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Measuring Land-Use Regulations and Their Effects in the Housing Market

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MEASURING LAND-USE REGULATIONS AND THEIR EFFECTS IN THE HOUSING MARKET

By

John M. Quigley
Steven Raphael
Larry A. Rosenthal

May 2009

UNIVERSITY OF CALIFORNIA, BERKELEY

Housing Markets and the Economy

Risk, Regulation, and Policy

Edited by Edward L. Glaeser and John M. Quigley

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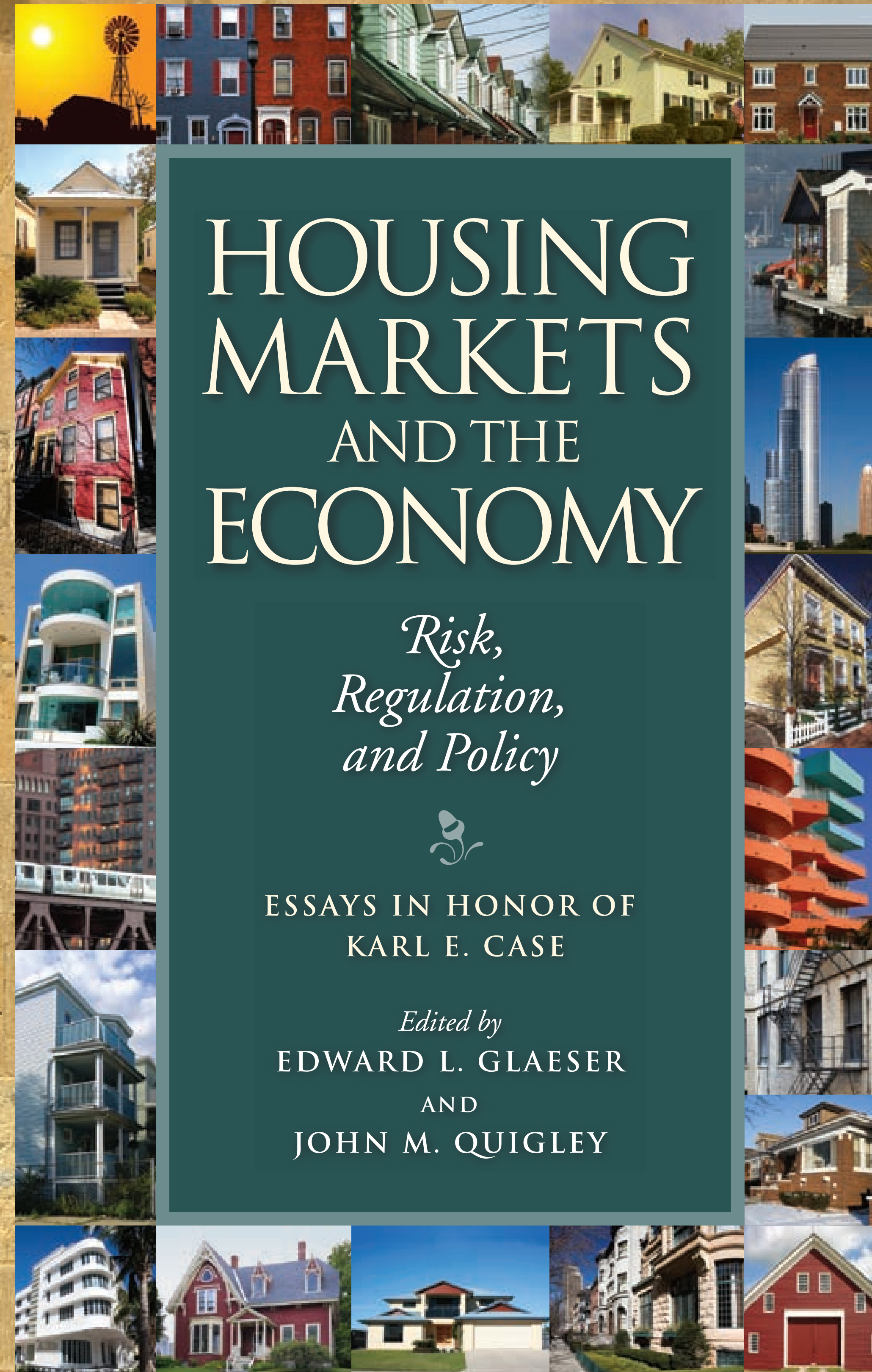
HOUSING MARKETS AND THE ECONOMY



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Measuring Land Use Regulations and Their Effects in the Housing Market

John M. Quigley
Steven Raphael
Larry A. Rosenthal

Land use regulation—the power of local governments to control residential development within their boundaries—is ubiquitous across American cities and metropolitan areas. Regulations range from limits on residential densities to prescriptions concerning building design, construction, and the aesthetics of urban and suburban neighborhoods. Aside from setting requirements for permits and limits on new construction, localities may require developers to participate in public hearings. Regulations frequently require analysis of the environmental and fiscal effects of proposed projects.

The application of these regulations affects the pattern and pace of development, the price of land and housing, the demographic character of local communities, the economic and ethnic composition of neighborhoods and cities, and the rents and selling prices of residences. Specific rules are, for the most part, locally enacted and controlled, and they may be adopted for a variety of reasons. Study of the attributes of regulation and its administration must take place at the level of the jurisdiction. Yet, outside of particular enactments and decisions, the details of regulations are nowhere compiled systematically. The ways in which the regulations are actually applied and enforced are rarely

We are grateful for the comments of Edward Glaeser, Richard Green, and Stephen Malpezzi. This research was funded by the MacArthur Foundation. Additional resources were provided by the Berkeley Program on Housing and Urban Policy. We are grateful for the support and assistance of Paul Campos of the Home Builders Association of Northern California, Joan Douglas of the Bay Area Chapter of the Association of Environmental Professionals, and Erika Poethig of the MacArthur Foundation. Expert research assistance has been provided by Corie Calfee, Paavo Monkkonen, and Joseph Wright.

measured, in part because of the complexity and unpredictability of such processes. For this reason, estimates of the impact of local regulations on housing outcomes have been quite mixed (Quigley and Rosenthal, 2005).

This chapter assembles data on the local regulation of housing and its administration for the separate jurisdictions in one large metropolitan housing market. We conduct this study in California, a state known for its high home prices, stringent regulation of residential development, and rare "as of right" entitlements of land. Hence, we do not expect our findings to reflect typical conditions around the country. We focus on the San Francisco Bay Area, renowned for its restrictive regulatory environment. The Bay Area comprises nine counties within the 11-county San Francisco Consolidated Statistical Area (CSA). San Francisco is the fifth-largest CSA in the United States, with a population of 7.1 million people in 2000.

We analyze raw data on land use regulation and administration from five independent sources compiled at various times over the past 18 years. First, we utilize data from three independent surveys of building officials in this metropolitan region, conducted in 1992, 1998, and 2007. We also report systematic information from the developers who must contend with local entitlement processes, and we incorporate their perspectives and interpretations into the description. Finally, we utilize survey information obtained from members of the professional association of environmental consultants who facilitate the permitting process in the region.[1]

We begin with a brief description of the San Francisco Bay Area and its regulatory environment, and we include information placing California into a national perspective. The next section introduces the surveys and instruments used to compile information on land use regulatory processes, and is followed by a section that presents descriptive statistics and introduces the indexes of regulation we derive from them. Before the concluding section, we describe relationships among the different measures of regulation and relate these measures to observable outcomes in housing prices and rents.

The Bay Area's Regulatory Environment

The San Francisco Bay Area is composed of 101 local political jurisdictions (called "cities" under the California constitution) and nine county

1. All data analyzed in this chapter are available for download at http://urbanpolicy.berkeley.edu. Details, definitions, and data collection methods may be found in Calfee et al. (2007), available at the same Web site.

governments.[2] One jurisdiction, San Francisco, features a consolidated city and county government. Each of the cities is empowered to adopt and administer its own land use regulations; counties regulate land only within the unincorporated areas lying outside cities. There are thus 109 Bay Area jurisdictions with direct authority to facilitate or inhibit growth and development. Although the unincorporated land areas of Bay Area counties greatly exceed the combined acreage of their cities, more than 90 percent of the Bay Area's population lives in the latter. Figure 9.1 indicates the land use boundaries within the region. For each jurisdiction, we compile information from the surveys of local regulation described in the survey results section herein.

We analyze linkages among the residential builders who apply for construction permits, the governing land use authorities, and housing outcomes. We recognize that, in the Bay Area and elsewhere in California, the sphere of policies influencing the pace and nature of housing development extends well beyond how permits are granted and denied in individualized proceedings. For example, a long-established state system governs the adoption and review of general plans issued by land use jurisdictions. These plans must include housing "elements" detailing how local governments offer to accommodate allocated proportions of housing growth. The housing elements are reviewed, by the state government in Sacramento, to determine whether local regulation allows construction of a sufficient number of units affordable to lower-income households.[3]

Developers and others can sue land use authorities to insure that statewide planning standards for allowing residential development are observed. However, this litigation is largely procedural rather than substantive, and remedies typically involve paper-trail planning revisions rather than the issuance of permits for specific projects (Calavita, Grimes, and Mallach, 1998). This distinguishes the California land use system from other states like New Jersey, which have made use of a more forceful "builder's remedy" to overcome obstacles to building. In California, local evaluation of building-permit applications is

2. Two outlying counties to the south (Santa Cruz and San Benito), included within the federally defined 11-county Bay Area CSA, are both excluded from the regional Association of Bay Area Governments (belonging instead to the Association of Monterey Bay Area Governments). Our analysis here includes the nine counties physically bordering the San Francisco Bay: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma.

3. As of mid-May 2008, 84 percent of the 109 Bay Area jurisdictions we study here were deemed by the California Department of Housing and Community Development (HCD) to be in full compliance with state housing-element law. A statewide report showing the compliance status of each city and county is regularly updated and made downloadable via HCD's Web site at http://www.hcd.ca.gov/hpd/hrc/plan/he/status.pdf.

FIGURE 9.1 Cities and Counties of the San Francisco Bay Area

viewed as discretionary rather than ministerial, and considerable deference is paid by the courts and other bodies to decisions of local regulators.

In addition, a variety of state and regional bodies exert influence over the Bay Area's transportation expenditures, air quality management, water supply and quality, earthquake and fire safety, and other policies affecting land. These entities represent a measure of local-government collaboration on these subjects. However, there is no mechanism coordinating regional decisions concerning housing supply, job creation, or economic development more broadly. Local government retains its primacy concerning what gets built, where, and when. In a metropolitan area with more than 100 authorities, this means that land administration may vary greatly, and that the real costs and time burdens of entitling land can be fragmented, opaque, and unpredictable. These conditions bedevil measurement of regulatory conditions. Further, because permit decisions not "as of right" are essentially discretionary acts on the part of regulators, developers bear the risk that review standards may vary greatly from place to place and may fluctuate even during the pendency of a single project proposal.

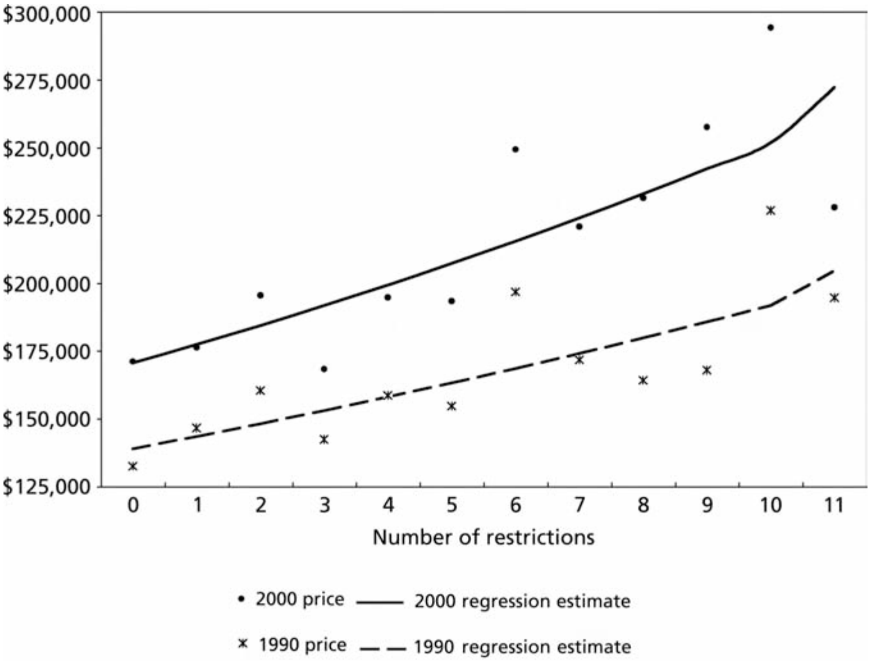
Two additional, state-level regimes bear mention. First, the California Environmental Quality Act[4] (CEQA) requires localized assessment of all projects involving discretionary agency approval. The measurement of environmental impact adds cost and complexity to the enforcement of traditional zoning and growth control regimes. Planners report that CEQA undermines traditional zoning and planning approaches for locating residential projects (Landis et al., 2006). Enacted by the California legislature in 1970, CEQA ostensibly imposes uniform requirements across jurisdictions, but in practice the stringency of environmental review is quite idiosyncratic.

Second, in 1977 the state enacted a Permit Streamlining Act[5] to address excessive cost and delay in local land use decisions. The goal of the law was to rationalize land use decision making and to make it more transparent and predictable for both developers and project opponents. Despite these efforts and subsequent reform attempts, residential permit review remains time consuming and expensive in a state infamous for its high-cost real estate markets.

In combination, these factors create an environment of extensive regulation of development at the state and local level. The figures that follow depict these conditions and place them into national context. Figures 9.2 and 9.3, based on the Census Public Use Micro Samples for 1990 and 2000, show that California jurisdictions adopting greater numbers of growth control measures

4. California Public Resources Code, §21000 et seq.
5. California Government Code, §65920 et seq.

FIGURE 9.2 California Home Values and Number of Growth-Restricting Measures, 1990 and 2000



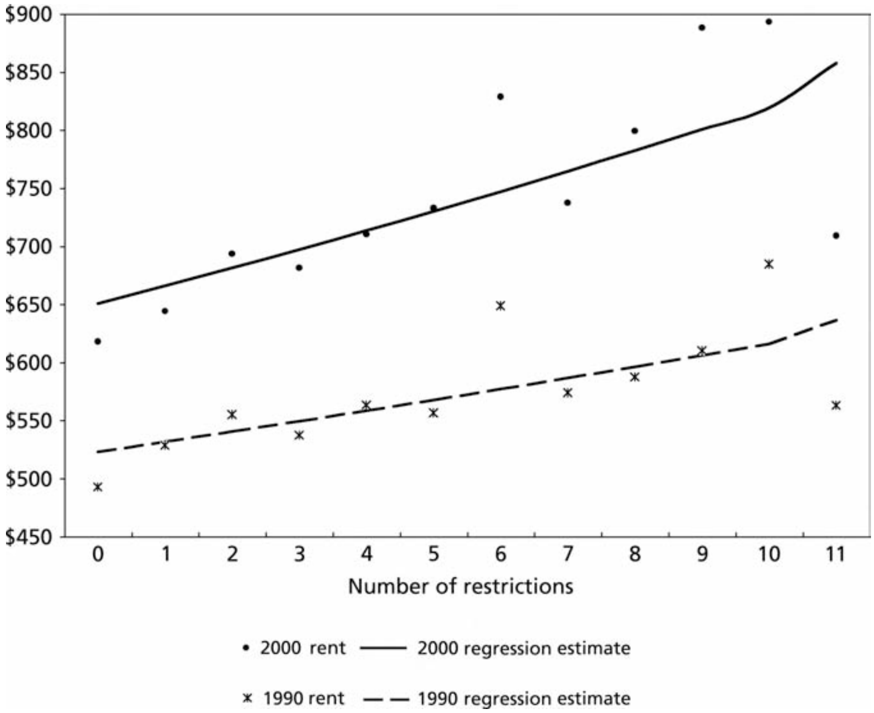
SOURCE: Quigley and Raphael (2004).

tend to have higher house prices and rent levels (Quigley and Raphael, 2004). Figure 9.4 compares the link between land use restrictions and the prices of houses in California relative to conditions elsewhere around the country. The figure matches metropolitan statistical area–level (MSA-level) house prices reported in the 1990 census with an index of land use regulation based on data from a national survey of local building and planning officials (Malpezzi, 1996). Compared to metropolitan areas in other regions, California's urban centers feature real estate markets that are both expensive and inhospitable toward new residential projects.

The economics of land use suggests a variety of motivations for stringent development controls exercised by local government, motivations not always mutually exclusive.[6] Regulation may be motivated by both budgetary

6. For further discussion on the imposition of stringent land controls, see, e.g., Fischel (1985), Mills and Oates (1975), Pogodzinski (1995), Quigley and Rosenthal (2005), and Rolleston (1987).

FIGURE 9.3 California Rents and Number of Growth-Restricting Measures, 1990 and 2000

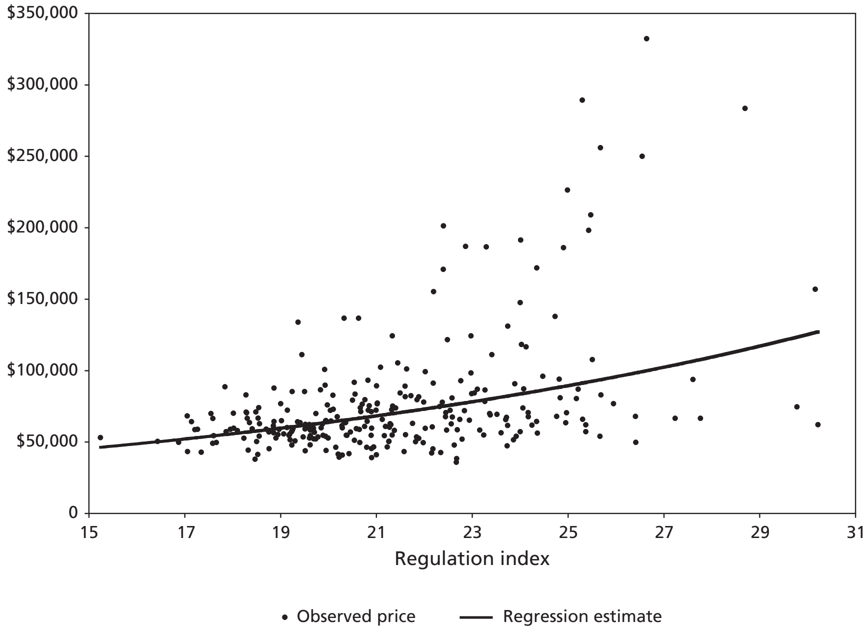


SOURCE: Quigley and Raphael (2004).

facts and subjective perceptions. Purposes may include maintenance of fiscal balance, protection of amenities, maximization of private land values, preservation of neighborhood aesthetics, and even certain forms of social exclusionism.

As will be described in greater detail below, our analytical approach recognizes that community features and housing market outcomes may be jointly determined. Moreover, our survey and our regulatory index include factors relating to local political attitudes toward growth. However, we do not specifically attempt to isolate the socioeconomic factors underlying patterns of regulatory stringency in the Bay Area. Rather, we mean to improve on the measurement of regulation utilizing a multifaceted strategy, incorporating the experiences of those working in the regulated sector, and then to evaluate how well observed levels of restrictiveness correlate with prices and rents.

Figure 9.4 Housing Prices and Regulation, U.S. Metropolitan Areas, 1990



SOURCE: Stephen Malpezzi, personal communication.

The Survey Instruments

Data on land use regulation typically focus on enactments by category, frequency, and timing; this approach has clear shortcomings. Indeed, the enactment of rules may reflect concurrent political conditions in some very general way. But the rules may reveal little about how the business of regulation is actually conducted. One city may have 20 quite restrictive-looking enactments that are rarely enforced; another may have only one or two, regularly used as the basis for denying a majority of permit applications. Accordingly, our survey of building officials supplements simple enactment data by asking specifically about implementation effects such as cost, delay, and likelihood of permit approval. We also surveyed developers and their environmental consultants to provide context and perspective concerning the application of local standards to actual residential projects. The first survey of growth control measures in California that we draw on was undertaken by Glickfield and Levine in 1988, reported in a Lincoln Institute monograph (Glickfield and Levine, 1992) and then expanded and updated in 1992 (Levine, 1999). In 1998, the California Department of Housing and Community Development (HCD) administered a second, parallel instrument to update the Glickfield and Levine (1992) survey. The HCD survey collected information about growth control measures enacted between 1995 and 1998.[7] Supplementing these prior efforts (which already included Bay Area jurisdictions), we conducted a third survey in 2007, covering regulation of land use by political jurisdictions in the Bay Area specifically. The current survey was modeled on one originally designed by Anita Summers and her colleagues at the Wharton School, administered to a national sample of political jurisdictions in 1990. The Summers survey instrument was updated in 2005 and again administered intensively in Philadelphia as well as in several other metropolitan regions (see Gyourko, Saiz, and Summers, 2008).[8]

Our online survey of builders and developers asked them to report experiences at the project level regarding permit applications in various jurisdictions. This survey was undertaken with the cooperation and assistance of the Home Builders Association of Northern California (HBANC). HBANC is a nonprofit association with a membership of about 1,000 firms representing developers, builders, and the construction trades. Our builder survey yielded information on 62 projects in 33 jurisdictions in the San Francisco Bay Area.

Finally, we undertook an additional online survey, fielded to members of the Bay Area Chapter of the National Association of Environmental Professionals (BAC/NAEP). BAC/NAEP members serve as consultants to governments and firms in the land use approval process mandated by CEQA. We obtained responses from environmental consultants relating to 27 projects in 14 different jurisdictions. The survey of CEQA consultants excluded BAC/NAEP members who work solely as employees of or as contractors to the local governments surveyed in our poll of building officials.

7. This latter survey, combined with the previous Glickfeld and Levine survey, formed the basis for recent analyses of local growth control and growth management programs by John Landis and his associates (Landis, 2000, 2006; Landis, Deng, and Reilly, 2002).

8. The results of the original Summers survey of local officials were analyzed in Summers, Cheshire, and Senn (1993). Subsequently, that survey formed the basis for a series of extensions by Stephen Malpezzi and his associates (Green, Malpezzi, and Mayo, 2005; Malpezzi, 1996; Malpezzi and Green, 1996) analyzing national land use patterns. A revised version was subsequently administered to all jurisdictions in the greater Philadelphia region, now the seventh largest CSA in the United States (Gyourko and Summers, 2006). Our response rate, 79 percent, is somewhat higher than the 64 percent response rate obtained by Summers in Philadelphia using a similar instrument.

Survey Results

The Glickfield and Levine and HCD Surveys

The Glickfield and Levine 1992 survey and the HCD 1998 survey were devoted entirely to issues of growth regulation and management. The four categories of enactments covered by these early surveys are (1) growth control (e.g., limits on residential permits, restrictions on annexation); (2) growth management (e.g., adequate public facilities ordinances, urban limit lines); (3) zoning changes (e.g., up- and down-zoning, prescribed floor-area ratios); and (4) related growth control measures (e.g., fees and exactions, supermajority voting requirements for zoning changes and specified planning decisions).

As reported elsewhere (e.g., Quigley and Raphael, 2005), California jurisdictions adopted many restrictive land use and growth control measures during the 1990s, with substantial growth in the use of adequate public facility ordinances, provisions for growth management in town plans, and urban limit lines. Three indexes of the stringency of growth control, derived from the earlier surveys, are reported in figure 9.5. The restrictiveness indexes are counts of the number of restrictive adoptions reported by survey respondents, computed from the 1992 and 1998 surveys of California building and planning officials. The hospitality index measures the receptiveness of local jurisdictions to development.[9]

The 2007 Survey and the Berkeley Land Use Regulation Index (BLURI)

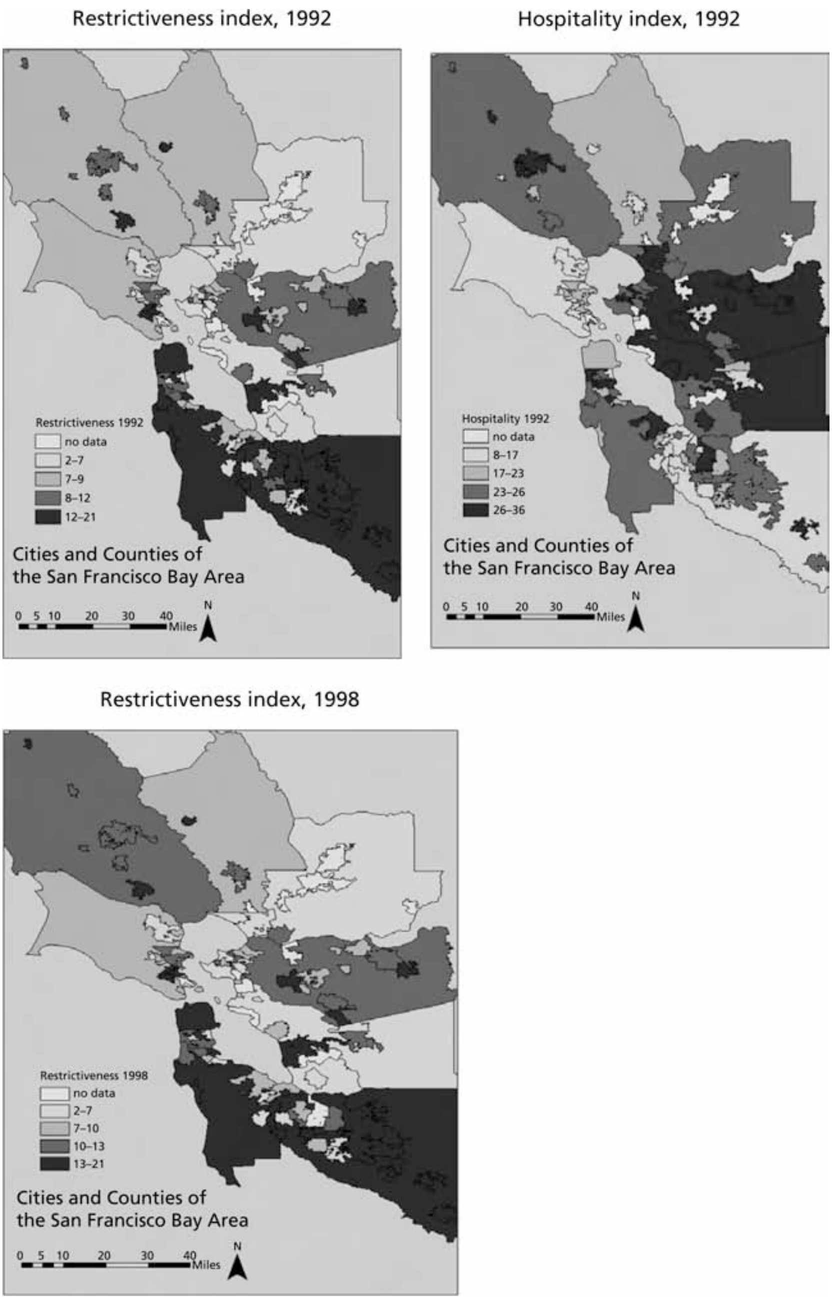
Our 2007 survey of local building officials asked about a variety of factors affecting housing development. Duration, timing, and specific regulations were addressed. The more recent survey also asked about political influence, project approval procedures, delays, inclusionary zoning, and open space. Survey responses were obtained from 86 jurisdictions. Our survey instrument, based on the Summers/Wharton survey and then adapted for California, is available online at http://urbanpolicy.berkeley.edu.

THE BLURI AND ITS COMPONENTS

Using the responses to the 2007 survey, we develop an index, the Berkeley Land Use Regulation Index (BLURI), comprising 10 separate measures of

9. These indexes are described in greater detail by Landis (2000) and Rosenthal (2000).

FIGURE 9.5 Indexes of Growth Management for the San Francisco Bay Area



distinct aspects of local practice: political influence, project approvals, zoning change, development caps, density restrictions, open space requirements, infrastructure improvement obligations, inclusionary housing, project approval delays, and permit approval rates. Some key components of the BLURI are noted later, together with details on their calculation.[10] For the Political Influence Index, we aggregate responses to questions concerning the involvement of different actors in permit decisions and the importance of various influences on residential development. The separate panels of table 9.1 summarize the responses to these questions for the Bay Area governments and report a composite index of political influence. The underlying survey items address, in detail, formal and informal actions, attitudes among various constituencies, and specific features of the entitlement process. Interestingly, the city of Berkeley ranks in the middle of the political influence distribution, as do diverse, mixed-income places like San Jose and Vallejo. Jurisdictions reporting strong political influence in these processes include unincorporated Marin County, the city of Richmond, and the city and county of San Francisco.

Project Approvals/Zoning Change. To describe the approval process for new development projects, respondents were asked to note which particular reviews are required when no zoning change is sought. These reviews may be mandated by the planning commission, the city council or board of supervisors, a landmark or historical department, fire department, health department, parking or transportation authority, a provision of CEQA, a growth management analysis, or some other procedure. The index is constructed as the sum of 11 dichotomous variables. Survey responses indicate that small towns like Piedmont and Larkspur have relatively few regulatory layers in the governance of permit applications. Larger city governments like San Francisco and Berkeley, among others, have the greatest number of project approval participants and processes, among our respondent jurisdictions.

Zoning-change requests may trigger reviews by a variety of local bodies. The survey asked respondents to report additional approvals necessary when applicants require variances, conditional use permits, and the like. Table 9.2 reports the kinds of reviews and their frequencies across Bay Area jurisdictions

10. More extensive analyses, as well as histograms of each component, are reported in a longer narrative downloadable via http://urbanpolicy.berkeley.edu. In the text here, we report on indexes of political influence, project approvals, zoning change, and caps on units and densities. Appendix tables 9A.2, 9A.3, and 9A.4 provide information on the indexes describing open space dedications, infrastructure obligations, inclusionary housing, and permit delays and approval rates.

TABLE 9.1 BLURI: Political Influence Index (Observations in 86 Bay Area Jurisdictions)

Involvement in residential development	Mean	Standard deviation
Local elected officials	4.5	0.90
Neighbors/community pressure	4.1	0.97
State legislature	1.9	1.03
Courts and litigation	1.8	0.93
Ballot measures	1.9	1.24
Organized labor	1.6	0.99
Planning/zoning staff	4.8	0.57
Environmental advocates	3.0	1.20
Factors affecting development of single-family housing		
Supply of developable land	4.7	0.84
Density restrictions	3.3	1.41
Infrastructure requirements	2.8	1.36
Local fiscal conditions	2.4	1.18
Inclusionary housing ordinances	2.3	1.10
Parking requirements	2.4	1.29
School crowding	1.9	1.06
CEQA review	2.7	1.33
Density bonuses	1.7	0.79
Citizens' attitudes on growth	3.4	1.23
Elected officials' positions on growth	3.5	1.26
Mixed-use requirements	2.0	1.16
Impact fees/exactions	2.5	1.17
Duration of entitlement process	2.7	1.17
Factors affecting development of multifamily housing		
Supply of developable land	4.5	0.92
Density restrictions	3.4	1.40
Infrastructure requirements	2.9	1.30
Local fiscal conditions	2.4	1.16
Inclusionary housing ordinances	2.6	1.27
Parking requirements	2.9	1.28
School crowding	1.9	1.05
CEQA review	2.8	1.17
Density bonuses	2.2	1.07
Citizens' attitudes on growth	3.6	1.21
Elected officials' positions on growth	3.8	1.14
Mixed-use requirements	2.6	1.29
Impact fees/exactions	2.7	1.20
Duration of entitlement process	2.9	1.22
Political Influence Index Score	**98.63**	**23.56**

NOTES: Scores range from 1 (not involved) to 5 (very involved). CEQA = California Environmental Quality Act.

Table 9.2 BLURI: Project Approval and Zoning Change Indexes (Observations in 86 Bay Area Jurisdictions)

	Frequency	
Required reviews (1 = yes)	**For project approval and issuance of building permit**	**For projects requiring zoning change**
Planning commission	65	80
City council (or board of supervisors)	19	82
Landmarks/historical commission	14	1
Architectural/design review	51	10
Building department	72	45
Fire department	71	63
Health department	23	65
Parking/transportation	23	24
CEQA review	68	26
Growth management analysis	12	73
Other	20	17
	Mean	**Standard deviation**
Project Approval Index Score	5.01	2.13
Zoning Change Index Score	5.74	2.41

NOTES: Scores range from 1 (not involved) to 5 (very involved). CEQA = California Environmental Quality Act.

for both the Project Approval and Zoning Change Indexes. The table also summarizes each of the parallel indexes generated.

Development Caps and Density Restrictions. We also asked local officials whether their jurisdictions had adopted limits on the number of permits issued. Gauged to cover numerical or proportional growth, such caps may govern single-family housing, multifamily housing, or the residential population itself. The caps subindex is the sum of five dichotomous variables.

Respondents were also asked if their jurisdiction imposes minimum lot sizes and, if so, at what levels. An index of density restrictions was created by summing four dichotomous variables specifying separate, minimum-lot-size categories. The great majority of responding jurisdictions report no caps at all; outlying areas like Cotati and Petaluma in Sonoma County, and Gilroy and Morgan Hill in Santa Clara County, are among those experimenting with such restrictions. Density restrictions of various types are more prevalent, particularly in county unincorporated areas and a number of suburban enclaves.

TABLE 9.3 BLURI: Development Caps and Density Restrictions Indexes (Observations in 86 Bay Area Jurisdictions)

Development caps (1 = yes)		**Frequency**
Single-family home permits		14
Multifamily permits		13
New single-family housing		10
New multifamily housing		10
Population growth		4
Density restrictions (1 = yes)		**Frequency**
Minimum lot size less than .5 acres		73
Minimum lot size between .5 and 1 acres		31
Minimum lot size between 1 and 2 acres		26
Minimum lot size 2 or more acres		20
	Mean	**Standard deviation**
Development Caps Index Score	0.59	1.26
Density Restrictions Index Score	1.69	1.34

NOTE: Scores range from 1 (not involved) to 5 (very involved).

Table 9.3 reports the frequencies of responses concerning items underlying both the Development Caps and Density Restrictions Indexes.

COMBINING THE SUBINDEXES

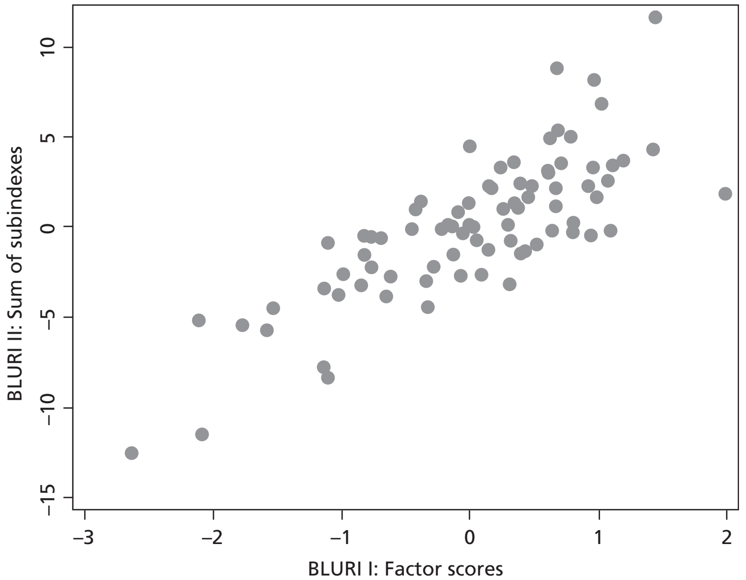
For the analysis of regulatory impact, we develop a single indicator, the BLURI, summarizing restrictiveness in each Bay Area jurisdiction. The 10 subindexes described here and in appendix table 9A.1 are combined by standardization and aggregation. Each component is normalized to a mean of zero and a standard deviation of one, so that different metrics are accorded equal weight in aggregation. Two techniques are used to aggregate the 10 components: a simple summation and a factor extraction. Standard principal-components analysis, applied to the 10 elements, produces a single factor that explains 76 percent of the covariances among the original variables. Moreover, the second factor generated by this method has an eigenvalue of less than one, suggesting that a single factor is sufficient to explain the variability of the underlying data. The simple correlation between the scores of the single factor extracted from the 10 indexes and the sum of the subindexes is 0.79. Table 9.4 reports the correlations among the values of the 10 standardized subindexes and two BLURIs constructed from the

TABLE 9.4 Correlation Matrix of BLURI Subindexes and BLURI Values

	Political influence	Project approvals	Zoning changes	Develop-ment caps	Density	Open space	Infrastructure improvements	Inclusionary housing	Approval delays	Rate of approval	BLURI I	BLURI II
Political influence	1.00											
Project approvals	0.11	1.00										
Zoning changes	0.06	0.72	1.00									
Development caps	0.17	0.01	0.19	1.00								
Density	–0.07	0.04	0.13	0.22	1.00							
Open space	0.08	0.29	0.20	0.01	0.04	1.00						
Infrastructure improve-ments	–0.04	0.07	0.09	0.02	0.10	0.19	1.00					
Inclusionary housing	0.19	0.20	0.15	–0.03	–0.20	–0.04	–0.13	1.00				
Approval delays	0.20	0.02	0.16	0.33	0.14	0.03	–0.02	0.04	1.00			
Rate of approval	–0.12	–0.16	–0.20	–0.07	–0.30	–0.12	–0.09	–0.18	0.07	1.00		
BLURI I	0.23	0.87	0.90	0.26	0.23	0.36	0.14	0.23	0.22	–0.37	1.00	
BLURI II	0.41	0.59	0.64	0.48	0.29	0.43	0.31	0.26	0.51	–0.04	0.79	1.00

NOTES: BLURI I is computed by factor analysis using the first principal factor of the covariance among the 10 subindexes. BLURI II is computed as the simple sum of values of the 10 subindexes.

FIGURE 9.6 Scatterplot: BLURI Factor Scores by Raw Sum of Indexes (N = 86)



NOTE: BLURI = Berkeley Land Use Regulation Index.

underlying data.[11] Appendix table 9A.1 reports factor loadings and correlations between the 10 subindexes and the composite BLURI level.

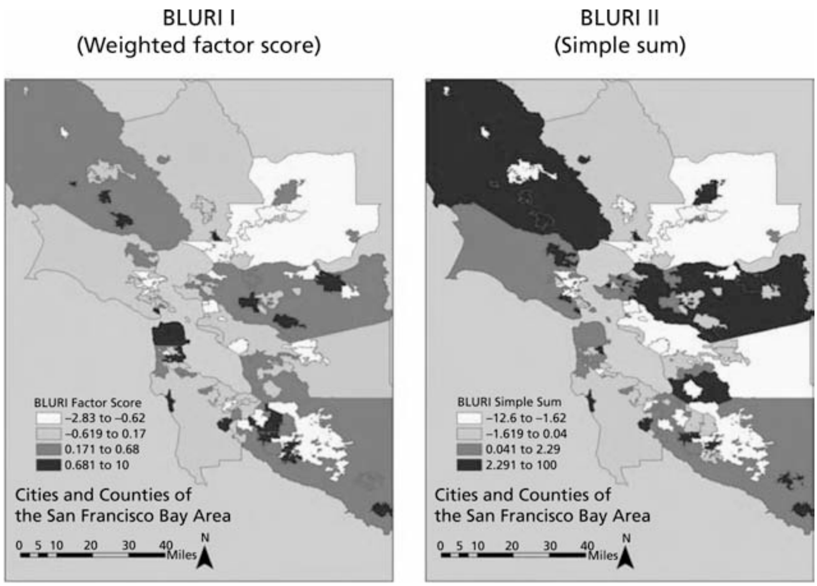
A scatterplot of the factor scores and the sum of the standardized values of the 10 subindexes is shown in figure 9.6. Remarkably, the complexity of the 10 underlying measurements can be summarized very well by either a single factor or by the sum of the underlying subindexes. Figure 9.7 reports the two BLURIs of land use restrictiveness in the San Francisco Bay Area.

Surveys of Bay Area Developers and Environmental Professionals

Respondents completing our 2007 developer survey provided information on a total of 62 projects located in 33 land use jurisdictions in the Bay Area.

11. We impute missing data points when aggregating the subindexes; otherwise, missing data for one component value would make the values of the other subindexes unusable. Data were missing from one jurisdiction for the Project Approval Index, from 15 jurisdictions for the Approval Delay Index, and from 20 jurisdictions on the Rate of Approval Index. Values for missing data points are imputed using the "impute" command (in Stata 9.0), which uses a multivariate regression to predict the missing values.

FIGURE 9.7 BLURI for the San Francisco Bay Area



NOTE: BLURI = Berkeley Land Use Regulation Index.

For each project, respondents identified the product type, size, and other characteristics. They also estimated an inherent *ex ante* entitlement risk for the project and its level of controversy. Developers then provided three summary measures describing each specific project: (1) the total time for the completion of the permit-review process; (2) the all-inclusive cost of securing the entitlement; and (3) the perceived accuracy of their initial estimates of the time that would be required to secure entitlements.

In a format similar to that used for our developer survey, environmental consultants answered a series of questions about recent development projects on which they served as hired experts. Responses cover 27 projects in 14 jurisdictions. In addition to questions about project characteristics, such as the type of development and the number of units, two sets of questions were asked about the environmental aspects of the process. The first set of items identified total cost, time, and related components of local review. Consultants responding to the survey also evaluated regulatory reasonableness, transparency, and other local conditions. Like the developers, these respondents also rated the perceived level of controversy and ex ante entitlement risk for particular projects. Beyond these factors, we asked how consultants rated the degree of environmental mitigation required, given the nature, design, and location of the project in question.

TABLE 9.5 Selected Project Level Indicators by Product Type (Survey of Developers)

	Single-family homes (37 projects)		Attached, mixed-use, and planned unit (25 projects)	
Indicator	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
Number of units	121	173	331	219
Controversy level (1–3)	1.57	0.55	2.04	0.89
Entitlement risk (1–5)	2.70	0.91	3.08	1.15
Number of special permits	2.03	1.40	2.60	1.47
Entitlement cost ($ millions)	1.31	1.88	2.34	3.34
Entitlement cost per unit	$22,620	$30,760	$9,070	$13,250
Time (years)	2.46	1.25	2.04	1.24
Accuracy (years)	1.25	0.88	0.72	0.85

Table 9.5 summarizes developer responses separately for single-family housing developments and for all other projects (i.e., apartments, condominiums, mixed-use, and planned-unit developments). As indicated in the table, developments of single-family housing in our sample involved fewer units—121 units on average, as opposed to 331 units for other developments. The level of controversy ex ante was considered substantially lower for single-family developments, averaging 1.6 on a scale of 1 to 3.[12] By comparison, other projects averaged 2.0 in terms of controversy. The ex ante entitlement risk was an average of 2.7, on a scale of 1 ("very low risk") to 5 ("very high risk") for single-family projects; in comparison, other projects scored an average of 3.1. Single-family projects also required fewer special permits for construction than other projects did.

When builders were asked to estimate "the all-inclusive cost of the entire entitlement process," responses averaged $1.3 million for single-family developments of varying sizes, and about $22,600 per new dwelling unit. Entitlement costs for other types of development, which tended to be significantly larger and more complex, averaged $2.3 million per project, or about $9,100 per dwelling unit. The single-family entitlement process averaged delays of almost two-and-a-half years, as opposed to delays of about two years for non-single-family construction.[13]

12. The survey item asked respondents to rate project controversy as "standard," "mildly controversial," or "pushing the envelope." These levels were given coded values from one to three, respectively.

13. These averages, and those in tables 9.6 and 9.7, conceal a great amount of variation. Our longer narrative describing this study, downloadable via http://urbanpolicy.berkeley.edu, presents frequency distributions for out-of-pocket costs associated with the entitlement process, total per-unit costs, time to entitlement, and accuracy of initial entitlement time estimates, all broken out by development type.

Table 9.6 Selected Project Level Indicators by Controversy Level (Survey of Developers)

	"Standard" projects (26 projects)		Mildly controversial and pushing the envelope (36 projects)	
Indicator	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
Number of units	175	184	227	239
Entitlement risk (1–5)	2.31	0.93	3.25	0.91
Number of special permits	1.65	1.02	2.69	1.56
Entitlement cost ($ millions)	1.41	2.01	1.98	2.98
Entitlement cost per unit	$18,870	$28,930	$15,740	$23,630
Time (years)	2.00	1.20	2.52	1.26
Accuracy (years)	0.92	0.78	1.12	0.98

Table 9.6 reports the same selected indicators of projects, entitlement delays, and costs by the level of ex ante controversy of the project. As expected, larger projects tended to be viewed as more controversial, as did those exhibiting greater entitlement risk or requiring special permits. Less controversial projects required about $1.4 million in entitlement costs, or about $8,000 per dwelling unit. More controversial projects required about $1.9 million in out-of-pocket costs, or about 10 percent more per dwelling unit produced. On average, more controversial projects took 25 percent longer—about six months—to receive permission to build.

Tables 9.7 and 9.8 present results from our survey of environmental professionals. Table 9.7 indicates that non-single-family projects tend to be much larger, averaging 271 units (nearly 200 units more than single-family developments, on average). The level of controversy tends to be lower for single-family projects, averaging 1.69 on the previously defined scale. For multifamily housing, the controversy level is 2.14, on average. Similarly, the level of entitlement risk for single-family homes is lower, although it is only about 5 percent less than for multifamily and other housing.

Indicators of delay and mitigation were only slightly lower for single-family housing developments than for multifamily housing and mixed use, although costs and the length of time for the environmental review process were higher. On a scale of 1 to 4, where 1 is "none" and 4 is "very high," single-family homes experienced an average delay of 2.6, whereas the average delay for non-single-family projects was 2.9. On the same scale of 1 to 4, developers of single-family projects were required to undertake a very similar

TABLE 9.7 Selected Project Level Indicators by Product Type (Survey of Environmental Professionals)

	Single-family homes (13 projects)		Apartments, condominiums, mixed-use, and other (14 projects)	
Indicator	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
Number of units	74.46	79.19	270.93	277.88
Controversy level (1–3)	1.69	0.75	2.14	0.66
Entitlement risk (1–5)	2.85	1.14	3.00	0.68
Number of drivers of risk	1.62	1.45	2.79	1.63
Delays (1–4)	2.63	1.29	2.93	0.73
Mitigation (1–4)	2.50	1.00	2.64	0.84
Time (years)	2.27	1.62	1.93	0.62
Entitlement cost	$110,300	$138,380	$301,150	$315,060
Entitlement cost per unit	$8,140	$20,650	$2,990	$6,650

TABLE 9.8 Selected Project Level Indicators by Controversy Level (Survey of Environmental Professionals)

	Standard projects (8 projects)		Mildly controversial and pushing the envelope (19 projects)	
Indicator	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
Number of units	135.38	200.46	193.58	240.24
Entitlement risk (1–5)	2.25	0.89	3.21	0.79
Number of drivers of risk	1.25	1.16	2.63	1.64
Delays (1–4)	2.33	1.03	2.95	0.97
Mitigation (1–4)	1.86	0.69	2.84	0.83
Time (years)	1.33	0.68	2.32	1.18
Entitlement cost	$40,190	$51,140	$285,120	$283,560
Entitlement cost per unit	$1,250	$2,160	$7,040	$17,250

level of environmental mitigation, rating an average of 2.5, whereas non-single-family projects were rated 2.6, on average. As with the developer survey, overall costs were much higher for multifamily and mixed-use projects, but per-unit costs and the time required for completion of the review process were not. On average, single-family projects took 2.3 years and multifamily and mixed-use projects took only 1.9 years. The costs for environmental review averaged $8,000 for each single-family unit built, as opposed to $3,000 for multifamily and mixed-use development.

Table 9.8 compares the average value of "standard" projects with those considered more controversial by the respondents. Similar to developers' experiences, the more controversial projects described by environmental professionals had more units, took more time to secure entitlements, had a higher overall cost, and had a higher cost per dwelling unit. For example, for the average "mildly controversial" or "pushing-the-envelope" project, the entitlement process took one year longer than for the average "standard" project. The unit cost of securing permits for the average standard project was less than one-fifth that of an average controversial project. Additionally, on the scale of 1 to 4, where 1 is "none" and 4 is "very high," more controversial projects had higher levels of delay than standard projects. Similarly, developers of more controversial projects ultimately faced more extensive legal obligations to mitigate environmental impact.

Land Use Restrictiveness, Prices, and Rents

Finally, we explore the relationship between these regulation measures and the cost of housing—monthly rents and the prices of owner-occupied homes—using the Public Use Micro Sample (PUMS) for the San Francisco Bay Area from the 2000 census. The census micro data provide a rich description of the hedonic characteristics of housing—numbers of rooms and bedrooms, structure types, year built, and quality of kitchen and bath. Dwelling units are identified geographically by Public Use Microdata Area (PUMA), not city or civil division. We allocate observations on dwellings by PUMA to cities in the Bay Area by proportional representation, using the geographical correlation engine developed at the University of Missouri.[14] This technique essentially weights observations from those PUMAs that contain more than one city or that cross city boundaries, in proportion to dwellings in those cities as a fraction of all dwellings in the PUMA.

To address the joint determination of regulation and housing market outcomes, we use preexisting measures of the political predisposition in each city, and more recent plebiscites showing citizen attitudes toward housing bond issuance, as instruments for the index of regulatory restrictiveness. In general,

14. This allocation mechanism is identical to that used in Quigley and Raphael (2005) (see footnote 2) to allocate observations in the 1990 and 2000 PUMS to California land use jurisdictions.

our instrumental variable (IV) estimates are similar to those generated by the ordinary least squares (OLS) models. Finally, to account for unmeasured spatial and civic factors, we include in these models indicator variables identifying jurisdictions that are "coastal" (bordering the San Francisco Bay or Pacific Ocean) and those that are counties governing unincorporated land outside chartered and incorporated California cities.

Table 9.9 presents the results of a series of regressions of housing value on the hedonic characteristics of individual owner-occupied dwellings and the measure of regulatory stringency developed in this research. The basic hedonic

TABLE 9.9 Regulatory Restrictions and the Value of Owner-Occupied Housing

	Ordinary least squares		Instrumental variable[a]	
	(1)	(2)	(3)	(4)
Number of rooms	0.155	0.155	0.155	0.156
	(76.32)	(78.65)	(75.82)	(78.17)
Number of bedrooms	0.032	0.015	0.029	0.009
	(9.21)	(4.56)	(8.35)	(2.65)
Age	0.002	0.001	0.002	0.001
	(17.86)	(4.32)	(19.07)	(4.78)
Complete kitchen	−0.210	−0.203	−0.209	−0.200
(1 = no)	(−3.04)	(−2.99)	(−3.03)	(−2.94)
Complete plumbing	−0.121	−0.107	−0.125	−0.111
(1 = no)	(−2.6)	(−2.35)	(−2.72)	(−2.45)
County dummy	−0.111	0.318	−0.098	0.321
	(−21.5)	(39.86)	(−18.74)	(40.74)
Coastal	−0.032	−0.166	−0.056	−0.194
	(−7.31)	(−37.82)	(−11.58)	(−40.60)
Log basic jobs		0.245		0.277
		(93.06)		(89.86)
Log developable land		−0.051		−0.039
		(−37.15)		(−26.54)
BLURI	0.012	0.022	0.038	0.053
	(23.42)	(40.59)	(28.67)	(35.53)
	[1.51]	[2.51]	[1.27]	[1.33]
R-squared	0.38	0.42	0.37	0.40
R-squared first stage			0.18	0.24

NOTES: Dependent variable in logarithms. All models include dummy variables for 10 structure types (e.g., condominium, single-detached), persons per room, and a constant term. BLURI = Berkeley Land Use Regulation Index.

[a] Instruments include the percent of votes: favoring Proposition 13 (1976); for Reagan (1980); and favoring housing bond propositions 46 and 1C (2002 and 2006, respectively).

model is identical to that used by Quigley and Raphael (2004, 2005). These regressions are based on the 62,905 owner-occupied dwellings in the San Francisco Bay Area reflected in the 2000 PUMS. The hedonic characteristics alone explain about 38 percent of the variance in the log of house values. This fraction increases to 42 percent when variables measuring changes in the nearby location of basic employment and the amount of vacant land are added to the model. The variable measuring restrictive regulation has a coefficient between 0.01 and 0.02 and a computed t-ratio above 20. When the models are estimated by instrumental variables using political preferences expressed well before the 2000 U.S. Census (e.g., the percent voting for Ronald Reagan in 1980), the coefficient on regulatory stringency is substantially larger.

Of course, large t-ratios computed for the regulatory measure are misleading, because the sample for these statistical models includes only about 80 different jurisdictions enacting land use regulations in the Bay Area. However, when the standard errors are appropriately grouped by jurisdiction, the t-ratio in the OLS model, including measures of jobs and developable land, remains statistically significant. The clustered t-ratios are reported in square brackets in the table.

Table 9.10 reports a comparable analysis based on the 38,184 rental units sampled in the 2000 census. The hedonic models explain a smaller fraction of the variance in log rents, only about 17 percent when job growth and developable land are included as variables.[15] The coefficient on the measure of regulatory stringency is again larger when the models are estimated by instrumental variables. To a greater extent than was true for the home value models already reported here, these coefficients are statistically significant when the standard errors are grouped appropriately.

A more detailed analysis of the influence of individual components of the constructed BLURI measure on house prices suggests that rents and house values are particularly sensitive to the complexity of the approvals process for new housing developments. Additional review requirements significantly add to the costs of navigating the entitlements process and increase the expense and delay in getting projects built. Table 9.11 summarizes this relationship. The table reports the results when our earlier price and rent models are reestimated using the project approvals subindex (PAI) and the political influence subindex (PI) instead of the broader BLURI of which they are part. The spec-

15. The differences in the explanatory power of the models for owner-occupied and rental dwellings may arise from less price variation among rental units (see Capozza, Green, and Hendershott, 1996).

Table 9.10 Regulatory Restrictions and Monthly Rents

	Ordinary least squares		Instrumental variable[a]	
	(1)	(2)	(3)	(4)
Number of rooms	0.050	0.052	0.047	0.050
	(16.78)	(17.86)	(15.62)	(16.46)
Number of bedrooms	0.093	0.088	0.096	0.090
	(19.67)	(18.96)	(19.97)	(18.80)
Age	−0.002	−0.003	−0.003	−0.003
	(−17.30)	(−20.43)	(−19.79)	(−23.99)
Complete kitchen	−0.157	−0.148	−0.177	−0.171
(1 = no)	(−6.31)	(−5.92)	(−6.88)	(−6.53)
Complete plumbing	−0.269	−0.267	−0.281	−0.282
(1 = no)	(−9.43)	(−9.36)	(−9.53)	(−9.48)
County dummy	−0.077	0.181	−0.065	0.222
	(−13.31)	(20.51)	(−11.08)	(23.31)
Coastal	−0.021	−0.108	−0.065	−0.176
	(−4.51)	(−22.93)	(−11.85)	(−29.45)
Log basic jobs		0.164		0.210
		(55.43)		(59.20)
Log developable land		−0.023		−0.017
		(−15.74)		(−10.84)
BLURI	0.009	0.014	0.046	0.060
	(14.91)	(23.44)	(30.79)	(36.83)
	[1.92]	[4.04]	[2.46]	[2.26]
R-squared value	0.15	0.17	0.10	0.10
R-squared first stage			0.17	0.19

NOTES: Dependent variable in logarithms. All models include dummy variables for 10 structure types (e.g., condominium, single-detached), persons per room, and a constant term. BLURI = Berkeley Land Use Regulation Index.

[a] Instruments include the percent of votes: favoring Proposition 13 (1976); voting for Reagan (1980); and favoring housing bond propositions 46 and 1C (2002 and 2006, respectively).

ification does not appear sensitive to using the raw PAI or PI composites or their logarithms, as reflected in the table.

The results suggest that the number of approvals required to authorize additions to the housing supply has a large effect upon the housing prices in a jurisdiction. These coefficients are statistically significant and economically important. The OLS models suggest that the addition of one required review to the development process is associated with price increases of about 4 percent. In terms of relative magnitudes, the PAI reported in table 9.2 has a mean of 5 reviews and a standard deviation of 2.13.

Table 9.11 Project Approvals Index, Political Influence Index, and House Values

	Ordinary least squares		Instrumental variable[a]	
	(1)	(2)	(3)	(4)
Project approval index	0.041	0.043	0.254	0.293
	(46.29)	(49.38)	(52.49)	(53.99)
	[2.99]	[3.90]	[2.46]	[2.25]
Log (project approval)	0.173	0.171	1.455	1.544
	(48.31)	(50.71)	(56.67)	(61.76)
	[2.52]	[3.32]	[2.22]	[2.32]
Political influence index	0.001	0.004	0.018	0.022
	(7.94)	(37.96)	(64.16)	(66.56)
	[0.46]	[2.48]	[3.04]	[3.06]
Log (political influence)	0.052	0.344	1.645	1.912
	(5.71)	(35.55)	(63.44)	(66.22)
	[0.32]	[2.18]	[2.59]	[2.74]

NOTES: Dependent variable in logarithms. All specifications are the same as those reported in tables 9.9 and 9.10. Columns (2) and (4) include the variables measuring growth in basic jobs and the amount of developable land.

[a] Instruments include the percent of votes: favoring Proposition 13 (1976); voting for Reagan (1980); and favoring housing bond propositions 46 and 1C (2002 and 2006, respectively).

House values and rents are both significantly affected by the composite index of regulatory stringency, whereas key components like political influence and project approvals and their logarithms appear to affect home values to a greater extent than they do rents.

Conclusion

This chapter presents a description of land use regulation in the San Francisco Bay Area, a region containing more than 100 independent regulatory authorities, and one in which housing prices have tripled since 1995 (and doubled since 1999).[16] We compare the results from our 2007 survey of government building officials with prior surveys conducted in the 1990s. We also compare these results with surveys of developers and land use intermediaries in the Bay Area, finding that regulatory stringency is consistently associated with higher costs for construction, longer delays in completing projects, and greater uncertainty about the elapsed time to completion of residential developments.

16. See http://www.ofheo.gov/hpi_download.aspx.

We find strong evidence that regulatory restrictiveness leads to higher house prices and higher rents in the jurisdictions imposing the regulations. These effects are quite large. An increase of one standard deviation in the number of governmental reviews required to authorize residential development (i.e., from a mean of five required agency reviews, to a total of seven) is associated with an 8 percent increase in the average prices of single-family housing in the existing stock. Regulation clearly seems profitable to the owners of existing housing.

APPENDIX

TABLE 9A.1 Factor Loadings and Correlations Between Subindexes and BLURI I

Subindexes	Factor loading	Correlation with factor score
Political influence	0.197	0.225
Project approvals	0.756	0.866
Zoning changes	0.788	0.902
Development caps	0.229	0.262
Density restrictions	0.199	0.228
Open space restrictions	0.314	0.359
Infrastructure improvements	0.126	0.145
Inclusionary housing	0.202	0.231
Approval of delays	0.195	0.223
Rate of approvals	−0.319	−0.366

TABLE 9A.2 BLURI: Open Space, Infrastructure Improvement, and Inclusionary Housing Indexes (Observations in 86 Bay Area Jurisdictions)

	Frequency		
Measure	Open space	Infrastructure improvements	Inclusionary housing
No restrictions	10	3	13
In lieu fees option	47	55	54
Restrictions	29	28	19

	Mean	Standard deviation
Open Space Index Score	0.71	0.32
Infrastructure Improvements Index Score	0.75	0.23
Inclusionary Housing Index Score	0.64	0.32

Table 9A.3 BLURI: Approval Delay Index (Observations in 79 Bay Area Jurisdictions)

	Estimated delay in months		
Type of project	**No zoning change**	**Zoning change**	**Subdivision**
1–4 single-family units	7	10	NA
5–49 single-family units	15	15	15
≥ 50 single-family units	17	17	18
Multifamily units	14	14	14
Median	13	14	17
		Mean	**Standard deviation**
Approval Delay Index Score		12.66	7.32

Table 9A.4 BLURI: Rate of Approval Index (Observations in 69 Bay Area Jurisdictions)

Type of project	Mean applications	Mean approvals
Zoning change	72	32
Subdivision applications	8	4
	Mean	**Standard deviation**
Rate of Approval Index Score	0.74	0.30

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Commentary

Richard K. Green

John Quigley, Steven Raphael, and Larry Rosenthal have written a chapter that is remarkable for its painstaking development of data characterizing land use regulation in the San Francisco Bay Area.[1] As such, it provides many important stylized facts about land markets in the Bay Area; it also argues that it finds that more stringent land use regulation is (not surprisingly) associated with higher home prices. The work will doubtless be useful to those studying land use regulation in the future. I, for one, found it interesting and astonishing that so many communities in the San Francisco Bay Area have a minimum lot size requirement of two acres. Given how valuable land is in the Bay Area, one would think the economic pressure to subdivide would overcome the political pressure not to do so. My guess is that many scholars and policy makers will refer to the Berkeley Land Use Regulation Index (BLURI) in the years to come.

Some Comments on the Broad Results

The first thing that is striking about empirical results is that the impact of layering land use regulations seems to have grown across time. In both figures 9.2 and 9.3, the slope of the relationship between the number of regulations and price or rent was steeper in 2000 than in 1990. This suggests that perhaps "unwritten" regulations are becoming increasingly important and are interacting with the written regulations.

Also striking is that the home price regressions perform much better than the rent regressions: the R-square on the home price regressions is around .4, whereas on the rent regressions it is around .1 to .15. This may be because there is less variation in rent than in prices across jurisdictions. The fact that rents have relatively low variation, whereas prices have much variation, implies that rent-to-price ratios must vary within the San Francisco Bay Area. To understand how this can happen, consider a simple version of the user cost model of housing:

$$\frac{\text{Rent}}{\text{Value}} = (1 - \tau_y)\text{r} + (1 - \tau_y)\tau_p + \text{m} - \pi$$

1. The only similarly thorough study I can think of is Schuetz and White's (1993) piece on land use regulation in the Milwaukee metropolitan area.

where τ_y = marginal income tax rate, r = before-tax cost of capital, τ_p = property tax rate, m = maintenance + depreciation + amortized transaction costs, and π = expected growth in rents.

Capozza, Green, and Hendershott (1996) show that cross-metropolitan variations in rent-to-price ratios can largely be explained by variations in the after-tax cost of capital across metropolitan areas, along with differences in property tax rates. In the San Francisco Bay Area context, property tax rates probably do not vary very much across communities (because of Proposition 13), but marginal federal and state tax rates may vary quite a lot, because incomes almost always vary a lot.[2] Local income measures are not included in the rent or price regressions. If the BLURI is correlated with per capita income, its significance in explaining home prices may reflect this correlation.

Beyond differences in taxes, differences in rent-to-price ratios may reflect differences in discount rates and in expected rent growth. Whether it is one or the other is important. Lower discount rates reflect lower expected risk; households who live in heavily regulated places may perceive that their risk is lower, and therefore are willing to pay more. If this is the case, it is not entirely clear that land use regulation is inefficient. On the other hand, if regulations are simply making land market inelastic, expectations about rent growth will be pushed upward, because increased future demand will be absorbed in higher rents rather than in greater supply. This is almost certainly not a welfare-improving result.

One final point on welfare: one of the arguments for land use regulation is that it increases the amenity value of jurisdictions—that it makes places more pleasant for day-to-day life. If this is in fact the case, the increased value should show up in differences in rents.

Some Cautions on the Bottom-Line Results

As I already noted, the BLURI is exceptionally useful, and I hope policy makers will consult with it in the future. That said, the index does not do a particularly good job of predicting either rents or prices. In four out of eight regressions, the adjusted t-statistics on the BLURI coefficient are less than 1.96, and in three regressions, they fail even the 90 percent confidence test of being different from zero. Making the result even less impressive is the fact that as an index, the BLURI is basically gathering numerous explanatory variables into one variable, which should make its coefficient estimate sharper.

2. In 2000, Atherton had a per capita income of $112,408, whereas Oakland's per capita income was $21,936. See U.S Bureau of the Census (2000).

This is not to say that land use regulation does not matter. It may be the case that most jurisdictions in the San Francisco Bay Area are above the threshold where it does matter, and that the variation—once regulation exceeds a certain threshold—does not make much difference. Perhaps we may look forward to future work in which researchers use Quigley, Raphael, and Rosenthal's techniques in a market that has a wider variety of land use regulatory schemes.

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Commentary

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Over the past two decades, there has been an increasing focus on supply-side issues in housing and other real estate markets. The regulation of land use and development is by no means the only supply-side issue—the roles of geography and natural constraint, labor and materials markets, and the "industrial organization" of the housing market come to mind—but regulatory issues are important and, at least in principle, more within human control than, say, the geographic challenges created by the existence of San Francisco Bay or Mount Davidson.

In this careful and well-constructed chapter, John Quigley, Steven Raphael, and Larry Rosenthal have made a valuable contribution to the growing literature on the measurement of development regulation and its effects on housing markets. One way much of this recent empirical research can be roughly categorized is between studies that measure the stringency of regulation across metropolitan areas (or less often, across states or countries). Such studies (for example, Glaeser, Gyourko, and Saks, 2006; Green, Malpezzi, and Mayo, 2005; Gyourko, Saiz, and Summers, 2008; Hwang and Quigley, 2006; Linneman et al., 1990; Mayer and Somerville, 2000; Quigley and Raphael, 2005; Quigley, Raphael, and Rosenthal, 2004; and many studies surveyed in the excellent review by Quigley and Rosenthal, 2005) take advantage of the substantial variation in regulatory regimes across U.S. metropolitan areas, and have the further advantage of giving us a big-picture view of a large number of the United States' diverse local housing markets. But among other shortcomings of such studies is the fact that all of us who engage in them are aware of the problematic maintained assumption that we can neglect within-metropolitan variation in regulatory regimes; Keith Ihlanfeldt (2007) provides a good example of such a critique. Studies that examine one or a few regulating jurisdictions, such as early studies by George Peterson (1974) and later work by Henry Pollakowski and Susan Wachter (1990) and Richard Green (1999), not only address but actually take advantage of the richness of within-market variation, but corresponding questions can be raised about their generalizability.

Although this chapter is a study of a single metropolitan area, in many respects it contributes to both strands of research. By using an index that is constructed in a manner broadly similar to those of the cross-metro studies, the authors undertake a within-market analysis that can be more directly compared to cross-market literature. One of their important findings is a validation of the critique that cross-market studies lose something by aggregating local regulating jurisdictions to a single metropolitan average. Another finding is that these results from the cross-metro studies and the within-metro study are qualitatively similar: more stringent regulations drive up housing costs within, as well as across, metropolitan areas.

There are other advantages of Quigley, Raphael, and Rosenthal's approach. Many of us would also express a prior belief that cross-metro differences in "average" regulatory environments might not provide an especially reliable guide to effects of a marginal change in actual regulations in a single jurisdiction; and real-world regulatory changes usually follow that path, rather than a large change in a wide range of regulations across many jurisdictions within a metropolitan area.

Quigley, Raphael, and Rosenthal also make some important contributions to our thinking about how to design regulatory surveys and how to construct indices from their results. Here I point out just three: (1) their care in reporting separately (as well as in aggregates) the responses of different actors in the development process (developers, government, and environmental officials); (2) their integration of the "usual suspects," such as growth management rules and density restrictions, with attitudinal and political questions; and (3) their construction of different aggregates for different development types (e.g., single-family versus multifamily).

I would also point out that their chapter is very much an investment. There is much inertia in regulatory environments. We now have a baseline of regulation for a wide range of San Francisco jurisdictions circa 2007. How will housing prices and development activity evolve going forward from this baseline? As we enter a period of price volatility after the recent long run-up and the subprime crisis, will we find (à la Malpezzi and Wachter, 2005) that more stringently regulated markets face a different risk-return tradeoff than more elastic markets? I expect there will be many fruitful follow-up studies by the present and other authors of the Bay Area, now that Quigley, Raphael, and Rosenthal have armed us with these indices.

There are too many interesting specific results in the chapter to review in detail here, but let me mention just a few. The usual ordinary least squares (OLS) regression of house prices or rents on regulatory indices raises suspicion that perhaps regulations are partly a response to past price changes (which in turn affect today's levels). Quigley, Raphael, and Rosenthal thus present both OLS and Instrumental Variables (IV) results that can mitigate the effects of this endogeneity. We carried out a similar cross-metro exercise in Malpezzi, Chun, and Green

(1998); we found that the IV results were qualitatively similar but smaller in magnitude and with smaller t-statistics. Quigley, Raphael, and Rosenthal find that their IV results are stronger and more precise. The Malpezzi, Chun, and Green results suggest that the main bias in OLS estimation of house price models with regulation on the right-hand side is related to endogeneity of the regulatory measure; the Quigley, Raphael, and Rosenthal results (and a similar result for Florida cities, found in Ihlandfeldt, 2007) suggest that measurement error might dominate. How this issue shakes out in other markets is a question for future work, and how much it might depend on a superior IV first stage by Quigley, Raphael, and Rosenthal are among the questions it would be interesting to answer. In fact, this suggests a follow-up chapter that brings the determinants of this regulatory stringency to center stage, à la Ortalo-Magné and Prat (2006).

Much remains to be done in this area. Most regulatory stringency measures are one-off designs.[1] Thus, studies are limited to cross-sectional experimental designs or to panel data on house prices, and other variables are related to a single cross-section of regulatory measures. Full cost-benefit analysis of land use regulation would extend the current studies of regulatory effects on house prices, rents, and construction activity to a wider range of possible cost and benefit measures—e.g., commuting patterns, environmental outcomes, and so forth.[2] And to date, most studies of these supply-side issues have focused on housing; extensions to office, retail, industrial, and other nonresidential real estate are naturals.

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1. Many, although not all, measures have been influenced or derived from questionnaires developed by Anita Summers and her Wharton associates (Linneman and Summers; Gyourko, Saiz, and Summers). Even the two surveys fielded by the Wharton teams are not completely compatible. Both survey efforts initially attempted to collect information within, as well as across, metropolitan areas; but despite the substantial effort they made, they found it difficult to collect sufficient information to present reliable within-metro indices. Over the past several years, the U.S. Department of Housing and Urban Development (HUD) has undertaken preliminary planning for a larger, government-sponsored effort collecting regulatory information across a wide range of markets, which could conceivably break through this barrier. As of this writing, it is unclear whether HUD will in fact fully undertake that effort.

2. The point is cogently made in Fischel (1990). See also Peterson (1974) and Malpezzi (1996).

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