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

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Abstract

Land-use regulation is undertaken by units of local government and is notoriously hard to measure. This paper assembles and reports the results of five complementary and overlapping surveys of local regulation in the San Francisco Bay Area. We compile measures derived from surveys of public officials conducted in 1992 and 1998 and another completed in 2007. In addition, we survey the perceptions of regulation among developers and land-use intermediaries. A rich description and comparison of regulatory patterns is provided. The paper also investigates relationships among various measures of regulation and housing outcomes. We find, for example, that the entitlement process increases the cost of a new single family dwelling by almost $23,000 in the Bay Area. Moreover, the requirement of an additional review by governmental agents to gain approval of new developments is associated with a four-percent increase in the prices of existing owner-occupied housing.

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I. Introduction

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

This paper 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 is comprised of nine counties within the eleven-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 eighteen years. First, we utilize data from three independent surveys of building officials in this metropolitan region -- conducted in 1992, 1998, and in 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. Section III introduces the surveys and instruments used to compile information on land-use regulatory processes. Section IV presents descriptive statistics and introduces the indexes of regulation we derive from them. Section V describes relationships among the different measures of regulation and relates these measures to observable outcomes in housing prices and rents.

II. 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 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 ninety percent of the Bay Area's population lives in the latter. Figure 1 indicates the land-use boundaries within the region. For each jurisdiction, we compile information from the surveys of local regulation described in section III below.

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

[1] All data analyzed in this paper 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 website.
[2] Two outlying counties to the south (Santa Cruz and San Benito), included within the federally defined eleven-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.

Figure 1
Cities and Counties of the San Francisco Bay Area

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 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 one hundred 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

[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 (DHCD) to be in full compliance with state housing-element law. A statewide report showing the compliance status of each city and county is *(continued at bottom of next page)*

conditions bedevil measurement of regulatory conditions. Further, since 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, Hood 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 decisionmaking 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 graphics which follow depict these conditions and place them into national context. Figures 2 and 3, based upon the Census

regularly updated and made downloadable via DHCD's website at http://www.hcd.ca.gov/hpd/hrc/plan/he/status.pdf.

[4] California Public Resources Code, §21000 et seq.

Public Use Micro Samples for 1990 and 2000, show that California jurisdictions adopting greater numbers of growth-control measures tend to have higher house prices and rent levels (Quigley and Raphael, 2004). Figure 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 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 which 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 facts and subjective perceptions. Purposes may include maintenance of fiscal balance, prevention of amenities, maximization of private land values, preservation of neighborhood aesthetics, and even certain forms of social exclusionism.

Our analytical approach described below 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 towards 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 upon the measurement of regulation utilizing a multifaceted strategy, incorporating the experiences

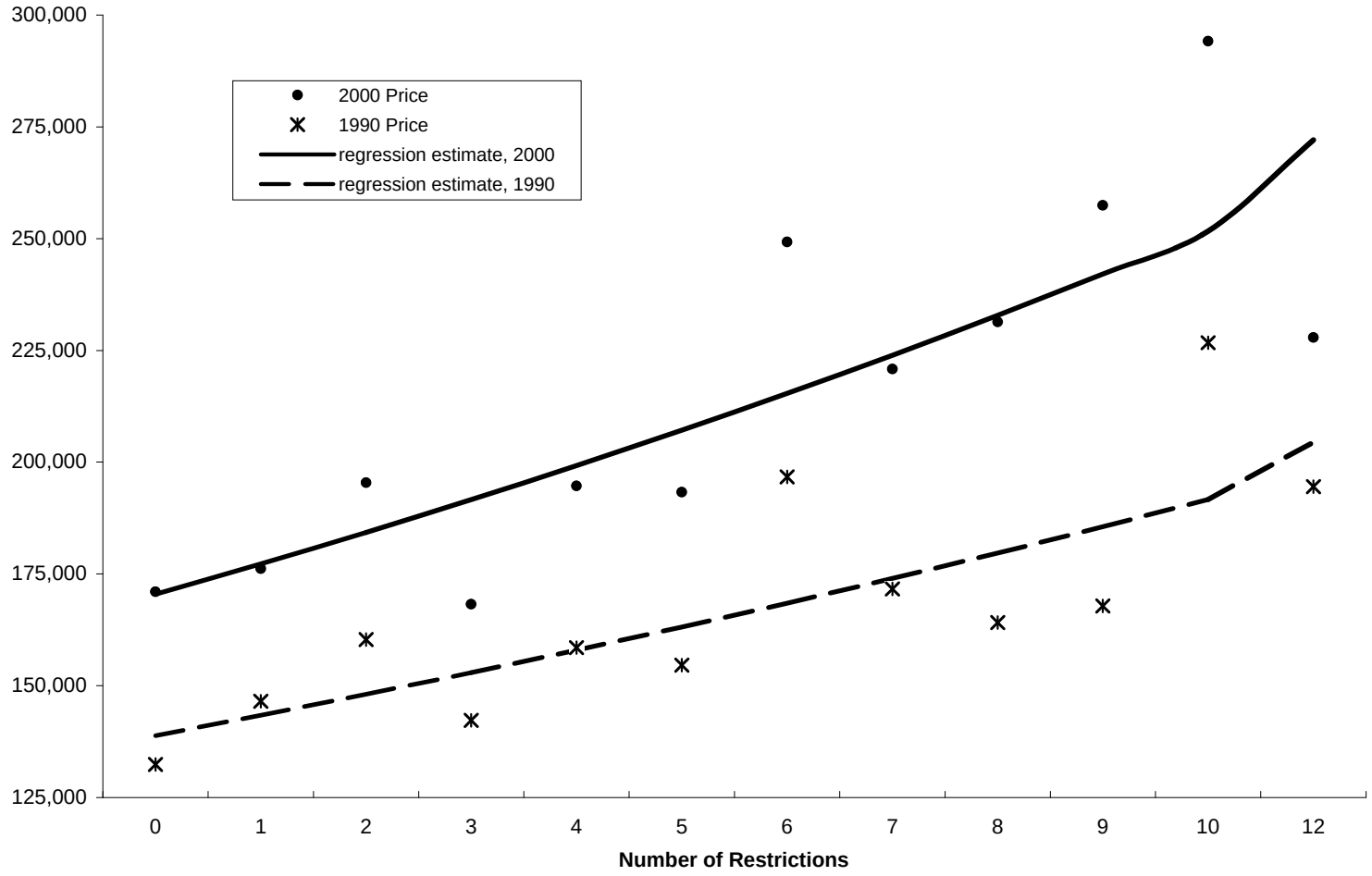
[5] California Government Code, §65920 et seq.
[6] For further discussion on the imposition of stringent land controls, see, e.g., Quigley and Rosenthal (2005), Pogodzinski (1995), Rolleston (1987), Fischel (1985), and Mills and Oates (1975).

of those working in the regulated sector, and then to evaluate how well observed levels of restrictiveness correlate with prices and rents.

III. The Survey Instruments

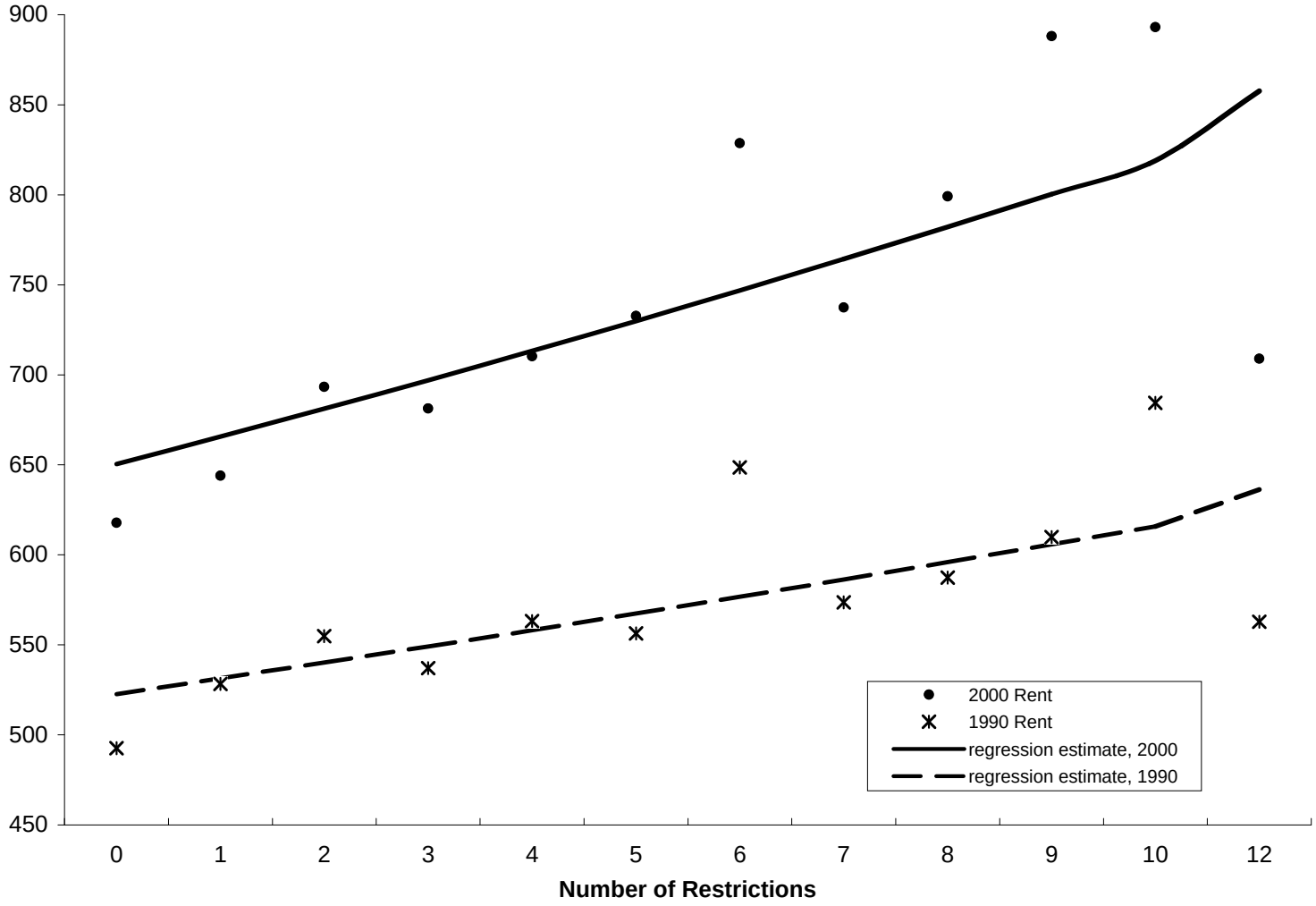
Data on land-use regulation typically focuses on enactments by category, frequency, and timing; this approach has clear shortcomings. Indeed, the enactment of rules may reflect concurrent political conditions in some very general way. But the rules may reveal little about how the business of regulation is actually conducted. One city may have twenty quite restrictive-looking enactments which 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.

Figure 2
California Home Values and Number of Growth-Restricting Measures
1990 and 2000



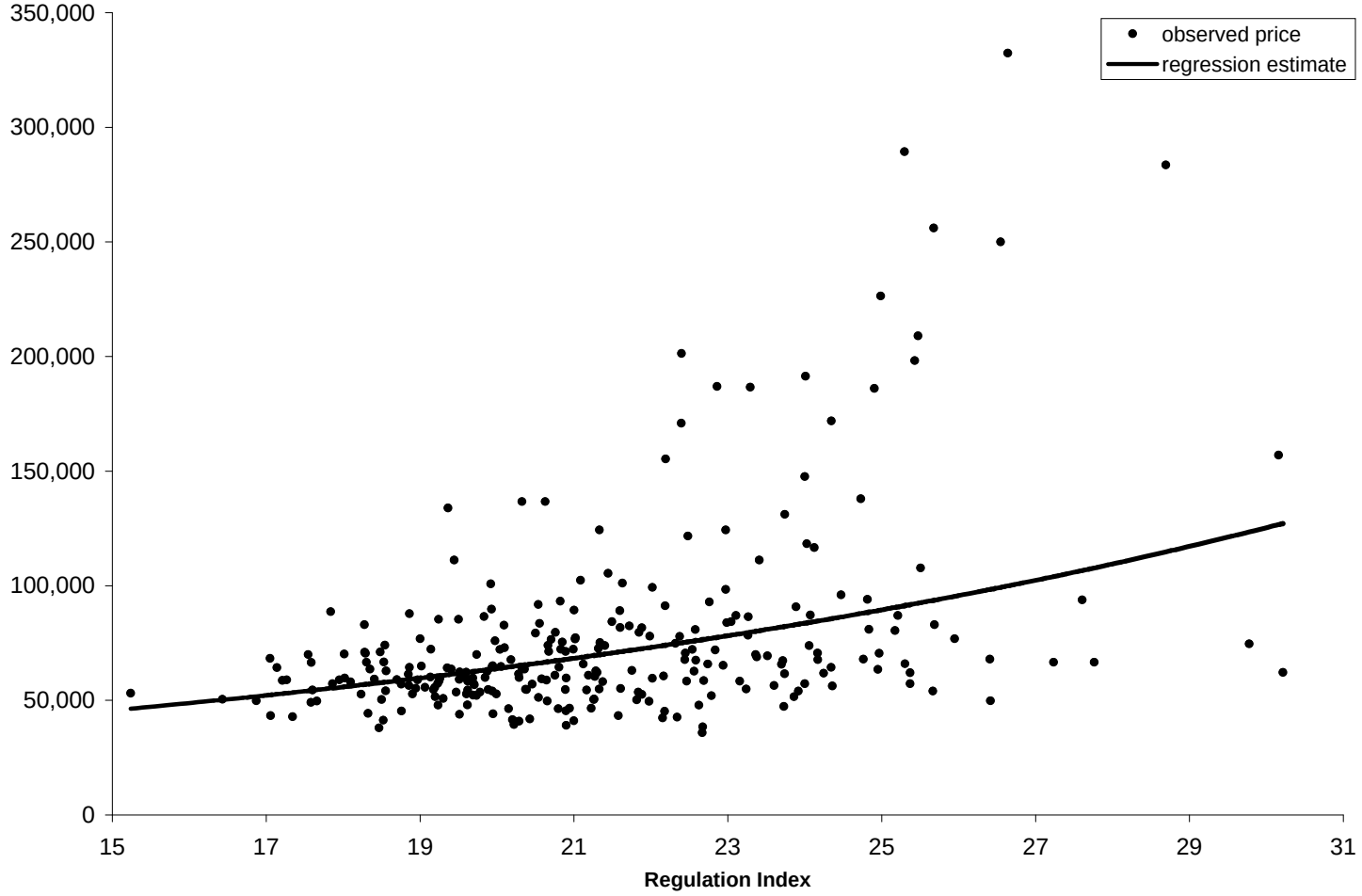
Source: Quigley and Raphael, 2004.

Figure 3
California Rents and Number of Growth-Restricting Measures
1990 and 2000



Source: Quigley and Raphael, 2004.

Figure 4
Housing Prices and Regulation, US Metropolitan Areas
1990



Source: Stephen Malpezzi, personal communication.

The first survey of growth control measures in California we draw upon was undertaken by Glickfield and Levine (G&L) 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 G&L 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 on-line 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 one thousand firms representing developers, builders, and the construction trades.

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

[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 (Malpezzi, 1996; Malpezzi and Green, 1996; Green, Malpezzi, and Mayo, 2005) 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 U.S. (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.

Our builder survey yielded information on sixty-two projects in thirty-three jurisdictions in the San Francisco Bay Area.

Finally, we undertook an additional on-line 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 twenty-seven projects in fourteen different jurisdictions. The survey of CEQA consultants excluded BAC/NAEP members who work solely as employees or as contractors to the local governments surveyed in our poll of building officials.

IV. Survey Results

A. The G&L and the HCD Surveys

The G&L 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: *growth control* (e.g., limits on residential permits, restrictions on annexation); *growth management* (e.g., adequate public facilities ordinances, urban limit lines); *zoning changes* (e.g., up- and down-zoning, prescribed floor-area ratios), and *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 decade of 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 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]

B. 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 upon the Summers/Wharton survey and then adapted for California, is available online (at http://urbanpolicy.berkeley.edu).

1. The BLURI Index and Its Components

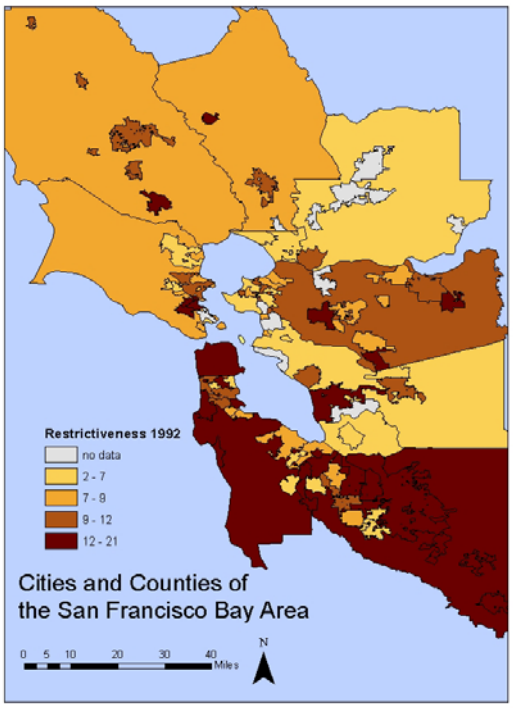
Using the responses to the 2007 survey, we develop an index, the *Berkeley Land Use Regulation Index* (BLURI), comprising ten separate measures of distinct aspects of local practice: political influence; project approvals; zoning change; development caps; density restrictions; open space requirements; infrastructure improvement obligations; inclusionary housing; project approval delays; and permit approval rates. Some key components of the BLURI are noted below, together with details on their calculation.[10]

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

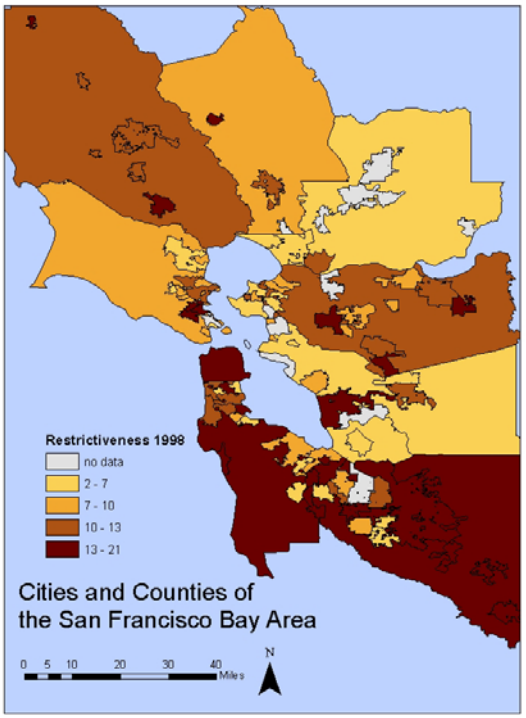
[10] More extensive analyses, as well as histograms of each component, are reported in a longer narrative downloadable via http://urbanpolicy.berkeley.edu. In the text here, we report upon indexes of political influence, project approvals, zoning change and caps on units and densities. Appendix Tables A2, A3, and A4 then provide information on the indexes describing open space dedications, infrastructure obligations, inclusionary housing, and permit delays and approval rates.

Figure 5
Indexes of Growth Management
for the San Francisco Bay Area

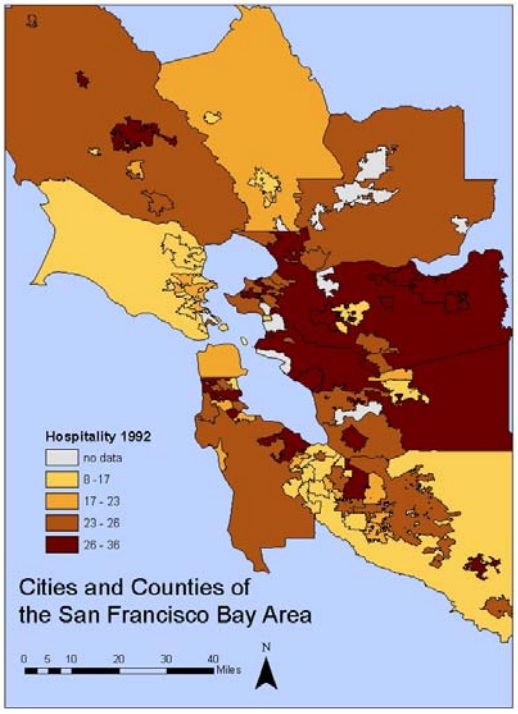
A. Restrictiveness Index, 1992



B. Restrictiveness Index, 1998



C. Hospitality Index, 1992



a. 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 1 summarize the responses to these questions for the Bay Area governments and reports 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.

b. 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

Table 1
BLURI: Political Influence Index
(Observations in 86 Bay Area Jurisdictions)

Involvement in Residential Development	Mean	Std. Dev.
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

Scores range from 1="not involved,"5="very involved."

Table 1 (cont.)
BLURI: Political Influence Index
(Observations in 86 Bay Area Jurisdictions)

Factors Affecting Development of Single-family Housing	Mean	Std. Dev.
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

Scores here and below range from 1="not important" to 5="very important."

Factors Affecting Development of Multifamily Housing	Mean	Std. Dev.
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**

department, fire department, health department, parking or transportation authority, a provision of the California Environmental Quality Act, a growth management analysis, or

some other procedure. The index is constructed as the sum of eleven 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 2 reports the kinds of reviews and their frequencies across Bay Area jurisdictions for both the Project Approval and Zoning Change Indexes. The table also summarizes each of the parallel indexes generated.

c. 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 3 reports the frequencies of responses concerning items underlying both the Development Caps and Density Restrictions Indexes.

Table 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	**Std. Dev.**
Project Approval Index Score	5.01	2.13
Zoning Change Index Score	5.74	2.41

2. Combining the Subindexes

For the analysis of regulatory impact, we develop a single indicator, the BLURI index, summarizing restrictiveness in each Bay Area jurisdiction. The ten subindexes

described here and in the appendix are combined by standardization and aggregation. Each component is normalized to a mean of zero and standard deviation of one, so that

Table 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	Std. Dev.
Development Caps Index Score	0.59	1.26
Density Restrictions Index Score	1.69	1.34

different metrics are accorded equal weight in aggregation. Two techniques are used to aggregate the ten components: a simple summation and a factor extraction. Standard principal-components analysis, applied to the ten 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 ten indexes and the sum of the subindexes is 0.79. Appendix Table A1 reports factor loadings and

correlations between the ten subindexes and the composite BLURI level. Table 4 reports the correlations among the values of the ten standardized subindexes and two BLURI Indexes constructed from the underlying data.[11]

A scatterplot of the factor scores and the sum of the standardized values of the ten subindexes is shown in Figure 6. Remarkably, the complexity of the ten underlying measurements can be summarized very well by either a single factor or by the sum of the underlying subindexes. Figure 7 reports the two BLURI indexes of land-use restrictiveness in the San Francisco Bay Area.

C. 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. 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: the total time for the completion of the permit-review process; the all-inclusive cost of securing the entitlement; and 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

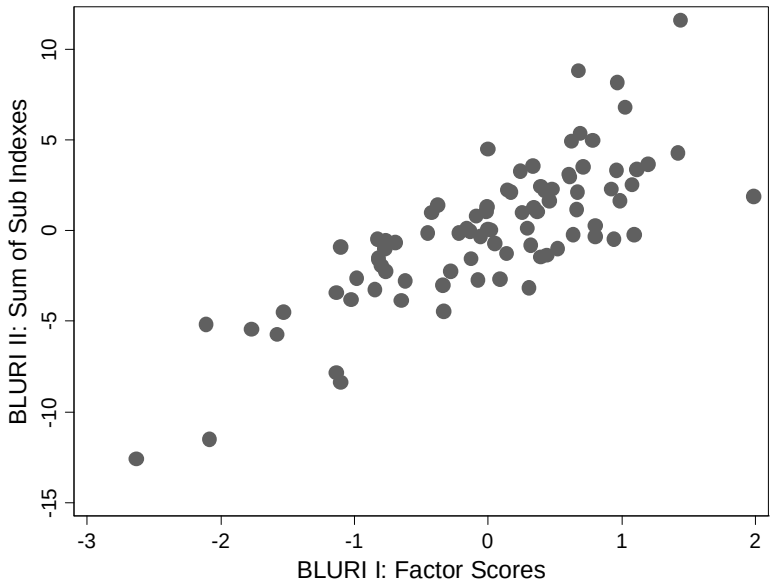
[11] We impute missing data points when aggregating the subindexes; otherwise, missing data for one component value would make the values of the other subindexes unusable. Data were missing from one jurisdiction for the Project Approval Index, 15 jurisdictions for the Approval Delay Index and 20 jurisdictions 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.

Table 4
Correlation Matrix of BLURI Subindexes and BLURI Values

	Political Influence	Project Approve	Zoning Changes	Dev. Caps	Density	Open Space	Infras. Improve	Inc. Hsg.	Apprv. Delays	Rate of Apprv.	BLURI Index I	BLURI Index II
Political Influence	1.00											
Project Approvals	0.11	1.00										
Zoning Changes	0.06	0.72	1.00									
Dev. 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						
Infras. Improve	-0.04	0.07	0.09	0.02	0.10	0.19	1.00					
Inc. Hsg.	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 Index I	0.23	0.87	0.90	0.26	0.23	0.36	0.14	0.23	0.22	-0.37	1.00	
BLURI Index 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

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

Figure 6
Scatterplot: BLURI Factor Scores by Raw Sum of Indexes
(n=86)

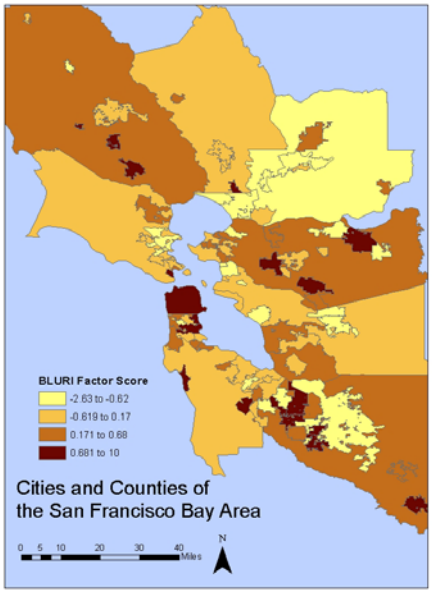


to questions about project characteristics, such as the type of development and the number of units, two sets of questions were asked about the environmental aspects of the process. The first set of items identified total cost, time, and related components of local review. Consultants responding to the 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 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

Figure 7
Berkeley Land Use Regulation Index for San Francisco Bay Area

A. BLURI Index I (Weighted Factor Score)



B. BLURI Index II (Simple Sum)

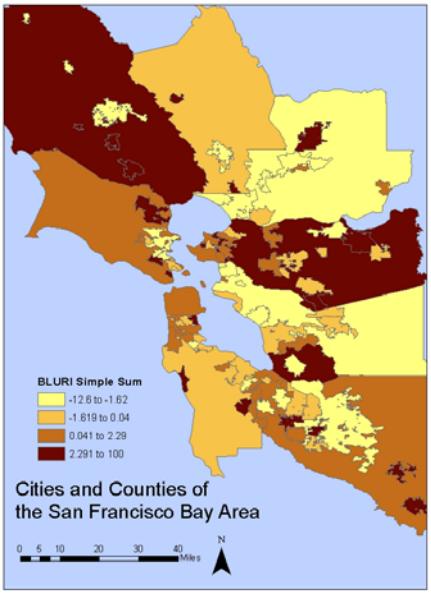


Table 5
Selected Project Level Indicators by Product Type,
Survey of Developers

	Single-Family Homes (37 projects)		Attached, Mixed Use, and Planned Unit (25 projects)	
Indicator	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Number of Units	121	173	331	219
Controversy Level (1 to 3)	1.57	0.55	2.04	0.89
Entitlement Risk (1 to 5)	2.70	0.91	3.08	1.15
Number of Special Permits	2.03	1.40	2.60	1.47
Entitlement Cost (millions of $)	1.31	1.88	2.34	3.34
Entitlement Cost per Unit ($)	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

housing in our sample involved fewer units – 121 units on average versus 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 almost two–and-a-half years, compared to delays of about two years for non-single-family construction.[13]

Table 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 ten percent more per dwelling unit

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

produced. On average, more controversial projects took twenty-five percent longer – about six months – to receive permission to build.

Table 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**	**Std. Dev.**	**Mean**	**Std. Dev.**
Number of Units	175	184	227	239
Entitlement Risk (1 to 5)	2.31	0.93	3.25	0.91
Number of Special Permits	1.65	1.02	2.69	1.56
Entitlement Cost (millions of $)	1.41	2.01	1.98	2.98
Entitlement Cost per Unit ($)	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

Tables 7 and 8 present results from our survey of environmental professionals. Table 7 indicates that non-single-family projects tend to be much larger, averaging 271 units (nearly two hundred 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, though it is only about five percent less than for multifamily and other housing.

[13] These averages, and those in the two following tables described here, 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.

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 had an average delay of 2.6, while the average delay for non-single-family projects was 2.9. On the same 1 to 4 scale, developers of single-family projects were required to undertake a very similar level of environmental mitigation, rating an average of 2.5, while 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 while multifamily and mixed-use projects took only 1.9 years. The costs for environmental review averaged $8,000 for each single-family unit built, compared to $3,000 for multifamily and mixed-use development.

Table 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 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,

Table 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**	**Std. Dev.**	**Mean**	**Std. Dev.**
Number of Units	74.46	79.19	270.93	277.88
Controversy Level (1 to 3)	1.69	0.75	2.14	0.66
Entitlement Risk (1 to 5)	2.85	1.14	3.00	0.68
Number of drivers of risk	1.62	1.45	2.79	1.63
Delays (1 to 4)	2.63	1.29	2.93	0.73
Mitigation (1 to 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 8
Selected Project Level Indicators by Level of Controversy,
Survey of Environmental Professionals

	Standard Projects (8 projects)		Mildly Controversial and Pushing the Envelope (19 projects)	
Indicator	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Number of Units	135.38	200.46	193.58	240.24
Entitlement Risk (1 to 5)	2.25	0.89	3.21	0.79
Number of drivers of risk	1.25	1.16	2.63	1.64
Delays (1 to 4)	2.33	1.03	2.95	0.97
Mitigation (1 to 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

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 impacts.

V. 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 housing – using the Public Use Micro Sample (PUMS), for the San Francisco Bay Area from the 2000 Census. The census micro data provides 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 which contain more than one city or which 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 pre-existing 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, our IV estimates are similar to those generated by the OLS models. Finally, to account for unmeasured spatial and civic

factors we include in these models indicator variables identifying jurisdictions which are "coastal" (bordering the San Francisco Bay or Pacific Ocean) and those which are counties governing unincorporated land outside chartered and incorporated California cities.

Table 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 model is identical to that used by Quigley and Raphael (2004, 2005). These regressions are based upon 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 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

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

Table 9
Regulatory Restrictions and the Value of Owner-Occupied Housing*
(dependent variable in logarithms)

	OLS		IV**	
	(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^2	0.38	0.42	0.37	0.40
R^2 first stage			0.18	0.24

Notes:

* All models include dummy variables for ten structure types (e.g., condominium, single-detached), persons per room, and a constant term.

** 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).

measures of jobs and developable land remains statistically significant. The clustered t-ratios are reported in square brackets in the table.

Table 10 reports a comparable analysis based upon 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 reported above, these coefficients are statistically significant when the standard errors are grouped appropriately.

A more detailed analysis of the influence on house prices of individual components of the constructed BLURI measure 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 11 summarizes this relationship. The table reports the results when our earlier price and rent models are re-estimated using the project-approvals subindex (PAI) and the political influence subindex (PI) instead of the broader BLURI index of which they are part. The specification does not appear sensitive to utilizing 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

[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 10
Regulatory Restrictions and Monthly Rents*
(dependent variable in logarithms)

	OLS		IV**	
	(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^2	0.15	0.17	0.10	0.10
R^2 first stage			0.17	0.19

Notes:

* All models include dummy variables for ten structure types (e.g., condominium, single-detached), persons per room, and a constant term.

** 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).

Table 11
Project Approvals Index, Political Influence Index and House Values*
(dependent variable in logarithms)

	OLS		IV**	
	(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:

* All specifications are the same as those reported in Tables 9 and 10. Columns (2) and (4) include the variables measuring growth in basic jobs and the amount of developable land.

** 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).

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 four percent. In terms of relative magnitudes, the PAI index reported in Table 2 has a mean of 5 reviews and a standard deviation of 2.13.

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

VI. Conclusion

This paper presents a description of land-use regulation in the San Francisco Bay Area, a region containing more than a hundred 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 to project completion, and greater uncertainty about the elapsed time to completion of residential developments.

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 eight-percent increase in the average prices of single-family housing in the existing stock. Regulation clearly seems profitable to the owners of existing housing.

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

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Appendix Table A1
Factor Loadings and Correlations
between Subindexes and BLURI Index 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 Delays	0.195	0.223
Rate of Approvals	-0.319	-0.366

Appendix Table A2
BLURI: Open Space, Infrastructure Improvement & 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	Std. Dev.
Open Space Index Score	0.71	0.32
Infrastructure Improvements Index Score	0.75	0.23
Inclusionary Housing Index Score	0.64	0.32

Appendix Table A3
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	**Std. Dev.**
Approval Delay Index Score	12.66	7.32

Appendix Table A4
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	**Std. Dev.**
Rate of Approval Index Score	0.74	0.30