Built-Out Cities?

How California Cities Restrict Housing Production Through Prohibition and Process

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Abstract

Given high rents and prices in California, housing production is at a relative historic low. Scholarship has connected restrictive land use regulations to high prices, with limitations on new construction being the assumed mechanism. Less research has focused on which regulations are most binding and where. In this paper, we seek to disentangle the impacts of two dimensions of land use regulation—prohibitions and process—on housing production. We do so by using two new data sources: the Terner California Residential Land Use Survey Data Set, and zoning capacity estimates from the Housing Element of cities' general plans, in a model of recently-permitted housing (from 2013-2017). We find that an index of regulatory prohibitions against higher density development is strongly associated with less permitting, especially permitting of multifamily housing. An index of process is uncorrelated with permitting, though the base data for this index is not complete. There is also greater endogeneity in measures of process: places with more development are more likely to report delays and other process complexities as constraints on that development. We also test the hypothesis that land use restrictions have a greater impact on production in more expensive places. Our findings show that the interaction between available zoned capacity and housing costs is significant and consequential. Combined with the fact that most expensive places have relatively little remaining zoned capacity for new housing, our findings offer a more comprehensive explanation for the low levels of new housing production in the state.

Introduction

California has a housing crisis. The primary drivers of the crisis are high demand to live in the state, which has always existed, and a low supply of housing to meet that demand, which is relatively new. Post-war California consistently boomed more than it busted. Between 1963 and 1988 California's real GDP more than doubled (U.S. Bureau of Economic Analysis, various). During that time it added almost 10 million people and over four million housing units—indeed, for most of the 1970s and 1980s the state added well over 200,000 housing units annually, falling below that only during periodic recessions (U.S. Census, various). One such recession occurred during the early 1990s, but the state's economy recovered by the mid-1990s. From 1997 to 2017 California's real GDP doubled again, and the population again grew by 10 million (U.S. BEA various, U.S. Census, various). This time, however, the state added only three million housing units, and housing production fell in many years to only 100,000 new units annually. California, in essence, entered an economic renaissance but built housing like it was in a recession.

The results are of this mismatch were predictable: as housing became scarce, prices rose, even amongst older stock that was once much more affordable. In the 1980s, the median value of an owner-occupied home built in Los Angeles County in the 1970s was $269,000 in 2016 dollars. By 2016, that value—for a home that was now 40 years old instead of 10—was $524,000 (U.S. Census, various).

So what holds housing production down—and keeps housing prices up—in California? The short answer, for many housing scholars, is regulation: local governments have made it harder to build housing. Yet, regulation is both a broad term and a black box. A wide variety of regulations exist, and while there is a strong correlation between regulatory stringency and housing prices, the actual process by which regulation creates high prices remains opaque.

This opacity arises for two related reasons. First is the sheer variety of regulations, and regulatory decisions, that localities can choose. This regulatory abundance means that different cities can use different regulations, but arrive at the same outcome of low housing production. One local government might have high minimum lot sizes, while its neighbor to the north has smaller lot sizes but higher minimum parking requirements and its neighbor to the south has few requirements of any sort, but just zones less land for housing. These three cities could be equally adept at blocking development, but an analyst correlating any given regulation with housing supply and price might find only weak relationships.

The second reason, which flows from the first, is that individual regulations might be interchangeable proxies for a larger problem, which is an underlying and hard-to-observe political antipathy to new housing. A high minimum lot size might be a legitimately binding restraint, but suppose a city with such a requirement was forced to remove it. Would this city now just welcome more housing? Or would it increase its parking requirements, reduce its height limits, or even just slow-walk permit applications to delay construction? Regulations, in short, must come from somewhere.

One can take this logic too far, and arrive at the zoning version of "guns don't kill people, people kill people." This conclusion would be mistaken. Underlying causes matter, but that does not mean proximate causes do not. Some regulations really are more burdensome than others are. Nevertheless, if in fact a regulatory regime is just the legal embodiment of a political atmosphere, then examining and removing any individual regulation might be akin to cutting the head off a hydra: two more sprout in its place, and the beast lives on.

Our goal in this paper is to look inside the black box of regulation, and discern how regulation does or does not influence housing supply, and thus price. We examine supply at the city level: our primary dependent variable is how much building occurs in a locality. Our focus is thus at the scale of the regulating authority (the city) rather than the scale of the market (the region). This allows us to assess the mechanism by which scholars theorize that regulation influences price.

We address three areas where the existing literature has spent little time. First, we divide regulation into two domains—process and prohibition—that we believe capture the major ways regulations can impede development and map directly to the determinants of supply inelasticity. Process refers to the steps developers must take once they start a project: how much parking they must provide, how many hearings they must attend, the magnitude of required impact fees, and so on. Prohibition refers to the ability to start a project at all: does the city allow housing development on much of its land? Is that allowed development restricted to detached single-family homes? Note that these measures may not strongly correlate with each other. Developers often complain about process, but complaints about process imply low levels of prohibition. A project cannot become cumbersome unless it is allowed to begin. Fighting over what an apartment developer must do implies zoning that allows apartments.

Second, we exploit a novel measure, available because of California's statewide Housing Element law, that helps capture a city's underlying attitudes toward development. All California cities must regularly report, first to regional planning agencies and then ultimately the state, an estimate of their "feasible capacity" to develop housing. These estimates, which are the product of study and negotiation within each city, use some objective measures (e.g., the availability of vacant land) but what matters for our purposes is that they are fundamentally subjective, because in fact every city in California could physically hold far more housing, if they decided to allow it. Allowing housing is a political decision, and when cities report their ability to hold housing to the state, they are revealing overall tolerance for development—a tolerance that different forms of regulation across both places and time come to reflect.

Here is a relevant example. In 1960, the zoned capacity of the city of Los Angeles was roughly 10 million people. By 1990, it had fallen to roughly four million, where it stays today (Morrow, 2013). Yet Los Angeles did not add mountains or water between 1960 and 1990. Nor did it lose land area. Nor did the field of structural engineering revisit its foundations, and determine that buildings simply could not be as tall as once was thought. What changed was residents' attitudes toward development, and the city's regulations, in different ways, came to reflect these attitudes. California's Housing Element law essentially collects a number signifying these attitudes from every city, in the form of its zoned capacity estimates. One can thus view these estimates as the underlying attitude that subsequent regulatory decisions make manifest.

Our third contribution is to test the interaction between regulation and demand. To date, the literature has underemphasized the historical endogeneity of demand, development, and regulation. Put simply, development is more likely to occur in desirable neighborhoods, but this development often creates a political constituency that prefers the status quo (having bought into the neighborhood, they do not want to see it change). If this constituency is politically powerful enough, it succeeds in enacting regulations to prevent new housing production. Housing development in that place will thus become less likely to occur than it had been before, but more likely to occur in that place than in other places where demand is lower. Development remains more common in the higher-income and higher-rent parts of metropolitan areas—usually near but not actually in the most affluent neighborhoods—because they remain the most desirable. This suggests, in theory, a strong connection between zoned capacity, rents, and development activity.

Our analysis of California bears that relationship out. Because developers want to build where returns are highest, regulatory constraints restrict production much more in high-rent cities than in low-rent cities. In fact, cities with low rents permit very little housing no matter how restrictive their regulatory environment. This result reinforces the idea that the state government should push for increased zoning capacity in places where demand is highest if more housing production is the goal. The state may wish to focus, moreover, on the actual outcome of housing production, rather than the details of cities' regulatory environments.

We organize the paper as follows. The next section presents background on previous efforts to assess the impacts of land use regulations on both housing prices and housing production. We include a discussion of the multiple challenges in this area, including that of measuring regulatory stringency and identifying the impacts thereof. Then, we describe the different sources of data we rely on in our analysis, the advantages of the new data on zoned capacity, and our approach to regression models. We divide the results of our analysis into five main findings, and then conclude with a discussion of the implications of this research for policy and suggestions for future efforts to refine the analysis.

Background: Regulatory Barriers to Housing Supply

In a competitive market, prices well above production costs should trigger their own decline, by attracting new entrants who see an opportunity to profit by underselling incumbent producers. Housing prices in many US regions have stayed well above construction costs for decades (Glaeser & Gyourko, 2003, 2017), so scholars have long assumed (and failed to disprove) that these markets are not competitive, and that new entry is being stifled.

One result of this assumption is a substantial empirical literature on zoning's role in distorting housing markets. In a 2005 review, Quigley and Rosenthal identify and summarize roughly 50 studies that examine the relationship between land use regulation and housing market outcomes. We identify an additional 25 (half focused on production and the other half focused on prices) and summarize them in Appendix A as an update to that review. The literature on this topic differs along two important dimensions: the outcome of interest (prices, production, or supply elasticities) and the measure of regulation.

Outcome of Interest

Prices and quantity change in the same set of equations, but over 80 percent of the existing research focus on prices. We find only a dozen papers that use supply as the outcome of interest (Thorson, 1997; Skidmore & Peddle, 1998; Levine, 1999; Mayer & Somerville, 2000; Quigley & Raphael, 2005; Zabel & Paterson, 2006; Glaeser & Ward, 2009; Schuetz, 2009; Kahn, 2011; Dempsey & Platinga, 2013; Jackson, 2016; Murray & Schuetz, 2019). Even fewer estimate supply elasticities and relate them to regulations (Saiz, 2010; Ball et al., 2010).

On the one hand, the disproportionate attention to prices is understandable. Prices are clearly the outcome of interest for public policy. Housing is the biggest expense for owners and renters, the primary investment vehicle for the typical owner, and the single largest commodity in any economy. Prices are also more likely to motivate research. High prices have an intrinsic impact on welfare that low supply does not. Scholars are thus more likely to initiate studies because prices are high than because new production is low. Production is of interest only as an intermediate outcome. Regulation's suppression of new supply is an implicit rather than explicit part of the analysis.

This same logic, however, means that the relationship between regulation and prices cannot exist without regulation influencing supply. One reason to explicitly examine supply, then, is to simply verify that this implicitly-hypothesized mechanism for price increases is in fact occurring.

Beyond that point, production may be useful to study because the nature of its relationship to regulation suggests fewer (or more manageable) problems with endogeneity. In theory, strict regulations reduce the housing market's price elasticity of supply. As such, in a more regulated environment an increase in demand will make prices increase by *more* than they would otherwise, and make supply rise by *less*.

This difference makes production a more straightforward outcome to assess. A regression of regulation and price confronts the following simultaneity problem. Regulation can make housing more expensive by restricting supply, but people who live in more expensive places might also have a greater taste for regulation. Perhaps they think regulations will ensure higher-quality housing, or they are more attentive to the financial stake they have in their housing asset (Katz & Rosen, 1987; Fischel, 1990). The causality thus runs both ways. Left uncontrolled, this endogeneity will create, in underspecified models, a confirming bias. It could generate a false positive in a significance test, inflate the coefficients on variables measuring regulation, or both.

Models that use supply as an outcome are not immune to bias, but their bias does run in the other direction. More expensive places are expected to see more housing production, ceteris paribus. The simultaneity threat that arises is that regulation can constrain supply (a negative relationship), but a surge of new supply might lead places to add regulation (a positive relationship). As a result, models of production that do not sufficiently control for incomes of places could yield Type I errors: null significance tests and/or positive coefficient on measures of regulation. Finding a significant negative correlation between regulation and production, therefore, ought to be more compelling than finding a positive coefficient on price.

Scholars have used various approaches to overcome the endogeneity between land use regulations and prices, especially instrumental variables, panel models with lags, and regression discontinuity (Malpezzi et al., 1998; Mayer & Somerville, 2000; Malpezzi, 2002; Saiz, 2010). In the work that focuses on production, however, most models are either simple OLS or panel models. Two papers (Schuetz, 2009; Dempsey & Platinga, 2013) use instrumental variables and one uses a difference in differences approach (Dempsey & Platinga, 2013).

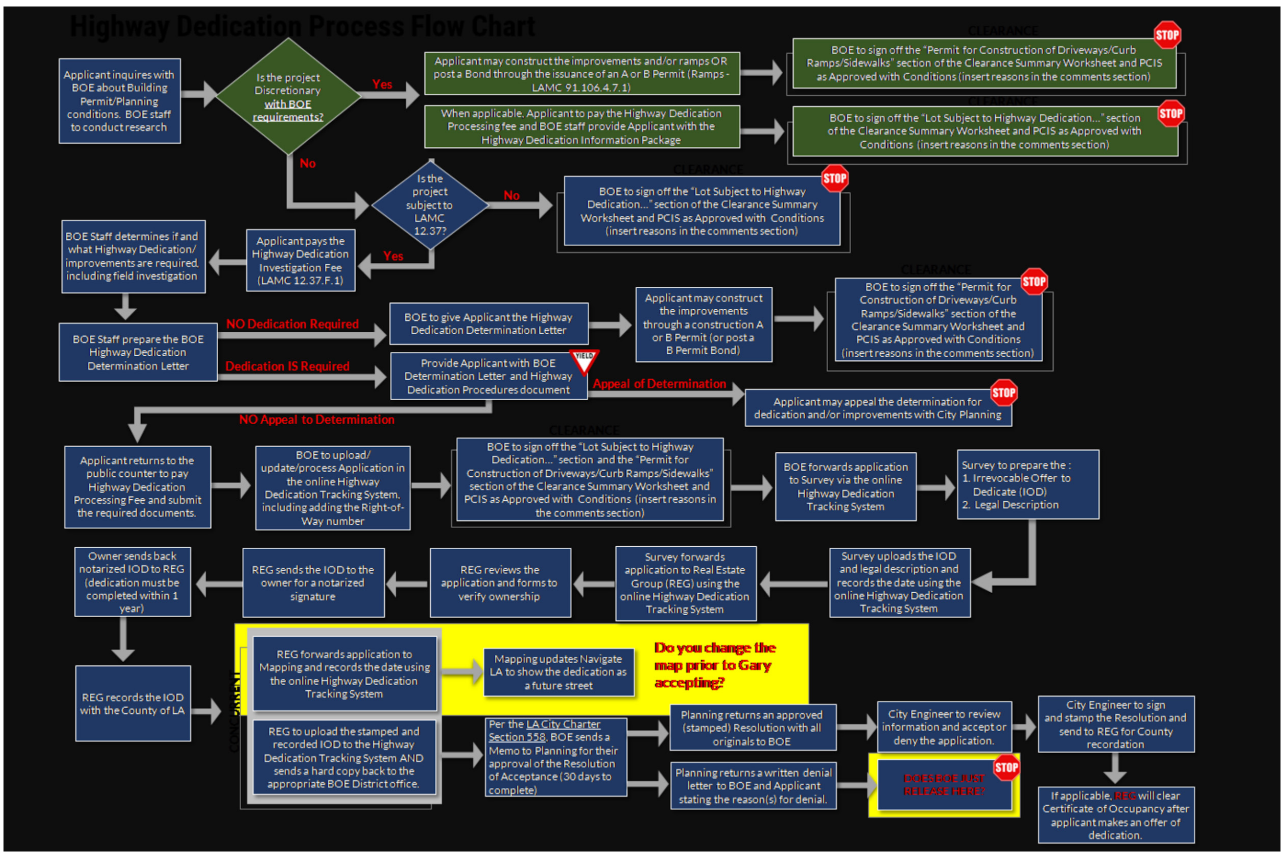
In California, Murray & Schuetz (2019) examine the presumed central driver of multifamily production—demand as measured by rents—and find that there is no correlation. This begs the question why, and motivates an examination of regulation as the reason more expensive places do not have more new construction.

Measure of Regulatory Stringency

The largest challenge in evaluating the role of regulation in production and prices is measuring regulation itself. Housing developments can face scores of regulations, not all of them present in all cities, not all of them enforced with equal intensity in those cities that have them, and not all of them requiring the same time and effort to satisfy. A traffic impact fee that in one city might require a single trip to one department in another city might require multiple reviews by multiple departments. Figure 1, for example, is a flowchart given by Los Angeles Bureau of Engineering to describe the process by which a multifamily developer navigates the requirement to widen a street. The process has between four and 26 steps, depending on the parcel. Measuring just this one requirement is a problem with no obvious solution.

Given this variety and complexity, there is virtually no way to capture regulatory stringency fully in a consistent quantitative measure. Nevertheless, scholars have come up with reasonable proxies. They have examined local zoning codes for the presence of specific measures (Downs, 2002; Schuetz, 2009), measured the difference between the average and marginal value of land (Glaeser et al., 2005), tracked the frequency of development litigation over time (Ganong & Shoag, 2017), and recorded the frequency of developer requests for discretionary approvals (Ben-Joseph, 2003).

Figure 1: Flowchart of Requirements to Widen a Street for Multifamily Housing



Source: Los Angeles Bureau of Engineering

One of the more common approaches to measuring regulation (used in over 20 of the 80 papers reviewed) is to survey planning staff. Surveys generally ask about the presence of common regulations (e.g., Glickfeld & Levine, 1992; Ihlanfeldt, 2007; Gyourko et al., 2008; Kok et al. 2014; Pendall et al., 2018), the cost and time to get building permits, and rates of enforcement (Monkkonen, 2013; Hilber & Vermeulen, 2016).

The accuracy of these survey-based measures remains an open question. In principle, planners should know the regulatory landscape best. Recent studies, however, have found that survey responses are frequently inconsistent, and sometimes do not correspond to the actual development process. Lewis & Marantz (2019) match eight surveys of California cities' land use regulations and find dramatic inconsistencies in survey answers from the same cities in different surveys. In the clearest case, different scholars conducted surveys of the same municipalities about growth management in 1988. Nine municipalities reported that they had urban growth boundaries in the first survey but not the second, while five municipalities reported an urban growth boundary in the second survey but not the first.[1]

In a study of entitlement processes, O'Neill et al. (2019) show that survey responses are often just wrong. They review survey results from eight California cities about the average time to process and approve a development. They then compare these survey estimates with detailed case studies that estimate actual average processing times for different kinds of entitlements. In almost all cases, the responses drastically underestimate the processing times. For example, in Los Angeles and Pasadena responses to the survey reported projects consistent with zoning taking two to six months, whereas projects' average time was almost a year in Los Angeles and a year and three months in Pasadena. Murray & Schuetz (2019) also identify inaccuracies in these survey data. Respondents' estimates of the share of land zoned for multifamily development in their jurisdiction do not match authors' estimates from zoning maps.

What accounts for inaccuracies and inconsistencies in survey responses? Lewis & Marantz (2019) propose some reasons, and some of the problems might be difficulties that afflict survey research in general. City planners, especially in restrictive cities, are probably busy, and the most knowledgeable people may have neither the time nor motivation to answer questions posed by academics carefully, especially if doing so would require original analysis of administrative datasets. So the survey may be outsourced in some cases to less knowledgeable respondents.

Additionally, the development approval process may be sufficiently complex that no one person can easily answer questions about it. Housing proposals may pass through the planning department, building and safety department, bureau of streets, and so forth. Different types of development, furthermore, might face different requirements, depending on their scale or location. Note that in Figure 1, the 4-through-26 steps of street widening in Los Angeles occur almost entirely outside the Planning Department. Some respondents will inevitably be more familiar with some parts of the process than others will, meaning almost every survey response will have some error arising from respondents encountering questions about processes about which they have less knowledge.

Survey questions themselves can inadvertently create false impressions. A survey might ask how much land a locality zones for multifamily housing, for example, but not ask how much of that land zoned for multifamily housing has been already built on. If two cities zone half their land for multifamily, but one is 70 percent built-out and the other 30 percent, the observed relationship between multifamily zoning and production would be inconclusive.

All these problems contribute to inaccuracy in surveys of planners. An interesting twist in the survey literature, however, is that even when they err in describing particular aspects of the regulatory landscape, they do seem to have an accurate sense of regulation overall. Researchers have found, for example, that planners' responses to subjective questions about constraints to development have more predictive power than the presence of specific regulations (Jackson, 2018; Lewis & Marantz, 2019). This offers a window into what regulation actually is. When planners "just know" that they are in a city where it is hard to build, they may be indicating, intentionally or not, that the city is hostile to new development and has numerous ways to express that hostility. They may also, relatedly, be internalizing the idea that the city is "full," and not realizing that this is a subjective assessment that can be changed (although probably not by them). We return to this issue when we discuss zoned capacity.

A final complication in the measurement regulation is the scale of analysis. Local governments regulate land use but housing markets are metropolitan. Of the research that focuses on housing production as the outcome of interest,

1. For more discussion on the use of surveys, see the comments on the Lewis and Marantz article in *the Journal of the American Planning Association* (volume 85 issue 4).

only Mayer & Somerville (2000) focus on the metropolitan scale, the other dozen studies use municipalities as the unit of analysis. Studies that use an average value of regulation across cities (e.g. Saiz, 2010; Lens & Monkkonen, 2016) within a metro necessarily lose some of the important information on heterogeneity and variation across the cities of that metro.

On the other hand, studies (like this one) that assess the impacts at the city level include both cities that are inside large and small metros in the same model. In some cases, they insufficiently consider the potential for heterogeneous impacts of regulation in these two scenarios. Moreover, in larger cities some of the interactions between regulations, supply, and prices actually occur at the neighborhood scale (Monkkonen et al., 2012).

Data and Methods

When housing prices rise, developers should build more housing units. The extent and pace of this building response is determined by the market's price elasticity of supply. A city that constrains housing production is making the supply of housing less elastic. How so? Supply elasticities have multiple determinants—including the capacity of the housing development sector—but two that cities control are the complexity of the production process (what we characterize as process) and the availability of inputs (in this case, land zoned for development). We measure these separately using questions from the California Land Use Survey (for more, see Mawhorter & Reid, 2018) and then additionally measure prohibition based on cities' estimates of new development potential in their Housing Elements.

Terner California Residential Land Use Survey (TCRLUS)

We draw on data gathered through a survey of California local governments that yielded responses from 252 cities and 19 counties (described in Mawhorter (2019)). Similar to other research based on surveys, e.g. the Wharton Land Use Regulation Index (Gyourko et al., 2008) or the Berkeley Land Use Regulation Index (Kok et al., 2014), we aggregate survey questions into topic-specific sub-indexes. We then combine these sub-indexes to create two overall indexes—measuring Process and Prohibition.

Sub-indexes avoid the problem of overweighting some topics because there are more survey questions about them, or more questions with a sufficient number of responses. For example, the TCRLUS has several questions about different aspects of zoning standards—front setbacks, side setbacks, and back setbacks. Using each of these questions separately would weight each of them as equal to the one question about share of land zoned multifamily. It makes more sense to consider setbacks overall, not each individual setback regulation, as comparable to the share zoned multifamily.

Both indexes have five sub-indexes. We list these sub-indexes and their component questions (14 questions for the process index and 10 for the prohibition index) in Appendix B. All sub-indexes take values from zero to one. To create them, we standardize each question's responses from zero to one, add them together, and then standardize the sum. Unfortunately, missing data was a problem with several of the questions for the process index. For instance, dollar estimates of impact fees charged were unusable so we include the response to the subjective question on the extent to which impact fees constrain development.

All sub-indexes are correlated with one another at the 0.1 level or lower, with only two exceptions. Questions about impact fees and public opposition to new housing as constraints were moderately correlated with delays (around 0.3-0.4). On the other hand, almost all sub-indexes were moderately or strongly correlated with the indexes. This includes correlation between the prohibition sub-indexes and the process index, and vice versa.

New Data Derived from Housing Element Estimates

We complement our survey data with a measure of zoned capacity from the Housing Element (HE) of each city's General Plan. California's Housing Element Law mandates that each city demonstrate that they have enough zoned capacity in their jurisdiction—in vacant sites or sites feasible for redevelopment—to accommodate a certain amount of new housing construction in their HE. The exact number of housing units they must accommodate is determined through a regional housing needs assessment process.[2] We reviewed the HE for each of the 540 HEs in California for the period 2014-2021, and extracted these numbers as an alternative measure of regulatory permissiveness.

The HE works as follows. A regional government assigns each city a number of units of "housing need" for households of different income levels.[3] These estimates are based on state

2. For more, see: http://www.hcd.ca.gov/community-development/housing-element/index.shtml.
3. Extremely-Low (0-30 percent of Area Median Income (AMI)), Very-Low (0-50 percent of AMI), Low (51-80 percent of AMI), Moderate (81 – 120 percent of AMI), and Above-Moderate (above 120 percent of AMI).

Table 1: Housing Element of the City of Martinez

Relationship of Residential Development Potential in Martinez to the City's Regional Housing Needs Allocation for 2015-2023 (Sites Currently Zoned for Residential Use)

Site Conditions	Sites Greater than 30 Units/Acre	Sites from 20 to 29 Units/Acre	Sites Less than 20 Units/Acre	Total Unit Potential
Development Potential				
Vacant Residential	60	0	391	528
Vacant Mixed Use	30	426	1	392
Underutilized Sites	235	0	13	248
Total	325	426	405	1,156
ABAG Need (2015-2023)				
Very Low and Low	196	--	--	196
Moderate	--	78	--	78
Above Moderate	--	--	195	195
Total Need	196	78	195	469
Excess Unit Potential Under "Default" Density	**+129**	**+348**	**+210**	**+687**

guidelines that correlate density to housing affordability. The state specifies density minimums depending on a city's context—its population and the characteristics of its location in an urbanized area.[4] For example, a jurisdiction in a metro area must have sites developable at a density of 30 units per acre to satisfy their targets for low-income housing.

When the HEs are updated, cities must demonstrate that they have the capacity to add that many units or more. They do so by identifying sites where housing can be built under existing zoning. Cities therefore have a choice: they can provide the state an estimated number of units at different densities, or for income levels. Where they report income levels, however, we infer densities using the state guidelines.

Table 1, taken from the HE of the City of Martinez, is an example of how cities present their zoned capacity. They break down the number of units of potential development in three different density categories (above 30 units/acre, from 20-29 units/acre, and below 20 units/acre), each of which corresponds to an income category (Very Low and Low, Moderate, Above Moderate). In addition, they differentiate between types of sites. The lower half of the table presents the "housing need" assigned to them through their regional government. They demonstrate a greater unit capacity than this number to be in compliance.

Our interest in the HE process does not stem from its being a valid or objective planning tool. To the contrary, the HE process has numerous flaws (Monkkonen et al., 2019). One can argue that calculating a precise number of housing units each city "needs" is largely impossible. Even if one thinks such a planning exercise is in principle possible, the particular process employed in California almost certainly falls short. Anecdotally, planning professionals understand that cities write HEs strategically (Dillon, 2017). Among other issues, the process largely rewards cities that resist new development. A large factor in projecting future need is predicting future growth, and future growth is predicted based on past growth. As such, localities that have blocked housing in the past, and thus seen little growth, are able to block housing going forward.[5]

The HE is useful to us, however, for three reasons. First, the HE is compulsory. Cities have a legal obligation to complete a housing element, which means the problems of nonresponse that plague academic land use surveys largely disappears. Of the 502 jurisdictions (458 cities and 44 counties) in California's MSAs or Micropolitan Areas we have the total zoned capacity for 487.

Second, the HE is consequential. The HE in California is the most frequently revised General Plan element (every five or eight years) and also the most heavily scrutinized. It is the only element of the local General Plan that a state agency reviews.[6] Cities who do not complete a housing element risk legal consequences, and the Housing Element is the

4. For example, is it in a metropolitan area, micropolitan area, or rural area.

5. Legislative changes to the Housing Element Law in 2017 and 2018 have reformed this process to some extent going forward, see Elmendorf et al. 2020.
6. See the website of HCD for details on the 'Building Blocks' of the HE, guidelines cities use in writing their HE: http://www.hcd.ca.gov/community-development/building-blocks/index.shtml.

Table 2: Number of Cities with Data Available by Region of California

Region	Total # Cities	Process Index*	Prohibition Index*	Zoned Capacity
Greater LA	191	79	98	189
SF Bay Area	108	53	68	107
San Diego	19	11	13	19
Sacramento	29	12	10	29
Monterey Bay Area	17	9	9	17
Fresno	16	5	5	16
Small Metros	81	28	26	81
Total Cities	**461**	**197**	**229**	**458**

Notes: This table shows, by region of California, how many cities we are able to construct indexes for using the Terner California Residential Land Use Survey data and the zoned capacity data from cities' Housing Elements.

building block for the city's political position with respect to development. Thus where cities may devote little time or resources to completing surveys sent by academics, they regularly assign senior planners to complete their HEs, or hire specialized consultants. The resulting studies are thorough. The Housing Element of the City of Sacramento, for example, is 264 pages long.

Third and perhaps most important, the HE is useful precisely because it is, for many cities, a political exercise that can help the city deflect new housing. Some lower-density cities in outlying areas with ample vacant land have development potential that greatly exceeds their assigned housing unit goals. If these cities do not want more housing, they might underreport their potential in the HE because they can meet the statutory requirements without a comprehensive review of development capacity on all parcels.

Other cities will optimistically assess development potential and thus over-report their actual zoned capacity, satisfying the state without actually making room for new development. This might occur, for instance, through a city denoting a commercial site with viable businesses on it as being "feasible" for multifamily redevelopment. This sort of reporting is more likely to occur in high-priced cities that have decided through their zoning codes they are "built-out". These latter cities are of most interest to us.

No cities are in fact "built-out." The modern elevator was invented in 1903, and engineers have known for half a century how to construct buildings over 100 stories tall. There are of course reasonable arguments against 100 story buildings, but most of urban California is between one and two stories. Build-out is a political judgment, and cities that determine themselves closer to build-out are cities that are politically more hostile to development.

A striking example here is Beverly Hills, a city well known for using the HE process to avoid building housing (Dillon, 2017). In 2019 Beverly Hills was assigned more multifamily housing units than it wanted. In protest, the city submitted a letter[7] to the regional government declaring that it had no feasible way to add more multifamily housing other than knocking down its existing rent controlled apartment buildings and redeveloping those sites at higher densities. Anyone familiar with Beverly Hills knows this statement is preposterous. The vast majority of Beverly Hills' residential land is zoned for low-density detached single-family housing—the city has abundant space for redevelopment.[8] The city's warning is only true if it chooses not rezone any of its land. And nothing, other than politics, stops it from rezoning.

The HE thus provides us with a source of data on zoning restrictions that quantifies a combination of the cities' build-out (relative to its zoning) and its disposition towards further development into one number: how many new units could be built under current zoning.[9] As such, we use the sample of 487 HEs as a new measure of housing restrictiveness. Of these 487 cities, 332 breakdown their zoned capacity by income categories,[10] 54 by density categories, and 9 by both income and density. We cannot clearly discern a breakdown in the remaining 92 HE. Thus, the zoned capacity numbers from the HE provide an improved measure of zoning prohibition. We extract three numbers per jurisdic-

7. Available online: http://www.scag.ca.gov/programs/Documents/082319John-MirischBeverlyHills.pdf (last accessed 12/27/2019).
8. Zoning map available online: http://www.beverlyhills.org/cbhfiles/storage/files/64529851516564397/FinalZoningMap.pdf (last accessed 12/27/2019).
9. This number, in fact, is what Jackson (2018) calls "Buildable Land Constraint". He measures it with a survey question asking planners to rate the importance of the Supply of Land in constraining housing development.
10. Most jurisdictions use the five or four categories as outlined by the HCD Building Blocks, but a significant minority report Moderate and Above-Moderate together and/or Extremely-Low, Very-Low, and Low together.

tion—low density (single-family) zoned capacity, medium to high density (multifamily) zoned capacity, and the total. [11]

Table 2 summarizes the availability of our different datasets measuring regulations. We break it apart by metro area to assess balance but also to demonstrate the concentration of cities in a handful of large metros. Greater Los Angeles contains roughly 40 percent of the state's population and cities.

Models

The underlying theory that motivates our models is that more housing construction will occur in cities with higher rents (a proxy for returns on development) unless that construction is prevented from occurring by outright prohibitions or by a regulatory process that makes development appear less profitable than investments elsewhere, and controlling for construction costs. Therefore, we test three variations of the hypothesis that cities with 'more' regulations (categorized as process / prohibitions / zoned capacity) will have less new housing construction. We use simple OLS models that model permitting as a function of rents.

log(Permits 2013-2017) = α + β1(ln(Rent) + β2Reg + β3City + β4Dem + Metro + e

Where rents are measured in 2013, Reg is one of three regulatory indexes (process, prohibition, or HE zoned capacity), and City denotes a vector of city controls including city size, job accessibility, and population density. Below, we present the results of parsimonious models that include these variables and metro fixed effects. As a robustness check, we ran models with additional controls (in the equation as Dem)—incomes, race/ethnicity, education levels, share multifamily in the city, and the recent (2009-2013) change in rents. The coefficients of interest did not differ substantially across models.

11. The full dataset extracted from Housing Elements, with notes on how we created variables, is available upon request.

Findings

Cities with higher levels of residential permitting between 2013 and 2017 are larger, have higher average incomes, and had relatively fewer jobs nearby. They have more zoned capacity, and tended to report fewer regulatory prohibitions but a more onerous regulatory process.

In Table 3, we group descriptive statistics for our main variables by quartiles of permits per 10,000 residents. Our sample has 449 'metropolitan' cities, so the first three quartiles contain 112 cities and the fourth quartile 113.

The differences are stark across these four groups of cities. There is a clear association between higher levels of permitting and city population, with less job accessibility, more regulatory process, and more zoned capacity. But zoned capacity is the same across the three lowest quartiles of permitting, and then jumps to double the zoned capacity in the top quartile.

Next, we assess the correlation between the measures of zoning restrictiveness from the TCRLUS, zoned capacity from the HEs, and the focus measures of housing costs and housing production. Table 4 presents these bivariate

Table 3: Descriptive Statistics by Quartiles of Permitting per 10,000 Residents

	Permits Issued between 2013-2017 per 10,000 Residents			
Variable	**Below 32**	**Between 32 and 76**	**Between 76 and 151**	**Over 151**
City Population (1000s)	29.38	44.07	51.02	52.21
Average Rent in 2013 (1000s of $)	1.37	1.30	1.41	1.44
Average Household Income in 2013 (1000s of $)	73.33	75.07	78.64	81.74
Population Density (1000s per square mile)	3.86	3.80	3.89	3.28
Job Accessibility (10000s)	14.13	9.01	6.62	5.66
Process Index	-0.25	-0.31	-0.02	0.11
Prohibition Index	-0.20	-0.13	-0.01	-0.23
Zoned Capacity / City's Housing Stock	0.10	0.10	0.12	0.23

Source: Authors' calculation with data from American Community Survey, TCRLUS, Housing Elements

Table 4: Bivariate Correlations between Measures of Regulation and Housing Outcomes

	Process Index (N= 207)	Prohibition Index (N= 228)	Zoned Capacity (log) (N= 438)	Zoned Capacity / Housing Units 2013 (N=438)
Hsg. Value (log)	0.20**	0.02	-0.35**	-0.58**
Rent (log)	0.21**	0.12	-0.33**	-0.51**
All Permits 2013-2017 (log)	0.09	-0.19**	0.66**	0.08
All Permits 2013-2017 / Housing Units 2013	0.06	-0.07	0.35**	0.28**
Multifamily Permits 2013-2017(log)	0.16*	-0.32**	0.40**	-0.10*
Multifamily Permits 2013-2017 / Housing Units 2013	0.16*	-0.32**	0.26**	-0.06
Process Index		0.06a	-0.10b	-0.17b **
Prohibition Index			-0.24c **	-0.10c

Source: TCRLUS, Housing Elements, U.S. Census.

Notes: In some cases, the number of observations differs. a has 197 observations, b has 203, and c has 233.

correlations. By far the strongest correlation is between permitting and zoned capacity, though notably more expensive cities also have less zoned capacity. Expensive cities tend to have more regulatory process but do not exhibit tendencies toward prohibition. The difference in relationships between process, prohibition and permitting is especially salient—places with more permitting have more regulatory process but fewer prohibitions.

Regulatory prohibitions and zoned capacity have a strong connection to overall rates of housing production when controlling for other city characteristics. A one standard deviation increase in zoned capacity is associated with a roughly 30 percent increase in permitting.

Table 5 reports the results of regressions of the logged number of permits issued 2013-2017 on the independent variables described above. As expected, cities with higher rents—and lower densities—see more production overall. Cities with more regulatory prohibitions have significantly less permitting—a one standard deviation increase in prohibitions is associated with a roughly 10 percent decrease in housing units permitted. Zoned capacity is strongly associated with permitting, with a relatively larger coefficient. A one standard deviation increase in zoned capacity is associated with a roughly 30 percent increase in permitting.

The coefficients of interest do not lose or gain significance in the model that includes all three measures of regulatory constraints. The coefficient on prohibitions becomes slightly larger and that on zoned capacity becomes smaller in their association with recent permitting. In identical models with additional controls (incomes, race/ethnicity, education levels, share multifamily in the city, and the recent (2009-2013) change in rents), the coefficients on the measures of regulation change very little (to 0.02, -0.25, and 0.37 respectively).

Multifamily housing production is especially sensitive to regulatory prohibitions. A one standard deviation increase in the prohibition index is associated with 20 percent less multifamily permitting.

Table 6 reports the results of nearly identical models to Table 5. The difference is the dependent variable is the logged number of multifamily permits issued from 2013 to 2017. One additional difference is that the sample for cities with data on zoned capacity specifically broken down between multifamily and single-family densities is smaller by about 80 cities. The 360 cities that provide a clear breakdown of zoned capacity by density levels are slightly higher income and permit more housing than the 84 that do not (13 percent in poverty vs. 16 percent and 113 permits per 10,000 residents vs. 105).

Table 5: Regression Results (OLS): DV = All Permits 2013 - 2017

Variable	Model 1	Model 2	Model 3	Model 4
Population (log)	1.10***	1.23***	0.82***	0.84***
	[0.08]	[0.08]	[0.08]	[0.12]
Rent (log)	0.79*	0.92**	1.31***	1.32***
	[0.42]	[0.40]	[0.27]	[0.44]
Density (log)	-0.14	-0.66***	0.01	-0.53***
	[0.10]	[0.17]	[0.04]	[0.17]
Jobs (log)	0.01	0.13	-0.01	0.11
	[0.13]	[0.12]	[0.07]	[0.12]
Process Index	0.03			0.05
	[0.08]			[0.07]
Prohibition Index		-0.27**		-0.35**
		[0.13]		[0.16]
Zoned Capacity			0.36***	0.31***
			[0.07]	[0.08]
Observations	195	227	444	184
Adj. R-squared	0.59	0.62	0.65	0.60

*Notes: Robust standard errors in brackets. Models include metro fixed effects. *, **, *** indicate significance at the 0.01, 0.05, 0.10 levels.*

Table 6: Regression Results (Tobit): DV = log Multifamily Permits 2013-2017

Variable	Model 1	Model 2	Model 3	Model 4
Population (log)	1.44***	1.45***	1.08***	1.28***
	[0.12]	[0.13]	[0.14]	[0.23]
Rent (log)	-0.06	0.71	0.61	0.59
	[0.80]	[0.65]	[0.55]	[0.83]
Density (log)	-0.02	-0.62**	0.35***	-0.56*
	[0.13]	[0.27]	[0.10]	[0.33]
Jobs (log)	0.36*	0.59***	0.18	0.41*
	[0.20]	[0.19]	[0.16]	[0.23]
Process Index	0.24*			0.21
	[0.13]			[0.13]
Prohibition Index		-0.73***		-0.99**
		[0.20]		[0.33]
Multifamily Zoned Capacity			0.29***	0.13
			[0.10]	[0.15]
Observations	195	227	360	149
Pseudo R-squared	0.14	0.15	0.11	0.15

*Notes: Robust standard errors in brackets. Models include metro fixed effects. *, **, *** indicate significance at the 0.01, 0.05, 0.10 levels.*

The prohibitions index exerts a stronger correlation to production than zoned capacity unlike the models for overall permitting. A one standard deviation increase in the prohibition index is associated with 20 percent less permitting, whereas a one standard deviation in zoned capacity correlates with a 17 percent change in permitting. Additionally, in the model with all three measures of regulation, zoned capacity loses significance and the coefficient on prohibitions is higher. The sample is smaller in Model 4 and cities without data for the prohibitions index are different: they permitted less new housing and have less zoned capacity than the rest of the sample.

As with the regressions on overall permitting, we run models with additional controls (incomes, race/ethnicity, education levels, share multifamily in the city, and the recent (2009-2013) change in rents). The coefficients on the measures of regulation change more in magnitude than in the regressions of all permits (to 0.22, -0.51, and 0.28, respectively), but significance do not change.

Cities with more onerous regulatory processes—as we are able to measure them—do not permit less housing.

The relationships between regulatory process and production are not as theory predicts. For example, in Table 5 the coefficient on the measure of regulatory process is insignificant and nearly zero, indicating that an onerous process as we measure it does not significantly correlate with less housing production. In Table 6, we see that a more constraining regulatory process is associated with more multifamily permitting, the opposite direction than theory predicts, although the coefficient is only significant at the 10 percent level.

There are two likely explanations for these results. The first is that the variables that make up the index, because they rely so heavily on questions about process being a constraint to development, are endogenous. That is, planners in cities where more housing development occurs are more likely to note the procedures as a constraint to this housing production than in cities where because of low demand no development occurs. This could be remedied with more objective data. The second possible explanation is that the causal impact of development on regulatory process outweighs the causal impact the other way around.

Zoned capacity and regulatory prohibitions matter more in expensive cities. Cities with lots of space and lax rules but low rents do not permit much housing.

Because of the importance of zoned capacity and its negative correlation with high-rent, high-job-access cities, we test the hypothesis that the relationship between zoned capacity and permitting is stronger where rents are higher. Figures 2 and 3 are graphical representations of the results of models identical to those reported in Tables 5 and 6 with one difference. In these models, zoned capacity is interacted with rents.

The relationship between zoned capacity and permitting is much more pronounced in high-rent cities. As an illustration, imagine a city with a rent of $900 (the 10th percentile in the state in 2013). If this city went from the 25th to 75th percentile in terms of zoned capacity, i.e. from 600 units to 4,400 units, its permitting rate would increase by roughly 50 percent, from around 110 to 165 units. However, if a city at the 90th percentile of rents ($2,100) saw the same increase in zoned capacity, it would permit three times as many housing units, jumping from 240 to 740. Zoned capacity packs a lot more punch when demand is higher—for all permits and for multifamily permits.

Figure 2: Interaction Plots Using Results in Appendix C: All Permits

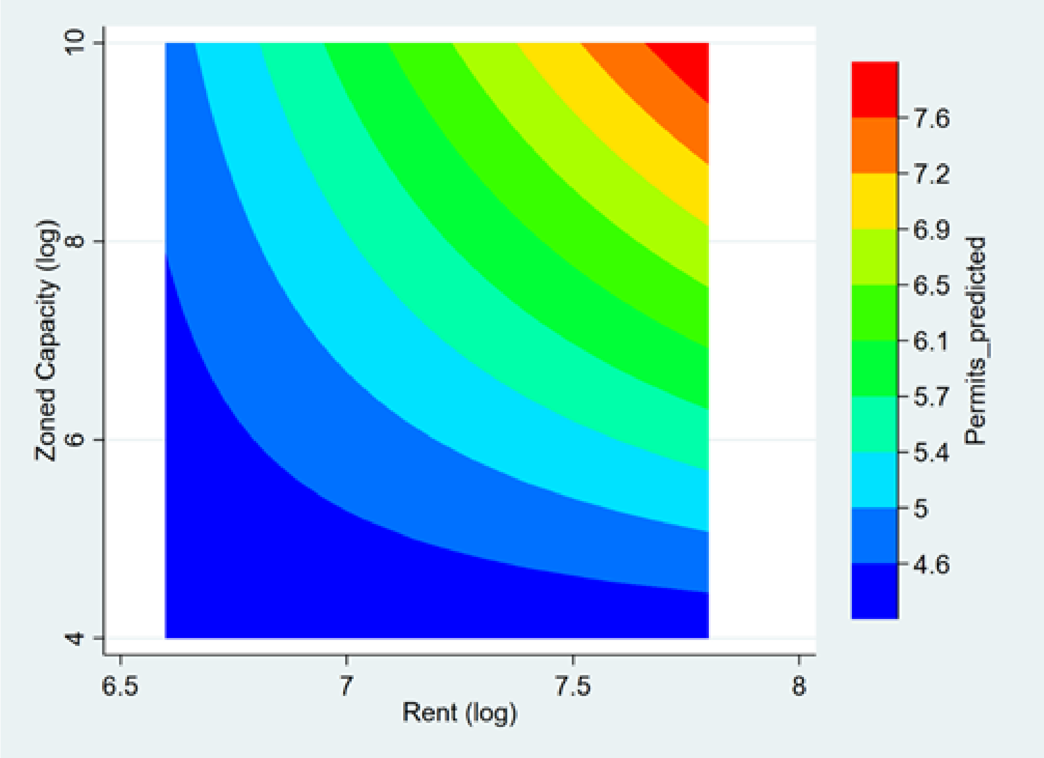
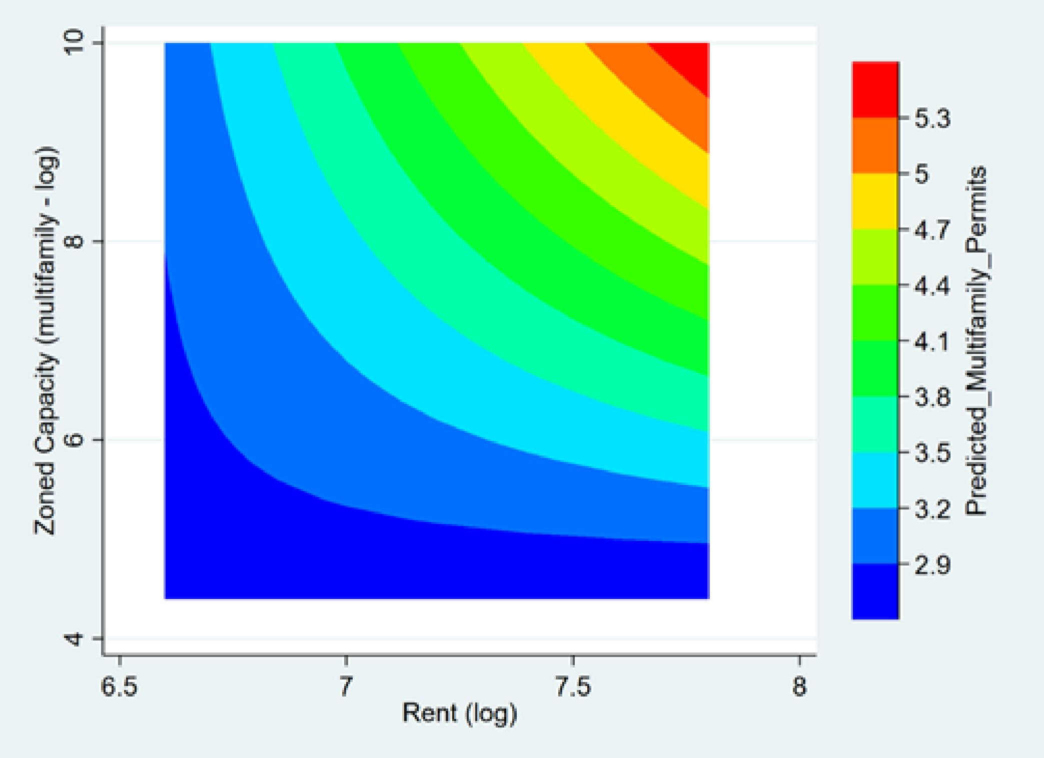


Figure 3: Interaction Plots Using Results in Appendix C: Multifamily Permits



Discussion and Conclusions

The results of our analysis suggest that regulatory prohibitions—a combination of low density zoning, setbacks, and other limits on what can be developed on a parcel—limit housing production in California's cities. A one standard deviation increase in an index of these prohibitions is associated with 10 percent less permitting overall and 17 percent less multifamily permitting.

Moreover, we find that the interaction between a combination of prohibitions and existing buildings, and market demand (as measured by rents), has a significant relationship to permitting. We measure this combination of prohibitions and existing buildings using cities' own quantitative estimates of their remaining zoned capacity, how many more housing units they could add. We find that more zoned capacity in places with low rents correlates to only slightly higher levels of housing production. Higher zoned capacity in places with high rents, on the other hand, is associated with much more production.

On the other hand, we do not find that regulatory processes—the various hurdles that developers must overcome to ensure that their developments are permitted—are significantly associated with less development. In fact, one model finds a positive association between permitting and process. The measures of process available at present need improvement because they are based primarily on surveys and the subjective opinions contained within. City planners in places without much demand for new housing are not likely to reply that regulatory processes are a constraint to development simply because the lack of demand is the major constraint.

Our zoned capacity models provide explanations for other findings in the literature. Jackson (2018), for instance, finds that cities' land supply is a primary determinant of housing production: "Housing supply in California cities is made inelastic by land constraints, not regulation." He bases this finding, however, on planners' responses to a survey question about developable land, not vacant land. "Vacant" is an objective measure, and "developable" is not. If planners in cities close to being "built-out" under their current zoning assume that increasing zoned capacity is not possible, then they might consider build-out a land constraint. But it is not. Most cities could easily add large numbers of new housing units if they rezoned. They do not even consider rezoning for the most part, however, and the resulting absence of housing is caused by legal restrictions, not an absence of land.

The zoned capacity analysis also helps explain the Murray & Schuetz (2019) finding that cities in California "with more expensive rent in 2012 did not build more apartments in subsequent years." These expensive cities have relatively little remaining zoned capacity. The most expensive decile of cities has an average zoned capacity of 460 units, representing an average potential increase in housing units of 6.7 percent. The median city in the state, in contrast, has space for 1,770 units, or 12.7 percent of their existing units. Crucially, however, the "limited capacity" of expensive cities is not an artifact of their being built out at significant densities. The expensive cities have a median population density per mile of 2,940, compared to the overall median in the state of 3,570. "Build-out" is a political decision about accepting housing.

Our results also have direct implications for zoning reform efforts in California. They suggest that reform efforts should focus on increasing capacity in expensive cities (and the expensive neighborhoods of these cities) if increasing overall production is their goal. This principle may be directly incorporated, for example, into the Regional Housing Needs Allocation (RHNA) process, which currently does not consider the likelihood of development in assessment of whether cities are meeting housing targets in their Housing Elements. As detailed in Elmendorf et al. (2020), requiring cities to assess actual development probabilities in their Housing Elements is now within the powers of the state department of Housing and Community Development, and as summarized by Monkkonen et al. (2020) cities truly interested in increasing housing production should begin by expanding zoned capacity in their high demand neighborhoods. As the state's RHNA process moves from zoning targets to actual housing production targets, it is important to recognize that upzoning in high-rent areas will yield more housing construction. •

Appendix A

Table 1: Summary of Empirical Literature Linking Land Use Regulation to Housing Supply

Author(s)	Year	Geography Covered	Dependent Variable	Regulation Measure	Model type
Thorson	1997	Parcels in IL	Permits (log)	Specific: Agricultural down-zoning	Stock-flow, 1979-1984 & 1985-1994
Skidmore & Peddle	1998	Cities in IL	Change in Units (using permits)	Specific: Development Impact Fees	Fixed effects panel
Levine	1999	Cities in CA	Change in Units (using Census data)	An index: Surveys of several areas	OLS, change 1980-1990
Mayer & Somerville	2000	U.S. metros	Permits (log)	Specific: Development or impact fees, delays	Panel (quarterly) 1985 to 1996
Quigley, Raphael & Rosenthal	2004	Cities in CA	Change in Units (using permits)	An index: Surveys of several areas	OLS, 1990-2000
Zabel & Paterson	2006	Cities in CA	Single-family permits	Specific: Critical habitat designation	Difference in difference 1990-2002
Glaeser & Ward	2009	Municipalities in Boston	Permits (log)	Specific: Lot sizes, wetlands by-laws, septic regulations, and subdivision rules	OLS, three cross sections
Schuetz	2009	Municipalities in MA	Permits (log)	Specific: Multifamily permitting rules	IV using historical characteristics
Kahn	2011	Cities in CA	Permits (log)	An index: Political ideology	Panel (annual) 2000 to 2008
Dempsey & Platinga	2013	Cities in OR (parcels)	A plot being developed	Specific: Urban growth boundaries	Difference in difference
Jackson	2016	Cities in CA	Permits (log)	An index: Surveys of several areas	Panel, 1970–1995
Murray & Schuetz	2019	Cities in CA	Permits per 10,000 people	Specific: Maximum density, height, and percent zoned multifamily	Tobit, change 2013-2018

Appendix A

Table 2: Summary of Empirical Literature Linking Land Use Regulation to Housing Prices (Building on Summary in Quigley and Rosenthal (2005))

Author(s)	Year	Geography Covered	Dependent Variable	Regulation Measure	Model type
Quigley & Raphael	2005	Cities in CA	House price (1990 and 2000)	Index: Based on surveys	Hedonic model
Green, Malpezzi, & Mayo	2005	45 U.S. metro areas	Supply elasticity	Index: Based on surveys	OLS
Ihlanfeldt	2007	Cities and counties in FL	House and land price (2000-2002)	Index: Based on surveys	Two stage least squares
Glaeser & Ward	2009	Cities & towns in Greater Boston	House price (2000 and 2005)	Index: Based on surveys	OLS
Saiz	2010	MSAs in the U.S.A.	Supply elasticity	Index: Based on surveys and a measure of developable land	Two stage least squares
Ball	2010	Southern England	Time to receive residential development approval	Specific: sites features, proposed buildings, local approval authorities, developers	OLS
Kahn, Vaugh, & Zasloff	2010	Parcels in CA	Housing units and house prices (2008)	Specific: Coastal boundary zone	Regression discontinuity
Zabel & Dalton	2011	Towns in MA	House prices (1987-2006)	Specific: Minimum lot size	OLS and difference-in-difference
Huang & Tang	2012	Cities in the US	House prices (2000 and 2009)	Index: Based on surveys	Fixed effects model
Kok, Monkkonen, & Quigley	2014	Cities in the San Francisco Bay Area	Land prices	Index: Based on surveys	OLS
Munneke, Sirmans, Slade, & Turnbull	2014	Housing near Brigham Young University	Housing prices	Specific: University policy limiting student housing location	Flexible hedonic model
Hilber & Vermeulen	2016	Planning authorities in England	Mixed—adjusted house price index	Specific: Refusal rate of large residential projects	Panel (1974 to 2008)
Jackson	2018	Cities and Counties in CA	Zillow Home Value Index (ZHVI)	Index: Based on surveys	Two-way fixed effects model

Appendix B

Indexes of Regulatory Process and Prohibitions[1]

Process Index

1. **Discretion in the planning process**

   Who approves multifamily projects (planning/commission/council—6 missing)

   By-right allowed in some cases? (y/n—0 missing)

   Is there a project size limit for by-right? (y/n—15 missing)

   Is discretion is a cause of delay? (y/n—0 missing)

2. **Approval time**

   How long to approve multifamily consistent w zoning (months—34 missing)

   How much does approval process constrain? (likert scale—3 missing)

   How much does permit time constrain? (likert scale—3 missing)

3. **Total impact fees per unit**

   How much does impact fee constrain? (likert scale—5 missing)

4. **The degree of public opposition in the city**

   How much does public opposition constrain? (likert scale—6 missing)

   How often citizens oppose development? Five categories of ranges (5 missing)

   How often electeds oppose development? Five categories of ranges (8 missing)

5. **California Environmental Quality Act**

   How common are CEQA lawsuits? Five categories of ranges (20 missing)

   How much does CEQA constrain? (likert scale—8 missing)

   CEQA is a cause of delay?

1 One of the process sub-indexes is the length of time to get a project approved and permitted. This is potentially endogenous to the development process itself, but tolerably so. We do not include rejection/approval rates because it is even more endogenous.

Appendix B

Prohibition Index

1. **Share zoned multifamily**

   Five categories of percentage ranges (3 missing)

2. **Zoning standards - Density**

   Maximum density (units per acre—36 missing)

3. **Zoning standards—Lot Coverage**

   Height limits (feet—21 missing)

   Front setbacks (feet—33 missing)

   Side setbacks (feet—45 missing)

4. **Minimum parking requirements**

   Resident parking (spaces—10 missing)

   Covered spaces (y/n—3 missing)

   Tandem parking allowed (y/n—4 missing)

5. **Growth management policies**

   Urban growth boundary (y/n—1 missing)

   Cap on permits (y/n—1 missing)

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