resident or property owner can potentially delay or stop a plan or development proposal. This reinforces the importance of certainty and by-right approvals for new urban infill housing.

Future research opportunities

These findings spark a number of future research opportunities. In particular, we need to better understand how regulations shape the characteristics of new housing at a fine geographic scale. I find that there is considerable within-city, and even within-neighborhood, variation in written land use regulations, regulatory interpretation, and community involvement. One approach would be to analyze the relationship between allowable density and actual developments by parcel across municipalities in a metropolitan area. This would be data intensive but would illuminate where and when regulations inhibit specific types of residential growth. It would be useful to engage in qualitative research on the development approval process. Interviewees explained that taking a building from conceptualization to final approval is often an iterative process that can vary depending on formal and informal feedback mechanisms from neighborhood organizations, planners, and elected officials. Most of the details are not contained in datasets. Past scholars have quantified development approvals in terms of typical approval timelines, and it is necessary to further examine how interest groups influence discretionary approval processes. Lastly, scholars could study how planners and developers view the benefits and costs of discretionary review and incentive zoning.

Conclusions

Written regulations and development approval process affect where and how much housing is produced. If planners and policymakers want to facilitate densification, allowing higher-density residential development by-right is a fundamental step. If approvals involve some discretionary action, regulations should be clearly written, provide transparency, and demonstrate a predictable path toward approval. This is not the case in Los Angeles, or in many

other high-demand cities. California's density bonus law, however, is a good example of a state exercising power to overcome exclusionary municipal zoning requirements. This takes pressure off local elected officials and planners for every project approval, particularly medium- and high-density developments that could potentially attract opposition. In general, these results point to the importance of planning for – and zoning for – higher development intensities, if cities want to address housing affordability and reduce greenhouse gas emissions through land use and transportation planning.

Appendix: Additional data descriptions

Amenity and accessibility data

Residential amenities include access to the beach, high-performing schools, and views. For each tract, I calculate the average Euclidean distance to the Pacific Ocean using USGS California shoreline data (Hapke et al., 2008). I calculate the average Academic Performance Index score based on the performance of neighborhood elementary schools (California Department of Education, 2015). I calculate the average elevation using the United States Geological Survey ten foot digital elevation model (United States Geological Survey, 2006).

Local and regional accessibility variables related to rail transit and BRT proximity, freeway proximity, neighborhood employment density, and regional job accessibility. For each tract, I calculate the area within a half-mile of a rail transit or BRT station (Center for Transit-Oriented Development, 2011). As a measure of regional automobile accessibility, I calculate each tract's average Euclidean distance to the nearest freeway ramp using CalTrans Enhanced National Highway System data (California Department of Transportation, 2013). I calculate each tract's employment density using 2000 Census Transportation Planning Package (CTPP) data (United States Department of Transportation, 2000). To measure regional job proximity, I use a gravity-based employment accessibility measure from Lens (2014), which is also based on 2000 CTPP data (United States Department of Transportation, 2000).

Geographic features

Geographic features that affect where housing is built include steep slopes and water bodies. First, I calculate the land area with slopes above 25% using the USGS digital elevation model and the ArcGIS Slope tool (Esri, 2011; United States Geological Survey, 2006). Second, the U.S. Census Bureau estimates the area of inland and coastal waters within each tract. Inland

waters are lakes, reservoirs, ponds, rivers, streams, creeks, and canals (United States Census Bureau, 2016). Examples include the Los Angeles River, Echo Park Lake, the Venice Canals, and the Hollywood Reservoir. Coastal waters include the Pacific Ocean near the American shoreline (United States Census Bureau, 2016). About one-quarter of tracts have some water, and I create an indicator variable equal to one if the tract met this criterion.

Other neighborhood characteristics

I use the homeownership share in 2000 as a proxy for homeowner and neighborhood association interests.[46] I divide tracts into three ordered homeownership categories: *low* for tracts in the bottom quartile, *average* for tracts in the middle two quartiles, and *high* for tracts in the top quartile. Additionally, since the geographic area of Census tracts vary, I calculate the land area of each tract. Lastly, I include measures of the multifamily housing stock, population density, non-Hispanic black population share, and Hispanic population share in 2000.

[46] Since the boundaries of Census tracts changed somewhat between 2000 and 2012, when necessary I used the Longitudinal Tract Database to extrapolate the 2000 totals to the 2012 boundaries (J. R. Logan, Xu, & Stults, 2014).

Conclusion

This dissertation is composed of essays about the evolution, political economy, and effects of land use regulations in Los Angeles. This research extends our understanding about why land use regulations are adopted, and how they matter. My central contributions to the scholarly literature are the addition of new longitudinal measures of land use regulation, and new knowledge about the determinants and effects of within-city zoning variation. These are timely topics for the future of just, environmentally sustainable, and prosperous cities. Land use regulations are important because of links between zoning, housing affordability, and greenhouse gas emissions. I began by chronicling and quantifying recent changes to land use regulations in Los Angeles. I followed by examining the determinants of upzoning, a relatively uncommon occurrence in the city. I concluded by studying how different zoning requirements matter for multifamily housing development. Throughout I paid particular attention to land use regulations near major public transit, the focus of many contemporary planners and policymakers.

Land use regulations are evolving, albeit slowly

Land use regulations in Los Angeles exhibit a combination of stability and piecemeal evolution. The most consistent dimension of land use regulation was Los Angeles's underlying zoning. The city changed the zoning designation on just two percent of the city's land area between 2002 and 2014. But, there were some broader land use policy shifts. Larger changes included neighborhood-scale transit-oriented development plans with a mix of policies that eased density caps and added new development and design standards. The city implemented density bonus incentives for affordable housing. Los Angeles loosened parking requirements in a

handful of areas. At the same time, the city notably preserved, or expanded, protections of single-family neighborhoods. Within the same neighborhoods – including areas within a short walk of rail transit – there was sometimes a simultaneous loosening of density restrictions on major corridors and new protections for single-family housing.

For scholars, these findings highlight the importance of quantifying and tracking land use regulations over time. Our ability to do this is greatly aided by archival datasets, and the availability of these data will continue to expand in the future. I will continue, and encourage other scholars to join me, in developing longitudinal spatial databases of local land use regulations. These datasets will help us to characterize what is "normal" in terms of zoning change. Additionally, there is a qualitative dimension that involves examining the goals and strategies of land use plans and policies. This mixed approach is useful for characterizing the richness of within-city regulatory variation. These planning and policy documents help illustrate the conflicted nature of land use regulation, between tensions to change and preserve, and whether the city should expand upward or outward.

Los Angeles's policymakers are facing major crises, including rising housing prices and climate change. Housing affordability is a particularly acute and prominent issue. Most neighborhood and citywide plans are long out-of-date in Los Angeles, and the majority of regulatory changes were a *substitute* for long-range planning – policy fixes to immediate problems – rather than a *response* to long-range planning. Breaking Los Angeles's ad hoc approach to land use regulation will require new and challenging planning processes at the neighborhood and citywide scales. In this planning, there will be fundamental disagreements about the city's future, and there is a good chance the plans will be litigated. But, my research

shows that change is possible in Los Angeles. And, in the end, it is Los Angeles's best chance to create a vision and plan with which to align its land use regulations.

Upzoning is unlikely in neighborhoods with homeowners and amenities

While some land use regulatory change is occurring in Los Angeles, upzoning was fairly uncommon in the city, and its occurrence provides insights into the determinants of density-enabling zoning changes. The parcels most likely to be upzoned were ones initially zoned for non-residential uses and not proximate to many existing residents. Upzoning was less unlikely in neighborhoods with higher shares of homeowners, which supports the "homevoter" hypothesis. Additionally, the odds of upzoning were lower in areas with amenities like access to the beach or high performing schools. Meanwhile, well-located parcels with non-residential zoning, in neighborhoods without too many existing homeowners, were more likely to be upzoned.

This research extends our understanding of determinants of land use regulatory change. While the results support the homevoter hypothesis, there are also exceptions that should spark future research. For instance, the failed Hollywood Community Plan is an example of a small group of property owners successfully stopping a density-increasing plan, even though homeownership rates are lower than the city average. Case studies of where small groups of strong-willed property owners prevail would be useful. Conversely, we should know more about the occasional upzoning that occurs in neighborhoods with high shares of homeowners. There are potential lessons from both kinds of outliers. The magnitude of the zoning change and the context seem to matter. The popularity of zoning changes and new development may hinge on a balance of preserving existing amenities, adding new amenities, and minimizing negative externalities, like road congestion. If amenities are a concern for homeowners, new development

that is perceived to add new amenities may soften local opposition. For instance, new development could be associated with new parks and open space, retail and restaurants, and/or funding for public services and infrastructure.

Land use regulations constrain multifamily housing construction

Land use regulations matter for multifamily housing development in Los Angeles. First, much of the city is off-limits to multifamily housing in the first place. Multifamily housing is built where regulations are more permissive and upzoning is more likely. The causality is unclear though. There are several possible explanations for the association between permissive zoning and multifamily housing construction. One is that density limits are generally a constraint on development, so growth spills over to where density limits are the loosest. But, it is also possible that the areas with the most permissive zoning are also best suited for multifamily (e.g., downtown Los Angeles). In the Vermont/Western plan area, I found that land use regulations guide, if not constrain, most mixed-use residential and multifamily developments. Development projects were commonly approved with deviations from the baseline zoning in terms of density, height, and parking provision. In conjunction with restrictive written zoning requirements, risky discretionary approval processes obstructed new multifamily housing construction. In general, zoning and approval processes are constraints, though not insurmountable for multifamily housing developers.

My research supports the hypothesis that developers would build more densely, particularly around public transit, if density restrictions were lifted. It also shows that we need to better understand the interaction between density restrictions, other written regulations, and approval processes. For instance, in Los Angeles, expert interviewees felt that the discretionary

process required for any development of at least 50 dwelling units added risk and complications to new development. Written regulations are just one piece of the puzzle, so we need to understand how regulations are implemented. We do not know much about the role of discretion in planning. My research suggests several questions for future research. What are the most common discretionary actions? Who is making the decisions? How transparent are the decisions? What are the motivations of various actors?

Reasons for optimism

I have used Los Angeles as a case study to answer important questions about local land use regulations. I am ultimately optimistic. Land use policy is slowly evolving to allow higher densities. More infill development is occurring in Los Angeles, particularly near transit. Local planners and policymakers are increasingly focused on promoting infill and affordable housing development, and ensuring that future growth is oriented around public transit. But, big questions remain about the future of single-family neighborhoods in Southern California, and how the benefits and costs of growth should be distributed. In short, we have much more to learn about why regulations are adopted and how regulations matter in different contexts.

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