What Planners Know:
Using Surveys about Local Land-Use Regulation to Understand Housing Development

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Problem, Research Strategy, and Findings: In order to understand how local land-use regulation affects housing development, many researchers have surveyed planners about their jurisdictions' policies and practices. But researchers have not systematically assessed whether such surveys yield valid and reliable information. We provide such an assessment by analyzing nine surveys conducted between 1988 and 2018 in California, the state where concern about underproduction of housing has been most pronounced. Each survey attempted to inventory local land-use regulations, and some surveys also queried planners about their subjective perceptions regarding constraints on housing development. We find strikingly different responses to similar inventory questions about specific land-use regulations in two surveys that were conducted months apart in the same municipalities, casting doubt on the reliability of such measures. Regression analysis reveals that subjective survey measures concerning land supply and density restrictions predict subsequent housing production, unlike counts of purportedly objective measures. Comparing survey data to recently developed GIS data indicates that planners identify land supply as a significant constraint on residential development in municipalities where a relatively low proportion of land is vacant or in agricultural use, while identifying regulatory restrictions as a constraint in jurisdictions with little land zoned for multifamily use.

Takeaway for Practice: Asking planners to identify which land-use regulations their localities have "on the books" does not provide a clear measure of regulatory stringency. By contrast, municipal planners' subjective perceptions may capture otherwise unmeasurable characteristics of local land-use policy. Although planners' subjective perceptions can provide a relatively holistic measure of local land-use policy, they have limited value for policy prescription. Given the problems of survey-based measures, state and federal government agencies should collect, harmonize, and distribute data concerning local land-use regulation, including zoning district designations. Fair housing assessment tools and regional planning processes could facilitate these activities.

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Introduction

Does local land-use regulation constrain housing supply and increase housing costs? To what degree? In an effort to answer these questions, academic researchers and federal, state, and regional agencies frequently rely upon surveys of planners in order to gather information about local land-use regulation. Such surveys are important sources of information, because local regulatory regimes are often complex and opaque, and there is typically no centralized, authoritative source for much of the relevant data.

When government agencies and researchers seek to analyze a large number of jurisdictions, surveys provide a relatively feasible alternative to reviewing myriad idiosyncratic regulatory documents, such as local ordinances. But researchers have not systematically assessed the properties of such surveys, and planners have voiced skepticism about their value (Burchell & Lahr, 2008; Calfee et al., 2007). In order to assess the reliability and validity of different kinds of survey questions, this article analyzes nine surveys of municipal planners in California conducted between 1988 and 2018. It is, to our knowledge, the first systematic comparison of this kind.

Concerns about the potential adverse impacts of land-use regulation on housing production are particularly acute in California, and – as a result – many relevant surveys focus on California, facilitating our analysis. Such surveys have been cited in support of proposed regulatory reforms limiting local control over land-use regulation (State of California, Legislative Analyst's Office, 2015; State of California, Senate Committee on Housing, 2019). They have also served as the basis for research in urban planning, political science, and economics (e.g., Donovan & Neiman, 1992a; Kok, Monkkonen, & Quigley, 2014; Landis, 2006; Malpezzi, 1996; Pendall, 2000). Moreover, surveys of California planners helped to lay the

groundwork for a pilot project by the U.S. Department of Housing and Urban Development (HUD) to consider the feasibility of a national survey of local land-use regulations (Burchell & Lahr, 2008), although the proposed national survey has not occurred.

We conduct three analyses using a total of nine surveys. First, we compare responses to two surveys sent to the same municipalities within months of each other in 1988. Second, we use regression models to assess whether survey responses predict subsequent levels of housing-permit issuance, drawing on eight surveys, including the two 1988 surveys and six others conducted between 1992 and 2007. Third, we use recently developed GIS data including regionwide zoning classifications to interpret the responses from a ninth survey, which was conducted in 2017 and 2018, and which included subjective items similar to those analyzed in the regression models.

Our findings suggest that surveys *can* tap local planners' distinctive knowledge, but that some kinds of questions are more effective than others in this regard. We find that planners' subjective perceptions concerning the impact of local density restrictions and land supply consistently predict subsequent variation in housing development. By contrast, there are grounds for concern regarding the reliability and validity of responses to seemingly objective questions used to construct inventories of land-use regulations. Because subjective questions cannot identify specific local policies susceptible to reform, we suggest a variety of supplements and alternatives to surveys of local planners, such as regionwide standardization of local zoning designations. The relevant data collection and standardization procedures would draw on the expertise of regional and local planning agencies, as well as the legal authority of state governments and the federal government.

Planners as Informants about Local Residential Land-Use Policy

In many areas of social science, researchers often rely on individuals to report about the organizations (agencies, departments, firms, etc.) where they work. When the number of organizations is relatively large, intensive interviewing is often impractical, leading scholars to survey organizational members with specialized knowledge. Such studies rely on individuals to report on the activities, policies, or standard operating procedures of an entire organization or governmental unit. These individual *informants* are presumed to possess distinctive knowledge concerning relevant practices, requirements, and social relationships, in contrast to *respondents* in a typical mass survey, who provide information on their "personal feelings, opinions, and behaviors" (Seidler, 1974, p. 816; see also, Maestas, Buttice, & Stone, 2014). In effect, since the organization or entity cannot speak for itself, the researcher solicits information from one or more persons to describe how the organization operates. In studies of land-use regulation, scholars from an array of disciplines have extensively used surveys of planners to assess local government practices and requirements (e.g., Donovan & Neiman, 1992a; Jackson, 2018; Landis, 2006; Levine, 1999; Malpezzi, 1996; Malpezzi, Chun, & Green, 1998; Pendall, 2000; Pendall, Wegmann, Martin, & Wei, 2018; Quigley & Raphael, 2005; Quigley, Raphael, & Rosenthal, 2004, 2009; Saiz, 2010). Scholars have also relied on informant surveys to study other planning topics, such as natural hazards (e.g., Burby & May, 1997).

Informant surveys may be necessary in order to obtain reasonably large samples for studies of local land-use regulation, because much of the relevant information is buried in idiosyncratic plans and zoning ordinances. Moreover, relevant policies and practices can emerge from informal negotiations between city governments and developers (Fischel, 2015), from bureaucratic decision rules in economic development and planning departments (Reese &

Rosenfeld, 2002), or from the varied deliberative traditions and norms of city councils or planning commissions (Rudel, 1989).

Studies of land-use regulation relying on survey data have rarely assessed the possibility that expert informants' reports are subject to substantial error. But research on other topics, discussed below, suggests that measurement error in informant surveys may arise from myriad sources, including inadequate knowledge or recall of organizational practices, systematic bias resulting from a desire to make oneself or one's organization look good, and unintended influences due to question wording or question order (Sudman & Bradburn, 1973; Tourangeau, Rips, & Rasinski, 2000).

Social science researchers have expressed concern about the *reliability* of informant surveys on a variety of topics. In this context, a measure is reliable if different informants from a single organization, such as a local government or business firm, would provide the same data on the concept of interest. But researchers who have managed to collect data from multiple informants in each organization studied have often found that informants in the same organization give inconsistent answers (Phillips, 1981; Ramsey, Spira, Parisi, & Rebok, 2016; Seidler, 1974; Walker & Enticott, 2004). Unfortunately, problems of reliability often cannot be addressed by selecting the "right" informant to complete a survey, because reliance on a single informant entails inherent measurement flaws and potential biases, no matter the informant's expertise or position in the organization (Enticott, 2004; Maestas et al., 2014; Wright et al., 2001). Thus, although a researcher may hope that surveying the one planner who works for a small municipality – or surveying a long-serving planning director of a larger city – would provide fully accurate responses, the literature on organizational informants suggests otherwise. Researchers can increase reliability by gathering information from multiple informants in an

organization. But doing so is particularly problematic for survey research on local land-use regulation, because many municipalities employ only one full-time planner or no full-time planners (see, e.g., State of California, Governor's Office of Planning and Research, 2018).

Surveying planners about local land-use regulation also raises concerns regarding *validity* (i.e., whether the method really measures the phenomenon that the researchers seek to investigate). Local ordinances and regulations may be ambiguous, and "interpretation of the same written language can vary across municipalities" (Schuetz, 2006, p. 6). Moreover, every state has a distinctive legal setting and vocabulary for its development-approvals process, raising additional concerns for inter-state comparison (Burchell & Lahr, 2008). Finally, even if interpretations of seemingly similar requirements do not vary among municipalities, enforcement of those requirements may be uneven (Quigley & Rosenthal, 2005).

Given these potential pitfalls, it is noteworthy that some social science research about topics other than land-use regulation suggests that "subjective" (sometimes called "perceptual") questions about informants' impressions sometimes can be more valid and reliable than "objective" questions concerning directly observable phenomena. For example, in a study involving multiple informants from multiple neighborhoods, informants within each neighborhood provided relatively consistent responses to subjective questions about their neighborhood, such as those asking how worried local residents were about crime or about the quality of extracurricular programs in the schools (Houston and Sudman, 1975). But there were significant inconsistencies among informants within neighborhoods on objective questions concerning, for example, the number of schools in the neighborhood and the degree of crowding in the schools. Wright et al. (2001) found a higher degree of consistency among informants' subjective assessments of job performance in their firms, as compared with informants' responses

concerning the existence of certain personnel policies at their firms. The researchers expected that more specifically worded (i.e., objective) questionnaire items would yield more reliable results, but concluded, "the data do not support the idea that 'objectifying' the rating eliminates, or even reduces, measurement error" (Wright et al., 2001, p. 898). Summarizing results from numerous studies in psychology, Gigerenzer (2007) explains that simple, subjective judgments about future outcomes, made on the basis of rapidly constructed impressions and "gut feelings," are often more accurate than judgments based on the rationalist method of systematically weighing evidence to derive a reasoned response.

These findings are noteworthy, because research relying on surveys of planners has privileged objective responses. Some surveys of planners ask *only* questions concerning whether a local government has adopted particular land-use regulations, such as, "Does your city have a measure which establishes a population growth limit or restricts the level of population growth for a given time frame (i.e., annual basis)?" (Glickfeld & Levine, 1992, p. 92). We describe these as *objective* questions, as illustrated in Table 1. A report prepared for HUD, based on focus group assessments of a proposed survey instrument, strongly recommended that surveys of planners concerning local land-use regulations should solicit objective information, rather than information based on informants' perceptions (Burchell & Lahr, 2008), and researchers have created *regulatory inventory indexes* that combine responses to such objective questions (e.g., Quigley & Raphael, 2005).

Some surveys also include items concerning informants' perceptions of local conditions or overall policy, such as questions asking the informant to review a list of factors and, "[o]n a scale of 1 to 5, ... rate the importance of each of the following factors in regulating the rate of residential development in your community (1 = not at all important; 5 = very important)"

(Gyourko, Saiz, & Summers, 2008, p. 720). We describe these as *subjective* questions, as illustrated in Table 1. Typically, when researchers have drawn on subjective questions from land-use regulation surveys at all, they have done so only to combine such responses in indexes with objective measures (e.g., Malpezzi, 1996; Saiz, 2010). Our analysis, by contrast, distinguishes between ostensibly objective regulatory inventory questions and subjective questions concerning informants' perceptions.

[INSERT TABLE 1 ABOUT HERE]

Data and Methods for Comparing Land-Use Regulation Surveys

We analyze nine surveys of municipalities in California, conducted over three decades, from 1988 to 2018 (Table 2). We first compare the responses of municipalities that answered similar objective inventory questions on each of two surveys mailed in the second half of 1988 – one survey conducted by the University of California Riverside Growth Project Group (UCRGPG), and another by Glickfeld and Levine (G&L). We then assess whether subjective or objective survey items predict subsequent residential building permit issuance, via regression analysis of eight surveys: The UCRGPG survey, the 1988 G&L survey and a 1992 update, a survey conducted by the Public Policy Institute of California (PPIC) in 1998 and 1999, a 2004 survey used to generate the Wharton Residential Land Use Regulatory Index (WRLURI), a 2007 survey used to generate the Berkeley Land Use Regulation Index (BLURI), and surveys conducted by Rolf Pendall in 1994 and 2003. Finally, to interpret responses to subjective questions, we compare non-survey GIS data with subjective responses from a survey administered by the Terner Center for Housing Innovation (TCHI) in 2017 and 2018.

[INSERT TABLE 2 ABOUT HERE]

Data for the WRLURI, BLURI, and TCHI surveys are publicly available, and we obtained the other six sets of survey results from the original investigators. As Table 2 indicates, the UCRGPG covered Southern California municipalities, the G&L surveys and the TCHI survey covered municipalities and counties throughout California, the PPIC survey was sent to all California municipalities outside of the rural north and the Central Coast region, and the BLURI survey was sent to municipalities and counties in the Bay Area. The WRLURI and Pendall surveys were sent to national samples of jurisdictions, with responses from more than 100 California municipalities in each case.

We describe our methods in the remainder of this section and present the analyses in the following section. A Technical Appendix discusses our regression models and the relevant variables in greater detail. A separate online-only supplement provides survey questions, summary statistics, correlation tables, full regression models, and additional detail concerning the construction of the survey-based variables in the regression models.

Assessing the Reliability of Objective Questions

We assess the reliability of objective questions by comparing responses to similar regulatory inventory questions from the two earliest surveys, which were administered to the same cities by different research teams a few months apart. The UCRGPG surveyed local planning directors (or their designates) in late summer 1988 (Donovan & Neiman, 1992a; Donovan, Neiman, & Brumbaugh, 1994), and the G&L survey was mailed in fall 1988 (Glickfeld & Levine, 1992). G&L administered their survey to city managers and city clerks, rather than planning directors, but the recipients were instructed to direct "the staff person who is the most knowledgeable on the purpose, content and impacts of your city's growth control and

growth management measures" to complete the survey, noting that "[i]n many jurisdictions, the Planning Director would probably be the appropriate person" (Glickfeld & Levine, 1992, p. 90).

One-hundred-thirty-two municipalities responded to both the UCRGPG survey and the 1988 G&L survey, and we cross-tabulate these municipalities' responses to similar questions.[1] Because the surveys were conducted within a few months of each other, the relevant questions provide a unique opportunity to assess response reliability, although the comparison is restricted to regulatory inventory questions, summarized below, which were the focus of the 1988 G&L survey.

For the 132 municipalities sampled in both surveys, we are unable to identify whether the same informant furnished the responses to each survey, but this is not problematic for the purpose of assessing general problems of reliability. If different local officials in the same municipality gave different answers to similar questions, then this would be an example of low *inter*-informant reliability. If the same local official in the same locality gave different answers to similar questions, then this would be an example of low *intra*-informant reliability. Either kind of reliability problem is grounds for concern.

Comparing Objective and Subjective Questions

In order to compare "objective" and "subjective" questions, we analyze inter-survey correlations of subjective survey items and, separately, indexes constructed from regulatory inventory items, drawing on the UCRGPG survey, the 1988 and 1992 G&L surveys, the PPIC survey, the WRLURI survey, the BLURI survey, and the two Pendall surveys. Inter-survey correlations enable us to compare the durability of objective and subjective measures over time. If one type of measure is more highly correlated across time, then it may be superior.

We also use multivariable regression to model the number of single-family and multifamily housing permits issued over a ten-year period as a function of objective and subjective measures from the surveys, controlling for relevant demographic, economic, and geographic attributes. We expect that survey-based measures concerning regulatory restrictions will be negatively associated with the number of residential building permits subsequently issued, based on prior research associating increased regulatory stringency with reduced housing production (e.g., Quigley & Raphael, 2005; Jackson, 2016). If one type of measure (objective or subjective) is consistently uncorrelated with subsequent housing outcomes, then we have reason to doubt its validity. If a measure is *positively* correlated with subsequent housing outcomes, it clearly does not indicate restrictions on housing supply.

Four of the surveys – UCRGPG, PPIC, WRLURI, and BLURI – included nearly identical subjective questions, asking informants about the importance of density restrictions and land supply in constraining residential development. These survey items measure perceived constraints with 5-point Likert scales, which constitute the subjective measures that we analyze (see Table 1).

All eight of the surveys included in the regression models had objective questions concerning the adoption of particular land-use regulations. Relevant regulations include limits on the number of building permits issued annually, restrictions on population growth, infrastructure requirements for new residential development, voter approval requirements for increased residential density, and super-majority vote requirements for the city council to change the zoning ordinance. We create regulatory inventory indexes by additively combining binary (i.e., yes/no) responses to such survey items. For example, if a survey asked about four regulatory instruments (e.g., a residential building permit limit, a population ceiling, a voter approval

requirement for zoning changes, and an adequate public facilities requirement), each positive response would be coded as 1. Thus, a municipality that reported adopting three of the four instruments would have an index value of three (1+1+1+0).

Numerous prior studies of land-use regulation rely on such additive indexes to represent *regulatory restrictiveness*, which is not directly observable (e.g., Ihlanfeldt, 2007; Kok et al., 2014; Quigley & Raphael, 2005). Notably, an index could be an invalid measure of regulatory restrictiveness if it erroneously includes items, if it is over-inclusive (i.e., the included items do not, in fact, restrict residential development), or if it is under-inclusive (i.e., omitted items restrict residential development) (see generally, McIver & Carmines, 1981).

Erroneous reporting can result if informants are simply mistaken about the presence of a given regulatory instrument. Such errors can arise due to factors including "the informant's position, length of time in the organization, … the size and complexity of the organization [e.g., a local government or planning department], the breadth of information sources, and the volatility of external and internal changes" (Bagozzi, Yi, & Phillips, 1991, p. 424).

Even accurately reported regulations might not actually restrict residential development, in which case the resulting index would be *over-inclusive* (Landis, 1992). Some local governments that adopt seemingly restrictive regulations may lack the capacity to implement them (Quigley & Rosenthal, 2005). Communities that have officially enacted growth controls, perhaps in an attempt to assuage local political opposition to development, may nevertheless operate in less visible ways that undermine the relevant regulations (Warner & Molotch, 1995). Urban growth boundaries may encourage new housing development in high-priority (e.g., downtown) areas, even while restricting growth in outlying parts of the municipality (Pendall, 2000).

An index could be *under-inclusive* if it omits regulations that restrict residential development. Officials in municipalities with longstanding, low-density zoning ordinances may never have felt a need to pass the types of growth controls developed in the 1970s and 1980s, such as urban growth boundaries and annual limits on building permits, which are the main components of some regulatory inventory indexes (see Fischel, 1990). An inventory that omits single-family zoning, or treats it as equivalent to less common regulatory instruments, might erroneously indicate that such localities have few regulatory restrictions on housing development.

Despite these limitations, indexes constructed from objective questions have at least two potential advantages. First, they are relatively easy to interpret for purposes of policy reform, in comparison with subjective survey items. Second, even if individual index components contain significant measurement error, the unreliability can average out when numerous binary indicators are combined in an index, resulting in a total score which is often very reliable (Nunnally, 1978).

Interpreting Responses to Subjective Questions

In order to better understand the meaning of planners' subjective perceptions, we analyze bivariate correlations between non-survey GIS measures (e.g., local zoning, land development, and topography) and subjective responses to the TCHI survey. These correlations help to discern the meaning of subjective survey items, which are susceptible to multiple interpretations. For example, an item indicating that land supply constrains residential development could reflect respondents' views about geographic constraints due to natural features and existing development. But it could also reflect the quantity of land zoned for residential uses, so that "a city reporting a low 'supply of land' could have plenty of developable space, but with only a small amount zoned for new residential development" (Jackson, 2018, p. 135).

Distinguishing between such possibilities has previously been challenging, due to the idiosyncrasies of local zoning designations and the dispersal of the relevant data. But a dataset developed by the Southern California Association of Governments (SCAG) partially resolves this problem, by providing consistent 2016 zoning classifications for Southern California municipalities. We combine the SCAG zoning dataset with additional GIS data, described below, and responses to TCHI's 2017-18 survey, which included subjective items regarding land supply and zoning designations.

Sample, Dependent Variable, and Control Variables

Our sample consists of California municipalities incorporated as of the 1990 Census that were covered in the 1990 Census of Transportation Planning Package and were included in at least one of the eight surveys analyzed in the regression models. Our dependent variables are based on the counts of single-family and multifamily units permitted in each jurisdiction over a ten-year period. We use the log of the number of permits issued over a ten-year period in order to capture both upswings and downturns in housing production, illustrated in Figure 1. Building permits are a widely used measure of housing development, although this measure may be over-inclusive if not all permitted units are built, or under-inclusive if some units are not formally permitted (see Durst & Wegmann, 2017). The independent variables of interest are regulatory inventory indexes and measures of informants' subjective perceptions from the surveys listed in Table 2. The control variables, listed in Table 3 and detailed in the Technical Appendix, consist of municipality-level demographic, economic, and geographic variables.

[INSERT FIGURE 1 AND TABLE 3 ABOUT HERE]

How Reliable Are Objective Survey Responses?

Our first analysis compares responses to similar objective questions from the UCRGPG survey and the 1988 version of the G&L survey, in order to assess response reliability. Both of these surveys were mailed during the second half of 1988, and one might therefore expect nearly identical responses from the municipalities that completed both. On the other hand, the two surveys used somewhat different wording for the relevant questions and ordered these questions differently. In addition, due to the slight variation in timing, some jurisdictions conceivably may have adopted or abandoned regulatory requirements between the two surveys. Both surveys asked whether the municipality had adopted: (1) a population ceiling; (2) a cap on residential development; (3) a cap targeted specifically to multifamily development; (4) a requirement for a popular vote concerning rezoning (i.e., some form of ballot measure); (5) a requirement for a super-majority vote by the city council for a rezoning; and (6) an urban growth boundary.

The cross-tabulation of binary responses, summarized in Table 4, raises questions about the reliability of any particular component of a regulatory inventory measured by survey. Simply examining pairwise correlations between the two surveys may provide undue confidence in the consistency of the two sets of results, because the large majority of responses to each question were negative (i.e., both surveys indicate that the municipality had not adopted the relevant regulatory instrument). Since researchers are principally concerned with the *presence* of a given regulatory instrument, we focus on the possibility of false positives. The numbers in bold italics count municipalities that answered "yes" on one survey and "no" on the other for a given question. We measure the percentage of inconsistent "yes" answers as follows: In the denominator we count the total number of affirmative responses to the relevant question on both

surveys; for the numerator, we count the number of conflicting responses (i.e., "yes" on one survey and "no" on the other).

[INSERT TABLE 4 ABOUT HERE]

Although it is not surprising that the two surveys elicited some inconsistent responses, it is noteworthy that – for five of the six regulatory instruments analyzed in both surveys – *most* of the municipalities that answered "yes" on one survey answered "no" on the other survey. This finding also suggests that if repeated surveys indicate that municipalities have adopted or abandoned regulatory instruments between surveys, as discussed by Pendall et al. (2018), some of the apparent instability may be due to false positives or false negatives.

Comparing Objective and Subjective Survey Responses

Local constraints on residential development may be very durable, even if the specific regulations vary across time (Fischel, 2015; Glaeser & Ward, 2009). If so, for any city, a given measure of regulatory stringency should be reasonably correlated over time. If objective regulatory inventory indexes are more highly correlated across time than variables derived from subjective measures, then such correlations might suggest that regulatory inventory indexes serve as a superior measure. On the other hand, if such indexes are no more correlated across time than more subjective measures (or are less correlated across time), then we have reason to doubt their superiority. The correlation tables, presented in the online-only supplement, indicate that both our objective measures and subjective measures are somewhat correlated over time, with coefficients generally ranging from roughly 0.2 to 0.5 for both kinds of measures. These correlations do not provide any *prima facie* reason to prefer one kind of measure over the other.

Next, we assess whether informants' responses to subjective and objective questions can predict housing production variation across cities, using multivariable regression as described above. We separately test two subjective measures relating to the perceived impact of density restrictions and land supply, as well as one objective measure – the regulatory inventory indexes described above. All of the subjective questions about land supply and density use a 5-point Likert scale.

[INSERT TABLE 5 ABOUT HERE]

The results, reported in Table 5, indicate that informants' perceptions about the importance of constraints on land supply and density consistently predict future development, whereas the ostensibly objective measures do not. Informants' perceptions that their cities' density restrictions constrain development are consistently associated with lower rates of *multifamily* permitting, but not single-family permitting. For example, a 1-point increase on the relevant 5-point Likert scale from the UCRGPG survey is associated with 28% less multifamily permitting over the ensuing 10-year period.[2] The corresponding figures for PPIC and BLURI are 15% and 26%, respectively. The relevant coefficient from the WRLURI survey is not statistically significant, but this is not surprising, because the ten-year period covered by the WRLURI models captures the entirety of the Great Recession. Planners' perceptions that the supply of land constrains development are consistently associated with reduced *single-family* permitting, and the association is statistically significant at conventional levels in three of the four relevant specifications. By contrast, the additive indexes of individual regulatory instruments are not associated with single-family development for any survey, during any time period. Only one of the eight regulatory inventory indexes (from the 1992 G&L update) is

associated with multifamily permitting, and the association is in the *opposite* of the expected direction. Similarly, all of the alternate specifications of the indexes described in the online-only supplement yield statistically insignificant results.

In sum, the regression models show that informants' perceptions of constraints on development due to *land supply* are associated with reduced *single-family* permitting (but not multifamily permitting), whereas their perceptions that *density restrictions* constrain development are associated with reduced *multifamily* permitting (but not single-family permitting). This pattern is logical. New single-family development ordinarily relies on sizeable tracts of undeveloped land. By contrast, multifamily development, by its nature, need not consume large amounts of land. Instead, it may depend largely on the extent of demand and the existence of regulatory constraints. Accordingly, density restrictions, expressed through zoning or other means, might have more "bite" for multifamily development. This logic, however, is based on our own assumptions about the informants' interpretation of the relevant questions. We assess the plausibility of these assumptions in the next section.

What Do Subjective Survey Items Measure?

Even as the number of studies drawing on surveys of planners concerning local land-use regulation has increased, scholars have devoted limited attention to the properties of the relevant measures. As noted above, even accurate objective inventories of land-use regulations may be under-inclusive, if they omit regulations that exert substantial influence, or over-inclusive, if they incorporate regulations that do not affect development. The preceding analysis suggests that subjective measures may be less susceptible to reporting errors or problems of over- and under-inclusion.

Unfortunately, this potential benefit comes at the cost of greater ambiguity. For example, informants might interpret "constraints on land supply" to refer to the amount of land in a jurisdiction that is undevelopable due to topographic features (such as steep slopes). But they could also understand such constraints to reflect the proportion of land in a jurisdiction that has already been developed, or the proportion of land subject to regulatory restrictions, or some combination of these factors.

Comparing planners' responses to non-survey evidence of land-use regulation across local jurisdictions could aid interpretation of the subjective items that were included in the regression models. Only very recently has such a comparison become possible, due to SCAG's creation of a consistent region-wide parcel-level zoning dataset for municipalities and counties within its jurisdiction (Southern California Association of Governments, 2018). Table 6 presents a series of bivariate correlations between zoning measures from the SCAG dataset and subjective items included in the 2017-2018 TCHI survey of California municipalities. The TCHI survey asked, separately, how much the "Supply of developable land," the "Amount of land zoned for single-family development," and the "Amount of land zoned for multifamily development" constrain residential development. The latter two questions are analogous to subjective questions about density restrictions on earlier surveys, although the TCHI survey did not include a subjective item explicitly mentioning "density restrictions." For each question, response options were arrayed on a five-point Likert scale, ranging from "Not a constraint" to "Severe constraint."

[INSERT TABLE 6 ABOUT HERE]

We first measure correlations between the relevant survey items and the percentage of land that is undeveloped, a measure derived from the National Land Cover Database (2011

vintage). This GIS-based measure is uncorrelated with both of the survey items concerning zoning, but it is significantly correlated with the survey item concerning land supply. Unsurprisingly, this correlation is negative, indicating that planners generally identify "land supply" as a significant constraint in municipalities where a relatively low proportion of land is vacant or in agricultural use.

Our findings concerning the zoning items similarly accord with our regression results. We find no correlation between the percentage of land in a municipality zoned for single-family use and the perception that the "[a]mount of land zoned for single-family development" constrains development, but we find a significant negative correlation between the percentage of land zoned for multifamily residential use and the perception that the "[a]mount of land zoned for multifamily development" constrains development. In other words, planners in jurisdictions with relatively little land zoned for *single-family* use generally do not perceive this characteristic as constraining residential development. By contrast, planners in jurisdictions with little land zoned for *multifamily* use *do* perceive this limitation as a constraint on residential development. This pattern is consistent with the regression models, which indicate that density restrictions (as perceived by informants) constrain multifamily housing, but not single-family housing. Notably, in California, multifamily development has recently predominated over single-family development (Figure 1).

Surveying Planners about Local Land-Use Regulation

Our analyses suggest that planners possess distinctive forms of meaningful knowledge about local conditions that affect the production of housing, but that survey questions asking about the presence or absence of specific policies may not effectively tap this knowledge. Accordingly, researchers and policy-makers should be wary of seemingly objective

survey questions, and researchers should not rely on survey-based counts of regulations to measure stringency. Note, however, that our results do *not* suggest that stringent land-use regulation has no effect on housing supply. Indeed, studies that do not rely on informant surveys provide powerful evidence that – in strong housing markets – restrictions on residential density decrease multifamily housing production (e.g., Schuetz, 2009; Glaeser, Gyourko & Saks, 2005, pp. 335-356). Our regression models identifying associations between multifamily permitting and subjective measures of the effects of density restrictions accord with these studies.

Planners' subjective responses may help to characterize important elements of the local decision-making environment – such as antigrowth political culture, a preference for commercial over residential development, or development-related political rancor – capturing tacit understandings that objective indicators cannot. In the realm of local growth policy, with its strongly political, emotional, and path-dependent qualities, it is perhaps not surprising that informants' "gut" sense of local regulatory conditions would capture an important, and indeed predictive, dimension of local decision-making. These gut reactions do not, in and of themselves, point the way toward particular reforms of local land-use regulation. Nevertheless, informants' perceptions may help researchers to identify variation in local choices and behaviors, particularly in combination with additional techniques summarized below.

Implications for Survey Design

Our findings indicate that it would be a mistake to confine surveys to ostensibly objective inventories of specific local regulations, as advocated by some practitioners and scholars consulted in conjunction with HUD's national pilot project (Burchell & Lahr, 2008). Instead, we suggest that researchers modify survey instruments, and augment or validate survey results with other sources of data. In addition, following up a survey with in-depth interviews of a smaller

sample of planners may help to reveal exactly what planners have in mind when they rate land constraints or density restrictions as important factors limiting new housing in their communities.

Informant survey instruments should elicit information about potential sources of ambiguity, which are myriad. For example, whether an ordinance compels action, or simply authorizes it, is a matter that must sometimes be resolved by courts, if it is resolved at all. Moreover, surveys may ask informants to distinguish between law and policy,[3] or between formal and informal policies,[4] but the boundaries between these categories are often porous. The extremes are clear: A tacit understanding within a planning department is an informal policy, and a municipal ordinance is a formal policy. But there are many intermediate cases, including internal memos, statements by staff members at public meetings, and city council resolutions.

Ambiguity also can arise due to varying interpretations of legal terminology, and survey designers may not be attuned to all pertinent nuances. For example, the BLURI survey instrument asked informants to identify the "approvals and/or reviews ... required for projects needing a zoning change (e.g.[,] a conditional use permit, variance, or other rezoning)." Several informants noted in the free response section of the survey that they did not view either a conditional use permit or a variance as a zoning change, and that both kinds of entitlements require different approvals from each other *and* from a rezoning. In addition to including free-response sections, surveys should address the potential ambiguity of questions by giving informants the opportunity to indicate whether each question is unclear and – if so – why.

Implications for State, Regional, and Federal Data Collection Programs

The value of survey results hinges, in part, on response rates and respondents' candor. Incorporating survey results into policy debates about state intervention in local land use regulation, which has occurred recently in California,[5] makes the potential reputational impacts

of survey responses more salient. Informants might fear that their responses could cast their cities in a negative light, and such reputational concerns could result in lower response rates or less candid responses to future surveys. The latter problem could particularly undermine the validity of subjective survey responses. Notably, scholars have long maintained that informant surveys are suitable only when valid information is unavailable from other sources (see, e.g., Houston and Sudman, 1975, p. 163), and future improvements in non-survey sources of land-use data could largely obviate the need for informant surveys on this topic.

State agencies and regional entities, such as metropolitan planning organizations (MPOs) and councils of governments (COGs), could play an important role in standardizing and routinizing collection of local regulatory data concerning zoning designations, the duration of permit reviews, and the numbers of different types of variances issued. Indeed, some MPOs are already developing relevant data. For example, SCAG's standardized region-wide zoning dataset, described above, combines GIS parcel features with data on zoning and planning boundaries from local governments, subject to a quality control process that includes review by local officials (Seo, Wen, Choi, & Vo, 2015). Such datasets would address a major shortcoming of the surveys analyzed above, most of which provide relatively crude measures of the direct restrictions on density included in zoning ordinances. Ideally, such regionally standardized datasets might eventually include all regulatory entitlements associated with a parcel, including variances and conditional use permits. State governments and the federal government could encourage (or require) MPOs and COGs to undertake such standardization efforts, which would be an important first step toward a valid national survey of land-use regulation.

State and federal regulatory programs could facilitate the collection of information about forms of land-use regulation that have been the subject of survey questions, but that are not

likely to be captured in the parcel-level data collected by MPOs and COGs. For example, in 2015, HUD adopted the Affirmatively Furthering Fair Housing (AFFH) rule, requiring local governments receiving certain federal grants to conduct an Assessment of Fair Housing using a tool provided by HUD (80 Fed. Reg. 42272). HUD suspended the AFFH rule and withdrew the assessment tool for local governments in 2018, but a future administration could reinstate it. Moreover, California has adopted a law maintaining the relevant requirements for local governments in the state (Cal. Stat., ch. 958, 2018), and other states could follow suit. In addition, many state governments require municipalities to submit housing production plans, subject to state guidelines (Ramsey-Musolf, 2017).

Fair housing assessment tools and planning guidelines could include questions concerning the details of regulatory instruments, such as permit caps, adequate public facilities requirements, and impact fees. They could also request references to the relevant provisions of local ordinances, thereby enabling researchers to validate the responses. This information is typically very difficult to gather via survey, because it requires additional research by informants, which can significantly reduce response rates. By contrast, local governments are more likely to provide information in order to secure the intergovernmental aid associated with some state planning mandates and HUD's suspended AFFH rule.

Thus, planners can develop alternative sources of information to surmount the limitations of the types of surveys we have analyzed. MPOs and COGs can help to reduce the opacity of local regulatory regimes by spearheading data standardization, as SCAG has done for zoning. State housing agencies, or HUD, could ensure that plan review processes and fair housing assessments require local governments to provide adequate information concerning the kinds of regulatory instruments that have been the subject of survey research. This information should

include citations to the relevant ordinances, which would facilitate verification and validation. In short, planners themselves, who have sometimes questioned the utility of the surveys they are sent, could help to make such surveys unnecessary.

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[1] The two research groups were aware of each other's activities, but do not appear to have extensively analyzed the inter-survey correspondences (Donovan & Neiman, 1992b, p. 333 n. 2; Glickfeld & Levine, 1992, p. 13 n. 25).

[2] Where $\ln(Y) = \alpha + \beta X + \varepsilon$, a 1-unit increase in X produces an increase in $E[\ln(Y)]$ of $\widehat{\beta}$, so that a 1-unit increase in X multiplies $E[Y]$ by $e^{\widehat{\beta}}$. For example, based on the coefficient of -0.335 reported for the UCRGPG survey in Table 5 (row 4), we have $e^{-0.335} \approx 0.72$, indicating that a 1-unit increase in the perceived importance of density restrictions in constraining or slowing residential development is associated with a 28% decrease in multifamily units subsequently permitted.

[3] The G&L 1988 survey instrument asks whether a jurisdiction has adopted "measures," which it defines to include "initiatives adopted by the voters or regulatory ordinances adopted by the city council," but to exclude "resolutions or other policy statements."

[4] The UCRGPG and PPIC surveys include several questions beginning with the phrase, "Does your city have a FORMAL policy to…."

[5] For example, a bill proposing to streamline approval processes for multifamily housing invokes findings from research based on the G&L surveys (Cal. Senate Bill 4, Dec. 3, 2018, sec. 1(a)(2); cf. Jackson, 2016). In analysis of a similar bill, the California Senate Housing Committee cited the TCHI survey (State of California, Senate Committee on Housing, 2019, p. 10).

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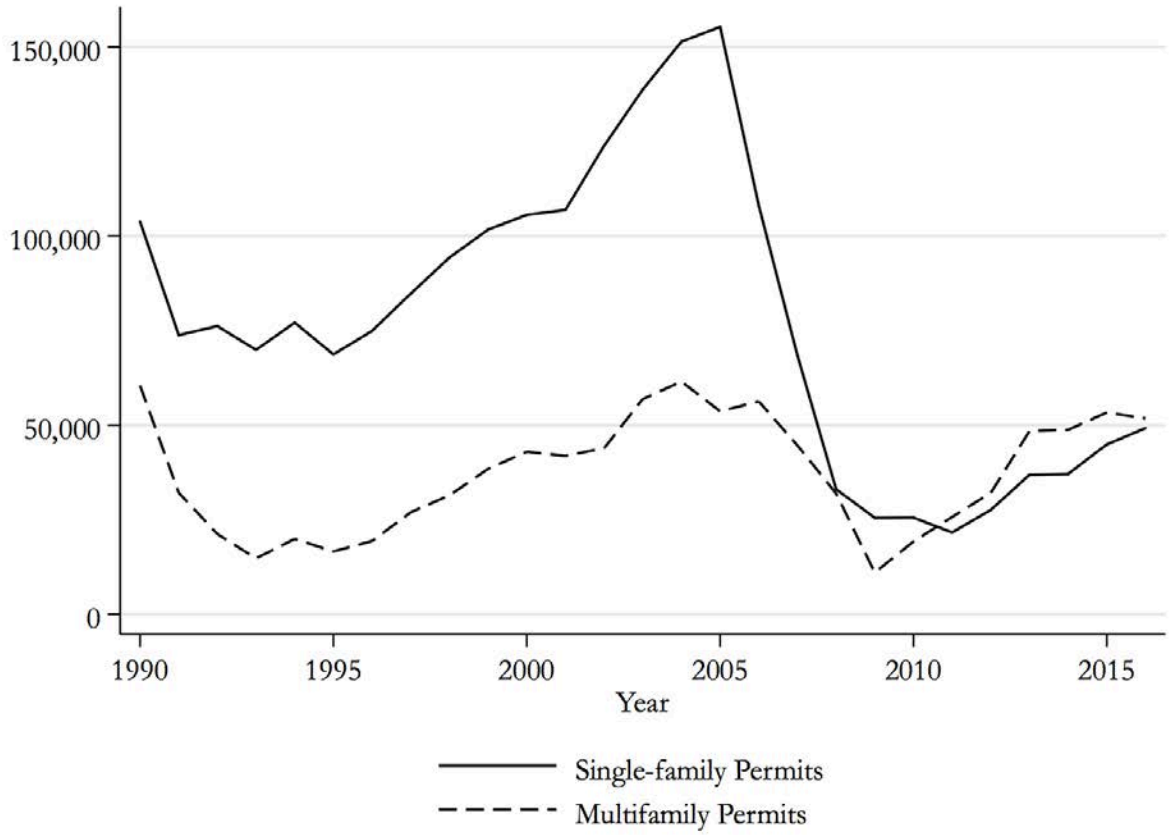
Figure 1: Annual Residential Building Permits Issued in California (1990-2016)



Source: California Construction Industry Research Board (annual data, 1990 - 2016).

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Table 1: Comparing Objective and Subjective Survey Items

	Type of Survey Question	
	Objective	***Subjective***
Asks the informant to report…	… specific factual characteristics, features, or practices of their organization	… a judgment or opinion regarding their organization, its practices, or its environment
Response options typically consist of…	… Yes or No (and sometimes Don't Know or Not Applicable)	… a multi-point Likert scale, often arrayed between "strongly agree" and "strongly disagree"
Example:	"Does your city have a measure which establishes a population growth limit or restricts the level of population growth for a given time frame (i.e., annual basis)?"	"On a scale of 1 to 5, ... rate the importance of each of the following factors in regulating the rate of residential development in your community (1 = not at all important; 5 = very important)"

Note: Objective example from Glickfeld & Levine (1992, p. 92); Subjective example from Gyourko et al. (2008, p. 720).

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Table 2: Surveys Analyzed

	Survey	Year	Sampling Frame	N (CA municipalities)	Question Type	
					Objective	*Subjective*
(1)	University of California, Riverside Growth Project Group (UCRGPG)	1988	Southern California municipalities	147	Yes	Yes
(2)	Glickfeld & Levine (G&L)	1988	California municipalities & counties	386	Yes	No *
(3)	G&L	1992	California municipalities & counties	410	Yes	No *
(4)	Pendall	1994	Municipalities and counties with populations ≥ 10,000 in the 25 largest US metropolitan areas	207 †	Yes	No
(5)	Pendall	2003	Municipalities and counties in the 50 largest US metropolitan areas	172 †	Yes	No
(6)	Public Policy Institute of California (PPIC)	1998-99	California municipalities††	297	Yes	Yes
(7)	Wharton Residential Land Use Regulatory Index (WRLURI)	2004	USA municipalities on International City Managers Association mailing list	185 †	Yes	Yes
(8)	Berkeley Land Use Regulation Index (BLURI)	2007	San Francisco Bay Area municipalities and counties	81	Yes	Yes
(9)	Terner Center for Housing Innovation (TCHI)	2017-18	California municipalities & counties	250	Yes	Yes

Notes: * The 1988 G&L survey instrument includes subjective questions about the reasons for adoption of growth controls, but not about informants' perceptions concerning constraints on residential development. The 1992 G&L survey instrument includes subjective questions informants' perceptions of constraints, but the associated responses were not included in the dataset that one of the original investigators provided to the authors.

† CA municipalities only, drawn from a national sample.

†† Located in the following counties: Alameda, Butte, Colusa, Contra Costa, Fresno, Glenn, Kern, Kings, Los Angeles, Madera, Marin, Merced, Napa, Orange, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Joaquin, San Mateo, Santa Barbara, Santa Clara, Shasta, Solano, Sonoma, Stanislaus, Sutter, Tehama, Tulare, Ventura, Yolo, Yuba.

Sources: The surveys are described in the following: (1) Donovan & Neiman (1992a); (2) Glickfeld & Levine (1992); (3) Levine et al. (1996); (4), (5) Pendall et al. (2018); (6) Lewis & Neiman (2000); (7) Gyourko et al. (2008); (8) Calfee et al. (2007); (9) Mawhorter & Reid (2018).

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Table 3: Dependent and Control Variables

Variable	Definition
(1) Single-family units*	Count of single-family units permitted
(2) Multifamily units*	Count of multifamily units permitted
(3) Total population†	Total population
(4) % non-Hispanic white	% of total population identifying as non-Hispanic white
(5) % foreign born	% of total population that is foreign-born
(6) Median household income†	Median household income
(7) % 18 and under	% of total population aged 18 and under
(8) % owner-occupied	% of occupied housing units that are owner-occupied
(9) % single-family detached	% of total housing units that are single-family detached units
(10) Median year built	Median year of construction for housing units
(11) Accessibility index†	Gravity index based on distance to employment
(12) Region	Seven dichotomous variables equal to one if a municipality is located in the region, and zero otherwise. The seven regions, with consitutent counties, are: *Bay Area:* Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma *Central Coast:* Monterey, San Benito, San Luis Obispo, Santa Barbara *Greater Sacramento:* El Dorado, Nevada, Placer, Sacramento, Sutter, Yolo, Yuba *San Diego-Border Region:* Imperial, San Diego *San Joaquin Valley:* Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare *Southern California:* Los Angeles, Orange, Riverside, San Bernardino, Ventura *Balance of state*
(13) Incorporation era	Four dichotomous variables equal to one for the historical era during which a municipality incorporated, and zero otherwise. The eras are: *1850 - World War I armistice* (1850 - Nov. 11, 1918); *Interwar & World War II* (Nov. 12, 1918 - Sept. 2, 1945); *Post-World War II* (Sept. 3, 1945 - June 6, 1978); *Post-Proposition 13* (June 7, 1978 - 1990).
(14) Net area (sq. mi.)†	Area of municipality, net of water, slopes greater than 15%, and state and national parks
(15) % developed	% of net area that is developed

Notes: * indicates that, for the regression models, we add one to the variable and take the natural log.
† indicates that, for the regression models, we take the natural log.

Sources: (1), (2) California Construction Industry Research Board (annual data, 1990 - 2016); (3) - (10) U.S. Census Bureau, decennial census (1990, 2000, 2010) and American Community Survey (2010 5-year data & 2012 5-year data); (11) Census Transportation Planning Package (1990, 2000, 2006-2010), U.S. Decennial Census (1990, 2000), American Community Survey (2010 5-year data); (12) U.S. Census Bureau, TIGER/Line Shapefiles; (13) State of California, Department of Finance (2013); California Association of Local Agency Formation Commissions (2011); (14), (15) National Historical Geographic Information System; U.S. Census Bureau, TIGER/Line Shapefiles; U.S. Geological Survey (2000, 2013, 2014a, 2014b).

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Table 4: Comparison of 1988 Survey Responses

Question Category	Survey			% Inconsistent Yes
	UCRGPG	*G&L*		
		NO	*YES*	
(1) Population ceiling	*NO*	95	***6***	77%
	YES	***21***	8	
(2) Residential development cap	*NO*	115	***3***	25%
	YES	***1***	12	
(3) Multifamily residential development cap	*NO*	109	***8***	56%
	YES	***1***	7	
(4) Popular vote for rezoning	*NO*	120	***6***	73%
	YES	***2***	3	
(5) Super-majority city council vote for rezoning	*NO*	110	***5***	95%
	YES	***14***	1	
(6) Urban growth boundary	*NO*	109	***9***	100%
	YES	***5***	0	

This table compares responses to two surveys administered to the same municipalities within the span of several months. The full questions are reproduced in the online-only supplement, and the numbers at the left of this table correspond to the order of the questions in the supplement. The percentage of inconsistent "yes" responses is the number of conflicting answers divided by the total number of affirmative responses across the two surveys for the relevant question. For example, the percentage for row (1) is calculated as follows: $100 * \frac{21+6}{21+6+8}$.

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Table 5: Subjective and Objective Survey Items as Predictors of Housing Permits

Dependent Variable	Survey Measure	Measure Type	Survey							
			UCRGPG (N = 144)	***PPIC*** (N = 261)	***WRLURI*** (N = 151)	***BLURI*** (N = 74)	***G&L, 1988*** (N = 333)	***G&L, 1992*** (N = 348)	***Pendall, 1994*** (N = 206)	***Pendall, 2003*** (N = 164)
Single-family permits	Density restrictions	Subjective	-0.008	-0.033	-0.036	-0.097	-	-	-	-
			(0.053)	(0.042)	(0.053)	(0.087)				
Single-family permits	Land supply	Subjective	-0.123 **	-0.168 ***	-0.154 **	-0.147	-	-	-	-
			(0.055)	(0.042)	(0.066)	(0.144)				
Single-family permits	Regulatory Inventory Index	Objective	0.095	0.081	-0.088	-0.027	0.032	0.064	-0.054	-0.088
			(0.064)	(0.057)	(0.128)	(0.104)	(0.049)	(0.053)	(0.074)	(0.080)
Multifamily permits	Density restrictions	Subjective	-0.335 ***	-0.139 *	0.096	-0.301 **	-	-	-	-
			(0.115)	(0.079)	(0.103)	(0.135)				
Multifamily permits	Land supply	Subjective	-0.164	-0.045	0.064	-0.710 **	-	-	-	-
			(0.116)	(0.081)	(0.124)	(0.303)				
Multifamily permits	Regulatory Inventory Index	Objective	0.054	0.098	-0.102	0.122	0.092	0.132 *	0.150	-0.014
			(0.136)	(0.113)	(0.160)	(0.310)	(0.074)	(0.072)	(0.151)	(0.131)

Each row in this table summarizes up to eight multivariable regression models. In each model, the specified dependent variable is regressed on the specified survey measure and a vector of control variables. The controls are described in Table 3, with more detail provided in the Technical Appendix. A separate online-only supplement provides complete estimation results for each regression. Based on these separate regressions, each of the numerical cell entries above reports the ordinary least squares coefficient for the specified survey measure.

Note: Robust standard errors in parentheses; * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

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Table 6: What Do Subjective Survey Items Measure?

Subjective survey items		Attributes measured via GIS		
		% of land that is undeveloped	***% of land zoned for single-family residential use***	***% of land zoned for multifamily residential use***
In your experience observing the development process, how much do the following factors constrain residential development?	***Supply of developable land***	-0.484 ***	0.143	0.099
	Amount of land zoned for single-family development	-0.163	0.100	-0.019
	Amount of land zoned for multifamily development	-0.004	0.148	-0.225 **

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

This table reports Spearman correlations between subjective perceptions reported on the TCHI survey (2017-2018) and attributes measured via the Southern California Association of Governments (SCAG) 2016 zoning update (2018) and the National Land Cover Database (2011 vintage). The sample includes municipalities covered by the Southern California Association of Governments that responded to the TCHI survey (N = 93). The single-family and multifamily GIS zoning measures include parcels zoned as "Specific Plan" areas in which the land use is residential, as well as parcels zoned for mixed residential and commercial development in which the land use is residential. The multifamily GIS measure also includes parcels zoned for a combination of single-family and multifamily development.

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Technical Appendix

We assess whether subjective or objective survey items predict subsequent residential building permit issuance, via analysis of eight of the surveys described in the main text and listed in Table 2: the UCRGPG survey, the two G&L surveys, the PPIC survey, two surveys conducted by Rolf Pendall, and the surveys used to generate the WRLURI and the BLURI. Table 5 reports the coefficients and robust standard errors for the variables of interest only. The full results are included in the online-only supplement, which also details the construction of the objective regulatory inventory indexes. This Technical Appendix provides additional detail concerning the dependent and control variables. It also discusses the validity of the regression models summarized in Table 5, focussing on issues of multicollinearity and endogeneity.

Dependent Variables

We measure permit issuance over a ten-year period separately for single-family and multifamily units, lagging the start of each ten-year period by two years from the time of the relevant survey. For example, the UCRGPG survey was conducted in 1988, and the dependent variables for the relevant regression models measure units permitted from 1990 through 1999. By lagging the dependent variable, we mitigate threats to the validity of our models due to endogeneity, discussed in more detail below. A two-year lag, as compared with a one-year lag, enables us to better align the dependent variables with the census data used to construct many of the control variables.

We transform the dependent variables by taking the natural log. The use of logged dependent variables facilitates interpretation and comparability between the single-family and multifamily models. We add one to each count of permits before taking its natural log, so that our sample does not exclude municipalities that issued no permits. In the multifamily models, the

proportion of cities with no permits (4% to 19%, depending on the sample), raises possible concerns about the appropriateness of the ordinary least squares estimator, but we obtain similar results using negative binomial regression with untransformed dependent variables.

Independent Variables

Our independent variables of interest are subjective and objective measures derived from the surveys listed above. As discussed in the main text, four of the surveys (UCRGPG, PPIC, WRLURI, and BLURI) included nearly identical subjective questions, asking informants about the importance of density restrictions and land supply in constraining residential development. These survey items, which are reproduced in the online-only supplement, measure perceived constraints with 5-point Likert scales, which constitute the subjective measures that we analyze (see Table 1). As described in the main text, all eight surveys include objective items concerning the adoption of particular land-use regulations, and we create regulatory inventory indexes by additively combining binary (i.e., yes/no) responses to such survey items. To the extent possible, our regulatory inventory indexes are constructed from questions that are comparable across surveys, but we also test alternative index specifications used by previous researchers. The online-only supplement details the components of the main indexes and the alternative specifications.

We control for a variety of municipality-level attributes, detailed in the remainder of this section. Table 3 lists our control variables, and the online-only supplement provides summary statistics. Our controls are measured at times coinciding as closely as possible to the beginning of each period covered by the dependent variables, which measure housing units permitted over a ten-year period. Variables derived from the decennial census and the American Community Survey include the natural logarithm of total population, the percentage of the population

identified as non-Hispanic white, the percentage of the population that is foreign-born, the percentage of the population aged 18 and under, the percentage of housing that is owner-occupied, the median year of construction for housing units, and the natural logarithm of median household income.[1] In addition to these standard socio-economic covariates, we also control for constraints on buildable land, job accessibility, and incorporation era, as described in the remainder of this section.

Constraints on Buildable Land

Our models incorporate two variables indicating geographical constraints on buildable land. First, we measure land area in each municipality, net of slopes of at least 15% and any additional territory within a state or national park. This is because development is often economically infeasible in steep-sloped areas (Saiz, 2010), and it is effectively permanently precluded by regulation in state and national parks. Second, we use this net land area variable as the denominator of a measure of the percent of developed land area, with the numerator coming from land cover data from the 1992, 2001, and 2011 vintages of the National Land Cover Database.

Job Accessibility

Because many of the municipalities in our sample are located in polycentric metropolitan areas with multiple employment centers, we use a gravity-based job accessibility index in lieu of a simple measure of proximity to a central business district. We use data from the Census Transportation Planning Package (CTPP), which is the only source that provides relevant employment location data for the entire study period. As discussed in detail below, the lowest level of aggregation for CTPP employment data varies, depending on the year and the location.

The index is calculated, weighted, and aggregated to the municipality-level using the following formula:

$$A_m = \sum_{i=1}\left(\left(\frac{P_i}{P_m}\right) * \sum_{j=1}\left(\frac{E_j}{d_{ij}^2}\right)\right),$$

where A_m is the accessibility index value of municipality m, P_i is the population aged 18-64 in CTPP geography i (either a block group (BG), transportation analysis zone (TAZ), tract, or tract/remainder) located in m, P_m is the population aged 18-64 in municipality m, E_j is the number of jobs in geography j, and d_{ij} is the Vincenty distance from i to j, squared as per convention.

The calculation of the index for municipalities in our sample is somewhat complicated by inconsistencies in the level of aggregation for place-of-work tabulations within and among the different vintages of CTPP. The level of aggregation in the 1990 CTPP varies within California, depending on the MPO that covered the relevant territory. For some MPO areas, 1990 place-of-work counts are available at the BG level; for others the lowest level of aggregation for 1990 is the TAZ; for the largest MPO – SCAG – the lowest level of aggregation for the 1990 place-of-work data is the tract level. For the 2000 CTPP, the data are consistently available at the tract/remainder level, and for the 2006-2010 CTPP, the data are consistently available at the tract level. We allocate 1990 TAZ-level data to municipalities using the BG-to-TAZ crosswalk provided with the 1990 CTPP. We allocate the 1990 and 2006-2010 tract-level data to municipalities using geographic correspondence engines provided by the Missouri Census Data Center (n.d., 2016). No allocation was required for the 2000 CTPP data, which are consistently available at the tract/remainder level.

Concerns about bias due to variation in the level of aggregation are mitigated by the summation to the municipality level. The index is substantively sensible (e.g., San Francisco

ranks highest, the City of Needles – located in the Mojave Desert – ranks lowest), and is very strongly correlated across decades: the correlation between the logged 1990 index and the logged 2000 index is 0.93, the correlation between the logged 2000 index and the logged 2006-2010 index is 0.97, and both correlations are significant at $p < 0.01$.

Incorporation Era

The regression models include four dummy variables indicating the historical era during which a municipality incorporated – (1) Before the end of World War I; (2) Between the end of World War I and the end of World War II; (3) Between the end of World War II and the adoption of Proposition 13, a 1978 California ballot measure that substantially restricted property taxation and reshaped public finance in the state; (4) After Proposition 13.

Incorporation date relates to a city's age of settlement, and is indicative of the era in which the locality likely initiated its regulation of land use. It is distinct from median housing construction year, and we measure both variables separately in our regression models. (The Pearson correlation between median year of construction and years since incorporation, considered as continuous variables, is only -0.2 (significant at $p < 0.01$, using 2000 data).) Given that there are distinctive periods in U.S. metropolitan development patterns (Hanlon, 2010; Muller, 2004), we believe a periodization scheme for incorporation dates – a set of dichotomous variables for different historical eras – is more appropriate than a continuous measure of years elapsed since incorporation. We therefore distinguish between pre-World War I cities, which often include dense business districts and significant areas of pre-automobile settlement; interwar incorporations, representing the era of early suburbanization that often occurred along street railway and interurban rail lines; and postwar suburbs, representing a massive wave of auto-oriented communities, often mass-produced bedroom suburbs. We further distinguish

incorporations occurring after the adoption of Proposition 13, a 1978 California ballot measure that disrupted the state/local fiscal system. Proposition 13 may have changed the local calculus both about whether to incorporate and whether to allow residential development, because it substantially reduced the ability of municipalities to rely on local property tax revenues.

Model Validity

In this section we discuss two common threats to the validity of regression models – inter-correlation among the independent variables (i.e., multicollinearity), which can result in inflated standard errors, and endogeneity, which can result in biased coefficient estimates.

Multicollinearity

Multicollinearity is not a concern in our models, due to minimal inter-correlation between the survey-based measures and the control variables. The subjective measure of constraints due to density restrictions is either uncorrelated or weakly correlated with all controls in all models. The land supply variable is moderately correlated with one control variable in the PPIC model and with one control variable in the UCRGPG model ($\rho = \pm 0.4$), and the regulatory inventory index variable is moderately correlated with one control variable in the BLURI single-family and multifamily models ($\rho = 0.4$).

Endogeneity

The concept of endogeneity is a catchall, encompassing bias due to omitted variables, measurement error, reverse causality, and sample selection, among other problems (Wooldridge, 2002, pp. 49–50). The threat of endogeneity is a major concern in the economic literature on land-use regulation (see, e.g., Ihlanfeldt, 2007; Quigley & Rosenthal, 2005; Saiz, 2010), and our models directly account for some potential causes of endogeneity. For example, we mitigate

concerns about simultaneity bias by lagging the dependent variable, relative to the independent variable, and our control variables mitigate various kinds of omitted variable bias.

Both the strengths and weaknesses of subjective and objective survey measures closely track concerns about endogeneity. Indeed, subjective measures may be particularly valuable when more precise tools for mitigating endogeneity are unavailable. In particular, subjective variables in our regression models may mitigate some forms of endogeneity for precisely the same reasons that they do not clearly demarcate particular policies that might be susceptible to reform – they measure latent phenomena based on gut sense.

In studies of land-use regulation, a recurring substantive concern related to endogeneity is that any particular form of land-use regulation may simply be a vessel for existing residents' preferences that would also prevail with a different set of regulatory instruments (see, e.g., Quigley & Rosenthal, 2005; Schuetz, 2009). In this case, land-use regulation would be a proxy for a latent variable measuring local preferences concerning density. Scholars have attempted to address this concern by using two-stage models with instrumental variables that are posited to be exogenous to the outcomes in the second stage (e.g., Ihlanfeldt, 2007; Rothwell & Massey, 2010; Schuetz, 2009). The instruments typically include density, sometimes combined with other socio-economic characteristics, measured at a time prior to the study period.

Such instruments can be problematic for both theoretical and practical reasons. As a matter of theory, demographic changes are likely related to the unobserved latent characteristics motivating two-stage models, violating the identification assumptions for such models (Glaeser & Ward, 2009, p. 273 n. 5; Lens & Monkkonen, 2016, p. 17). As a practical matter, municipal-level density and other demographic characteristics are often unmeasurable at times significantly predating the study period. This is because, in many areas of the U.S. (including California),

municipal boundaries changed frequently during the second half of the twentieth century, due to annexations and incorporations.[2]

Even if valid instruments are available, such instruments mitigate only one potential source of endogeneity. Scholars have devoted substantially less attention to identifying or mitigating endogeneity due to erroneous informant reports, or the problems of over-inclusion and under-inclusion that we discuss in the text. Our analyses suggest that these potential sources of mismeasurement merit significantly more attention from scholars of land-use regulation.

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[1] The reported model specifications do not include housing values or rents as controls, because these variables are very highly correlated with median household income. (In our samples, the correlation coefficients among these variables, in log form, range from 0.85 to 0.90.) Including median home value and median gross rent as controls (individually or in combination) does not change the direction, magnitude, or statistical significance of the coefficients on the independent variables of interest in any of the model specifications.

[2] This problem does not affect studies in which the unit of analysis consists of metropolitan areas, because metropolitan areas are composed of counties, which have relatively stable boundaries (e.g., Rothwell & Massey, 2010). Nor does it affect studies covering areas with longstanding, stable municipal boundaries (e.g., Schuetz, 2009).

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Online Supplemental Appendices

What Planners Know: Using Surveys about Local Land-Use Regulation to Understand Housing Development

Appendix A: Comparison of Similar Survey Questions from 1988 Surveys

This appendix presents the questions used to construct Table 4 in the article. The questions come from the 1988 University of California Riverside Growth Project Group (UCRGPG) survey, and the 1988 version of the survey by Glickfeld & Levine (G&L). Responses to the UCRGPG survey indicating "NA" or "Don't know" were coded as missing. If a question presented additional response options (other than "Yes" and "No"), we recoded the responses as binary variables. In these cases, the recoding rules are described in a note following the relevant question. Ellipses indicate the location of material excised from the original survey instrument for purposes of presentation in this appendix.

(1) Population ceiling

UCRGPG

Is there a population ceiling prescribed by any FORMAL policy in your community? 1=Yes 2=No 3=NA

G&L 1988

Does your city have a measure* which establishes a population growth limit or restricts the level of population growth for a given time frame (i.e., annual basis)?

**"Measure" includes initiatives adopted by the voters or regulatory ordinances adopted by the city council. It excludes resolutions or other policy statements.*

a._____ YES b._____ NO

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(2) Residential development cap

UCRGPG

Do your city's policies include a limit on the total number of HOUSING/RESIDENTIAL units authorized for construction in a given year? 1=Yes 2=No 3=NA

G&L 1988

Does your city have a measure which restricts the total number of permitted residential building permits in a given time frame (i.e., annual basis) for:

a._____ YES b._____ NO

If YES, applies to (1)_____ single family or (2)_____ multiple family or (3)_____ both

Note: For row (2) of Table 4, responses to the relevant G&L question were coded as "Yes" if the informant checked option *a* and any combination of the housing types to which the permit restriction could apply.

(3) Multifamily residential development cap

UCRGPG

Does your city place a limit on the total number of multi-family dwellings built in a given year? 1=Yes 2=No 3=NA

G&L 1988

Does your city have a measure which restricts the total number of permitted residential building permits in a given time frame (i.e., annual basis) for:

a._____ YES b._____ NO

If YES, applies to (1)_____ single family or (2)_____ multiple family or (3)_____ both

Note: For row (3) of Table 4, responses to the relevant G&L question were coded as "Yes" if the informant checked "Yes" for option *a* and either option *(2)* or option *(3)*.

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(4) Popular vote for rezoning

UCRGPG

Does your city require a vote of the people
for some or all zoning changes? 1=Yes 2=No 3=NA

G&L 1988

Does your city have a measure which did any of the following (check all applicable responses):

...

_____ Requires voter approval to increase residential densities.

(5) Super-majority city council vote for rezoning

UCRGPG

Does your city require MORE than a simple majority on the city council or planning commission to approve some zone changes? Please mark ONE of the following.

1. ____ Yes, BOTH on city council and planning commission.
2. ____ Yes, but ONLY on the city council.
3. ____ Yes, but ONLY on the planning commission.
4. ____ No, simple majorities only are required.

Note: For row (5) of Table 4, responses were coded as "Yes" if the informant checked options 1 or 2, and "No" if the informant checked options 3 or 4.

G&L 1988

Does your city have a measure which did any of the following (check all applicable responses):

...

_____ Requires super majority council vote to increase residential densities.

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(6) Urban growth boundary

UCRGPG

Does your city have a FORMAL policy to restrict residential development to areas that are already developed? 1=Yes 2=No 3=NA

G&L 1988

Has your city established an urban limit line or greenbelt, other than the boundaries of your city, beyond which residential, commercial and/or industrial development is not currently permitted?

a._____ YES b._____ NO

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Appendix B: Comparable Subjective Survey Questions

This appendix presents the questions used to construct the subjective indicators concerning density restrictions and land supply. The questions come from the 1988 University of California Riverside Growth Project Group (UCRGPG) survey, the 1998-1999 Public Policy Institute of California (PPIC) survey, the 2004 survey that forms the basis of the Wharton Residential Land Use Regulatory Index (WRLURI), and the 2007 survey used to generate the Berkeley Land Use Regulation Index (BLURI). Ellipses indicate the location of material excised from the original survey instrument for purposes of presentation in this appendix.

UCRGPG

Please review the following list of factors and circle the number that you feel best describes how important <u>each</u> factor is in CONSTRAINING or SLOWING residential development in your city. Number "1" indicates that you judge the factor as <u>not</u> at all important, and the number "5" indicates very important. Please CIRCLE a number for each factor.

	Not at All Important				Very Important
	(Circle one category)				
...					
Supply of land for residential use	1	2	3	4	5
Density restrictions on residential land	1	2	3	4	5

PPIC

Please review the following list of factors and circle the number that you feel best describes how important <u>each</u> factor is in CONSTRAINING or SLOWING residential development IN YOUR CITY. Number "1" indicates that you judge the factor as not at all important, and the number "5" indicates very important. Please CIRCLE a number for each factor.

	Not at All Important				Very Important
	<u>(Circle one number for each item)</u>				
...					
Supply of land for residential use	1	2	3	4	5
Density restrictions on residential land	1	2	3	4	5

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WRLURI

On a scale of 1 to 5, please rate the importance of each of the following factors in regulating the rate of residential development in your community (1 = not at all important; 5 = very important). Please circle the appropriate number.

	Single family units						Multi family units				
- Supply of land	1	2	3	4	5		1	2	3	4	5
...											
- Density restrictions	1	2	3	4	5		1	2	3	4	5

BLURI

SINGLE FAMILY. On a scale of 1 to 5, how important is each of the following factors in affecting the rate of single-family residential development in your jurisdiction? Please rate the importance of all factors listed.

1 Not important	2	3 Important	4	5 Very important
Supply of developable land				
1	2	3	4	5
Density restrictions				
1	2	3	4	5

...

MULTIFAMILY. On a scale of 1 to 5, how important is each of the following factors in affecting the rate of multifamily residential development in your jurisdiction? Please rate the importance of all factors listed.

1 Not important	2	3 Important	4	5 Very important
Supply of developable land				
1	2	3	4	5
Density restrictions				
1	2	3	4	5

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Appendix C: Components of Regulatory Inventory Indexes

This appendix details the composition of the regulatory inventory indexes used in the main regression models, summarized in Table 5 and detailed in Appendix F. It also details the composition of alternatives used in previous research, which we included in unreported model specifications, all of which yielded statistically insignificant results for the regulatory inventory index coefficients.

The items come from the 1988 University of California Riverside Growth Project Group (UCRGPG) survey, the 1988 and 1992 Glickfeld & Levine (G&L) surveys, the 1994 Pendall survey, the 1998-1999 Public Policy Institute of California (PPIC) survey, the 2003 Pendall survey, the 2004 survey that forms the basis of the Wharton Residential Land Use Regulatory Index (WRLURI), and the 2007 survey used to generate the Berkeley Land Use Regulation Index (BLURI).

All quotes are from the survey instruments. In some instances, capitalization and font-style (e.g., italics / underlining) from the survey instruments have been altered.

UCRGPG

Main Regression Models

Add one for each of the following: Residential permit limit (=1 if city "limits the total number of building permits issued in a given year[,]" and/or "city's policies include a limit on the total number of housing/residential units authorized for construction in a given year[,]" and/or city places "a limit on the total number of multi-family dwellings built in a given year"); Supermajority city council approval required for some or all zoning changes; Population ceiling; Voter approval required for some or all zoning changes; Urban growth boundary; Adequate public facilities requirement (=1 if there is "any formal policy … to affect residential growth rates by requiring that traffic standards be satisfied before new development occurs," and/or "capital improvements and public works projects (e.g., street widenings or sewer expansions) and infrastructure [are] used to control the rate and/or location of residential development").

Alternate Specification

Donovan and Neiman (1992) – Add one for each of the following: Residential permit limit; Supermajority city council approval required for some or all zoning changes; Population ceiling; City design review standards; Schools review development plans; Moratoria on sewer, water permits; Require capital improvements; Link growth rates to traffic standards;

Recent rezoning to reduce residential density; Point system to rank new projects; Growth limited to external (state/county) rates; Limitations on multi-family units; Limitations on number of water connections.

G&L 1988

Main Regression Models

Add one for each of the following: Residential permit limit; Supermajority city council approval required for some or all zoning changes; Population ceiling; Voter approval required for some or all zoning changes; Urban growth boundary; Adequate public facilities requirement.

Alternate Specification

Quigley and Raphael (2005) – Same as Main Regression Models, but also add one for each of the following: Recent rezoning or general plan amendment to reduce residential density; Recent rezoning to open space; Growth management element in general plan; Measure requiring adequate service level for approval of commercial / industrial development; Measure restricting commercial square footage that can be build within a given time frame; Measure restricting industrial square footage that can be built within given time frame; Measure rezoning commercial/industrial land to less intense use; Measure reducing permitted height of commercial/office buildings; Other measures to control development.

G&L 1992

Main Regression Models

Same as Main Regression Models for G&L 1988.

Alternate Specification

Jackson (2016) – Same as Main Regression Models for G&L 1988, but also add one for each of the following: Recent rezoning or general plan amendment to reduce residential density; Recent rezoning to open space; Growth management element in general plan; City has a "measure which restricts the structural floor area which can be built on a given parcel according to the size or slope of the parcel"; City has a "measure which restricts the total number of new subdivided lots that can be created in a given time frame (e.g., annual basis)";

City has a "measure which provides for phased or 'tiered' development areas where development approval and infrastructure extension are sequenced or deferred until a certain time period or until existing developed areas are substantially developed[.]"

Pendall 1994

Main Regression Models

Add one for each of the following: Low-density only zoning; Permit cap; Population ceiling; Current moratorium; Popular vote required for rezoning; Adequate public facilities requirement; Urban growth boundary.

PPIC

Main Regression Models

Add one for each of the following: Supermajority city council approval required for some or all zoning changes; Residential building permit limit (=1 if city has "a policy that limits the total number of building permits issued in a given year[,]" and/or "city's policies include a limit on the total number of housing/residential units authorized for construction in a given year[,]" and/or "city limit[s] the total number of multi-family dwellings built in a given year"); Adequate public facilities requirement (=1 if city has "a formal policy … to affect residential growth rates by requiring that traffic standards be satisfied before new development occurs[,]" and/or "capital investments and public works projects (e.g., street widening or sewer capacity) [are] used to control the rate or location of residential development"); Voter approval required for some or all zoning changes; Urban growth boundary; Population ceiling.

Pendall 2003

Main Regression Models

Add one for each of the following: Low-density only zoning; Permit cap; Population ceiling; Current moratorium; Popular vote required for rezoning; Adequate public facilities requirement; Urban growth boundary.

WRLURI

Main Regression Models

Single-Family – Add one for each of the following: Annual limit on single-family permits; Annual limit on single-family construction; Minimum lot size requirement; Supermajority city council approval required for some or all zoning changes.

Multi-family – Add one for each of the following: Annual limit on multi-family permits; Annual limit on multi-family construction; Limit on number of multi-family dwellings; Limit on number of units per multi-family dwelling; Supermajority city council approval required for some or all zoning changes.

Alternate Specifications

Sub-indexes of the WRLURI (Gyourko et al., 2008):

- *Local zoning approval index* – Add one for each of the following: Local planning commission required to approve zoning changes; Local zoning board required to approve zoning changes; Local council, managers, commissioners required to approve zoning changes; County board of commissioners required to approve zoning changes; County zoning board required to approve zoning changes; Environmental review board required to approve zoning changes; Town meeting vote required to approve zoning changes.

- *Local Project Approval Index* – Add one for each of the following: Local planning commission required to approve new projects; Local council, managers, commissioners required to approve new projects; County board of commissioners required to approve new projects; Environmental review board required to approve new projects; Public health office required to approve new projects; Design review board required to approve new projects.

- *Supply Restrictions Index* – Add one for each of the following: Limits on building permits, single-family; Limits on building permits, multifamily; Limits on residential units for construction, single-family; Limits on residential units for construction, multifamily; Limits on number of units in multifamily dwellings; Limits on multifamily dwellings.

BLURI

Main Regression Models

Single-Family & Multi-family – Add one for each of the following: Annual limit on population growth; Requirements for developers to dedicate open space in their projects; Requirements for developers to provide infrastructure improvements for their projects;

Single-Family – Also add one for each of the following: Annual limit on single-family building permits; Annual limit on new single-family units; Minimum lot-size requirements for single-family development.

Multi-Family – Also add one for each of the following: Annual limit on multi-family building permits; Annual limit on new multi-family units.

Alternate Specifications

Kok et al. (2014):

- *Approvals index* – number of independent reviews required for a building permit.
- *Zoning change index* – number of independent reviews required for a zoning change.[1]

[1] The relevant survey instrument defines zoning changes to include variances and conditional use permits, which as several planners responding to this survey noted in open-ended comments, have a different legal status from the legislative action of rezoning, and might therefore be expected to require a different number of approvals.

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Appendix D: Summary Statistics

Survey: UCRGPG

Variable	N	Mean	SD	Min	Max
Single-family permits (+1), 1990-1999 (log)	144	6.2	1.5	2.9	9.3
Multi-family permits (+1), 1990-1999 (log)	144	4.8	2.1	0.0	8.8
Total population, 1990 (log)	144	10.5	1.0	6.7	13.0
% non-Hispanic white, 1990	144	58.7	23.7	3.2	97.0
% foreign-born, 1990	144	21.6	12.0	3.4	58.1
Median household income in 1989 (log)	144	10.6	0.4	9.8	11.9
% age 18 and under, 1990	144	27.6	6.7	6.6	41.9
% owner-occupied, 1990	144	58.9	16.4	16.9	97.8
Median year structure built, 1990	144	1967.8	8.7	1941	1985
% developed, 1992	144	84.1	20.0	12.9	100.0
Net land area, 1990 (log)	144	2.1	1.0	-1.2	4.5
% single-family detached, 1990	144	55.6	17.6	7.3	99.6
Accessibility index, 1990 (log)	144	10.2	1.2	5.7	12.0
Importance of density restrictions	144	3.3	1.3	1	5
Importance of land supply	144	3.7	1.4	1	5
Regulatory inventory index	144	0.8	1.0	0	4

Survey: PPIC

Variable	N	Mean	SD	Min	Max
Single-family permits (+1), 2000-2009 (log)	261	6.5	1.6	1.6	10.2
Multi-family permits (+1), 2000-2009 (log)	261	5.2	2.2	0.0	10.5
Total population, 2000 (log)	261	10.5	1.2	6.8	14.0
% non-Hispanic white, 2000	261	49.8	23.8	0.2	93.7
% foreign-born, 2000	261	24.0	12.0	3.7	57.0
Median household income in 1999 (log)	261	10.8	0.4	10.0	12.2
% age 18 and under, 2000	261	29.2	6.5	8.8	42.8
% owner-occupied, 2000	261	60.9	13.6	23.8	97.0
Median year structure built, 2000	261	1970.9	9.7	1940	1994
% developed, 2001	261	78.6	20.8	6.1	99.9
Net land area, 2000 (log)	261	2.2	1.2	-0.8	5.4
% single-family detached, 2000	261	61.1	15.9	6.2	99.7
Accessibility index, 2000 (log)	261	9.9	1.1	6.5	12.5
Importance of density restrictions	261	2.8	1.3	1	5
Importance of land supply	261	3.5	1.4	1	5
Regulatory inventory index	261	0.7	0.8	0	4

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Survey: WRLURI

Variable	N	Mean	SD	Min	Max
Single-family permits (+1), 2006-2015 (log)	151	5.7	1.5	1.6	9.5
Multi-family permits (+1), 2006-2015 (log)	151	4.8	2.3	0.0	11.3
Total Population (log) (2006-2010 ACS)	151	10.5	1.2	8.2	15.1
% non-Hispanic white (2006-2010 ACS)	151	45.4	24.8	0.0	93.9
% foreign-born (2006-2010 ACS)	151	24.4	11.3	3.1	52.9
Median household income (log) (2006-2010 ACS)	151	11.0	0.4	9.9	12.3
% under age 18 (2006-2010 ACS)	151	25.6	6.2	7.6	45.4
% owner-occupied (2006-2010 ACS)	151	59.7	12.4	21.9	96.5
Median year structure built (2006-2010 ACS)	151	1973.3	11.8	1939	2002
% developed, 2001	151	80.0	19.7	14.1	99.9
Net land area, 2000 (log)	151	2.1	1.2	-0.8	5.8
% single-family detached (2006-2010 ACS)	151	60.9	16.0	6.3	97.8
Accessibility index, 2000 (log)	151	9.9	1.2	6.5	12.5
Importance of density restrictions (single-family)	151	2.9	1.3	1	5
Importance of land supply (single-family)	151	4.5	1.0	1	5
Regulatory inventory index (single-family)	151	0.9	0.7	0	3
Importance of density restrictions (multi-family)	151	3.3	1.3	1	5
Importance of land supply (multi-family)	151	4.4	1.0	1	5
Regulatory inventory index (multi-family)	151	0.3	0.7	0	4

Survey: BLURI

Variable	N	Mean	SD	Min	Max
Single-family permits (+1), 2009-2016 (log)	74	4.9	1.7	0.0	8.1
Multi-family permits (+1), 2009-2016 (log)	74	4.5	2.7	0.0	10.0
Total Population (log) (2008-2012 ACS)	74	10.4	1.2	7.4	13.8
% non-Hispanic white (2008-2012 ACS)	74	53.1	22.3	11.6	88.8
% foreign-born (2008-2012 ACS)	74	25.1	11.3	8.5	53.8
Median household income (log) (2008-2012 ACS)	74	11.4	0.3	10.7	12.0
% under age 18 (2008-2012 ACS)	74	22.4	4.2	8.7	31.1
% owner-occupied (2008-2012 ACS)	74	61.4	11.7	36.9	88.5
Median year structure built (2008-2012 ACS)	74	1970.0	12.5	1939	2001
% developed, 2011	74	85.5	12.5	39.3	99.6
Net land area, 2010 (log)	74	1.8	1.2	-1.6	5.0
% single-family detached (2008-2012 ACS)	74	60.5	15.9	5.4	93.8
Accessibility index, 2006-2010 (log)	74	10.1	0.8	7.0	12.5
Importance of density restrictions (single-family)	74	3.2	1.4	1	5
Importance of land supply (single-family)	74	4.7	0.8	1	5
Regulatory inventory index (single-family)	74	3.2	1.0	0	6
Importance of density restrictions (multi-family)	74	3.3	1.4	1	5
Importance of land supply (multi-family)	74	4.6	0.9	1	5
Regulatory inventory index (multi-family)	74	2.1	0.9	0	5

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Survey: G&L, 1988

Variable	N	Mean	SD	Min	Max
Single-family permits (+1), 1990-1999 (log)	333	6.2	1.6	0.0	9.8
Multi-family permits (+1), 1990-1999 (log)	333	4.8	2.2	0.0	10.3
Total population, 1990 (log)	333	10.2	1.3	5.0	15.1
% non-Hispanic white, 1990	333	61.0	23.8	1.4	94.2
% foreign-born, 1990	333	19.4	11.7	2.4	59.4
Median household income in 1989 (log)	333	10.5	0.4	9.6	11.9
% age 18 and under, 1990	333	28.0	6.8	6.7	44.7
% owner-occupied, 1990	333	58.6	14.5	10.6	97.8
Median year structure built, 1990	333	1967.4	8.6	1939	1985
% developed, 1992	333	80.7	18.3	6.1	100.0
Net land area, 1990 (log)	333	1.9	1.2	-1.2	5.8
% single-family detached, 1990	333	59.0	16.4	7.3	99.7
Accessibility index, 1990 (log)	333	10.0	1.1	5.7	12.7
Regulatory inventory index	333	0.8	1.0	0	5

Survey: G&L, 1992

Variable	N	Mean	SD	Min	Max
Single-family permits (+1), 1994-2003 (log)	348	6.3	1.7	0.0	10.0
Multi-family permits (+1), 1994-2003 (log)	348	4.7	2.3	0.0	10.5
Total population, 1990 (log)	348	10.2	1.3	5.0	15.1
% non-Hispanic white, 1990	348	61.2	24.3	1.4	98.0
% foreign-born, 1990	348	19.5	11.6	2.4	59.4
Median household income in 1989 (log)	348	10.5	0.4	9.6	11.9
% age 18 and under, 1990	348	27.9	6.9	6.6	44.7
% owner-occupied, 1990	348	59.3	14.7	10.6	97.8
Median year structure built, 1990	348	1967.4	8.8	1939	1987
% developed, 1992	348	80.3	18.6	12.9	100.0
Net land area, 1990 (log)	348	1.9	1.2	-1.4	5.8
% single-family detached, 1990	348	59.4	16.1	7.3	99.7
Accessibility index, 1990 (log)	348	9.9	1.2	5.7	12.7
Regulatory inventory index	348	0.9	1.0	0	4

Survey: Pendall 1994

Variable	N	Mean	SD	Min	Max
Single-family permits (+1), 1996-2005 (log)	206	6.6	1.5	3.1	10.0
Multi-family permits (+1), 1996-2005 (log)	206	5.4	2.1	0.0	10.9
Total population, 1990 (log)	206	10.8	0.9	9.3	15.1
% non-Hispanic white, 1990	206	62.3	22.1	1.8	93.1
% foreign-born, 1990	206	20.3	11.0	5.5	58.1
Median household income in 1989 (log)	206	10.6	0.3	9.9	11.7
% age 18 and under, 1990	206	26.4	6.1	7.4	40.0
% owner-occupied, 1990	206	59.1	14.0	16.9	96.2
Median year structure built, 1990	206	1966.8	9.6	1939	1987
% developed, 1992	206	86.3	16.1	13.5	100.0
Net land area, 1990 (log)	206	2.2	1.0	0.1	5.8
% single-family detached, 1990	206	56.1	15.2	7.3	99.6
Accessibility index, 1990 (log)	206	10.4	0.9	6.8	12.7
Regulatory inventory index	206	1.3	0.8	0	3

Survey: Pendall 2003

Variable	N	Mean	SD	Min	Max
Single-family permits (+1), 2005-2014 (log)	164	6.0	1.5	1.6	9.4
Multi-family permits (+1), 2005-2014 (log)	164	6.0	1.5	1.6	9.4
Total population, 2000 (log)	164	10.8	0.9	9.3	15.1
% non-Hispanic white, 2000	164	53.1	23.3	2.8	89.4
% foreign-born, 2000	164	24.3	12.4	5.2	55.9
Median household income in 1999 (log)	164	11.0	0.4	10.2	12.2
% age 18 and under, 2000	164	27.4	6.0	11.6	41.3
% owner-occupied, 2000	164	61.2	14.4	23.8	95.6
Median year structure built, 2000	164	1968.9	10.9	1939	1994
% developed, 2001	164	86.3	15.6	23.1	100.0
Net land area, 2000 (log)	164	2.3	1.1	-0.1	5.8
% single-family detached, 2000	164	58.9	15.3	18.1	99.6
Accessibility index, 2000 (log)	164	10.4	0.8	8.3	12.5
Regulatory inventory index	164	0.8	0.9	0	4

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Appendix E: Correlation Tables

Table E-1: Correlations among Subjective Responses Concerning Density Restrictions

	PPIC	WRLURI, single-family	WRLURI, multi-family	BLURI, single-family	BLURI, multi-family
UCRGPG	0.226 **	0.105	0.27 **	-	-
N	100	60	60	-	-
PPIC		0.341 ***	0.407 ***	0.186	0.176
N		113	113	57	57
WRLURI, single-family			-	0.324 *	-
N			-	27	-
WRLURI, multi-family				-	0.519 ***
N				-	27

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

This table reports Spearman correlation coefficients for responses based on a 5-point Likert scale, indicating informants' ratings of the extent to which density restrictions constrain residential development. The relevant questions are reproduced in Appendix B. Comparison between the UCRGPG and BLURI surveys was not possible, because the samples do not overlap.

Table E-2: Correlations among Subjective Responses Concerning Land Supply

	PPIC	WLURI, single-family	WLURI, multi-family	BLURI, single-family	BLURI, multi-family
UCRGPG	0.315 ***	0.359 ***	0.291 **	-	-
N	100	60	60		
PPIC		0.289 ***	0.329 ***	0.182	0.064
N		113	113	57	57
WLURI, single-family				0.509 ***	-
N				27	
WLURI, multi-family				-	0.379 *
N					27

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

This table reports Spearman correlation coefficients for responses based on a 5-point Likert scale, indicating informants' ratings of the extent to which land supply constrains residential development. The relevant questions are reproduced in Appendix B. Comparison between the UCRGPG and BLURI surveys was not possible, because the samples do not overlap.

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Appendix F: Full Regression Models

Survey: UCRGPG; Dependent Variable: Log of Single-Family Permits (+1), 1990-1999

	(A)	(B)	(C)	(D)
Total population, 1990 (log)	0.641 ***	0.638 ***	0.583 ***	0.609 ***
	(0.181)	(0.182)	(0.182)	(0.180)
% non-Hispanic white, 1990	0.008	0.008	0.010	0.007
	(0.008)	(0.008)	(0.008)	(0.008)
% foreign-born, 1990	0.006	0.006	0.007	0.004
	(0.014)	(0.014)	(0.014)	(0.014)
Median household income in 1989 (log)	0.483	0.493	0.518	0.465
	(0.457)	(0.459)	(0.458)	(0.457)
% age 18 and under, 1990	0.009	0.009	0.015	0.008
	(0.023)	(0.023)	(0.022)	(0.022)
% owner-occupied, 1990	-0.001	-0.001	-0.002	-0.001
	(0.012)	(0.012)	(0.013)	(0.012)
Median year structure built, 1990	0.067 ***	0.067 ***	0.064 ***	0.066 ***
	(0.012)	(0.013)	(0.013)	(0.013)
% developed, 1992	-0.004	-0.004	-0.003	-0.005
	(0.008)	(0.008)	(0.008)	(0.008)
Net land area, 1990 (log)	0.301	0.301	0.322 *	0.314
	(0.193)	(0.194)	(0.192)	(0.190)
% single-family detached, 1990	0.000	0.000	0.000	0.000
	(0.010)	(0.010)	(0.011)	(0.010)
Accessibility index, 1990 (log)	-0.291 **	-0.290 **	-0.226 *	-0.251 *
	(0.127)	(0.129)	(0.134)	(0.133)
Region				
Central Coast	-0.329	-0.327	-0.110	-0.351
	(0.244)	(0.247)	(0.259)	(0.236)
San Diego-Border Region	-0.011	-0.007	0.029	-0.056
	(0.216)	(0.220)	(0.219)	(0.224)
Incorporation era				
Interwar & WWII	-0.081	-0.078	-0.115	-0.106
	(0.249)	(0.252)	(0.236)	(0.241)
Post WWII	-0.337 **	-0.337 **	-0.320 **	-0.350 **
	(0.142)	(0.142)	(0.141)	(0.144)
Post Prop. 13	-0.832 ***	-0.830 ***	-0.803 ***	-0.810 **
	(0.317)	(0.317)	(0.304)	(0.319)
Importance of density restrictions		-0.008		
		(0.053)		
Importance of land supply			-0.123 **	
			(0.055)	
Regulatory inventory index				0.095
				(0.064)
N	144	144	144	144
R^2	0.758	0.758	0.768	0.762

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

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Survey: PPIC; Dependent Variable: Log of Single-Family Permits (+1), 2000-2009

	(A)	(B)	(C)	(D)
Total population, 2000 (log)	0.375 **	0.384 **	0.434 ***	0.343 **
	(0.161)	(0.163)	(0.163)	(0.163)
% non-Hispanic white, 2000	0.003	0.003	0.004	0.002
	(0.006)	(0.006)	(0.006)	(0.006)
% foreign-born, 2000	-0.004	-0.004	-0.001	-0.004
	(0.010)	(0.010)	(0.010)	(0.010)
Median household income in 1999 (log)	-0.217	-0.159	-0.128	-0.232
	(0.331)	(0.348)	(0.325)	(0.333)
% age 18 and under, 2000	0.007	0.006	0.000	0.005
	(0.016)	(0.016)	(0.016)	(0.017)
% owner-occupied, 2000	-0.008	-0.008	-0.011	-0.008
	(0.009)	(0.009)	(0.009)	(0.009)
Median year structure built, 2000	0.068 ***	0.067 ***	0.064 ***	0.067 ***
	(0.009)	(0.009)	(0.009)	(0.009)
% developed, 2001	-0.003	-0.003	-0.002	-0.003
	(0.006)	(0.006)	(0.006)	(0.006)
Net land area, 2000 (log)	0.532 ***	0.520 ***	0.454 **	0.563 ***
	(0.175)	(0.177)	(0.175)	(0.178)
% single-family detached, 2000	0.012	0.013	0.013	0.012
	(0.009)	(0.008)	(0.008)	(0.009)
Accessibility index, 2000 (log)	0.072	0.071	0.058	0.085
	(0.118)	(0.117)	(0.116)	(0.118)
Region				
Bay Area	-0.091	-0.119	-0.124	-0.118
	(0.171)	(0.172)	(0.162)	(0.172)
Central Coast	0.584 ***	0.559 ***	0.203	0.549 ***
	(0.151)	(0.151)	(0.189)	(0.156)
Greater Sacramento	0.454	0.435	0.412	0.484
	(0.388)	(0.383)	(0.358)	(0.380)
San Diego-Border Region	0.030	0.038	-0.014	0.003
	(0.209)	(0.210)	(0.202)	(0.204)
San Joaquin Valley	0.433 **	0.418 **	0.394 *	0.439 **
	(0.211)	(0.208)	(0.207)	(0.211)
Balance of state	0.135	0.140	0.113	0.172
	(0.405)	(0.410)	(0.417)	(0.407)
Incorporation era				
Interwar & WWII	0.017	0.017	0.010	0.022
	(0.166)	(0.164)	(0.158)	(0.167)
Post WWII	-0.377 **	-0.386 ***	-0.374 ***	-0.381 **
	(0.147)	(0.147)	(0.142)	(0.147)
Post Prop. 13	-0.328	-0.327	-0.282	-0.327
	(0.232)	(0.233)	(0.208)	(0.228)
Importance of density restrictions		-0.033		
		(0.042)		
Importance of land supply			-0.168 ***	
			(0.042)	
Regulatory inventory index				0.081
				(0.057)
N	261	261	261	261
R^2	0.753	0.754	0.768	0.755

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

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Survey: WRLURI; Dependent Variable: Log of Single-Family Permits (+1), 2006-2015

	(A)	(B)	(C)	(D)
Total Population (log) (2006-2010 ACS)	0.413 **	0.430 **	0.478 **	0.414 **
	(0.195)	(0.197)	(0.192)	(0.193)
% non-Hispanic white (2006-2010 ACS)	0.011	0.012	0.013 *	0.013 *
	(0.007)	(0.007)	(0.008)	(0.007)
% foreign-born (2006-2010 ACS)	0.018	0.018	0.019	0.018
	(0.012)	(0.011)	(0.012)	(0.012)
Median household income (log) (2006-2010 ACS)	0.653	0.666	0.554	0.618
	(0.587)	(0.590)	(0.578)	(0.571)
% under age 18 (2006-2010 ACS)	0.008	0.008	0.005	0.010
	(0.018)	(0.018)	(0.018)	(0.018)
% owner-occupied (2006-2010 ACS)	-0.027 **	-0.028 **	-0.029 **	-0.026 **
	(0.012)	(0.012)	(0.012)	(0.012)
Median year structure built (2006-2010 ACS)	0.052 ***	0.052 ***	0.052 ***	0.053 ***
	(0.009)	(0.009)	(0.009)	(0.009)
% developed, 2001	-0.003	-0.003	-0.002	-0.003
	(0.008)	(0.008)	(0.008)	(0.007)
Net land area, 2000 (log)	0.479 **	0.463 **	0.402 *	0.478 **
	(0.207)	(0.208)	(0.204)	(0.206)
% single-family detached (2006-2010 ACS)	0.019 *	0.020 *	0.021 **	0.019 *
	(0.010)	(0.010)	(0.010)	(0.010)
Accessibility index, 2000 (log)	0.135	0.120	0.148	0.129
	(0.136)	(0.141)	(0.131)	(0.139)
Region				
Bay Area	-0.191	-0.219	-0.236	-0.217
	(0.278)	(0.279)	(0.271)	(0.292)
Central Coast	-0.192	-0.230	-0.193	-0.209
	(0.471)	(0.466)	(0.482)	(0.474)
Greater Sacramento	0.452 *	0.393	0.441 *	0.395
	(0.262)	(0.255)	(0.238)	(0.278)
San Diego-Border Region	0.167	0.166	0.171	0.163
	(0.257)	(0.258)	(0.255)	(0.257)
San Joaquin Valley	0.637 **	0.618 **	0.614 **	0.615 **
	(0.271)	(0.268)	(0.264)	(0.272)
Balance of state	0.747	0.725	0.699	0.675
	(0.476)	(0.482)	(0.491)	(0.467)
Incorporation era				
Interwar & WWII	0.201	0.202	0.120	0.191
	(0.215)	(0.216)	(0.214)	(0.221)
Post WWII	-0.222	-0.225	-0.189	-0.231
	(0.200)	(0.201)	(0.199)	(0.205)
Post Prop. 13	-0.117	-0.106	-0.109	-0.159
	(0.342)	(0.342)	(0.336)	(0.345)
Importance of density restrictions (single-family)		-0.036		
		(0.053)		
Importance of land supply (single-family)			-0.154 **	
			(0.066)	
Regulatory inventory index (single-family)				-0.088
				(0.128)
N	151	151	151	151
R^2	0.745	0.746	0.753	0.746

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

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Survey: BLURI; Dependent Variable: Log of Single-Family Permits (+1), 2009-2016

	(A)	(B)	(C)	(D)
Total Population (log) (2008-2012 ACS)	1.149 ***	1.107 ***	1.117 ***	1.145 ***
	(0.355)	(0.356)	(0.369)	(0.357)
% non-Hispanic white (2008-2012 ACS)	0.021	0.024	0.025 *	0.021
	(0.015)	(0.015)	(0.015)	(0.015)
% foreign-born (2008-2012 ACS)	0.008	0.013	0.015	0.007
	(0.026)	(0.026)	(0.026)	(0.025)
Median household income (log) (2008-2012 ACS)	1.707 *	1.585 *	1.529 *	1.733 *
	(0.885)	(0.919)	(0.880)	(0.866)
% under age 18 (2008-2012 ACS)	0.042	0.048	0.040	0.043
	(0.035)	(0.040)	(0.036)	(0.035)
% owner-occupied (2008-2012 ACS)	-0.080 ***	-0.078 ***	-0.077 ***	-0.081 ***
	(0.021)	(0.021)	(0.022)	(0.022)
Median year structure built (2008-2012 ACS)	0.067 ***	0.067 ***	0.068 ***	0.067 ***
	(0.015)	(0.016)	(0.015)	(0.015)
% developed, 2011	-0.022	-0.020	-0.022	-0.021
	(0.016)	(0.016)	(0.016)	(0.016)
Net land area, 2010 (log)	0.037	0.071	0.039	0.044
	(0.358)	(0.359)	(0.363)	(0.359)
% single-family detached (2008-2012 ACS)	0.052 **	0.052 **	0.053 ***	0.052 **
	(0.020)	(0.020)	(0.019)	(0.020)
Accessibility index, 2006-2010 (log)	0.254	0.219	0.342	0.236
	(0.456)	(0.495)	(0.447)	(0.463)
Incorporation Era				
Interwar & WWII	-0.791 **	-0.662 *	-0.778 **	-0.779 **
	(0.366)	(0.368)	(0.373)	(0.371)
Post WWII	-0.128	-0.110	-0.102	-0.105
	(0.281)	(0.283)	(0.277)	(0.300)
Post Prop. 13	0.384	0.237	0.467	0.373
	(0.770)	(0.787)	(0.774)	(0.770)
Importance of density restrictions (single-family)		-0.097		
		(0.087)		
Importance of land supply (single-family)			-0.147	
			(0.144)	
Regulatory inventory index (single-family)				-0.027
				(0.104)
N	74	74	74	74
R^2	0.791	0.796	0.794	0.791

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted incorporation era is 1850-World War I armistice.

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Survey: G&L 1988; Dependent Variable: Log of Single-Family Permits (+1), 1990-1999

	(A)		(B)	
Total population, 1990 (log)	0.761	***	0.755	***
	(0.108)		(0.112)	
% non-Hispanic white, 1990	0.003		0.003	
	(0.006)		(0.006)	
% foreign-born, 1990	-0.008		-0.008	
	(0.009)		(0.010)	
Median household income in 1989 (log)	0.141		0.141	
	(0.281)		(0.280)	
% age 18 and under, 1990	0.009		0.009	
	(0.017)		(0.018)	
% owner-occupied, 1990	0.002		0.003	
	(0.008)		(0.008)	
Median year structure built, 1990	0.070	***	0.069	***
	(0.008)		(0.008)	
% developed, 1992	0.000		0.000	
	(0.005)		(0.005)	
Net land area, 1990 (log)	0.280	**	0.282	**
	(0.112)		(0.114)	
% single-family detached, 1990	0.008		0.007	
	(0.008)		(0.008)	
Accessibility index, 1990 (log)	-0.255	***	-0.250	***
	(0.089)		(0.091)	
Region				
Bay Area	0.296	**	0.293	**
	(0.123)		(0.122)	
Central Coast	0.290		0.267	
	(0.283)		(0.285)	
Greater Sacramento	0.633	**	0.645	**
	(0.261)		(0.262)	
San Diego-Border Region	0.089		0.076	
	(0.191)		(0.190)	
San Joaquin Valley	0.592	***	0.593	***
	(0.183)		(0.183)	
Balance of state	0.365		0.377	
	(0.308)		(0.308)	
Incorporation era				
Interwar & WWII	-0.064		-0.058	
	(0.182)		(0.184)	
Post WWII	-0.311	***	-0.301	***
	(0.111)		(0.112)	
Post Prop. 13	-0.652	***	-0.625	***
	(0.215)		(0.219)	
Regulatory inventory index			0.032	
			(0.049)	
N	333		333	
R^2	0.777		0.777	

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

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Survey: G&L, 1992; Dependent Variable: Log of Single-Family Permits (+1), 1994-2003

	(A)	(B)
Total population, 1990 (log)	0.623 ***	0.604 ***
	(0.114)	(0.118)
% non-Hispanic white, 1990	0.003	0.003
	(0.006)	(0.006)
% foreign-born, 1990	-0.002	-0.002
	(0.010)	(0.010)
Median household income in 1989 (log)	0.043	0.046
	(0.330)	(0.328)
% age 18 and under, 1990	0.003	0.004
	(0.017)	(0.017)
% owner-occupied, 1990	0.005	0.005
	(0.009)	(0.009)
Median year structure built, 1990	0.070 ***	0.068 ***
	(0.010)	(0.010)
% developed, 1992	0.001	0.001
	(0.006)	(0.006)
Net land area, 1990 (log)	0.399 ***	0.413 ***
	(0.125)	(0.127)
% single-family detached, 1990	0.006	0.006
	(0.008)	(0.008)
Accessibility index, 1990 (log)	-0.254 **	-0.247 **
	(0.101)	(0.101)
Region		
Bay Area	0.355 ***	0.343 ***
	(0.135)	(0.132)
Central Coast	0.568 *	0.536 *
	(0.289)	(0.293)
Greater Sacramento	0.888 ***	0.881 ***
	(0.283)	(0.283)
San Diego-Border Region	0.159	0.144
	(0.215)	(0.211)
San Joaquin Valley	0.754 ***	0.747 ***
	(0.230)	(0.231)
Balance of state	0.452	0.484
	(0.341)	(0.340)
Incorporation era		
Interwar & WWII	0.099	0.119
	(0.178)	(0.180)
Post WWII	-0.326 **	-0.307 **
	(0.127)	(0.130)
Post Prop. 13	-0.565 **	-0.536 **
	(0.236)	(0.237)
Regulatory inventory index		0.064
		(0.053)
N	348	348
R^2	0.719	0.720

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

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Survey: Pendall, 1994; Dependent Variable: Log of Single-Family Permits (+1), 1996-2005

	(A)		(B)	
Total population, 1990 (log)	0.599	***	0.611	***
	(0.225)		(0.225)	
% non-Hispanic white, 1990	-0.004		-0.004	
	(0.007)		(0.007)	
% foreign-born, 1990	-0.021	*	-0.021	*
	(0.012)		(0.012)	
Median household income in 1989 (log)	0.706		0.734	*
	(0.431)		(0.440)	
% age 18 and under, 1990	-0.001		-0.000	
	(0.021)		(0.021)	
% owner-occupied, 1990	-0.014		-0.015	
	(0.011)		(0.011)	
Median year structure built, 1990	0.046	***	0.046	***
	(0.011)		(0.012)	
% developed, 1992	-0.011		-0.011	
	(0.008)		(0.008)	
Net land area, 1990 (log)	0.463	**	0.456	**
	(0.228)		(0.227)	
% single-family detached, 1990	-0.004		-0.004	
	(0.010)		(0.010)	
Accessibility index, 1990 (log)	-0.448	***	-0.462	***
	(0.134)		(0.135)	
Region				
Bay Area	0.089		0.097	
	(0.141)		(0.141)	
San Diego-Border Region	-0.183		-0.187	
	(0.194)		(0.194)	
Incorporation era				
Interwar & WWII	0.067		0.052	
	(0.219)		(0.220)	
Post WWII	-0.217		-0.228	
	(0.146)		(0.148)	
Post Prop. 13	-0.452	*	-0.475	*
	(0.231)		(0.243)	
Regulatory inventory index			-0.054	
			(0.074)	
N	206		206	
R^2	0.760		0.760	

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

Survey: Pendall, 2003; Dependent Variable: Log of Single-Family Permits (+1), 2005-2014

	(A)		(B)	
Total population, 2000 (log)	-0.077		-0.068	
	(0.243)		(0.239)	
% non-Hispanic white, 2000	-0.006		-0.005	
	(0.008)		(0.008)	
% foreign-born, 2000	-0.006		-0.003	
	(0.012)		(0.012)	
Median household income in 1999 (log)	0.787		0.840	
	(0.506)		(0.521)	
% age 18 and under, 2000	-0.018		-0.018	
	(0.020)		(0.019)	
% owner-occupied, 2000	-0.029	***	-0.031	***
	(0.010)		(0.010)	
Median year structure built, 2000	0.042	***	0.041	***
	(0.012)		(0.012)	
% developed, 2001	-0.008		-0.007	
	(0.008)		(0.008)	
Net land area, 2000 (log)	1.016	***	1.017	***
	(0.232)		(0.227)	
% single-family detached, 2000	0.016		0.016	
	(0.011)		(0.011)	
Accessibility index, 2000 (log)	-0.043		-0.123	
	(0.173)		(0.193)	
Region				
Bay Area	-0.235		-0.228	
	(0.174)		(0.171)	
Greater Sacramento	0.192		0.179	
	(0.276)		(0.287)	
San Diego-Border Region	0.073		0.034	
	(0.197)		(0.193)	
Incorporation era				
Interwar & WWII	0.309		0.327	
	(0.231)		(0.222)	
Post WWII	-0.363	**	-0.364	**
	(0.162)		(0.159)	
Post Prop. 13	-0.310		-0.319	
	(0.231)		(0.235)	
Regulatory inventory index			-0.088	
			(0.080)	
N	164		164	
R^2	0.744		0.747	

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

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Survey: UCRGPG; Dependent Variable: Log of Multi-Family Permits (+1), 1990-1999

	(A)	(B)	(C)	(D)
Total population, 1990 (log)	1.106 **	0.989 **	1.030 **	1.089 **
	(0.450)	(0.426)	(0.440)	(0.456)
% non-Hispanic white, 1990	0.018	0.016	0.020	0.018
	(0.016)	(0.015)	(0.016)	(0.016)
% foreign-born, 1990	0.048	0.056 *	0.050 *	0.047
	(0.029)	(0.028)	(0.030)	(0.030)
Median household income in 1989 (log)	-0.078	0.331	-0.031	-0.088
	(0.942)	(0.926)	(0.934)	(0.941)
% age 18 and under, 1990	-0.055	-0.067	-0.048	-0.056
	(0.044)	(0.042)	(0.042)	(0.044)
% owner-occupied, 1990	-0.051 **	-0.054 **	-0.052 **	-0.051 **
	(0.023)	(0.023)	(0.024)	(0.023)
Median year structure built, 1990	0.027	0.030	0.022	0.026
	(0.033)	(0.032)	(0.034)	(0.033)
% developed, 1992	0.019	0.019	0.020	0.018
	(0.021)	(0.022)	(0.022)	(0.021)
Net land area, 1990 (log)	0.443	0.459	0.470	0.450
	(0.427)	(0.422)	(0.432)	(0.429)
% single-family detached, 1990	0.021	0.021	0.021	0.021
	(0.021)	(0.021)	(0.022)	(0.021)
Accessibility index, 1990 (log)	-0.671 **	-0.637 **	-0.584 *	-0.648 **
	(0.308)	(0.296)	(0.310)	(0.312)
Region				
Central Coast	0.539	0.599 *	0.831 **	0.527
	(0.350)	(0.327)	(0.411)	(0.364)
San Diego-Border Region	-0.324	-0.142	-0.270	-0.349
	(0.335)	(0.343)	(0.332)	(0.358)
Incorporation era				
Interwar & WWII	0.004	0.106	-0.042	-0.010
	(0.458)	(0.480)	(0.455)	(0.453)
Post WWII	0.090	0.056	0.112	0.082
	(0.335)	(0.323)	(0.330)	(0.334)
Post Prop. 13	-0.306	-0.219	-0.267	-0.293
	(0.471)	(0.450)	(0.443)	(0.478)
Importance of density restrictions		-0.335 ***		
		(0.115)		
Importance of land supply			-0.164	
			(0.116)	
Regulatory inventory index				0.054
				(0.136)
N	144	144	144	144
R^2	0.549	0.583	0.558	0.550

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

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Survey: PPIC; Dependent Variable: Log of Multi-Family Permits (+1), 2000-2009

	(A)	(B)	(C)	(D)
Total population, 2000 (log)	0.730 ***	0.769 ***	0.745 ***	0.690 ***
	(0.219)	(0.224)	(0.223)	(0.219)
% non-Hispanic white, 2000	0.013	0.012	0.013	0.012
	(0.012)	(0.012)	(0.012)	(0.012)
% foreign-born, 2000	0.040 **	0.040 **	0.041 **	0.040 **
	(0.018)	(0.018)	(0.018)	(0.018)
Median household income in 1999 (log)	-0.821	-0.578	-0.797	-0.838
	(0.593)	(0.608)	(0.597)	(0.593)
% age 18 and under, 2000	-0.037	-0.039	-0.038	-0.039
	(0.032)	(0.032)	(0.033)	(0.033)
% owner-occupied, 2000	-0.016	-0.019	-0.017	-0.016
	(0.015)	(0.015)	(0.015)	(0.015)
Median year structure built, 2000	0.074 ***	0.070 ***	0.073 ***	0.073 ***
	(0.016)	(0.016)	(0.016)	(0.016)
% developed, 2001	-0.004	-0.005	-0.003	-0.003
	(0.011)	(0.011)	(0.011)	(0.011)
Net land area, 2000 (log)	0.458 **	0.407 *	0.437 *	0.495 **
	(0.228)	(0.237)	(0.235)	(0.229)
% single-family detached, 2000	-0.003	-0.000	-0.002	-0.002
	(0.015)	(0.015)	(0.015)	(0.015)
Accessibility index, 2000 (log)	0.161	0.155	0.158	0.177
	(0.196)	(0.199)	(0.196)	(0.197)
Region				
Bay Area	0.509	0.392	0.500	0.475
	(0.309)	(0.317)	(0.312)	(0.315)
Central Coast	0.175	0.068	0.072	0.132
	(0.230)	(0.232)	(0.319)	(0.237)
Greater Sacramento	0.360	0.280	0.349	0.397
	(0.379)	(0.363)	(0.381)	(0.378)
San Diego-Border Region	-0.407	-0.373	-0.419	-0.441
	(0.589)	(0.571)	(0.591)	(0.596)
San Joaquin Valley	-0.125	-0.187	-0.135	-0.118
	(0.322)	(0.325)	(0.324)	(0.324)
Balance of state	0.229	0.251	0.223	0.274
	(0.558)	(0.554)	(0.559)	(0.571)
Incorporation era				
Interwar & WWII	-0.362	-0.360	-0.364	-0.356
	(0.338)	(0.333)	(0.339)	(0.340)
Post WWII	-0.446 *	-0.482 **	-0.445 *	-0.450 *
	(0.239)	(0.238)	(0.239)	(0.241)
Post Prop. 13	-0.271	-0.268	-0.259	-0.269
	(0.414)	(0.422)	(0.420)	(0.409)
Importance of density restrictions		-0.139 *		
		(0.079)		
Importance of land supply			-0.045	
			(0.081)	
Regulatory inventory index				0.098
				(0.113)
N	261	261	261	261
R^2	0.601	0.606	0.602	0.603

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

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Survey: WRLURI; Dependent Variable: Log of Multi-Family Permits (+1), 2006-2015

	(A)	(B)	(C)	(D)
Total Population (log) (2006-2010 ACS)	1.407 ***	1.367 ***	1.380 ***	1.414 ***
	(0.326)	(0.315)	(0.325)	(0.324)
% non-Hispanic white (2006-2010 ACS)	-0.004	-0.005	-0.004	-0.002
	(0.013)	(0.012)	(0.012)	(0.013)
% foreign-born (2006-2010 ACS)	0.030 *	0.027	0.030 *	0.031 *
	(0.017)	(0.017)	(0.017)	(0.017)
Median household income (log) (2006-2010 ACS)	1.077	1.093	1.069	1.012
	(0.815)	(0.812)	(0.816)	(0.828)
% under age 18 (2006-2010 ACS)	-0.021	-0.023	-0.021	-0.020
	(0.033)	(0.033)	(0.033)	(0.034)
% owner-occupied (2006-2010 ACS)	-0.022	-0.022	-0.022	-0.022
	(0.023)	(0.023)	(0.024)	(0.024)
Median year structure built (2006-2010 ACS)	0.045 ***	0.045 ***	0.046 ***	0.046 ***
	(0.013)	(0.013)	(0.013)	(0.013)
% developed, 2001	-0.004	-0.004	-0.005	-0.004
	(0.010)	(0.010)	(0.010)	(0.010)
Net land area, 2000 (log)	-0.082	-0.014	-0.056	-0.089
	(0.315)	(0.307)	(0.314)	(0.314)
% single-family detached (2006-2010 ACS)	-0.024	-0.024	-0.024	-0.024
	(0.016)	(0.016)	(0.016)	(0.016)
Accessibility index, 2000 (log)	-0.012	-0.009	-0.000	-0.019
	(0.241)	(0.237)	(0.247)	(0.243)
Region				
Bay Area	0.362	0.468	0.388	0.375
	(0.313)	(0.339)	(0.326)	(0.315)
Central Coast	0.770	0.872	0.753	0.727
	(1.072)	(1.092)	(1.071)	(1.076)
Greater Sacramento	0.855	0.988	0.858	0.796
	(0.609)	(0.609)	(0.612)	(0.614)
San Diego-Border Region	-0.041	-0.038	-0.037	-0.058
	(0.541)	(0.563)	(0.543)	(0.541)
San Joaquin Valley	0.835 *	0.890 **	0.848 *	0.810 *
	(0.457)	(0.441)	(0.459)	(0.466)
Balance of state	1.119	1.156	1.162	1.027
	(0.822)	(0.851)	(0.848)	(0.831)
Incorporation era				
Interwar & WWII	-0.324	-0.304	-0.306	-0.328
	(0.412)	(0.410)	(0.417)	(0.413)
Post WWII	0.103	0.128	0.075	0.108
	(0.287)	(0.286)	(0.294)	(0.287)
Post Prop. 13	0.144	0.152	0.120	0.119
	(0.473)	(0.488)	(0.483)	(0.478)
Importance of density restrictions (multi-family)		0.096		
		(0.103)		
Importance of land supply (multi-family)			0.064	
			(0.124)	
Regulatory inventory index (multi-family)				-0.102
				(0.160)
N	151	151	151	151
R^2	0.698	0.701	0.699	0.699

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

Survey: BLURI; Dependent Variable: Log of Multi-Family Permits (+1), 2009-2016

	(A)	(B)	(C)	(D)
Total Population (log) (2008-2012 ACS)	0.833	0.670	0.896	0.828
	(0.562)	(0.563)	(0.537)	(0.573)
% non-Hispanic white (2008-2012 ACS)	0.040	0.045	0.059 *	0.041
	(0.028)	(0.028)	(0.031)	(0.028)
% foreign-born (2008-2012 ACS)	0.070	0.079 *	0.105 **	0.072
	(0.047)	(0.046)	(0.049)	(0.048)
Median household income (log) (2008-2012 ACS)	-0.601	-0.626	-0.865	-0.619
	(1.467)	(1.429)	(1.460)	(1.497)
% under age 18 (2008-2012 ACS)	0.100	0.101	0.119 *	0.097
	(0.063)	(0.062)	(0.062)	(0.062)
% owner-occupied (2008-2012 ACS)	0.022	0.022	0.019	0.022
	(0.035)	(0.037)	(0.040)	(0.035)
Median year structure built (2008-2012 ACS)	0.013	0.011	0.014	0.012
	(0.031)	(0.030)	(0.031)	(0.030)
% developed, 2011	-0.024	-0.019	-0.024	-0.023
	(0.026)	(0.026)	(0.024)	(0.026)
Net land area, 2010 (log)	0.385	0.518	0.209	0.373
	(0.641)	(0.624)	(0.617)	(0.644)
% single-family detached (2008-2012 ACS)	-0.065 *	-0.069 **	-0.061 *	-0.063 *
	(0.033)	(0.033)	(0.033)	(0.035)
Accessibility index, 2006-2010 (log)	0.509	0.374	0.592	0.551
	(0.943)	(0.890)	(0.772)	(1.057)
Incorporation era				
Interwar & WWII	-0.781	-0.545	-0.855	-0.820
	(0.831)	(0.842)	(0.748)	(0.836)
Post WWII	-0.709	-0.769	-0.776	-0.792
	(0.537)	(0.515)	(0.539)	(0.580)
Post Prop. 13	0.696	0.321	0.454	0.749
	(1.087)	(0.947)	(0.748)	(1.104)
Importance of density restrictions (multi-family)		-0.301 **		
		(0.135)		
Importance of land supply (multi-family)			-0.710 **	
			(0.303)	
Regulatory inventory index (multi-family)				0.122
				(0.310)
N	74	74	74	74
R^2	0.660	0.681	0.702	0.661

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted incorporation era is 1850-World War I armistice.

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Survey: G&L 1988; Dependent Variable: Log of Multi-Family Permits (+1), 1990-1999

	(A)	(B)
Total population, 1990 (log)	0.743 ***	0.724 ***
	(0.184)	(0.188)
% non-Hispanic white, 1990	0.011	0.010
	(0.010)	(0.010)
% foreign-born, 1990	0.038 **	0.037 **
	(0.018)	(0.018)
Median household income in 1989 (log)	-0.515	-0.513
	(0.519)	(0.513)
% age 18 and under, 1990	-0.021	-0.019
	(0.029)	(0.029)
% owner-occupied, 1990	-0.034 **	-0.033 **
	(0.016)	(0.016)
Median year structure built, 1990	0.046 ***	0.043 **
	(0.017)	(0.018)
% developed, 1992	0.015	0.015
	(0.012)	(0.012)
Net land area, 1990 (log)	0.536 ***	0.542 ***
	(0.186)	(0.188)
% single-family detached, 1990	0.002	0.001
	(0.014)	(0.014)
Accessibility index, 1990 (log)	-0.273 *	-0.256
	(0.155)	(0.156)
Region		
Bay Area	0.618 ***	0.610 ***
	(0.217)	(0.215)
Central Coast	0.260	0.192
	(0.334)	(0.338)
Greater Sacramento	1.081 ***	1.116 ***
	(0.413)	(0.417)
San Diego-Border Region	0.035	-0.004
	(0.280)	(0.283)
San Joaquin Valley	0.235	0.236
	(0.290)	(0.289)
Balance of state	0.592	0.627
	(0.446)	(0.448)
Incorporation era		
Interwar & WWII	-0.264	-0.247
	(0.268)	(0.269)
Post WWII	-0.290	-0.262
	(0.230)	(0.237)
Post Prop. 13	-0.336	-0.257
	(0.379)	(0.397)
Regulatory inventory index		0.092
		(0.074)
N	333	333
R^2	0.589	0.591

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

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Survey: G&L, 1992; Dependent Variable: Log of Multi-Family Permits (+1), 1994-2003

	(A)		(B)	
Total population, 1990 (log)	0.727	***	0.688	***
	(0.160)		(0.162)	
% non-Hispanic white, 1990	-0.000		-0.001	
	(0.008)		(0.008)	
% foreign-born, 1990	0.025	*	0.024	*
	(0.014)		(0.014)	
Median household income in 1989 (log)	-0.202		-0.196	
	(0.607)		(0.599)	
% age 18 and under, 1990	-0.034		-0.033	
	(0.026)		(0.026)	
% owner-occupied, 1990	-0.015		-0.015	
	(0.015)		(0.015)	
Median year structure built, 1990	0.054	***	0.050	***
	(0.015)		(0.015)	
% developed, 1992	0.014		0.015	
	(0.009)		(0.009)	
Net land area, 1990 (log)	0.653	***	0.681	***
	(0.188)		(0.189)	
% single-family detached, 1990	-0.007		-0.008	
	(0.014)		(0.013)	
Accessibility index, 1990 (log)	-0.244		-0.228	
	(0.160)		(0.159)	
Region				
Bay Area	1.024	***	1.000	***
	(0.206)		(0.204)	
Central Coast	0.718	**	0.651	**
	(0.287)		(0.293)	
Greater Sacramento	1.385	***	1.371	***
	(0.453)		(0.454)	
San Diego-Border Region	0.121		0.091	
	(0.320)		(0.317)	
San Joaquin Valley	0.325		0.310	
	(0.369)		(0.368)	
Balance of state	1.166	**	1.232	**
	(0.561)		(0.558)	
Incorporation era				
Interwar & WWII	-0.311		-0.268	
	(0.287)		(0.287)	
Post WWII	-0.106		-0.065	
	(0.228)		(0.228)	
Post Prop. 13	0.086		0.148	
	(0.357)		(0.357)	
Regulatory inventory index			0.132	*
			(0.072)	
N	348		348	
R^2	0.599		0.602	

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

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Survey: Pendall, 1994; Dependent Variable: Log of Multi-Family Permits (+1), 1996-2005

	(A)	(B)
Total population, 1990 (log)	0.990 ***	0.956 ***
	(0.357)	(0.365)
% non-Hispanic white, 1990	0.017	0.016
	(0.012)	(0.012)
% foreign-born, 1990	0.032 *	0.031 *
	(0.018)	(0.018)
Median household income in 1989 (log)	0.249	0.173
	(0.716)	(0.713)
% age 18 and under, 1990	-0.023	-0.024
	(0.039)	(0.039)
% owner-occupied, 1990	-0.027	-0.027
	(0.017)	(0.017)
Median year structure built, 1990	0.048 **	0.048 **
	(0.021)	(0.021)
% developed, 1992	-0.006	-0.006
	(0.012)	(0.012)
Net land area, 1990 (log)	0.654 *	0.674 *
	(0.360)	(0.365)
% single-family detached, 1990	-0.002	-0.003
	(0.015)	(0.015)
Accessibility index, 1990 (log)	-0.099	-0.059
	(0.243)	(0.238)
Region		
Bay Area	0.862 ***	0.839 ***
	(0.231)	(0.231)
San Diego-Border Region	-0.765	-0.752
	(0.477)	(0.478)
Incorporation era		
Interwar & WWII	0.501	0.542 *
	(0.308)	(0.314)
Post WWII	0.207	0.239
	(0.284)	(0.297)
Post Prop. 13	0.508	0.572
	(0.423)	(0.419)
Regulatory inventory index		0.150
		(0.151)
N	206	206
R^2	0.544	0.546

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.

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Survey: Pendall, 2003; Dependent Variable: Log of Multi-Family Permits (+1), 2005-2014

	(A)		(B)	
Total population, 2000 (log)	0.354		0.355	
	(0.396)		(0.395)	
% non-Hispanic white, 2000	-0.002		-0.002	
	(0.011)		(0.011)	
% foreign-born, 2000	0.020		0.020	
	(0.017)		(0.018)	
Median household income in 1999 (log)	-0.288		-0.280	
	(0.737)		(0.749)	
% age 18 and under, 2000	-0.090	***	-0.090	***
	(0.027)		(0.027)	
% owner-occupied, 2000	-0.043	**	-0.044	**
	(0.017)		(0.018)	
Median year structure built, 2000	0.064	***	0.064	***
	(0.018)		(0.018)	
% developed, 2001	0.014		0.014	
	(0.013)		(0.014)	
Net land area, 2000 (log)	1.058	***	1.058	***
	(0.399)		(0.401)	
% single-family detached, 2000	0.019		0.020	
	(0.013)		(0.014)	
Accessibility index, 2000 (log)	0.304		0.292	
	(0.318)		(0.352)	
Region				
Bay Area	0.316		0.317	
	(0.279)		(0.281)	
Greater Sacramento	0.130		0.128	
	(0.368)		(0.371)	
San Diego-Border Region	-0.417		-0.423	
	(0.490)		(0.492)	
Incorporation era				
Interwar & WWII	-0.328		-0.325	
	(0.410)		(0.416)	
Post WWII	-0.262		-0.262	
	(0.278)		(0.278)	
Post Prop. 13	0.262		0.261	
	(0.417)		(0.419)	
Regulatory inventory index			-0.014	
			(0.131)	
N	164		164	
R^2	0.656		0.656	

Robust standard errors in parenthesis; * p<0.10, ** p<0.05, *** p<0.01.
Omitted region is Southern California; Omitted incorporation era is 1850-World War I armistice.