Title

Growth Management Revisited: A Reassessment of its Efficacy, Price Effects, and Impacts on Metropolitan Growth Patterns

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John D. Landis, Lan Deng, and Michael Reilly

Once a favorite topic of urban economists and land use planners, local growth control and growth management (LGC&M) programs have become passé, swept off the front pages of professional and academic journals alike by more current topics like smart growth and sprawl. Smart growth, with its emphasis on bottom-up, locally appropriate, and proactive planning is *in*, while growth management, with its reputation for top-down planning and blunt regulation is *out*. In reality, of course, smart growth is simply the newest adaptation of growth management (which is itself an adaptation of growth control), albeit with a more incentive- and project-based focus. Likewise, controlling sprawl has long been growth management's principal spatial objective. Thus, how well past and ongoing efforts at growth management programs have succeeded in meeting their objectives should be of prime concern to today's advocates of smart growth.

Outside the immediate visage of regional policy analysts and smart growth boosters, the LGC&M movement remains extremely active, especially at the ballot box and especially in California (Baldassare 2001). A 15-year analysis by Fulton et al. (2000) shows LGC&M activity to be strongly correlated with state and regional growth rates—rising during expansionary periods such as the late-1980s and late-1990s, and falling during slowdown periods such as the early-1990s. Although exact numbers are hard to come by, we estimate that about three-quarters of California cities and two-thirds of California counties have adopted some form of LGC&M program since 1980.

Their continuing popularity notwithstanding, many questions remain about the efficacy and effects of LGC&M programs. Four are of particular interest.

1. To what extent do different LGC&M approaches really restrict the amount, pace, or location of growth?
2. To what extent are the resulting supply restrictions reflected in local real estate prices, especially housing prices?
3. Which LGC&M programs and approaches yield their promised benefits and which do not?
4. Do LGC&M programs cause growth to be systematically displaced from more restrictive to less restrictive communities, leading to such negative outcomes as sprawl and wasteful commuting?

Using California as its lens, this paper focuses on these unresolved questions. In no other US state is growth as tightly managed at the local level as California. Likewise, in no other state is there such a diversity of local growth management approaches and experiences. From a research perspective, because California lacks a statewide growth management framework, the effectiveness or ineffectiveness of growth management can be traced back to its local implementation.

The remainder of this paper is organized into five sections. The next section reviews recent theoretical and empirical research into the use and efficacy of LGC&M programs. The following section develops an updated taxonomy of growth management and growth control measures, paying special attention to the circumstances under which such measures are likely to affect housing supplies. Section III considers the question of efficacy by comparing pre- and post-control building permit volumes between specific growth-managed communities and carefully selected sets of comparison or peer communities. Section IV uses GIS and cross-sectional regression analysis to identify empirical relationships between LGC&M programs, housing production shortfalls, and local housing prices. Section V extends the peer-based comparison analysis to consider some of the potential benefits of growth management. The final section looks at the spatial displacement effects of LGC&M programs.

I. RECENT RESEARCH

LGC&M research activity cooled during the 1990s compared to prior decades. Yet it is quality, not quantity, that ultimately matters, and recent research efforts have generally been more comprehensive and nuanced than previous studies. This section summarizes the recent LGC&M literature, focusing on issues of program effectiveness, motivation, and regional spillovers.

Motivations for Adopting Controls: Do local decisions to adopt LGC&M measures really reflect heartfelt anxieties over growth, or are they simply attempts by existing homeowners to maximize housing and property values? Planners and political scientists, largely working from survey data, tend to see them as the former. In two separate analyses of the LGC&M measures in California, Glickfeld and Levine (1992) and Levine (1999) concluded that the principle causal factor behind the adoption of LGC&M measures was rate of regional population growth. Economists, especially William Fischel (1990, 2001), observing that LGC&M measures are disproportionately adopted by upper-income communities, tend to see them as examples of purposeful rent-seeking. Brueckner (1998) found that many LGC&M cities pursue a sort of "prisoner's dilemma" pattern of thinking in following their neighbors in adopting controls. More recently, an analysis by Lewis and Neiman (2002) found the popularity of local growth management policies among California cities to be correlated with higher levels of homeownership, higher percentages of Hispanic residents, less transient populations, and the availability of sewer service. Even after accounting for these and other factors, LGC&M use was found to be far more prevalent in the San Francisco Bay Area than elsewhere in the state.

Control Effectiveness: How effective are LGC&M programs at controlling growth? Other than studies of Portland's urban growth boundary, the recent literature in this area is surprisingly sparse. In a comparison of seven mid-size growth control cities in California with similar non-controlled cities, Landis (1992) found that the principal effect of local controls was to even out rates of development over time, reducing building activity during boom years and redistributing it to otherwise lean years. In a more recent and comprehensive econometric study, also focused in California, Levine (1999) found that LGC&M measures had significantly reduced new housing construction in the communities that had adopted them, and had significantly displaced multi-family housing construction outward, adding to overall sprawl pressures.

On a national level, a recent analysis by Mayer and Somerville (2000) of housing construction in 44 US metropolitan areas between 1985 and 1996 found that housing starts were 45 percent lower in metropolitan areas dominated by jurisdictions with more stringent land use controls. Supply effects varied by the type of regulation: direct cost measures such as development fees had little effect on supply levels, while measures that lengthened the approvals process or made it more complex reduced new construction activity. Mayer and Somerville's findings are consistent with Staley's argument (2001) that the increased uncertainty and transactions costs associated with LGC&M regulations function to discourage new housing investment. In an analysis of construction activity in 63 Ohio cities between 1980 and 1994, Staley found that subjecting rezoning decisions to public vote—an especially unpredictable

LGC&M approach—reduced new housing construction activity, irrespective of whether particular rezoning requests were approved or rejected.

Housing Price & Equity Effects: Numerous studies conducted during the 1980s quantified the adverse housing price effects of LGC&M measures (see Lillydahl and Singell 1987 and Downs 1991 for reviews of such studies). Two recent national studies (Mayer and Somerville 2000, Landis and Elmer 2002) confirm the determining relationship between housing construction activity and housing prices.

Other studies have broadened our understanding of the relationship between LGC&M programs and housing prices. Several authors have argued that at least some of the increase in housing prices attributed to LGC&M programs should more properly be counted as an increased willingness to pay for living in an attractive, well-managed community (Navarro and Carson 1991, Bruecker 1998). Exactly where the dividing line might lie between housing price increases due to improved amenities versus supply shortages is not clear. Nelson (2000), for example, attributes recent increases in the price of housing in the Portland region to improved amenities and development quality rather than to that region's well-known urban growth boundary.

Still other studies (Landis 1992, Shen 1996) note that the local housing price effects of LGC&M programs depend on what happens elsewhere in the market. If neighboring and otherwise similar communities are willing to accommodate the housing demand displaced from LGC&M communities, the total housing price effect may be quite modest.

To what extent are those priced out of local housing markets by LGC&M programs more likely to be poor or minorities? (To prevent precisely this outcome, many communities exempt affordable housing projects from some or all LGC&M requirements.) In a recent national study comparing local land use regulations, housing production, and community economic and demographic characteristics, Pendall (2000) found strong correlations between building cap programs and large-lot zoning, reduced rental housing construction, and lowered proportions of Black and Hispanic residents. Other LGC&M programs, including urban growth boundaries, adequate public facilities ordinances, and temporary building moratoria were not found to affect rental housing construction or racial composition.

Quality of Life: To what extent do LGC&M programs actually succeed in preventing a further deterioration in community services and quality of life—the argument most commonly given in favor of their adoption? Beyond case studies describing Portland's use of its urban growth boundary to successfully protect farmland at the metropolitan fringe, the literature in this area is fairly sparse. A theoretical analysis by Ding et al. (1999) using a mono-centric model of urban growth demonstrated that coordinating policies limiting outward metropolitan expansion with those favoring infill development and increased urban infrastructure investment could conceivably lead to a higher level of social welfare than a more *laissez-faire* approach.

Empirical tests of this question are hampered by problems of causality. Because, as noted previously, wealthy communities are more likely to adopt LGC&M measures than poorer ones, it's hard to determine whether the higher quality of life in such communities is due to controls versus income. Landis (1992), in the previously cited study, found that a sample of seven

LGC&M communities out-performed their respective uncontrolled counterparts with respect to fiscal health. In a side by side comparison of the Atlanta and Portland metropolitan areas, Nelson (2000) attributed the latter's ability to maintain (and in some cases improve) its quality of life characteristics to the regional urban growth boundary.

A related issue concerns the degree to which LGC&M communities can successfully insulate themselves from regional growth pressures. Levinson's evaluation (1997) of Montgomery County, Maryland's very stringent adequate public facilities ordinance (APFO) and travel demand management programs suggest that they have not been very effective either in matching the provision of transportation infrastructure to private development, or in changing traveler behavior to reduce trip lengths and congestion. Levinson blames this failure on the tendency to proscribe particular regulatory solutions rather than using pricing strategies such as impact and congestion fees.

Spillover Effects: Growth is like toothpaste. Squeezed out of one location, it must go somewhere else. Thus, the question is not whether growth spillover occurs. It does; where does it go? The short answer, as reported by Fischel (1990), Wachter and Cho (1991), and Altshuler and Gomez-Ibañez (1993), is from more-controlled to less-controlled communities. A more detailed answer, as provided by Shen (1996) in a study of the Bay Area, and Pendall (1999) in a national analysis, is from wealthier communities to less wealthy ones. Pendall's research also suggests that displacement effects vary by type of control: APFOs and development fees did not displace growth and in some cases, encouraged more compact growth forms. Low-density zoning and building permit caps, by contrast, contributed to sprawl by displacing growth outward.

Most recently, in a far ranging and comprehensive analysis of LGC&M programs in 490 California jurisdictions, Levine (1999) found that measures which either removed land from development or reduced development intensities served to displace both ownership and rental housing to less-controlled jurisdictions. Indeed, Levine estimated that fully one-third of the rental housing constructed in California during the 1980s was displaced from a controlled to uncontrolled community. APFOs and urban limit lines, on the other hand, did not appear to significantly shift development between communities. Looking deeper, Levine attributes the increasing suburbanization of low-income and minority populations in California to the outward displacement of rental housing and affordable ownership housing. Lastly, in a study of policy asymmetry, Levine found the cumulative effects of pro-development policies aimed at increasing supplies of affordable and market-rate housing to be far weaker than the effects of slow-growth policies.

II. LGC&M TRENDS IN CALIFORNIA

Multiple Taxonomies

California cities and counties have more than two dozen different regulatory programs at their disposal for regulating growth and development (Schiffman 1995). As Figure 1 shows, these programs can be classified multiple ways:

- **By policy object.** While a few LGC&M programs such as zoning and environmental impact assessment are directed at multiple aspects of the development process, most are narrower in both scope and use. Urban growth boundaries, annexation limits, and sphere-of-influence adjustment procedures, for example, are all directed toward regulating the supply of land available for development. The object of housing and commercial space caps, on the other hand, is principally to limit the supply of buildings—thereby limiting the impacts of the activities that use buildings. The purpose of development impact fees and adequate public facilities ordinances (APFOs) is to minimize development's fiscal and public service impacts, just as the purpose of linkage fees, inclusionary zoning, farmland protection ordinances and many types of environmental regulations is to minimize development's fiscal, social, and environmental side effects.

  The popularity of broad-brush versus narrower approaches waxes and wanes. Broad-brush approaches such as planned unit development gained popularity in the 1960s because of their promise of combining comprehensiveness with flexibility. Narrower and more focused approaches emerged in the 1970s and 1980s when the promise of more comprehensive approaches went unfulfilled. Recent attempts to promote state and regional growth management and smart growth initiatives may herald a re-emergence of more broad-brush approaches.

- **Spatially comprehensive vs. special purpose/limited-scope approaches.** Kelley (1993) distinguishes between comprehensive regulatory approaches such as zoning and subdivision controls, which apply everywhere in a community, and special purpose/limited scope approaches, which apply in select locations, under specific circumstances, or are intended to achieve specific outcomes. All California cities and counties are required by state law to have valid general plans, zoning ordinances, and subdivision regulations. Beyond this traditional troika of comprehensive approaches, jurisdictions may at their option also adopt more specialized approaches such as growth caps, environmental zoning ordinances, adequate public facilities ordinances, farmland preservation laws, transfer of development rights, and many more. Indeed, as noted in several early summaries of growth management (Urban Land Institute 1975, Porter 1986), California jurisdictions spearheaded the national trend away from comprehensive approaches and toward more specialized ones.

Figure 1: Characteristics of Local Growth Control & Management Programs in California

Implementation Tool	Policy Object	Comprehensive vs. Limited Scope	Development Control vs. Impact Mitigation	Formal vs. Ad hoc	Typical Method of Enactment
Traditional zoning	Land supply, land use & building intensity	Comprehensive	Development limitations	Depends on ease of re-zoning	Ordinance
Subdivision regulations	Lot quality	Comprehensive	Development limitations	Formal	Ordinance
Environmental assessment & review	Development intensity	Comprehensive	Both	Ad hoc	State statute
Infrastructure financing districts	Public service costs	Limited scope	Mitgation	Formal	Ordinance/referendum
Development impact fees	Public service cost externalities	Limited scope	Mitigation	Formal	Ordinance
Conditional use permit	Land and building quality	Limited scope	Both	Ad hoc	Policy
Specific & area plans	All aspects of development	Limited scope	Both	Formal	Ordinance
Planned unit development	All aspects of development	Limited scope	Both	Formal designation/ad hoc requirements	Ordinance & subsequent rezoning
Adequate Public Facilities Ordinances	Public cost externalities	Both or either	Mitigation	Formal	Ordinance
Development agreements	Land supply & building intensity	Limited scope	Both	Ad hoc	Policy
Environmental zoning	Environmental externalities	Limited scope	Development limitations	Mostly formal	Ordinance
Urban service boundary	Land & building supply	Comprehensive	Development limitations	Formal	Ordinance/initiative
Urban limit line/Growth boundary	Land & building supply, public service costs	Comprehensive	Development limitations	Formal	Ordinance/initiative
Annual population or housing cap	Building supply	Comprehensive	Primarily development limitations	Formal	Ordinance/initiative
Annual commercial space cap	Building supply	Limited scope	Primarily development limitations	Formal	Ordinance/initiative
Annexation limits	Land supply	Comprehensive	Development limitations	Formal & ad hoc	Ordinance/initiative/policy
Sphere-of-Influence boundary adjustments	Land supply	Limited scope	Development limitations	Formal & ad hoc	Initiative/policy
Development exactions	Public service costs	Limited scope	Mitigation	Ad hoc	Ordinance/policy
Linkage fees	Public service cost externalities	Limited scope	Mitigation	Formal	Ordinance/policy
Agricultural land preservation contracts	Farmland preservation	Limited scope	Development limitations	Formal	State statute/local policy
Inclusionary zoning	Private externalities	Limited scope	Mitigation	Formal	Local policy
Transfer of development rights	Building quality (intensity)	Limited scope	Development limitations	Formal	Ordinance/Local policy
Purchase of development rights	Public service quality (open space)	Limited scope	Development limitations	Ad hoc	Ordinance/Local policy
Conservation Easements	Public service quality (open space)	Limited scope	Development limitations	Ad hoc	Ordinance/Local policy
Land Trusts	Private & public benefits	Limited scope	Mitigation	Ad hoc	Ordinance/Local policy

- **Development control vs. impact mitigation.** The nation's first zoning ordinances were enacted to limit development densities and separate incompatible uses (Scott 1971). Soon thereafter, as zoning practices advanced, planners started specifying appropriate locations for future development so as to be consistent with local comprehensive plans. More recent LGC&M approaches function as add-ons to these traditional approaches by specifying the extent to which private property owners may generate adverse spillover impacts, and the degree to which those impacts must be mitigated. Starting with congested public facilities in the 1970s, the list of adverse development impacts to be mitigated has expanded to now include habitat, traffic congestion, open space, affordable housing, noise, and visual blight, among others.

- **Formal vs. ad hoc programs.** Most LGC&M programs are *formal*—their use, rules, procedures, criteria, specifications, and exceptions are codified into law and must be implemented as such. Review procedures are relatively standardized and, to the degree they allow legislative or administrative discretion, are either limited or else subject to the issuance of formal findings. A smaller but not insignificant number of LGC&M programs are more *ad hoc*. Review procedures are more flexible and are less bound by rules and substantive criteria or by formal findings. Outcomes can be negotiated rather than specified. Some LGC&M programs fall into both camps. They include some standardized review procedures but also allow for considerable discretion.

- **By method of enactment.** Prior to 1970, most local land use controls were enacted by ordinance, usually in response to state requirements. Beginning with Livermore in 1972 and Petaluma in 1974, the impetus behind LGC&M programs shifted to the local level. More and more, local growth control ordinances were adopted in response to local growth issues. The success of Proposition 13 in 1978, however, demonstrated the power of savvy grassroots organizations to sidestep the legislative process and effect political change directly via citizen initiative. Over time, the forum for framing and debating LGC&M programs has shifted away from city council chambers and toward supermarkets and other locations where voter signatures are collected. Today, even when LGC&M programs are enacted by ordinance, it is often in response to, or out of fear of, a nascent initiative.

- **By degree of stringency.** All land use regulations limit development to some extent—the issue is how much. Regulations that limit the locations and impacts of development are sometimes termed *growth management*. By contrast, regulations that limit the amount and/or flow of development well below market levels are known as *growth controls* (Landis 1992). In practice, the distinction between growth control and growth management is much less clear. As Glickfeld and Levine (1992) first observed, most California jurisdictions employ multiple approaches, often mixing growth control and growth management programs. Generally speaking, the more LGC&M programs in place, the greater their cumulative stringency. Because of fear of lawsuits, formal and comprehensive programs tend to be less individually stringent than ad hoc and more narrowly-focused approaches.

LGC&M Trends

Every city and county in California regulates growth and development in a different way. Multiply the 20+ LGC&M programs available to local governments in California by the state's 500+ cities and counties and one begins to get a sense of the immense complexity of California's LGC&M landscape and the difficulties of characterizing it. Several surveys have been administered to help in this effort, two by Glickfeld and Levine (1992) and one by the California Department of Housing and Community Development (2001). Figures 2 and 3 synthesize the results of those surveys

Among growth control measures, annual housing caps enjoy the most widespread popularity, with more than 120 cities and counties having adopted them in some form since 1970 (Figure 2a). Enacted in the 1970s and 1980s to deal with problems of over-burdened public facilities, today, housing caps are often seen as an effective means for preserving open space and combating sprawl. Annual limitations on commercial development are far less popular, as are permanent restrictions on annexation. The latter, however, have recently been gaining in popularity as a grassroots approach to limiting sprawl.

The most common approach to managing growth in California is also the oldest: restricting building height and bulk. Since 1970, nearly two-thirds of California cities and counties have substantially cutback on allowable building heights and massing (Figure 2b). Taking a related approach, more than 175 California jurisdictions have embarked on some form of comprehensive down-zoning initiative. (On the flip side, more than fifty California cities have engaged in some form of area-wide up-zoning, usually to promote commercial development.) Residential adequate public facilities ordinances (APFOs) are also extremely popular, as are commercial APFOs. Led by San Diego and San Jose in the 1970s, quite a few California city councils adopted urban service boundaries and urban limit lines—lines beyond which urban services would not be provided until sites planned for development and inside the line had been built-out. More recent boundary limitation efforts have generally taken the form of initiative-based urban growth boundaries, in which all urban-scale development outside the boundary is effectively prohibited.

Patterns of Use

In terms of absolute numbers, LGC&M programs are more popular among mid-sized cities than among large or small cities, and more popular in Northern California than elsewhere in the state. Fast-growing Bay Area cities in particular are more likely to adopt some form of growth control or management program, often by initiative, and often in combination.

In relative terms, however—that is, compared to the total number of jurisdictions in a particular category—patterns of LGC&M use are different (Figure 3). Relative to the total number of jurisdictions, annual housing caps are actually less popular in the Bay Area and

Figure 2a:
Growth Control Measures Adopted by California Cities and Counties: 1980 - 1998

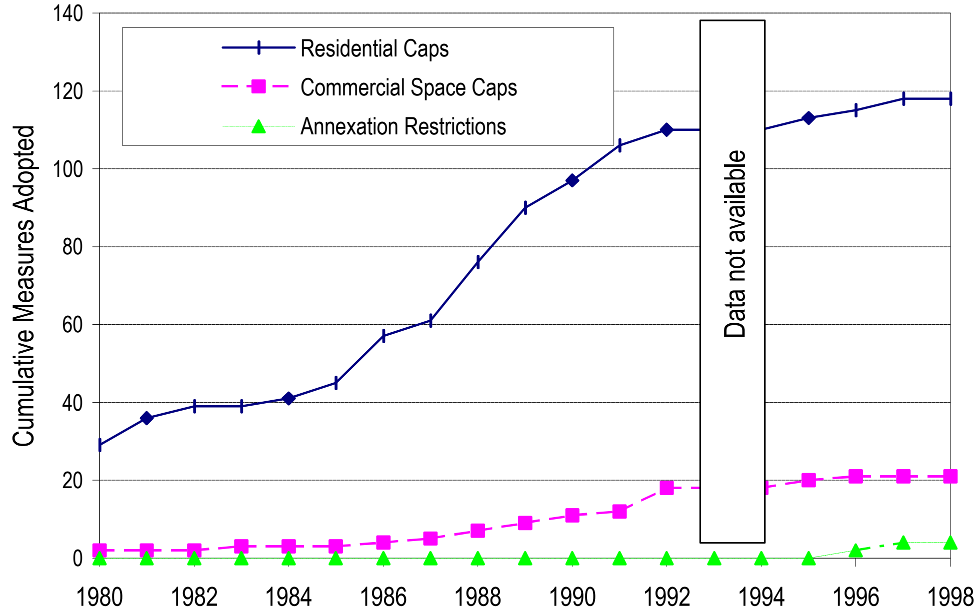

Figure 2b:
Growth Management Measures Adopted by California Cities and Counties: 1980 - 1998

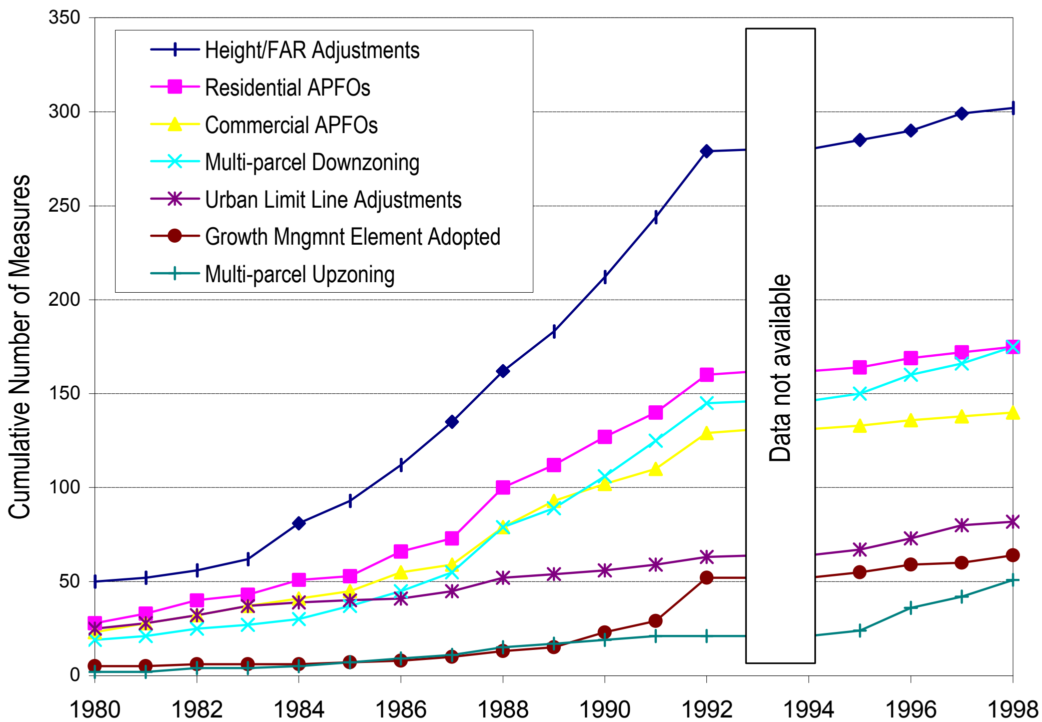

Figure 3: Growth Control and Management Measures Adopted by California Cities 1985-98, by Region, Size, Growth, and Growth Rate

Type of Measure Enacted	All Cities	Percent of Cities Adopting by Region				Percent of Cities Adopting by 1995 Population					Percent of Cities Adopting by 1985-95 Population Growth					Percent of Cities Adopting by Pct.Population Growth: 1985-95				
		Southern California	Northern California	Central Valley	Other	1-10,000	10,001 - 25,000	25,001- 50,000	50,001-100,000	100,001+	1-10,000	10,001 - 25,000	25,001- 50,000	50,001-100,000	100,001+	1 to 5%	5 to 10%	10 to 25%	25 to 50%	50%+
Sample Size	322	138	74	54	50	77	73	69	58	39	193	59	17	8	4	33	34	99	62	53
Pct. Adopting Growth Control Measures																				
Population and Residential Caps	2%	1%	1%	2%	4%	1%	0%	3%	2%	3%	1%	3%	0%	0%	0%	0%	3%	1%	3%	0%
Commercial Space Caps	1	1	0	0	4	1	0	1	0	3	1	2	0	0	0	0	3	1	0	0
Systematic Restrictions on Annexation	1	1	3	0	0	1	0	1	0	3	1	2	0	0	0	3	3	1	0	0
Pct. Adopting Growth Management Measures																				
Urban limit line/Urban growth boundary adopted or tightened	5	1	14	7	0	4	6	6	5	3	5	7	0	0	26	0	0	7	10	2
Residential APFO	4	2	7	4	0	3	4	3	3	3	3	5	0	0	25	6	0	3	5	2
Growth Management Element	3	1	7	4	4	5	1	3	2	8	3	7	0	0	25	6	3	4	3	4
Commercial APFO	2	2	1	2	2	1	3	3	2	0	2	3	0	0	0	0	0	2	3	2
Pct. Adopting Significant Zoning Changes																				
Significant multi-parcel upzoning	8	5	5	13	14	5	14	6	9	5	8	9	6	13	0	3	9	5	11	13
Significant multi-parcel downzoning	7	8	7	9	4	4	6	1	12	21	6	10	18	25	25	0	9	10	2	17
Significant cross-use rezoning	7	7	7	7	10	5	10	6	9	10	7	7	24	0	0	0	12	7	11	8
Changes to height and/or FAR regulations	5	3	8	9	4	5	6	7	3	5	6	5	0	0	25	9	6	6	5	4
Pct. Adopting Related Measures																				
Individual Annexation Restrictions	26	17	26	56	22	30	21	29	24	31	23	37	59	25	25	9	15	15	52	47
Residential Fee Increases	5	3	5	9	8	4	11	3	5	3	6	7	6	0	0	3	3	6	7	9
Imposition of Super-majority Vote Requirement	2	1	3	0	0	1	0	1	2	3	2	2	0	0	0	6	3	1	0	0

Sources: Glickfeld and Levine, 1992; UCB/HCD Survey, 1998

Southern California than elsewhere in the state. Annexation restrictions, by contrast, are relatively more popular in Northern California, as are urban limit lines and growth boundaries, and residential APFOs. Growth management measures in particular are popular in cities of all sizes that have recently experienced significant population growth.

The most common approach to managing growth is through zoning. Eight percent of those cities responding to one of two growth control surveys have initiated major up-zoning efforts. Similar percentages have undertaken down-zoning or re-zoning programs. Managing growth and development through zoning changes is especially popular among cities in California's Central Coast and Central Valley regions. Smaller cities are more likely than large cities to up-zone, while larger cities are more likely to down-zone.

More than a quarter of California cities have recently chosen not to annex specific parcels in order to accommodate requested development. Slower growth through reduced annexation activity is an especially popular "coping strategy" in very fast-growing cities, and in Bay Area and Central Valley cities. Relative to their numbers, Central Valley and Central Coast cities are also more likely to have raised the impact fees they charge residential developers. Citizens of Bay Area cities, on the other hand, are more likely to have enacted so-called "super-majority" approval requirements limiting the ability of their city council or board of supervisors to approve large development projects on a simple majority vote.

III. LGC&M PROGRAMS AND GROWTH

The use of LGC&M programs by California jurisdictions increased and expanded during the 1990s. How effective is this new generation at limiting population growth and housing development?[1] Using 1989 and 1995 survey data provided by Glickfeld, Levine, and Fulton (1992), and 1998 survey results published by the California Department of Housing and Community Development (2000), we first identified a representative sample of *case study jurisdictions* with LGC&M programs in place in 1995. We further distinguished between communities with residential growth caps, residential APFOs, binding urban growth boundaries and limit lines, strict annexation controls, and voter-imposed super-majority approval requirements. Several jurisdictions have adopted multiple LGC&M programs.

Next, for each case study jurisdiction, we identified a set of *peer jurisdictions* of similar initial size and location. Altogether, we identified 8 case study cities with residential adequate public facilities ordinances (APFOs) and 37 peer cities; 7 case study cities with annual housing caps and 23 peer cities; 4 case study cities with urban growth boundaries or urban limit lines and 12 peer cities; 3 case study cities which limit annexation, together with eight peers; and 3 case study cities requiring a super-majority of the city council to approve all general plan and zoning changes, together with 14 peer cities.

Figure 4 lists each case study jurisdiction and its peers.[2] Despite our best attempts, it was not possible to select an exclusive set of case study and peer cities for each LGC&M category. (Many cities with housing caps, for example, have also enacted residential APFOs.) Only one city, Moreno Valley, is a case study city for two LGC&M categories, however multiple cities appear on several peer lists. In some cases, cities that have adopted one type of LGC&M program are listed as peers of cities with other types. For example, within the urban growth boundary (UGB) category, Morgan Hill is listed as a peer city for Santa Cruz. Morgan Hill in fact hadn't adopted a UGB as of 1995, but it did limit housing construction on an annual basis. Similarly, Santa Monica appears as a peer city in the APFO category, despite having a well-deserved reputation for putting developers through the regulatory ringer. Lastly, because it only recently adopted its own annual housing cap, Tracy appears as a peer city in the residential cap category.

Finally, using 1990 and 2000 Census data, we compared 1990–2000 population and dwelling unit growth rates between each case study jurisdiction and its individual peers as well as between all case study cities and their collective peers (see Figure 5). Because they are more reflective of local variations, the former set of comparisons tend to be more pronounced, while the latter are more representative. For comparison purposes, the population and number of dwelling units in all California cities during the 1990s grew by 19.2% and 14%, respectively. [3]

- **Annual Housing Caps:** Annual housing caps are the most stringent form of growth control, a fact reflected in the numbers. The average population growth rate during the 1990s in the seven case study cities with annual housing caps was 17.6%, compared to 25.6% for their collective peers. Surprisingly, case-peer differences were much smaller in the case of housing than population. Indeed, compared collectively, the average rate of new housing construction between 1990 and 2000 was about the

Figure 4: Selected Growth Control Case Study Cities and Their Peers, by Control Type

Residential Caps	Growth Control City	Livermore	Redlands	Simi Valley	Camarillo	Manteca	San Clemente	Petaluma	
	Peer Cities	Tracy Pittsburg Antioch Walnut Creek Danville	Highland Rialto Fontana Yucaipa	San Buenaventura Santa Clarita Thousand Oaks	Santa Paula Moorpark Agoura Hills	Tracy Ceres Lodi	Mission Viejo Dana Point Vista	San Rafael Novato	
Residential APFOs	Growth Control City	San Ramon	Riverbank	Burbank	Moreno Valley	Hemet	Clovis	Carlsbad	Vacaville
	Peer Cities	Benicia Martinez Antioch Danville Dublin Pittsburg	Lathrop Waterford Hughson Patterson Oakdale Ripon	West Covina Baldwin Park Alhambra El Monte Santa Monica	San Bernardino Fontana Rancho Cucamonga Ontario Corona	San Jacinto Lake Elsinore Perris Temecula	Madera Sanger Reedley Selma	San Marcos Vista Encinitas Poway	Woodland Fairfield Pittsburg
Urban Growth Boundaries/ Urban Limit Lines	Growth Control City	Santa Cruz	Visalia	Vacaville	Chico				
	Peer Cities	Morgan Hill Saratoga Watsonville Marina	Hanford Tulare Porterville	Woodland Fairfield Pittsburg	Paradise Oroville				
Annexation Limits	Growth Control City	Moreno Valley	Rohnert Park	Lancaster					
	Peer Cities	San Bernardino Fontana Rancho Cucamonga Ontario Corona	Napa Novato	Palmdale					
Voter-enacted super-majority approval requirements	Growth Control City	Cypress	Lemon Grove	Solana Beach					
	Peer Cities	Brea La Habra La Mirada Paramount Placentia Cerritos Stanton Fountain Valley	Santee Poway La Mesa Imperial Beach	San Marcos Coronado					

Figure 5: Population and Housing Unit Growth Rates for Growth Control Case Study Cities and Their Peers

Growth Control Type		1990-2000 Population Growth Rate	1990-2000 Housing Units Growth Rate
Residential Caps	Growth Control & Management Case Study Cities (n=7)	18%	16%
	Peer Cities (n=26)	26%	17%
Residential APFOs	Growth Control & Management Case Study Cities (n=8)	36%	31%
	Peer Cities (n=32)	30%	22%
Urban Growth Boundaries/ Urban Limit Lines	Growth Control & Management Case Study Cities (n=4)	26%	24%
	Peer Cities (n=12)	22%	17%
Annexation Limits	Growth Control & Management Case Study Cities (n=3)	19%	13%
	Peer Cities (n=8)	32%	21%
Voter-enacted super-majority approval requirements	Growth Control & Management Case Study Cities (n=3)	4%	4%
	Peer Cities (n=14)	10%	1%

same in the housing cap cities as in their peers. (Compared individually, the rate of housing construction in the cities with caps actually exceeded that of their peers.). Given differences in household size, one may infer from these results that housing cap programs limit the construction of single-family homes more than apartment units. In sum, housing cap programs are somewhat effective at limiting population growth below the levels of the unconstrained market.

- **Residential APFOs:** The function of residential APFOs is not to limit growth, at least not explicitly. Rather, it is to help cities cope with the fiscal and infrastructure impacts of growth. Thus, the fact that cities with residential APFOs actually grew faster during the 1990s than their collective and individual peers is not too much of a surprise. Indeed, given the even larger case-peer differences in housing construction rates, one might go so far as to conclude that the principal effect of residential APFOs is to make the cities that adopt them "safe" for additional development (Deakin1989).
- **Urban Growth Boundaries:** Urban growth boundaries and urban limit lines, their advocates argue, limit the spatial growth of the cities that adopt them, but not necessarily the numerical amount of growth. A comparison of population and dwelling unit growth rates between four California cities with long-time UGBs and twelve peer cities suggest that these arguments have some merit. Compared collectively, 1990–2000 population and housing unit growth rates in the four cities with UGBs and ULLs exceeded their peers by 20% and 38%, respectively. Compared individually, the differences were even greater. As implemented in California so far, UGBs and ULLs do seem to be successfully redirecting growth from the urban fringe back into interior areas.
- **Annexation Limits:** Most new development in California occurs at the urban fringe. Accordingly, we would expect regulations that limit municipal annexation to also limit population growth and housing construction. Judging from the experiences of the three case study cities with annexation limits *vis à vis* their peers, this is indeed

the case: compared collectively, population and housing growth rates in Moreno Valley, Rohnert Park and Lancaster during the 1990s were about 60% of the level of their peers.

- **Voter-Enacted Supermajority Approval Requirements:** Development proposals in most California cities may be approved by a simple majority vote of the city council. In a very few cities, voters have sought to put further limits on their elected officials by requiring that development approvals receive a super-majority or two-thirds city council vote. Such requirements are explicitly intended to slow the rate of growth and development. To a large degree, they succeed. Compared individually and collectively, rates of population and housing growth in the three case study cities with voter-enacted super-majority approval requirements were only 40% to 50% of those of their peers.

In summary, based on the comparisons presented in Table 5, some types of LGC&M programs, principally residential caps, annexation controls, and voter-enacted supermajority approval requirements, *do* appear to significantly limit population growth in the cities that adopt them. Annexation limits and super-majority requirements also limit housing construction. Other LGC&M programs, notably UGBs, function to redistribute growth. The more restrictive a particular control measure, the less popular it is likely to be. Thus, residential APFOs, which do little if anything to restrict residential growth, are extremely popular, while annexation limits and super-majority approval requirements, which are more effective, are less popular. Residential development caps fall in the middle of this continuum: not wildly popular nor particularly effective.

IV. GROWTH CONTROLS, HOUSING PRODUCTION AND HOUSING PRICES

California is the nation's housing price leader as well as its growth control leader. According to the National Association of Realtors, nine of the country's ten least affordable housing markets are in California (NAR 2001). LGC&M programs can affect housing prices in two ways: directly, by increasing the costs of land development and construction; and indirectly, by restricting supply (Dowall 1984). Direct effects dominate during periods of slack housing demand while indirect effects dominate during growth periods. Most empirical studies relating LGC&M programs to housing prices do not distinguish between direct and indirect effects. Rather, they make use of reduced-form regression equations to compare median or individual housing prices with the local presence or absence of LGC&M programs (Schwartz, Hanson, and Zorn 1985). Positive regression coefficients are interpreted as indicating that the presence of a LGC&M program adds to the price of housing. Thus, the nature of the relationship between local LGC&M measures and housing supply reductions is inferred rather than observed.

To accurately identify the price effects of supply constraints requires comparing the quantity of housing constructed during a given period with the quantity of housing that would or should have been constructed during the same period *in the absence of supply constraints*. As a practical matter, it is far easier to undertake such comparisons at the metropolitan statistical area (MSA) level—where rates of housing construction can easily be compared with rates of job growth—than at the municipal level, where the issue of how best to determine local "fair-share" housing allocations is extremely contentious.

Approach

The approach taken here is different than that used in previous empirical studies. Instead of a reduced form approach, we compare estimates of 10-year housing demand based on nearby job growth with 10-year estimates of new housing supply, as measured by permit activity. All calculations are undertaken at the level of individual jurisdictions. The resulting pattern of housing production surpluses and shortfalls is then compared to the local incidence of different LGC&M programs as well as to local housing price levels.

Job growth and housing demand are tied together spatially through the identification of 40-minute commute sheds around local job centers. Using this approach, housing supply and demand are said to be in balance when the number of new housing units within each commute shed exactly balances job growth at the center of each commute shed, adjusted for the average number of jobs per household. Job growth histories and projections were obtained from local councils of government, including the Association of Bay Area Governments (ABAG), the Association of Monterey Bay Area Governments (AMBAG), the Sacramento Area Council of Governments (SACOG), the San Diego Association of Governments (SANDAG), the San Joaquin County Council of Governments, the Southern California Association of Governments (SCAG), and from Stanislaus, Merced, and Fresno counties. We start with the normative assumption that there ought to be sufficient new housing built in every jurisdiction such that the maximum commute time to work does not exceed forty minutes. To put this assumption to work requires the use of a geographic information system (GIS) to identify and amalgamate different commute sheds. This was done using a nine-step process:

1. Every major job center within California was located on an ArcView (GIS) base map of major roadways (freeways and state highways) and county, city, and census-designated place (CDP) boundaries. In general, job centers were located near or at city centers.
2. Freeways were coded to a travel speed of 50 miles per hour. At-grade state roads were coded to travel speeds of 25 miles per hour.
3. ArcView Network Analyst was used to identify 40-minute commute routes (roadway links) emanating out from each job center.
4. Commute sheds were identified as 3-mile buffers around each commute link. Note that this definition of commute shed allows for a 40-minute maximum freeway trip coupled with a three-mile trip along local roads.
5. Each commute shed was then "overlaid" on top of a map of cities and CDPs. The resulting GIS map layer identified which particular cities and CDPs fall within which commute sheds.
6. The capacity of a particular city or CDP to accommodate projected housing growth was assumed to be proportional to its physical area. To identify the appropriate housing growth pro-rating factor, we identified each city's and CDP's land area as a proportion of the total commute shed area. An example may help to clarify this operation. Suppose the 40-minute commute shed for Job Center 1 encompasses three cities having the following areas:

City A:	30 acres
City B:	50 acres
City C:	20 acres
Total area in commute shed	100 acres

   Using this pro-rating procedure, 30% of the housing growth associated with projected job growth at Job Center 1 would be allocated to City A, 50% would be allocated to City B, and 20% would be allocated to City C. Note that this area-based pro-rating procedure, unlike a gravity model allocation, does not assume that a city's/CDP's share of job-related housing growth should decline with distance. Nor is it capacity based. Cities are allocated housing based on their areas and proximity to job centers, not on how much land is or isn't available. How cities/CDPs should accommodate housing growth, through infill or greenfield development, is appropriately a local matter.
7. Using this method, pro-rating factors were established for every city/CDP within every 40-minute commute shed.

8. We then multiplied 1990–2000 job growth at each job center by the appropriate pro-rating factor, and divided the total by the average number of households per job in each county as of 1990. Among counties, household-to-job ratios varied from a low of 0.5 in San Francisco County to a high of 2.0 in El Dorado County. A higher household-to-job ratio indicates that there are fewer workers per household.
9. For each city/CDP, we then summed total projected housing growth across all job centers to yield an aggregate (multi-job center commute shed) estimate of projected housing unit growth.

We then compared our estimates of job-based housing demand (Step 9) with the actual number of residential permits, as published by the Construction Industry Research Board. In addition to calculating the numerical difference between demand and supply, we also calculated the ratio of demand to supply by dividing the local growth in households attributable to job growth by residential permits. Balance ratio values greater than one indicate housing production shortfalls; values less than one indicate production surpluses. The advantage of balance ratios is that they better distinguish between absolute production and "fair share" production based on job growth. Demand estimates, permit activity, and supply-demand balance ratios for the 1990-1999 period are presented by city and CDP in Appendix A.

As with any analytical approach, this one is subject to numerous simplifications. The choice of a forty-minute commute shed is somewhat arbitrary.[4] Freeway-based commute sheds are considered but transit-based commute sheds are not. Projected household growth is pro-rated on the basis of a city's total land area, not its developable land area. Cities and CDPs lacking developable land (within their borders) are presumed to accommodate their projected household growth either through some form of infill or by annexing unincorporated lands. Lastly, neither housing demand nor supply are disaggregated into categories, whether by structure type (single- vs. multi-family), tenure (owner vs. renter) or affordability.

Underlying this analysis are two fundamental assumptions regarding housing demand in California. The first is that the demographic demand for housing during a given period, measured at the metropolitan scale, is principally a function of job growth.[5] The more jobs that are created in a metropolitan area, the greater the demand for housing.[6] Three other components of housing demand—vacancy adjustment, replacement demand, and required upgrading—while not unimportant, account for a far smaller share of total housing demand.[7] A second critical assumption is that, except for homelessness, there is no such thing as permanent, un-accommodated demand. Households searching for housing in tight markets are assumed to resolve their situations either by paying a higher price for the unit of their choice, by crowding-up, by moving elsewhere, or by becoming homeless.

The strengths of the commute shed approach are as apparent as its weaknesses. The analysis correctly identifies job growth as the driver of housing demand. It presents a methodology for analyzing the balance between jobs and housing that transcends municipal, county, and even regional boundaries. The magnitude of past and potential housing spillover between metropolitan regions (e.g., between the Bay Area and the San Joaquin Valley) can be assessed. The data inputs into the analysis are understandable, straightforward and readily available on a statewide basis, making for a consistent statewide approach.

Growth Regulation and Housing Production Shortfalls

Having constructed consistent measures of local housing supply and demand, we now consider whether and how such measures vary by city size, density, income, and most important for our purposes, the presence of LGC&M measures (Figure 6). Compared by size of city, housing production was much more likely to lag demand in small cities than in large ones. Among cities with 1990 populations of 20,000 or less, the average demand-supply balance ratio during the 1990s was 7.6, meaning that only one unit of new housing was constructed for every seven-and-a-half units needed. Among cities with populations between 20,000 and 50,000, the average demand-supply balance ratio was 2.8. Bigger cities did a better job accommodating their housing needs. Among cities with 1990 populations between 50,000 and 100,000, housing demand and supply were roughly in balance during the 1990s. Among the very largest cities, including Los Angeles, San Diego, San Jose, San Francisco, Sacramento, Oakland, and Long Beach, the average demand-supply ratio during the 1990s was about two. The principal difference between very small cities and very large cities—neither of which were able to accommodate their respective shares of housing production during the 1990s—was that the former mostly *chose* not to grow, whereas the latter usually had difficulty finding sites for housing development.

Dense cities, those with population densities above 5,000 persons per square mile, were far more likely to have accommodated their pro rata shares of housing production than lower density communities. For cities with densities in the range of 2,000 to 5,000 persons per square mile, the average demand-supply balance ratio during the 1990s was almost 3.0. Among cities with densities between 5,000 and 10,000 persons per square mile, the average demand-supply balance ratio was 1.32. Among the state's most dense cities (those with densities in excess of 10,000 persons per square mile), the average demand-supply ratio was only 1.0. The superior housing performance of higher density cities was as much due to their comparative lack of job growth as to their greater housing production.

Surprisingly, California cities with LGC&M programs performed extremely well during the 1990s in providing housing supply to meet demand (Figure 7). The mean housing demand-supply balance ratio among the seven case study jurisdictions with housing construction caps in place in 1995 was .93 meaning that more than enough housing units were built in such communities between 1990 and 1999 to match demand. Even more surprisingly, both individually and collectively, the seven housing cap cities significantly outperformed their peers in meeting local housing demand.

The eight case study cities with residential APFOs did even better, building nearly 1.6 new homes during the 1990s per unit of demand. Their peer cities, by contrast, slightly under-produced new housing relative to demand. This supports the previous finding that residential APFOs may actually function to make the communities that adopt them "safe" for development. Housing production also exceeded demand in the four case study cities with long-standing urban

Figure 6: City Housing Demand-Supply Balance Ratios by Metropolitan Area, City Size, Density, and Median Household Income Level

City Characteristic	Statewide		Southern California (LA/Orange/SB/ Riverside/Ventura)		Bay Area		San Diego County		Other	
	Mean	Cities	Mean	Cities	Mean	Cities	Mean	Cities	Mean	Cities
1990 Population										
0-20,000	7.57	111	2.43	40	5.03	34	4.32	2	16.09	35
20,000-50,000	2.82	111	1.27	59	3.29	31	3.16	5	7.49	16
50,000-100,000	1.08	70	0.56	43	2.02	19	1.81	7	0.46	1
100,000-300,000	1.31	35	0.81	22	2.95	7	0.78	3	1.61	3
> 300,000	2.05	7	0.28	2	2.10	3	1.32	1	6.22	1
Total Sample	3.86	334	1.29	166	3.60	94	2.26	18	12.40	56
1990 Density (persons/sq. mile)										
< 2,000	8.37	90	3.73	40	5.33	30	3.64	4	26.88	16
2,000-3,500	2.93	101	0.80	44	2.29	35	1.85	6	10.56	16
3,500-5,000	2.86	50	1.01	16	2.53	13	1.53	3	4.96	18
5,000 - 10,000	1.32	72	0.29	46	4.30	15	2.10	5	1.05	6
>10,000	0.09	21	0.03	20	1.22	1	na	na	na	na
Total Sample	3.86	334	1.29	166	3.60	94	2.26	18	12.40	56
1989 Median Household Income										
less than $40,000	4.57	188	1.82	95	2.49	30	1.40	12	11.65	51
$40,000 - $50,000	3.37	71	0.69	31	3.32	32	3.60	3	20.08	5
$50,000 - $60,000	1.83	37	0.84	19	2.57	15	4.37	3	na	na
$ 60,000 - $70,000	1.85	12	1.01	8	3.54	4	na	na	na	na
greater than $70,000	3.91	26	-0.25	13	8.07	13	na	na	na	na
Total Sample	3.86	334	1.29	166	3.60	94	2.26	18	12.40	56

Figure 7: City Housing Demand-Supply Balance Ratios for Growth Control Cities and Their Peers

Growth Control Type	Measure	Avg. Housing Demand-Supply Balance Ratios, 1990-2000
Residential Caps	Growth Control & Management Case Study Cities (n=7)	0.93
	Peer Cities (n=26)	1.04
Residential APFOs	Growth Control & Management Case Study Cities (n=8)	0.61
	Peer Cities (n=32)	1.12
Urban Growth Boundaries/ Urban Limit Lines	Growth Control & Management Case Study Cities (n=4)	0.83
	Peer Cities (n=12)	4.93
Annexation Limits	Growth Control & Management Case Study Cities (n=3)	1.00
	Peer Cities (n=8)	1.62
Voter-enacted super-majority approval requirements	Growth Control & Management Case Study Cities (n=3)	1.69
	Peer Cities (n=14)	1.43

growth boundaries. This was not the case in their peer cities, where demand was nearly five times the level of new supply. Housing production also matched demand in the three case study cities which limit annexation, something that was not true for their peers. Indeed, only in cities with voter-enacted super-majority approval requirements did housing production during the 1990s lag demand.

Leaving open the possibility that the commute-shed methodology used to estimate demand might be unreliable, these findings call into question long-held arguments that LGC&M programs—at least those types discussed above—constrain housing production below "fair share" levels. Quite the opposite appears to be true: Compared to their peers, cities with LGC&M programs in place did a better job during the 1990s meeting the demand for housing. What's going on? Assuming that LGC&M programs have *some* effect on housing production, these findings support prior arguments that LGC&M programs are mostly a response to perceptions of runaway growth (Glickfeld and Levine 1992, Landis 1992), and not an attempt to exclude housing, development, or population growth.

Production Shortfalls and Housing Prices

If economic theory has any validity, then housing production shortfalls or surpluses, *whatever their source*, should be reflected in housing prices. The bigger the shortfall (or surplus), the higher (or lower) the price. This simple relationship has always been difficult to demonstrate empirically, especially at the level of individual jurisdictions.

To determine the effects of housing production levels on prices, we used regression analysis to compare the housing demand-supply balance ratios estimated above with median home sales prices during the fourth quarters of 1999 and 2000, as obtained from the California Association of Realtors (CAR).[8] Throughout California, as well as nationally, the fourth quarter of 1999 was the peak of the expansion. One year later, by the fourth quarter of 2000, the dot-com jobs bubble had mostly deflated, and its inflationary effects on the real estate market had started to subside. CAR coverage is very complete in the Bay Area, Southern California, and San Diego, somewhat complete in the Sacramento region, and less complete in other parts of the state.

Supply is certainly not the only factor that affects price. To account for important demand side influences, we also included in the model: (i) a measure of the total number of jobs (as of 2000) within a forty-minute driving distance of each city; and (ii) the median household income level of each jurisdiction as of 1989, as reported in the 1990 census. All else being equal, we would expect homes in more job-accessible locations to sell at a premium.

The relationship between incomes and housing price levels is more complicated. At one level, because income is the principle measure used to qualify homebuyers, at some point, income levels must *limit* price levels. Budget constraints aside, we also presume that higher-income households might *prefer* to spend more for housing, either for reasons of status, perceived investment potential, location, or because they are willing to pay a premium to live near other high-income households.

There are also subtle regional differences in how housing markets operate. Some are characterized on the supply side by large, volume-oriented builders. In other regions, it is the existing stock that provides the bulk of the supply. In some regions, land use controls act to re-arrange development locations and alter housing—as well as reduce overall supplies. In other regions, the effects of local land use controls are quite minimal. To identify these regional differences, we included four regional dummy variables denoting whether a particular jurisdiction was in the San Francisco, San Mateo, or Santa Clara counties in the Bay Area; in San Diego County; in Los Angeles, Orange, or Ventura counties in Southern California; or in the Inland Empire (Riverside and San Bernardino counties). To insure a unique solution, we did not assign a dummy variable to communities in the Sacramento or San Joaquin Valley regions. To allow for the possibility that the price responses to supply shortages also vary by region, we interacted the demand-supply balance ratios with each of the regional dummy variables. Lastly, to explore the possibility that the price effects of LGC&M programs go beyond limiting supply, we included a dummy variable indicating whether a particular jurisdiction had previously enacted an annual housing cap, urban growth boundary, or annexation limit.

Regression results are presented in Figure 8. The fourteen independent variables explain 79% and 72%, respectively, of the variation in fourth-quarter 1999 and 2000 median sales prices. These are impressive goodness-of-fit statistics considering that the models do not include variables describing the physical quality of the housing stock.

The coefficient of the housing demand-supply balance ratio—the variable of greatest interest—is positive as expected, statistically significant, and, judging from the standardized regression coefficient, of moderate importance. All else being equal, a unit increase in the value of the demand-supply ratio was associated with a housing price premium of $4,800 during the fourth quarter of 1999, and $7,600 during the fourth quarter of 2000. To better understand what these coefficient values mean, consider two identical homes, one located in a community with a 1990-2000 demand-supply balance ratio of 6.0, the other located in a community with a balance ratio of 3.0. As of the fourth quarter of 2000, and all else being equal, a home in the first community would have sold at a $23,000 premium over a home in the second community.

Figure 8: Regression Results Comparing Supply and Demand Factors and LGC&M Measures with Median Home Prices, 1999, 2000

Dependent Variable: Median Home Sales Price, by City	1999:4 Median Sales Price		2000:4 Median Sales Price	
Independent Variables	Standardized Coefficient	t-statistic	Standardized Coefficient	t-statistic
1990-1999 Housing Demand-Supply Balance Ratio -1	0.11	2.86	0.10	2.29
1989 Median Household Income	0.72	20.61	0.69	17.21
Employment in 40-minute Commute Shed	-0.06	-1.62	-0.09	-2.006
DV (LA/Orange/Ventura counties)	-0.04	-0.93	-0.01	-0.23
DV (SM/SF/Santa Clara counties)	0.26	6.63	0.23	5.21
DV (San Bern. and Riverside counties)	-0.08	-2.16	-0.03	0.72
DV (San Diego County)	0.01	0.16	0.01	0.31
Interaction (Balance Ratio * SF/SM/SCL DV)	-0.02	-0.47	0.06	1.38
Interaction (Balance Ratio * LA DV)	-0.11	-3.10	-0.08	-1.93
Interaction (Balance Ratio * SB/Riv DV)	-0.03	-0.87	-0.03	-0.46
Interaction (Balance Ratio * San Diego DV)	0.10	2.65	0.05	1.28
DV(UGB)	0.02	0.45	0.04	0.95
DV(Residential Caps)	-0.05	-1.54	-0.06	-1.47
DV(Annexation Limits)	-0.03	-0.95	-0.04	-1.06
Intercept	-145566.4	-5.88	-363736.0	-7.32
adjusted r-squared	0.79		0.72	
Number of Observations	235		235	

Of the other independent variables, income is by far the most important and statistically significant. All else being equal, a $1,000 increase in 1989 median household income across otherwise similar communities was associated with a median housing price increase of $9,830 in the fourth quarter of 1999, and $16,464 in the fourth quarter of 2000.

The coefficient associated with commute shed employment is statistically significant for the 2000 fourth quarter period, but only marginally so for the 1999 fourth quarter period. Unexpectedly, it is negative in both periods. Whether this finding reflects problems in the way we defined commute sheds or is the result of more fundamental preferences, we cannot say. Two of the four regional dummy variables were statistically significant in the fourth-quarter 1999 model, but only one—indicating the San Francisco-San Mateo-Santa Clara market—was in the fourth-quarter 2000 model. Of the supply/region interaction variables, only the coefficients denoting communities in Los Angeles, Ventura, Orange, and San Diego counties were statistically significant, and only for 1999. Among Los Angeles, Ventura, and Orange county communities, the greater the excess of demand over supply, the lower the fourth-quarter 1999 median sales price. Among San Diego county communities, by comparison, demand-supply imbalances were associated with higher home prices. The three LGC&M dummy variables were also insignificant, suggesting that the principal effect of LGC&M programs on housing prices occurs through supply limitations.

This analysis leads to two obvious and important but heretofore undemonstrated conclusions. First, local policies, programs and actions that limit new housing production, whatever their form or purpose, adversely affect housing prices. Second, such effects occur principally as a result of imbalances between housing supply and demand, and not as a result of amenity capitalization or other means. A third conclusion emerges by combining the results of this section and the previous one: To the extent that formal LGC&M programs do not constrain housing production below fair share levels, they are not principally responsible for California's high housing prices and rents.

V. GROWTH CONTROLS, COMMUNITY FISCAL HEALTH AND PUBLIC SERVICE QUALITY

Residents and elected officials support LGC&M programs for many reasons including stopping or slowing land-consuming sprawl, ameliorating traffic congestion, improving public service quality, supporting existing retail areas by keeping out big-box retailers, excluding lower-income households, and in some instances, to increase property values. Except for the last two, most of these arguments fall under the general heading of maintaining and promoting "quality of life." How well do LGC&M programs perform in this respect?

This is a far easier question to ask than to answer. Accurate, comprehensive, and reliable quality of life data are virtually non-existent at the local level. This is partly for reasons of cost, and partly because of the complexity of the issues involved. When standardized information is collected, as is the case for budgetary, crime, and school test score information, it is usually because it is required by a higher level of government.

To investigate the relationship between LGC&M programs and quality of life issues, we returned to our previous approach of comparing case study and peer communities. Specifically, we compared information on local expenditures, revenues, debt loads, police services, and crime rates between cities with different types of LGC&M programs and multiple peer cities. Two types of comparisons are reported: the first, between all case study cities (within a given LGC&M category) and their collective peers; and the second, between each case study city and its respective peers.

LGC&M Programs and Fiscal Performance

Fast growth and especially residential sprawl are widely presumed to adversely affect local budgets (Burchell 1998). On the expenditure side, extremely rapid growth and/or low-density development are presumed to shift the cost of providing infrastructure and public services from the declining cost side of the marginal cost curve to the increasing side (Ladd 1990). When and where LGC&M programs function to shift development to less expensive locations and/or require developers to assume a larger share of the cost of growth, they make growth less costly. On the revenue side, to the extent that LGC&M measures constrain development, and result in increased land and property values, property tax revenues should rise. In cases where slow growth means better growth, improvements in development quality may be positively capitalized into property values and thus into property tax revenues. Lastly, in jurisdictions where development—in particular new housing—doesn't pay its own way to begin with, slowing the pace of growth will necessarily reduce the revenue gap associated with growth. For all these reasons, per capita revenues should be higher, and per capita expenditures and debt loads should be lower in jurisdictions with LGC&M programs than in those without such programs.

In the real world, the relationships between growth, land use, property development, density and local fiscal health are certainly much more complicated and varied than this simple view would suggest. Through the judicious use of impact fees and exactions, some communities actually make money from new development. In jurisdictions with time-tested capital improvement programs, growth may actually result in increased economies of scale and reduced infrastructure and public service costs. To the extent that local residents are also local shoppers, more housing may mean increased sales tax revenues.

The California Controller's office annually collects detailed expenditure, revenue, and debt information from all California cities and counties. Detailed expenditure information is reported separately for seven categories, including general government, public safety, transportation, community development, health, culture & leisure, and public utilities. Revenue totals are reported for property, sales and other taxes; licenses, fees and service charges; utility income; interest income, and inter-governmental transfers. For purposes of consistency, enterprise expenditures and revenues (such as those from utilities and ports) were excluded from the current analysis, as were interest income and inter-governmental transfers. Debt load information covers principal and interest payments made to holders of general obligation bonds, revenue bonds, special assessment and benefit district bonds, and certificates of participation. The most recent year for which data are currently available is 1998.

Income Differences: Inter-jurisdictional differences in fiscal performance are usually presumed to arise either on the expenditures and cost side, or on the land use and revenue side. An equally likely explanation is that they arise from differences in income and income-related public service preferences. That is, wealthy communities may have different preferences and abilities to pay for their preferences than poorer communities.[9] Thus, before we consider differences in community fiscal performance due to growth and land use, we must first consider differences in income.

The first data column of Figure 9 compares 1989 median household income levels between LGC&M cities and their peers. Individually and collectively, there were no notable income differences between cities with annual housing caps or with annexation limits and their respective peers. Household incomes were also comparable among cities with UGBs and their peers when considered on a case-by-case basis. By contrast, household incomes in cities with residential APFOs and voter-required supermajority approval requirements were slightly higher than in their respective peer cities. At least with respect to household income, the case study cities and their peers are indeed comparable.

Per Capita Expenditures: Excluding enterprise operations, California cities spent an average of $900 per resident in 1998, the most recent year for which data is available. Contrary to expectations, per capita expenditures are generally higher in LGC&M communities than in their peers (Figure 9). Among communities with residential building caps and APFOs, case-peer expenditure differences range between 15% and 30%, depending on whether such comparisons are made individually or as a group. For cities with UGBs, case-peer differences are considerably greater. Among the much smaller group of cities with annexation limits or voter-required supermajority approval requirements, per capita expenditure levels are generally equivalent to or slightly lower than among their peers. Regardless of program type, case-peer differences were either about the same or else slightly reduced in 1998 as compared with 1990.

These findings suggest two interpretations. The first is that when compared across similar cities, growth and public service expenditures levels are only slightly related. Recall from

Figure 9: Fiscal Performance and Public Services Differences Among LGC&M Case Study Cities and Their Peers

LGC&M Type		Median Household Income, 1989 (source: Census)	Per Capita Expenditures (source: California Controller's Office)		Per Capita Property Tax (source: California Controller's Office)		Per Capita Sale Tax (source: California Controller's Office)		Outstanding Debt Load Per Capita (source: California Controller's Office)		Police Per 1000 residents		Crime Rate	
			1990	1998	1990	1998	1990	1998	1990	1998	1990	1998	1990	1998
Residential Caps	LGC&M Case Study Cities (n=7)	$44,399	554.07	649.52	$78	$75	$76	$102	$40	$58	1.15	1.07	0.04	0.03
	Peer Cities (n=26)	$44,395	471.12	557.30	$73	$65	$86	$98	$50	$125	1.28	1.11	0.05	0.03
	All LGC&M Cities/ All Peers	1.0	1.18	1.17	1.1	1.2	0.9	1.0	0.8	0.5	0.9	1.0	0.9	0.9
	Average Case-Peer Ratio	1.0	1.31	1.25	1.2	1.2	1.0	1.2	3.1	6.2	0.9	1.0	0.9	0.9
Residential APFOs	LGC&M Case Study Cities (n=8)	$38,414	681.38	684.61	$96	$82	$103	$116	$117	$221	1.33	1.17	0.06	0.04
	Peer Cities (n=32)	$35,894	563.93	592.51	$70	$59	$92	$97	$71	$169	1.41	1.25	0.06	0.04
	All LGC&M Cities/ All Peers	1.1	1.21	1.16	1.4	1.4	1.1	1.2	1.7	1.3	0.9	0.9	0.9	0.9
	Average Case-Peer Ratio	1.1	1.24	1.13	1.4	1.5	1.1	1.2	3.9	1.5	0.9	1.0	0.9	0.9
Urban Growth Boundaries/ Urban Limit Lines	LGC&M Case Study Cities (n=4)	$30,251	930.98	1,007.58	$73	$60	$121	$126	$92	$176	1.22	1.26	0.07	0.05
	Peer Cities (n=12)	$34,776	533.76	646.45	$62	$54	$87	$86	$105	$352	1.30	1.15	0.06	0.04
	All LGC&M Cities/ All Peers	0.9	1.74	1.56	1.2	1.1	1.4	1.5	0.9	0.5	0.9	1.1	1.2	1.1
	Average Case-Peer Ratio	1.0	1.76	1.59	1.2	1.1	1.3	1.5	0.7	0.7	0.9	1.1	1.3	1.1
Annexation Limits	LGC&M Case Study Cities (n=3)	$38,890	498.59	483.79	$30	$28	$69	$85	$3	$42	1.29	1.47	0.06	0.05
	Peer Cities (n=8)	$38,746	618.57	605.77	$65	$51	$92	$95	$146	$157	1.26	1.15	0.07	0.04
	All LGC&M Cities/ All Peers	1.0	0.81	0.80	0.5	0.6	0.7	0.9	0.0	0.3	1.0	1.3	0.8	1.2
	Average Case-Peer Ratio	1.0	1.04	0.90	1.0	0.6	0.9	1.3	0.0	1.6	1.2	1.4	0.9	1.2
Voter-enacted super-majority approval requirements	LGC&M Case Study Cities (n=3)	$44,944	507.79	544.97	$83	$91	$87	$138	$331	$363	1.27	1.12	0.05	0.03
	Peer Cities (n=14)	$42,624	509.46	609.30	$70	$69	$114	$139	$33	$83	1.53	1.37	0.06	0.03
	All LGC&M Cities/ All Peers	1.1	1.00	0.89	1.2	1.3	0.8	1.0	10.0	4.4	0.8	0.8	0.9	0.9
	Average Case-Peer Ratio	1.1	0.92	0.83	1.0	1.0	0.9	1.2	5.4	2.1	0.8	0.7	0.9	1.0

Section II that the two LGC&M programs that most affect population growth are housing caps and annexation limits. In the case of housing caps, per capita expenditures were slightly higher in the controlled cities than in their uncontrolled peers. In the case of cities with annexation limits, the opposite was true: per capita expenditures were lower in the controlled cities.

A second interpretation is that those communities most concerned about preserving their quality of life—and which are therefore more likely to try to limit growth—start from a position of providing more, better, and thus more expensive public services. In this view, higher per capita expenditures serve as a measure of civic quality and not of service inefficiency.

Per Capita Property Tax Revenues: Property taxes account for about 6.4% of local revenues among California cities. Per capita, California cities collected an average of $76 in property taxes in 1998, the most recent year for which data is available. Comparing LGC&M cities collectively to their peers, 1998 per capita property tax revenues were 20% higher among cities with residential caps, 50% higher among cities with APFOs, and 13% higher in cities with UGBs and ULLs. Among these three program types, case-peer differences were slightly greater in 1998 than in 1990.

As a practical matter, differences in property tax revenues must stem either from differences in tax rates or from differences in property values. Since property tax rates are not consistently higher in LGC&M communities than in their peers, the difference must stem from the value side.[10] We can think of a number of reasons why property values might be higher in controlled cities. To the extent that incomes are higher in LGC&M communities than in peer communities—something that is true only for the residential APFO cities—such differences would likely be capitalized into higher property values and thus higher property tax revenues. Likewise, to the extent that public services are better in LGC&M communities, those differentials would also be positively capitalized into property values.

Last, and perhaps most likely, the supply-constraining effects of LGC&M programs should cause prices and thus property values to rise. The evidence is a bit confusing. On the one hand, per capita property tax revenues are indeed higher in cities with residential caps than in peer cities—something we would expect given the growth-limiting effects of caps. On the other hand, the property tax revenue differentials between APFO cities and their peers are even larger, despite the lack of any observable supply constraint. Moreover, to the extent that APFOs require developers to undertake improvements which would otherwise be paid for from general revenues, per capita property tax revenues should actually be lower in cities with APFOs, not higher. Clearly, there are many other factors besides population growth and housing production that affect local property tax revenues.

Per Capita Sales Taxes: Sales tax rates in California range between 5% and 8%. Sales tax revenues are paid directly to the state, which then rebates 1–2% (of sales value) back to local government. The smallness of these percentages notwithstanding, sales tax revenues are extremely important to local budgets, and municipal competition for sales tax-generating land uses is fierce, As of 1998, sales tax revenues comprised 9.7% of local revenues, averaged across all California cities.

Comparing LGC&M cities collectively to their peers, 1998 per capita sales tax revenues were 4% higher among cities with residential caps, 19% higher among cities with APFOs, 47% higher among cities with UGBs, 11% *lower* in cities with annexation limits, and about the same in cities with voter-mandated super-majority approval requirements. Except for cities with UGBs, these differences are not statistically significant. As with per capita property tax revenues, case-peer differences in per capita sales tax revenues were generally greater in 1998 than in 1990.

Why are per capita sales tax revenues so much higher in cities with UGBs than in peer cities? Two complementary answers present themselves. The first is that cities may see UGBs as a way of discouraging retail sprawl and the resulting loss of downtown retail synergy and vigor. Second, county governments may be more reluctant to poach retail development when UGBs and ULLs are in place.

Per Capita Debt Loads: California jurisdictions use multiple debt instruments to fund needed capital infrastructure, including general obligation bonds, revenue bonds, certificates of participation, and bonds issued in anticipation of redevelopment and special district revenues. Most local debt instruments are subject to some type of statutory limitation, either voter approval, or particular use limits. As a result, local governments in California are generally under-indebted relative to their total tax and revenue capacity. Average per capita outstanding debt among California cities in 1998 was only $1002.

Because local debt issuances both start and end at overlapping intervals, outstanding debt loads can vary widely over just a few years, even within a single jurisdiction. Likewise, a single large debt issuance or retirement can significantly debt averages. This makes all city-to-city, group-to-group, and year-over-year comparisons somewhat suspect.

For example, comparing groups of LGC&M cities to their peers, 1998 per capita outstanding debt loads were more than 50% *lower* among cities with residential caps and UGBs, and 30% *higher* among cities with residential APFOs. If the same comparisons are made on the basis of LGC&M cities and their peers, 1998 per capita outstanding debt loads were more than 500% *higher* among cities with residential caps, 50% higher among cities with APFOs, and 25% lower among cities with UGBs.

Looking at both group and individual ratios together with actual debt levels suggests that communities with specific development controls in place—either annual residential caps, UGBs, or annexation limits—are somewhat better able to limit their infrastructure spending and per capita debt loads than similar cities lacking such controls. There are a number of reasons why this might be the case. LGC&M cities may be able to make more efficient use of their existing infrastructure. Similarly, such communities might be in a better position to exact capital improvements from developers. Ultimately, we suspect it is because cities with LGC&M programs in place tend to be better managed to begin with. Curiously, the adoption of residential APFOs does not appear to result in lower infrastructure costs and per capita debt loads, though that is certainly one of their principal purposes.

Public Service Quality

California cities, like most of their counterparts elsewhere in the United States, do not regularly collect information on the supply or quality of public services. Many suburban California cities, moreover, contract with different units of government, including counties, special districts and in some cases, even private businesses, to provide local public services. For both these reasons, comparing public service quality across municipalities and even over time is like comparing apples and oranges. A few standardized statistics, mostly related to public safety are collected. These include police staffing and crime rates.

Police Staffing: The number of police officers per capita measures service quality inputs not outputs. Comparing LGC&M cities collectively to their peers, 1998 police staffing levels were about the same in cities with and without residential caps, with and without residential APFOs, slightly higher in cities with UGBs, considerably higher in cities with annexation limits, and considerably lower among cities with voter-enacted council super-majority approval requirements. In no case are the differences statistically significant. As with the fiscal measures discussed above, case-peer differences were generally greater in 1998 than in 1990.

Crime Rates: Historically maligned for under-counting crime, FBI crime rate statistics have improved significantly in recent years. Comparing LGC&M cities collectively to their peers, 1998 crime rates were slightly lower in cities with residential caps, residential APFOs, and super-majority approval requirements, and slightly higher in cities with UGBs and annexation limits. Except for cities with annexation limits, none of the differences are statistically significant.

VI. GROWTH CONTROLS AND GROWTH DISPLACEMENT

Approach

Prior studies of the displacement effects of LGC&M programs have focused on the amount of displaced growth, not its location. To the extent that LGC&M programs really do displace growth, they should reduce the probability of site development in the cities that enact them while increasing those same probabilities in nearby, less-controlled cities. Is this in fact the case?

To find out, we examined changes in the spatial pattern of urban development between 1990 and 1998. Spatial data detailing the locations of urban development was obtained from the California Farmland Mapping and Monitoring Program (CFMMP), a division of the California Department of Conservation. Using a combination of remote-sensing and local ground-truthing, the CFMMP conducts a detailed bi-annual inventory of land cover for 38 California counties. CFMMP's "urban" category includes office, commercial, retail, industrial and related land uses, as well as residential development in excess of one unit per two acres. CFMMP data are generally accurate down to the one-acre level.

Once converted from generalized polygons to one-hectare grid cells, CFMMP data can be used to test the following statistical model:

Prob [An undeveloped grid-cell is developed between 1988 and 1998] = f ($X_1, X_2 \ldots\ldots Xn$)

The dependent variable in this model is the change in land use state of a grid cell or *site*—that is, whether or not it was developed—during a given time period. The *X*s, or independent variables, are those attributes thought most likely affect each site's conversion from non-urban to urban use. Independent variables can include physical site characteristics, locational and economic characteristics, the characteristics of nearby sites, and policy and administrative characteristics such as the presence of a LGC&M measure. Once measured, the dependent and independent variables are matched spatially using GIS.

Because the dependent variable is categorical rather than continuous, the model is estimated using logistical regression, also known as *logit*, rather than linear regression. Model parameters are estimated using a maximum-likelihood procedure in which the error terms are presumed to follow a Weibull distribution. In this case, because the dependent variable takes on just two categorical values (e.g., indicating either a change in land use or no change in land use), the type of logit model presented above is known as a binomial logit model.[11]

The use of small grid-cells as surrogates for development sites introduces a problem known as *spatial auto-correlation*. Spatial auto-correlation refers to the fact that adjacent or nearby objects tend to influence each other. Some types of spatial auto-correlation are legitimate, as in the case of the rancher who observes his next door neighbor selling to a developer and is influenced to do the same. Other types of spatial auto-correlation are simply artifacts, generated by the choice of the spatial unit of analysis. If, as in the current case, one-hectare grid cells are used to record land use change events, then any land use changes larger than one hectare will be recorded as multiple, adjacent events. The resulting over-counting of land use change will tend to bias the results of any statistical models calibrated on the basis of those changes.

Model Estimation and Results

Of the five LGC&M programs previously considered, only housing caps and UGBs are likely to displace development. We originally intended to investigate the displacement effects of housing caps and UGBs in both southern and northern California.[12] When preliminary model runs indicated the presence of too few housing cap and UGB programs in southern California[13] to generate robust results, we turned our attention to northern California alone. The northern California study area includes the nine counties of the San Francisco Bay Area (Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano and Sonoma), as well as five neighboring counties (Monterey, San Benito, San Joaquin, Santa Cruz, and Stanislaus) which now fall within commuting range of the Bay Area. The calibration sample consists of all one-hectare sites in each county which were undeveloped as of 1988, which were not publicly-owned (and therefore could be developed), which had a slope of less than 15%; and which were within 15 kilometers (9 miles) of a major highway or existing urban development .[14]

The dependent variable in all cases is the change in urbanization status of undeveloped sites: a site which was undeveloped in 1988 but urbanized in 1998 was assigned a value of "1." Sites which remained undeveloped were set to "0." Four sets of measures were included as independent variables:

1. **Demand Variables**, which measure the demand for sites as a function of their accessibility to job opportunities and job growth, as well local income levels. Two demand variables are included in each model: JOB_ACCESS90, which measures the distance-weighted accessibility of each site to all regional job centers; and, INC_RATIO90, which is the ratio of community median household income to regional median household income. All else being equal, we would expect sites with superior job accessibility to be more likely to be developed, and sites in upper income communities to be less likely to be developed.

2. **Own-site Variables**, which measure the physical and land use characteristics of each grid-cell as determinants of its development potential. Four own-site variables are modeled: FRWY_DIST, a measure of the distance from each site to the nearest freeway; PRIME_FARM, a dummy variable which indicates whether the site is classified as prime farmland by the CFMMP; SLOPE, the average percentage slope of each site; and FLOOD, a dummy variable indicating whether the site falls within FEMA-designated floodzones. Based on cost and market considerations, we would expect sites near freeways to be more likely to be developed, and sites classified as prime farmland or in floodzones to be less likely to be developed. Similarly, based on the higher cost of building on steep slopes, we would expect the probability of a site being developed to be inversely proportional to its slope.[15]

3. **Adjacency and Neighborhood Variables**, which summarize the environmental and land use characteristics of adjacent and neighboring grid-cells. Four neighborhood variables are modeled: ADJ_SLOPE, the average slope of the eight grid-cells surrounding each subject site; NEIGH_SLOPE, the average slope of the fifteen grid-cell ring 100 to 200 meters from the subject site; FLOOD_1X, the share of sites

within 100 meters of the subject site which are located in FEMA floodzones; and FLOOD_2X, the share of sites within 200 meters of the subject site located in FEMA floodzones. Including these variables in the model offers two benefits. It allows the characteristics of adjacent and neighboring sites to affect the development of subject sites, as well as reducing parameter bias due to potential spatial autocorrelation.

4. **Regulatory and Administrative Variables**, which are intended to capture the development-encouraging or constraining effects of different land use policies and regulations. With respect to land use *policy*, the dummy variable, IN_CITY, measures whether or not a site is located within an incorporated city. To some degree, all Bay Area cities and counties seek to encourage city-centered development and discourage growth in unincorporated areas. We would thus expect sites located within incorporated cities to be more likely to be developed than unincorporated county lands. A second set of dummy variables, one for each county, are included to reflect inter-county differences in land use regulation.

The potential spatial effects of UGBs and housing development caps are captured through two additional dummy variables, GC_DUM and SPILL_DUM. GC_DUM indicates whether a particular site is located in a city which had enacted either a housing cap or UGB as of 1995. All else being equal, we would expect sites located in growth control cities to be less likely to be have been developed than comparable sites in less regulated cities. That is, we would expect the parameter estimate of GC_DUM to be negative. SPILL_DUM indicates whether a site is located in a city or unincorporated area adjacent to a growth control city. If housing caps and UGBs really do displace growth to neighboring jurisdictions, the parameter estimate of SPILL_DUM should be positive, indicating an increased likelihood of development.

Two models were tested. Model A includes the IN_CITY and county dummy variables but not the two growth control dummy variables. Model B includes GC_DUM and SPILL_DUM as well. Estimation results are summarized in Figure 10. Overall, the estimated model fit the data fairly well. Concordance levels are on the order of 98%, meaning that the models correctly predicted which undeveloped sites would remain undeveloped and which would be developed 98 percent of the time.

Except for the GC_DUM dummy variable and two county dummy variables, all of the parameter estimates are statistically significant, and most are of the expected signs. Among the non-policy variables, the factors which most increased the likelihood of site development during the 1990s were freeway proximity (FRWY_DIST) and flat topography (SLOPE). Job accessibility, floodzone status, and farmland type played important but lesser roles. Early model runs revealed INC_RATIO, the ratio of community median income to regional median income, and a measure of potential NIMBYism, to be strongly multi-collinear with several other variables, and it was omitted from later model runs.

Sites located inside incorporated cities were much more likely to have been developed than sites outside cities. This suggests that city-centric development policies are having the desired effect, at least in northern California. With respect to the two growth control variables

Figure 10: Logistic Regression Model of 1988-98 Site-level Land Use Change Incorporating LGC&M Dummy Variables

Dependent Variable: Probability of site-level land use change between 1988 and 1998	Study Area: Extended Bay Area Jurisdictions		Study Area: Extended Bay Area Jurisdictions	
Independent Variables	Standardized Coefficient	Probability Level	Standardized Coefficient	Probability Level
IN_CITY [DV: Within incorporated city]	0.054	0.00	0.051	0.00
FRWY_DIST [Distance to freeway (km)]	-0.207	0.00	-0.211	0.00
JOB_ACCESS [Regional job accessibility]	-0.033	0.00	-0.041	0.00
PRIME_FARM [DV]	-0.034	0.00	-0.034	0.00
FLOOD [DV]	-0.069	0.00	-0.069	0.00
Slope [Percentage site slope]	-0.044	0.00	-0.044	0.00
GC_DUM [DV for cities with housing caps & UGBs]	not entered		0.002	0.14
SPILL_DUM [DV for areas adjacent to cities with housing caps & UGB]	not entered		0.015	0.00
DV: Contra Costa County	0.005	0.19	0.012	0.00
DV :Marin County	0.010	0.03	0.015	0.00
DV:Napa County	0.074	0.00	0.071	0.00
DV:San Benito County	0.024	0.01	0.020	0.03
DV:San Mateo County	0.007	0.09	0.010	0.03
DV:Santa Cruz County	0.041	0.00	0.042	0.00
DV:Solano County	-0.041	0.00	-0.033	0.00
DV:Sonoma County	0.010	0.07	0.011	0.06
DV:Stanislaus County	0.053	0.00	0.055	0.00
ADJ_SLOPE [Avg. 1x Neighbor Slope]	0.057	0.00	0.058	0.00
NEIGH_SLOPE [Avg. 2-3x Nbr. Slope]	-0.186	0.00	-0.191	0.00
FLOOD_1x [Flood zone 1x Nbr. Percent]	0.115	0.00	0.115	0.00
FLOOD_2x [Flood zone 2-3x Nbr. Percent]	-0.101	0.00	-0.106	0.00
Intercept	-5.499	0.00	-5.480	-7.32
Percent correct predictions	97.8%		97.8%	
Number of Observations	1,968,778		1,968,778	

(Model B), sites in cities with housing caps and UGBs were slightly more likely to have been developed during the 1990s than sites elsewhere, although the effect is not statistically significant at the .05 or .10 levels. Still, the fact that the GC_DUM parameter estimate is *not negative* suggests that programs such as caps and UGBs have not significantly reduced development activity in the cities that have enacted them. What they have done is contribute to sprawl. The parameter estimate for the SPILL_DUM variable is both positive and significant, indicating that undeveloped sites in cities and areas adjacent to cities with caps and UGBs were more likely to be developed than sites elsewhere. The displacement effect is not particularly large relative to other factors, but is both noticeable and significant.

Among individual counties, sites located in Napa, Santa Cruz, Monterey, San Joaquin, and Stanislaus counties were far more likely to have been developed than sites in other counties. All else being equal, sites in Solano County were less likely to have been developed than sites elsewhere. Holding other factors constant, including accessibility to jobs, the greater development attractiveness of outlying counties suggests that the cumulative effect of local development policies in the Bay Area—including but not limited to LGC&M policies—is to encourage fringe development and discourage infill and refill development.[16]

CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

Summary of Findings

Ten years ago, based on a matched-pair analysis of California jurisdictions with and without LGC&M programs, we concluded that such programs were neither as effective at controlling growth as their advocates had hoped, nor as injurious to housing affordability as their detractors claimed. The increased popularity of LGC&M programs and the development of improved impact-monitoring tools notwithstanding, we see little reason to alter that basic assessment.

This paper provides answers to four outstanding questions regarding the effectiveness of LGC&M programs as used by California jurisdictions. They are: (1) to what extent do different LGC&M approaches really restrict the amount, pace, or location of growth; (2) to what extent are any resulting supply restrictions reflected in local housing prices; (3) which LGC&M programs and approaches yield promised fiscal benefits and which do not; and (4) to what extent do LGC&M programs cause new development to be systematically displaced from more restrictive to less restrictive communities?

With respect to controlling growth, some types of LGC&M programs, principally residential caps, annexation controls, and voter-enacted super-majority approval requirements *do* appear to significantly limit population growth in the cities that adopt them. Annexation limits and super-majority requirements also limit housing construction. Other programs, most notably UGBs, function mostly to redistribute development from fringe areas toward more central locations.

With respect to housing prices, *all* local regulatory policies, programs and actions that significantly limit new housing production, whatever their form or purpose, adversely affect housing prices. Second, to the extent that specific LGC&M programs do not constrain housing production below what might be termed “fair share” levels, they are not principally responsible for California’s high housing prices and rents.

Contrary to expectations, per capita expenditures are generally higher in LGC&M communities than in otherwise-similar peer cities. Whether this is because local public services are more costly in LGC&M communities, or because residents of such communities prefer higher-quality services, we cannot say. We would assume the latter to be more likely. On the revenue side and measured per capita, both property tax and sales tax revenues are generally higher in LGC&M communities than in otherwise comparable jurisdictions. The LGC&M property tax premium is greatest for cities with APFOs, while the sales tax premium is greatest for cities with UGBs. On the debt side, and compared to jurisdictions without LGC&M programs, 1998 per capita outstanding debt loads were 50% lower among cities with residential caps and UGBs, but 30% higher among cities with residential APFOs. These findings suggest that communities with specific development controls in place may be somewhat better able to limit their infrastructure spending and resulting capital debt loads.

What do these revenues and expenditures buy? With respect to public safety, a comparable number of police officers and comparable crime rates. Within the range of normal sampling error, as of 1998, the number of police officers per capita and overall crime rates were comparable between each set of LGC&M communities and their respective peers. We would expect other public services to follow suit.

The relationship between LGC&M programs and growth displacement is more complex. From a regional or metropolitan perspective, the function of LGC&M programs has been to reduce local growth levels from *extremely* high to *manageably* high. The difference between the two takes the form of spillover growth. LGC&M programs are thus associated with an increased likelihood of development in the cities that adopt them as well as in nearby communities.

In sum, and depending on the particular approach, LGC&M programs can have small-but-noticeable effects on local growth rates and growth patterns, on local public expenditures and revenues, and to the extent that they limit the overall supply of new housing, on housing prices as well. The key word here is *small*, for if such measures do not generate the costs their opponents allege, neither do they generate the benefits their advocates hope for. Effectively planning for and managing growth requires a deft touch; most LGC&M programs operate as sledge hammers. Indeed, it is their blunt nature and the promise that they will manage growth that makes LGC&M programs so exceedingly and enduringly popular.

Additional Research

This paper has addressed a number of the outstanding questions regarding the effectiveness of LGC&M programs in California. Several questions remain, however, the most notable being that of public service quality, cost, and the quality of life. The principal reason California jurisdictions adopt LGC&M programs is to maintain their community character and local public service quality in the face of continued growth. Which combinations of good local planning, sound public budgeting, and LGC&M programs enable communities to successfully do so remains an open question. A second question concerns the cumulative and metropolitan-scale impacts of locally enacted growth control programs. Downs (1994) and others have criticized LGC&M programs as invariably working at cross-purposes and contributing to increased regional planning and policy fragmentation. Is this indeed the case? Third, and of wider interest, to what extent are the findings of this and other studies of the California LGC&M experience applicable in other states? Whether under the guise of smart growth or just good planning, LGC&M programs are spreading throughout the country. Are the middling experiences of California jurisdictions with LGC&M programs the result of political, social, and growth factors unique to California, or are they being replicated in other communities and states as well?

Policy Implications

Californians have turned to LGC&M programs not because they are drawn to regulation, but because they regard traditional planning and permitting approaches as too long-term or piecemeal for dealing with the immediate problems posed by continuous growth. The evidence presented here and elsewhere suggests that LGC&M programs *can* complement more traditional planning approaches by reducing the variability and unpredictability of growth, but when used in isolation from these other approaches, are likely to be ineffective at organizing growth or mitigating its impacts. Successful LGC&M programs don't replace planning, they augment it.

Where does all this leave smart growth, today's planning policy darling? Like growth control, smart growth is less of a coherent framework and more of an assemblage of individual programs and tools. To the extent that smart growth programs can be designed to take advantage of specific development and/or conservation opportunities—such as promoting infill development or encouraging higher densities where appropriate—they provide a perfect complement to ongoing planning and growth management programs. Likewise, smart growth initiatives are likely to be most successful to the extent they function as coordinating and/or implementing tools for well-drafted metropolitan-scale and local plans.

Notes

1 Prior research suggests that the ability of LGC&M programs to limit growth depends more on how they are implemented than on how they are designed (Porter 1986). This is particularly true for urban limit lines, urban growth boundaries, and adequate public facilities ordinances. The ability of development caps to limit growth also varies. Some caps are set to allow high levels of production. Others include significant loopholes and exceptions. Indeed, many California cities eschew formal growth controls altogether in favor of informal controls such as general plan changes and discretionary reviews. These latter measures are not only less controversial, over the long run, they can also be more effective (Landis 1992).

2 Our prior research made use of matched-pairs of growth control and non-control jurisdictions. The peer method used here, although perhaps not as robust a research design, provides for greater generality.

3 Including unincorporated areas, California's total population increased by 14% between 1990 and 2000. The number of dwelling units increased by 9%.

4 The use of 30-minute and 60-minute commute sheds did not lead to significantly different results.

5 In contrast to demographic (or housing unit) demand, the concept of economic demand, refers to a household's willingness-to-pay for different levels of housing services. Housing services include structural services, neighborhood services, location, investment potential, and exclusivity or status. Willingness-to-pay is principally shaped by household income levels and by the immediate user cost of housing, and only secondarily by demographic and economic preferences.

6 Housing analysts sometimes distinguish between demographic (or housing unit) demand and economic demand. Demographic demand refers to the number of housing units needed by a population of a given size and composition. In the very long-term, demographic demand is principally determined by population growth and changing rates of household formation. Both are influenced, but not determined by, job growth. In the mid-term, rates of household formation are held constant and housing unit demand is determined by population growth, which, in high-cost states like California, is principally a function of job growth. In the short-term, housing unit demand is affected by employment levels, household income levels, interest rates and borrowing provisions, and, of course, housing costs.

7 Vacancy adjustment refers to the additional number of housing units required to restore the "normal vacancy rate" in a given market. Depending on tenure, normal vacancy rates are typically in the range of three to five percent. When current vacancy rates are below "normal" levels, the difference between the two can be interpreted as a measure of unmet housing unit demand. Conversely, when current vacancy rates exceed normal levels, there is too much supply in the market. Replacement demand refers to the number of housing units needed to replace those lost to redevelopment and other public projects, as well as to normal depreciation and obsolescence. Required upgrading refers to the number of housing units needed to replace substandard dwellings.

8 The CAR data mostly covers resales, not sales of new homes. The fourth quarter of 1999 preceded (by one quarter) the peak of the Bay Area housing market. Housing prices started noticeably softening in the fourth quarter of 2000.

9 The idea that residents vote with their fee in selecting different bundles of community services and tax rates was first suggested by Charles Tiebout in 1956.

10 Proposition 13 limits property annual tax assessments to 1% of sales value, and annual assessment growth to 2%. Assessments can be raised above the 1% limit upon a 2/3 approval of local voters. The more frequent properties turn over, the more frequently assessments are adjusted to market value.

11 The use of logit models to analyze discrete choices at a single point in time is firmly grounded in micro-economic theory (McFadden 1974). The use of logit models to analyze discrete land use changes, particular changes identified from maps—while statistically feasible—introduces additional theoretical complications. In order for the estimated model parameters to be reliable—that is, to be free from bias—we must make two assumptions about the process of land use change itself. The first is that all participants in the land development process must act independently of each other. This includes landowners, developers, builders, brokers,

homebuyers, renters, and businesses. This assumption is intended to rule out the possibility of oligopolistic or strategic behavior.

A second assumption concerns the lack of presence of any identifiable participants, or agents. Discrete choice analysis has traditionally been used to model the behavior of identifiable agents such as voters, travelers and consumers. In the case of land use change, the agents of interest are land buyers and sellers. Models like the one identified above are known as reduced-form models because they include information on transaction outcomes but not on the agents involved in the transaction. In simple economic terms, there are no utility-maximizing buyers or profit-maximizing sellers present in the model to start or complete a transaction. This is only a problem to the extent that the characteristics of specific buyers and sellers might affect their actions. To deal with this problem, we invoke the idea of competition. Specifically, we argue that if land markets are competitive (e.g., there are no barriers to entry), then the characteristics and non-economic motivations of particular agents should not affect transaction outcomes. Whether developers are well-capitalized or poorly-capitalized, whether they specialize in residential development or retail development, whether their experience is local or national—in a competitive market, these factors should be of less importance than the strength of the demand for urban development and the availability of appropriate sites.

[12] Prior empirical work has demonstrated a much greater tendency for jurisdictions in and around the Bay Area to enact LGC&M programs.

[13] Ventura County jurisdictions enacted UGBs in 1997 as part of the countywide Save Open-space and Agricultural Resources (SOAR) Initiative.

[14] Sites more than 15 kilometers from a major highway or existing urban development were deemed too expensive to be developed given local infrastructure extension requirements. Likewise, sites with a slope in excess of 15% were deemed to be too expensive to develop by virtue of grading costs.

[15] In situations where views are rewarded in the marketplace with price and rent premiums, the probability of development may actually rise with slope.

[16] Some of the key economic and policy barriers to infill development in the Bay Area are discussed in Sandoval and Landis (2000).

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