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The Effects of Local Growth Controls on Regional Housing Production and Population Redistribution in California

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Summary. Based on two surveys of 490 Californian cities and counties, the study examines the effects of local growth-control enactment between 1979 and 1988 on net housing construction between 1980 and 1990. It is shown that local growth-management measures significantly displaced new construction, particularly rental housing, possibly exacerbating the expansion of the metropolitan areas into the interiors of the state. Further, the measures impacted low-income households and minorities particularly. Not all growth-control measures were associated with this change. Measures which limited available land or which downsized existing zoning had stronger effects.

Introduction

In this paper, the consequences of local growth-management enactment in California on regional housing production and population redistribution are examined. There is a sizeable literature on the effects of local land-use regulation on the supply and cost of housing. Theoretically, local land-use regulations have been postulated as increasing housing prices through a variety of mechanisms (Dowall, 1984; Mark and Goldberg, 1986; Fischel, 1985). First, local land-use regulations can raise the cost of construction through sub-division or development requirements (Elliot, 1981; Katz and Rosen, 1987). Secondly, local land-use regulations can limit the supply of new housing (Knapp, 1985). Thirdly, local land-use regulations can indirectly affect housing prices by improving the quality of life in a city through limiting population growth (Brueckner, 1990). Fourthly, builders may be encouraged to shift to more expensive homes because they are more profitable and, therefore, reduce the supply of affordable housing (Landis, 1986). Fifthly, local land-use regulations might shift demand to adjacent jurisdictions, thereby driving up the costs of housing in uncontrolled areas as well (Landis, 1992).

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Empirically, there have been numerous studies which have looked at the effects of land-use regulations on housing prices (Hamilton, 1978; Fischel, 1980; Rose, 1989; Pollakowski and Wachter, 1990; Wachter and Cho, 1991). Many of these have focused on traditional land-use regulations, such as zoning, though a few have looked at the 'new wave' of local growth-management ordinances. Also, most studies have tended to focus on the effects of local land-use regulation on the cost of existing housing, though a few studies have looked at the effects on vacant land (Nelson, 1988; Brueckner, 1990); local land-use controls tend to lower the value of vacant land because of restrictions over developing it.

Fischel (1985, 1990) has provided extensive reviews of these studies and has summarised conclusions about the effects of local land-use regulation on housing. In general, he argues, zoning increases the prices of existing housing, particularly in the suburbs, but it may also lower the value of vacant land. The mechanisms for affecting undeveloped land are in restricting the development of amenities that would be desirable, but which cannot be built (Brueckner, 1990, 1995).

The Effects of Growth-management Measures on Housing Supply and Price

Only a couple of studies have looked at the effects of the new wave of growth-control measures on housing prices, and the results are more ambiguous. Landis (1992) examined changes between 1980 and 1987 in the median home price for single-family homes in seven growth-controlled Californian cities and compared this with seven cities which did not have growth-control measures, matched by size, growth rate and development character. He found that median single-family home prices did not rise any faster over the period than the matched counterpart pro-growth cities, suggesting that existing growth controls were not the critical factors. Instead, he suggests that the measures may not be effective, may cause sufficient spillover to adjacent jurisdictions to relieve prices, or may be impacted by informal, yet effective, growth controls which were not measured.

Another study examined the effects of state-wide growth-management legislation between 1970 amd 1985 on three-year lagged changes in permitted residential and non-residential construction values at the state, metropolitan and county levels, for counties in the major metropolitan regions (Glickfeld and Levine, 1992). However, the cumulative effect of growth-management legislation showed no relationship to permitted construction values in California when controlling for population growth and interest rates.

Two Surveys on Local Growth Management in California

In early 1989, a survey of 443 city and county jurisdictions in California was conducted to document the enactment of local ordinances for growth management and growth control which were in effect as of the end of 1988 (Glickfeld and Levine, 1992). In that survey, administrators from all 57 counties and 386 of the 451 cities that existed at the time were interviewed. At the end of 1992, an update survey of Californian jurisdictions was conducted in order both to document changes in local growth-management legislation and to examine other land-use policies adopted by jurisdictions to reduce or minimise the impact of growth (Levine *et al.*, 1996). In this latest survey, information was obtained from 55 of the 57 counties and 410 of the 466 cities existing at the end of 1992. Jurisdictions covered in the two surveys accounted for 99.4 per cent of the 1990 population and 99.9 per cent of the land area.

A data-set was constructed which combined the two surveys and this database, in turn, was matched with 1980 and 1990 demographic and housing data (US Bureau of the Census, 1980, 1990). Because about 20 per cent of the population of the state lived in the unincorporated areas of counties in 1990, it was important to include this population.

For the counties, only data on the unincorporated areas were documented. California law allows communities to become incorporated into cities once they achieve a given population size and are capable of financing city services. Hence, county land-use policies only apply to the unincorporated areas. To assess the unincorporated areas, the areas within the county not belonging to cities were calculated with a geographical information system and, from the 1980 and 1990 census data, only the population living in the unincorporated areas was counted for the county policies. Because there were 34 cities which were incorporated between 1980 and 1990, the data for the unincorporated areas had to be adjusted to allow common comparisons.[1] In total, there were 490 city and county jurisdictions for whom 1980 and 1990 census comparisons could be made.

Growth-control Measures

Eighteen different types of measure designed to manage or control growth were documented (Table 1).[2] The types of measure fell into three general categories: residential (38 per cent); commercial (29 per cent); and other, which included control over vacant land and new sub-divisions (33 per cent). Ordinances were not documented since one ordinance could contain multiple growth-control conditions (or measures). Also, the extent to which these ordinances were enforced was not documented. Additional questions were also asked about the existence of temporary moratoria on development, infrastructure concerns leading to development restrictions, the existence of various development-impact fees, a range of growth-encouraging policies, and incentives for low- or moderate-income housing.

As of the beginning of 1993, 1461 measures were identified. Further, combining this information with that obtained for jurisdictions which completed the 1988 questionnaire, but not the 1992 questionnaire, it was estimated that there were over 1500 local growth-control measures in effect in California by the end of 1992. About 85 per cent of the jurisdictions had enacted at least one measure and the range varied from 0 to 13, with the mean being about 3. Further, there was over a 60 per cent increase in the enactment of measures between 1988 and 1992 in spite of a severe recession.

A growth-control scale was created by summing the individual measures. In the earlier study (Glickfeld and Levine, 1992), the sum of all individual measures was shown to be a better indicator than any one measure since it probably indicates the priority that a jurisdiction places on growth management. The theoretical range is from 0 to 18 on this scale, but the actual range is from 0 to 13.

Conditions Encouraging Growth Controls

There are a number of conditions which have triggered the widespread enactment of growth-control measures in the state. These have been discussed at length elsewhere (Glickfeld and Levine, 1992; Levine *et al.*, 1996). Briefly, the conditions are:

(1) During the 1980s, California's population increased by over 6 million persons, making this the largest increase over a decade by any state in US history. The growth rate of 2.3 per cent during the 1980s was, given the size of California, comparable to growth rates in many developing countries.

(2) Although suburbanisation had been occurring for a long time, the large population growth during the 1980s shifted large numbers of persons to the peripheral parts of metropolitan areas, putting pressures on rural and low-density suburban communities to build new infrastructure. Figure 1 shows net 1980–90 housing growth by counties. While the metropolitan counties of Los Angeles and San Diego showed sizeable increases in housing units, many inland areas also received sizeable increases.

(3) Accompanying suburban population growth have been increases in rental housing. Each jurisdiction in California was assigned to the nearest of four metropolitan centres—Los Angeles, San

Table 1. Growth control measures and percentage of jurisdictions adopting

Growth-control measure	Percentage adopting
Residential	
Adequate service levels required as a condition for approval of a residential development	41
Reduced permitted residential density	34
Restrictions on the number of residential building permits	13
Rezoned residential land to less intense use	10
Population growth limits	9
Requires voter approval to increase residential densities	5
Requires super-majority council vote to increase residential densities	2
Commercial	
Adequate service levels required as a condition for approval of commercial or industrial development	36
Reduced permitted height of commercial/office buildings	27
Rezoned commercial/industrial land to less intense use	18
Restricts commercial square footage that can be built within given time-frame	5
Restricts industrial square footage that can be built within given time-frame	4
Other measures	
Restrictions on structural floor area which can be built on a given parcel	43
Established urban limit line or greenbelt beyond which development is not permitted	19
Adopted growth management element in general plan	16
Phased development areas where development approval is deferred until certain time-period	14
Restrictions on number of new sub-division lots that can be created within given time-frame	5
Other measure to control rate, intensity, type and distribution of development	14

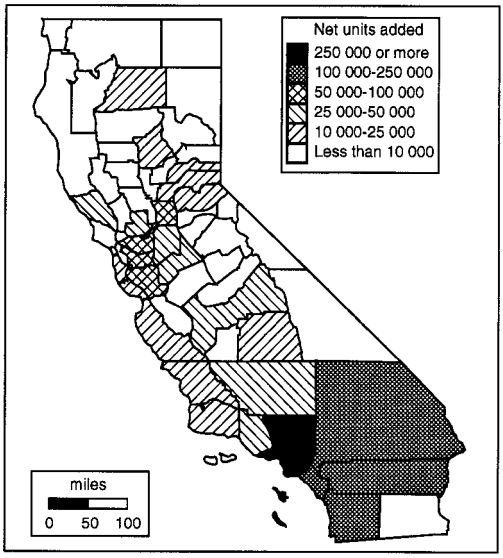

Figure 1. Housing growth in California County: net change in number of housing units, 1980–90.

Francisco, San Diego, Sacramento—and a GIS calculated the distance in kilometers to the city hall of each of these centres. Figure 2 shows the annual growth rate in the number of rental units in California as a function of distance from the nearest metropolitan centre. This distribution has been smoothed by taking the average of 15 sequential observations. As can be seen, the growth rate of rental housing increased up to a peak at about 130 km (80 miles) away, but there is another peak at about 275 km (170 miles) away.

(4) There has also been a shift in employment to the suburbs which, in turn, has increased traffic volumes. Many suburban cities have had to increase their expenditures on roadway and signal systems in order to meet the growing traffic volumes.[3]

(5) Since the early 1970s, there have been declines in federal support for infrastructure expansion with the failure of the state to make up the shortfall.

(6) Through a series of ballot measures, California voters also imposed restrictions on the ability of local governments to raise funds for local infrastructure development. Consequently, many jurisdictions in California experienced infrastructure deficiencies with limited fiscal resources.

(7) Also, some communities have shown exclusionary tendencies towards low-income and minority populations.

Displacement of Housing

In spite of these conditions, the effects of local growth-management enactment would be expected to impact future housing production, particularly if the ordinances are effectively enforced. One possible effect on local growth-management ordinances would be to displace construction activity to adjacent jurisdictions. An issue that has been frequently discussed is that of spillover from high-growth to lower-growth cities (Fischel, 1990; Wachter and Cho, 1991; Altshuler and Gomez-Ibanez, 1993). Wachter and Cho (1991), for example, show that the restrictiveness of the zoning in adjacent areas independently increased the prices of single-family homes. According to this view, local land-use regulation displaces the demand for housing to adjacent jurisdictions. Developers move to other jurisdictions to reduce costs as well as development time. An additional factor in extreme growth-control cities, of which there are very few, would be to prevent additional development from occurring altogether. According to this argument, developers, blocked from investing where they intended, move to adjacent jurisdictions because of the proximity to their intended real estate market.

There is some disagreement about where this displacement will occur. Wachter (Pollakowski and Wachter, 1990; Wachter and Cho, 1991) argues that the spillover will move to adjacent jurisdictions (diffusion) whereas Fischel (1980) and Downs (1992) argue that the spillover will move much further out on the urban periphery ('leapfrog' development). Brueckner (1990) argues that controls make vacant land in adjacent jurisdictions more valuable and, thereby, tend to encourage diffusion.

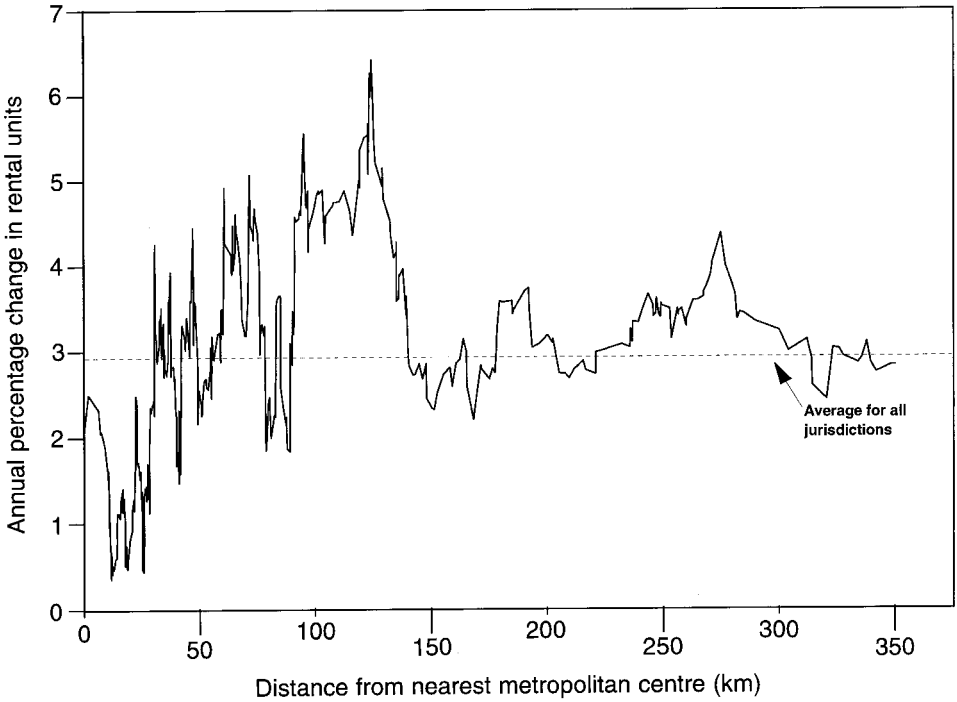

Figure 2. Growth of rental housing in the suburbs, 1980–90: growth in rental units by distance from nearest metropolitan centre (average of 15 sequential observations).

Methodology

To test properly whether displacement has actually occurred, one would need several sets of individual-level data indicating a propensity to shift from one jurisdiction to an adjacent one because of costs or development obstacles. This would require, for example, a survey of new residents of one city who would then be asked whether they had moved to that city because of a lack of opportunities in an adjacent city or, alternatively, a survey of developers showing that they had invested in one city because they could not invest in adjacent cities. Unfortunately, no studies of this type have been located.

A Model of Housing Displacement

Instead, an approximation is established which, while less precise than individual-level data, can indicate whether the displacement hypothesis is plausible. A model of housing change between 1980 and 1990 is developed and applied to individual jurisdictions. The conceptual form of the model is

Number of 1990 housing units	=	Number of 1980 housing units	+	Change in housing units between 1980–1990

In turn, the change in housing units between 1980 and 1990 is hypothesised to be a function of other variables including population growth, available land, interest rates, the existence of growth-control measures, or other local housing policies.

This model looks at *net* housing change—that is the result of all new units less all demolished units. Measuring net change has the advantage of not having to standardise housing construction due to shifts in the composition of housing (for example, an increase over time in single-family homes relative to multi-unit apartments). If developers shift their construction from more affordable

to more expensive housing (Landis, 1986), this should be seen as a reduction in the total number of new units.

The change component can be thought of as falling into three categories—demand, supply and policy. On the demand side, clearly the largest factor is the continuing population growth that impacts most California communities. Other demand factors are the relatively high income levels in the state and the huge influx of foreign investment that started during the 1980s. In terms of the model, all these demand factors are captured in the coefficient for the number of 1980 housing units; it represents the marginal increase in 1990 housing units per unit of 1980 housing. Some demand factors would be assumed to be relatively uniform across all jurisdictions, such as building costs or the prevailing interest rates for construction, whereas other demand factors would vary between jurisdictions, such as differential population growth rates.

On the supply side are a number of factors such as the availability of vacant land for new development, the average price of developable land and the accessibility of the community to nearby amenities (for example, shopping). Since good data on land values are not available, a number of variables that could be used as a proxy for these costs were tried. Eventually, population density for 1980 was chosen as a proxy for 1980 land costs, available land and adjacency to urban amenities.[4] The variable has the advantage of being almost unrelated to the number of 1980 housing units as well as to the number of enacted growth controls.[5] It also is a surrogate for spatial location since population densities drop off rapidly with distance from metropolitan cores, and has long been used as a proxy for land rent (Alonso, 1964; Haggett *et al.*, 1977; Levine, 1997).

The relationship between population density and housing growth occurs primarily because high-density jurisdictions have less available land for continual growth. For low-density jurisdictions, there is virtually no relationship between density and the growth rate.[6] It is hypothesised that jurisdictions with higher population densities will have slower increases in housing, all other things being equal, whereas there will be no relationship for lower-density jurisdictions.

The policy variables are those that are influenced by local government decisions, such as the existence of local growth controls or, conversely, various incentives for increasing the supply of housing. 'Policy' is both a supply and a demand variable since a local government's authority over land-use decisions can influence directly the availability of developable land as well as indirectly the demand for that land (for example, through zoning decisions which increase or decrease the number of units that can be built).

Growth Control and Net Housing Change

In the first stage, the effects of growth controls on net housing production are examined, controlling for 1980 housing and population density. The formal model is

$$Y_{1990} = \alpha + \beta_1 Y_{1980} + \beta_2 X_{d80} + \beta_3 X_{gc} + \varepsilon \quad (1)$$

where, Y_{1990} is the number of 1990 housing units; Y_{1980} is the number of 1980 housing units; X_{d80} is the 1980 population density; X_{gc} is the number of local growth measures enacted over a period lagged by one or more years before 1980–90; α is a constant; β_1, β_2 and β_3 are coefficients; and ε is the residual error (assumed to be normally distributed and uncorrelated with the other independent variables). It is assumed that the other unique variables are part of the error term, and that they are distributed normally with respect to the model.

The model is applied to 490 jurisdictions which completed the 1992 survey or the 1988 survey (if they did not complete the 1992 survey) and for which data on housing units were available from the 1980 and 1990 censuses. According to the model, the constant term captures any net change which is 'constant' for all jurisdictions; conceptually, while it makes little sense, since large jurisdictions will add more units on average than small ones, it is left in the model to minimise the error associated with the least-squares

estimator.[7] The coefficient for 1980 housing units is directly proportional to the true growth rate, adjusting for this constant.[8] If there was no change between 1980 and 1990 other than the constant, then the coefficient for Y_{1980} would, of course, be 1.00. If the coefficient for Y_{1980} is greater than 1.00, this indicates a net increase in housing units not associated with the other variables in the model (for example, a uniform increase in housing units due to general population growth).[9] Conversely, if the coefficient for Y_{1980} is less than 1.00, this indicates that there was either a net decrease in the number of housing units between 1980 and 1990 or that other variables account for some its variance. The coefficient for Y_{1980} indicates the average rate of growth for housing units, above and beyond the constant term, and would be expected to be very high.

The coefficient for 1980 density should be negative; jurisdictions with high 1980 densities will add proportionately fewer units than jurisdictions with lower densities. Finally, controlling for 1980 housing units and population density, it is expected that the number of growth controls enacted would negatively impact net housing production—that is, there should be relatively fewer units produced in growth-controlled cities and counties than in non-growth-controlled jurisdictions.

Results

Lag Effect

For the growth-control variable, the number of individual growth measures enacted is lagged behind the 1980–90 period. The measures would be assumed to take time to have an effect on housing supply. By taking a 10-year period for comparison, any differences between jurisdictions in lag effect should be minimised. To assess the optimal effects, Table 2 presents the results of testing four different lag models, from a 3-year lag to no lag.

As can be seen, in all four models, the constant term is significant as is the coefficient for 1980 housing units. The coefficient for density is negative, but not significant in any of the models. Controlling for these, the number of enacted measures is significant in two of the models, with 1- and 2-year lags, suggesting that the strongest effect is somewhere between the two. From the time a jurisdiction enacts a growth-control measure, it takes a year to two to affect the production of new housing. Because the R^2 for a 1-year lag is fractionally higher than for a 2-year lag, this model will be used for the rest of the analysis. Nevertheless, as a first cut, it is apparent that the enactment of growth controls negatively affects the production of new housing. According to the model, on average each growth control enacted between 1979 and 1988 reduced net housing change by about 884 units.

Reduction or Displacement?

In short, local growth-control or management measures appear to have reduced the number of housing units added during the 1980s, either by actually reducing the units produced or, more likely, through shifting the production to jurisdictions with no or few measures. An attempt was made to estimate the effect on the total dollar value of residential construction of growth-control enactment by time-series testing, between 1969 and 1993, the effects of state-wide growth-control enactment (lagged by one, two or three years) on the permitted value of state-wide residential construction, controlling for population growth, the annual prime lending rate, defence expenditures and the value of US new residential construction (excluding California). The coefficient of growth-control measures was not significant in any of the models, suggesting that the total number of control measures enacted in any one year did not appreciably affect residential construction investments one, two or three years later (details not shown).

It is more likely that the effect of the local growth-control measures was to redistribute new housing to jurisdictions with less control. Typically, these are either in rural areas

Table 2. Local growth controls and housing unit change (dependent variable: 1990 housing units; $N = 490$ jurisdictions)

	Coefficient (t-value)			
Independent variables	Model A	Model B	Model C	Model D
Constant	3097.61 (3.25) ****	3436.69 (3.57) ***	3500.78 (3.61) ***	3299.03 (3.16) **
1980 housing units	1.08 (108.38) ****	1.08 (108.21) ****	1.08 (108.11) ****	1.08 (104.03) ****
1980 density	−0.28 (−1.30) n.s.	−0.29 (−1.34) n.s.	−0.27 (−1.25) n.s.	−0.26 (−1.13) n.s.
Number of 1977–86 enacted growth-control measures (3-year lag)	−693.86 (−1.42) n.s.	—	—	—
Number of 1978–87 enacted growth-control measures (2-year lag)	—	−951.81 (−2.11)	—	—
Number of 1979–88 enacted growth-control measures (1-year lag)	—	—	−884.24 (−2.19) *	—
Number of 1980–89 enacted growth-control measures (No lag)	—	—	—	−594.64 (−1.55) n.s.
R^2	0.961	0.962	0.962	0.961

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$. n.s. = not significant.

or on the periphery of metropolitan areas (though there are many exceptions). A rough estimate can be made of how large was this displacement. From these 490 jurisdictions, 578 growth measures were enacted between 1979 and 1988 (out of a total of 1481 growth measures enacted for all years by these jurisdictions). Using the coefficient of 884.24 fewer units produced between 1980 and 1990 (from Model C of Table 2), approximately 511 091 units were either not produced or else displaced because of these measures, out of a total net increase of 1 574 633 for these 490 jurisdictions (or 32.5 per cent).[10] In other words, about 33 per cent of all new housing units created during the 1980s in California were redistributed by local growth-control measures. This is an extraordinary large percentage though there is a large variability in the estimate. However, even if it is assumed that this estimate is high and the lower limit of the 95 per cent confidence interval around the coefficient is taken (about 76.71 units per measure), then the displacement is still about 9 per cent of all new housing units. Growth-control measures appear to have significantly reduced or displaced new housing construction during the 1980s.

Effects of Specific Measures

Next, an examination was made of specific growth-control measures that contributed to the reduction or displacement of housing units between 1980 and 1990. The model was calculated, in turn, for each of the 18 measures with each measure being lagged by one year. The formal model was

$$Y_{1990} = \alpha + \beta_1 Y_{1980} + \beta_2 X_{d80} + \gamma_1 C_i + \varepsilon \quad (2)$$

where, Y_{1990} is the number of 1990 housing units; Y_{1980} is the number of 1980 housing units; X_{d80} is the 1980 population density; C_i is a specific growth-control measure enacted over between 1989 and 1988; α is a constant; β_1, β_2 and γ_1 are coefficients; and ε is the residual error (assumed to be normally distributed and uncorrelated with the other independent variables).

Four measures showed significant negative relationships with 1990 units, controlling for 1980 units and 1980 density, while the other 14 did not (details not shown). The growth measure having the strongest effect (as measured by the *t*-value of the coefficient) was the rezoning of land previously designated for residential development to agricultural or open-space use. Jurisdictions that enacted such a measure between 1979 and 1988 had, on average, 13 975 fewer net housing units developed between 1980 and 1990. In other words, removing land from that available for residential development definitely reduces the rate of new housing production.

The next-strongest measure associated with a slowing of the growth of housing units was the rezoning of land previously designated for commercial or industrial development to a less-intense use. Jurisdictions which enacted such a measure between 1979 and 1988 had, on average, 7035 fewer net housing units built between 1980 and 1990. It is not completely clear why a reduction in commercial or industrial land would negatively affect housing production. It is possible that vacant land near to previously designated commercial/industrial areas becomes less attractive for residential development (Brueckner, 1990). Also, mixed-use developments become discouraged when commercial developments are reduced. More research on this point is necessary.

A third measure which significantly reduces the number of residential units is the reduction in permitted residential densities by either general plan amendment or rezoning. Jurisdictions which enacted this type of measure between 1979 and 1988 built 3908 fewer net housing units, on average, between 1980 and 1989. The down-zoning of residential land to lower densities reduced the number of net housing units built. Finally, a fourth measure which is significantly associated with a net reduction in housing units is the reduction in permitted heights of commercial or office buildings. Jurisdictions which enacted this type of measure between 1979 and 1988 built 3830 fewer net housing units, on average, between 1980 and 1989.

These four measures show the strongest relationships with a reduction in new housing units. However, only 142 of the 498 jurisdictions adopted one or more of these stronger measures between 1979 and 1988. The other growth-control measures that were enacted (for example, infrastructure adequacy requirements, urban limit lines, housing caps) do not appear to have significantly reduced new housing units.

The Effect of Strong Growth-control Measures

This selectivity was examined further by creating two separate growth-control scales, one which sums the four measures which had strong effects (the strong measures) and another which sums the 14 growth-control measures which did not have significant effects (the weak measures). The model was then rerun with each of these growth-control scales substituted for the growth-control variable. The formal model was

$$Y_{1990} = \alpha + \beta_1 Y_{1980} + \beta_2 X_{d80} + \xi_1 X_{scale} + \varepsilon \quad (3)$$

where, Y_{1990} is the number of 1990 housing units; Y_{1980} is the number of 1980 housing units; X_{d80} is the 1980 population density;

Table 3. Types of measure and housing unit change (dependent variable: 1990 housing units; $N = 490$ jurisdictions)

	Coefficient (t-value)		
Independent variables	Model A	Model B	Model C
Constant	3 700.55 (4.17) ****	2 525.80 (2.64) **	4 424.97 (5.67) ****
1980 housing units	1.08 (111.17) ****	1.08 (107.65) ****	1.09 (123.88) ****
1980 density	−0.21 (−0.97) n.s.	−0.25 (−1.15) n.s.	−0.65 (−3.33) ***
Number of 1979–88 'strong' growth-control measures	−3444.84 (−4.34) ****	—	—
Number of 1979–88 'weak' growth-control measures	—	−28.50 (−0.05) n.s.	—
Number of 1979–88 'strong' growth-control measures for counties only	—	—	−17 482.00 (−11.47) ****
R^2	0.963	0.961	0.970

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$. n.s. = not significant.

X_{scale} is a scale for either the number of strong local growth measures (values 0–4) enacted between 1979 and 1988 or the number of weak local growth measures (values 0–14) enacted between 1979 and 1988; α is a constant; β_1, β_2 and ξ_1 are coefficients; and ε is the residual error (assumed to be normally distributed and uncorrelated with the other independent variables).

Table 3 shows the two models (A and B). As expected, the model with the four strong measures showed a highly significant negative effect on new housing units while the model with the 14 weak growth-control measures did not show a significant effect. For each of the strong measures enacted, about 3445 fewer housing units net were added between 1980 and 1990. In other words, it appears that growth-control measures which either remove land from development or reduce existing densities negatively impact new housing units.

On the other hand, the other types of growth-control measure appear to be more neutral in their effect. While the coefficient for the weak-measures scale is negative, as expected, it is not significant. These measures are frequently enacted in conjunction with one of the stronger measures. For example, of the 142 jurisdictions which enacted one or more of the strong measures, 54 per cent also enacted one or more of the weaker measures. Conversely, for those jurisdictions which did not enact any of the strong measures, only 33 per cent enacted one or more of the weaker measures. These other measures tend to complement a general policy towards controlling growth. More research

will be necessary to see if they have effects over a longer period. However, for the decade of the 1980s, they do not appear to have displaced new housing.

Strong Land-use Controls by County Governments

Much of the control over new developments has occurred in the unincorporated areas of the counties. County governments are responsible for the majority of agricultural and open-space land in the state and have generally tried to contain urban growth to certain designated, unincorporated areas. With the exception of the largest metropolitan counties, county governments will provide much less in the way of infrastructure and services and, instead, will assume that once an unincorporated area grows to a certain size it will become incorporated as a separate city. Consequently, county governments have been more selective with respect to growth. Model (3) was examined in more depth by analysing the results separately for city and county jurisdictions (for the unincorporated areas). It was found that the strong measures tended to have a greater effect in the unincorporated areas than in the city jurisdictions. Model 3C shows the effect of using an interaction term which measures the number of strong measures for county jurisdictions only. As seen, the negative effect on net housing production is very strong. For each strong measure enacted by a county, there were 17 482 fewer housing units produced during the 1980s whereas there was no effect for city jurisdictions.

This does not mean that these policies are not applicable to cities; there are subsets of cities for which the strong measures have an effect in reducing housing production. For example, cities with 1980 populations of between 40 000 and 70 000 showed significant negative effects associated with the strong measures. However, the measures are more restrictive in their effects on housing production in the unincorporated areas than in the city jurisdictions.

Since many of these unincorporated areas are at the periphery of metropolitan areas while others are in the suburban parts of urban counties, the strong measures can be considered informal urban-limit policies for the jurisdiction. It is interesting that formal urban limit policies were not significantly related to a decrease in net housing units. Nevertheless, the strong policies—which involve removing land from development and down-zoning existing densities—have the effect of reducing growth, and this effect tends to occur more in the unincorporated areas.

The Effects of Other Land-use Policies

It is important to understand how the growth-control measures interact with other land-use policies. Three alternative sets of land-use policies which could affect net housing production were examined—growth encouragement, incentives for affordable housing and rent control.

Growth-encouragement policies. The most significant of these is the encouragement of growth. Historically, California is a state that has promoted growth since the late 19th century (McWilliams, 1973). During most of its history, there was plenty of vacant land. The railroads and developers went to extraordinary lengths to attract demand for new housing development. Further, the growth of the defence industry during and after World War II brought millions of people to California which, in turn, led to an almost-continuous expansion of new housing throughout the state. Until the early 1970s, few jurisdictions attempted to reduce or control growth. Even in the 1970s, there were only a handful of jurisdictions that enacted measures designedto reduce, redirect or even stop population growth. The big increase in growth-control measures, however, occurred after 1980 (Glickfeld and Levine, 1992). Many jurisdictions had, and still have, policies designed to encourage growth and attract new developments.

In the 1992 survey, but not in the 1988 survey, the administrator who filled out the questionnaire was asked whether the jurisdic-

tion supported nine different growth-encouragement policies (Table 4). The questions were rated as to the importance of each of the nine measures. These have been rescaled so that if a policy was rated as 'Very important' or 'Important', it was coded as an existing policy. The nine policies were then summed into a pro-growth scale. From the 1992 survey, 457 jurisdictions provided information about their growth-encouragement policies. Overall, 84 per cent of these supported one or more pro-growth policies. The range varied from 0 to 9 with the mean being 3.0.

There is virtually no relationship between the number of growth-control measures a jurisdiction enacted and the number of pro-growth measures they had ($r = -0.07$, n.s.). Further, 71 per cent of the jurisdictions had at least one growth-control measure *and* at least one pro-growth measure. Some of this overlap can be explained by a balanced growth policy whereby growth is encouraged in some areas within a jurisdiction and discouraged in other areas (37 per cent of jurisdictions); this was particularly true of jurisdictions which are larger in area. However, about 34 per cent of the jurisdictions had both pro-growth and growth-control policies without an explicit balanced-growth policy. These policies may have been enacted at different times in response to unique political conditions. Unfortunately, information was not obtained about the year in which each of the pro-growth policies was enacted, and there is ambiguity about whether the pro-growth measures preceded or succeeded the growth-control measures.

Incentives for affordable housing. The second type of policy examined was incentives for affordable housing. In both the 1988 and 1992 surveys, jurisdictions were questioned whether they provided up to nine incentives for the construction of low- or moderate-income housing (Table 4). Seventy-three per cent of the jurisdictions had one or more affordable housing incentives; the mean was 2.2. A variable was created for the number of incentives for low- or moderate-income housing. In addition, a question was asked whether affordable housing units were excluded from residential growth controls. Overall, 10 per cent of the jurisdictions exempted low- or moderate-income housing units from any residential growth-control measures.

Rent control. The final type of land-use policy that was examined was the existence of rent control. In California, 15 of the jurisdictions in the database had some form of rent control as of 1992; most of these ordinances apply to existing housing and exclude new construction. However, it has been argued that the rent-control laws changed the political climate in those jurisdictions with the consequence of reducing new rental housing (Heskin *et al.*, 2000). A dummy variable was created indicating whether the jurisdiction had rent control or not.

To examine the interaction of these variables with the growth-control measures, another model was run, utilising the entire growth-control scale, lagged by one year. The formal model is

$$Y_{1990} = \alpha + \beta_1 Y_{1980} + \beta_2 X_{d80} + \beta_3 X_{gc7988} + \beta_4 X_{pro} + \beta_5 X_{ai} + \beta_6 X_{ex} + \beta_7 X_{rc} + \varepsilon \quad (4)$$

where, Y_{1990} is the number of 1990 housing units; Y_{1980} is the number of 1980 housing units; X_{d80} is the 1980 population density; X_{gc7988} is the number of local growth measures enacted during 1979–88; X_{pro} is the number of growth-encouragement policies; X_i is the number of affordable housing incentives; X_{ex} is a dummy variable indicating whether the jurisdiction excludes affordable units from residential growth controls; X_{gc} is a dummy variable indicating whether the jurisdiction has enacted a rent-control ordinance; α is a constant; $\beta_{1 \ldots} \beta_7$ are coefficients; and ε is the residual error.

Complete data were available for 457 jurisdictions. Table 5 presents the results. As seen, the effect of growth-control measures on net housing production is negative and significant while controlling for these other policies. Further, while the coefficients are in the expected positive directions, neither the number of growth-encouragement policies,

Table 4. Policies aimed at increasing growth

Growth-encouraging policies
1. General plan allows generous capacity for growth and flexibility to respond to new growth opportunities
2. Recent rezoning of land to higher density or intensity of use
3. Fast track for regulatory process in obtaining building permits
4. Financial incentives for new development
5. Low development fees
6. Direct infrastructure subsidies
7. Redevelopment agency incentives for new development exist
8. Aggressive economic development recruiting effort
9. Other growth-encouraging policy

Low- or moderate-income housing incentives
1. Density bonuses
2. Revenue bond programmes
3. Fast-track permit processing
4. City block grants
5. Redevelopment funding
6. Development fee waivers
7. Higher priority within growth-management restrictions
8. Other financial subsidies
9. Other low–moderate income incentive

nor the number of incentives for the construction of affordable housing, nor the exclusion of low- or moderate-income units from residential growth controls shows a significant relationship with net housing production during the 1980s. During the 1980s, encouraging growth did not lead to increased residential units nor did a commitment to build low- or moderate-income housing.

On the other hand, the effect of rent control on rental housing change was negative and strong. For those jurisdictions with rent control, there has been very little rental housing added, and in some cities there has even been a decline. Much of this has been the conversion of rental housing to owner-occupied housing (Heskin *et al.*, 2000). Including the variable in model (4), however, did not mitigate the negative effects of growth-control measures on rental housing production. In other words, irrespective of the existence of other land-use policies which could affect housing production, growth-control measures led to a net decrease in residential housing.

Table 5. Other land use policies and housing unit change (dependent variable: 1990 housing units; $N = 457$ jurisdictions)

Independent variables	Coefficient (t-value)
Constant	1 757.25 (1.21) n.s.
1980 housing units	1.10 (98.82) ****
1980 density	−0.04 (−0.18) n.s.
Number of 1979–88 growth-control measures	−993.67 (−2.27) *
Number of growth-encouragement measures	202.20 (0.63) n.s.
Number of low- or moderate-income housing incentives	308.66 (0.88) n.s.
Affordable units are excluded from residential controls	2 763.51 (1.23) n.s.
Rent control	−21 686.78 (−5.25) ****
R^2	0.964

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$. n.s. = not significant.

Effects of Growth Management on Housing Composition

The net reduction in housing units due to growth-control measures has consequences on the type of housing units constructed. Change between 1980 and 1990 in seven housing characteristics were examined in relation to the enactment of growth-control measures:

(1) Number of rental units.
(2) Number of owner-occupied units.
(3) Number of families.
(4) Median rent level.
(5) Median ownership (home) value.
(6) Median household income.
(7) Number of householders who lived in the unit five years previously.

The formal model is

$$H_{1990} = \alpha + \beta_1 H_{1980} + \beta_2 X_{d80} + \beta_3 X_{gc7988} + \varepsilon \quad (5)$$

where, H_{1990} is the value for the 1990 variable; H_{1980} is the value for the same variable in 1980; X_{d80} is 1980 population density; X_{gc7988} is the number of growth-control measures enacted by the jurisdiction between 1979 and 1988; α is a constant; $\beta_{1 \ldots} \beta_3$ are coefficients; and ε is the residual error. Again, if local growth-management legislation affected the composition of the housing characteristics, then there should be a negative relationship between the number of growth measures enacted between 1980 and 1990 and the seven dependent variables.

Table 6 presents the results. First, as seen, in all seven models, the R^2 values are very high. Secondly, the coefficients for the 1980 values are highly significant, as would be

expected. Thirdly, 1980 density is significant in two of the seven models. Lower densities are associated with a greater change in median rent levels and median ownership values. These would be expected as higher densities are typically associated with higher land costs. Fourthly, and finally, controlling for the 1980 value and 1980 density, five variables are correlated with the number of growth-control measures enacted during between 1979 and 1988. Jurisdictions with more growth-control measures:

(1) Added fewer rental units—about 404 fewer units per enacted measure. It was estimated that about 32 per cent of the net rental units added between 1980 and 1990 were displaced because of growth-control measures.
(2) Did not displace the number of owner-occupied units, though the coefficient was negative. However, when a second model was run using the scale for only the four strong measures, there was a displacement of new owner-occupied units—about 1944 per measure.
(3) Added fewer families—about 633 fewer per enacted measure.
(4) Increased median rent levels more over the decade, approximately by $5 per enacted measure.
(5) Increased median home values more—by about $2,360 per enacted measure.[11]
(6) Showed faster increases in median household income—about $319 per enacted measure.

In other words, growth-control measures in general are associated with fewer rental housing units being produced, with fewer families being added, but with increased rent levels, increased ownership value and increased household incomes. Since many of the growth-control measures are targeted implicitly against multi-family buildings (through down-zoning residential densities, reducing floor-area ratios, or by requiring political control over the approval of increased densities), they tend to discourage rental housing and lower-income households. Further, the stronger measures which either remove land from development or reduce existing densities tend also to displace owner-occupied units, though the other types of growth-control measures do not have this effect.

The strong income and ownership value effects seen are probably the result of two intermingled processes. First, by slowing the growth in rental housing units, the proportion of the population having higher incomes is increased; this is just an aggregate cohort phenomenon. But, it also appears that jurisdictions which are showing more rapid increases in higher-income households (so-called gentrifying communities) also pass more growth measures.[12] Some communities pass growth-control measures which, in turn, attract higher-income households. With the influx of higher-income households, the jurisdictions then enact more measures.

Effects of Growth Management on Population Composition

This implicit selectivity can be seen by examining population characteristics associated with growth-control measures. Changes in eight population characteristics between 1980 and 1990 were examined in relationship to the number of local growth-control measures:

(1) Total population.
(2) Number of persons of non-Hispanic White background.
(3) Number of persons of minority (non-White) background.
(4) Number of persons of Asian background.
(5) Number of persons of American Indian background.
(6) Number of persons of Black/African American background.
(7) Number of persons of Hispanic/Latino background.
(8) Number of persons who are senior, age 65 or older.

Table 7 shows the results of testing model (5) against these population characteristics. Again, the results are similar to the housing characteristics. First, with only one exception (the number of persons of American Indian ethnicity), the R^2 values are consistently

Table 6. Models of change in housing characteristics (coefficients, *t*-values and significance levels of models; $N = 490$ jurisdictions

1990 dependent variable	Constant	1980 value	1980 density	Number of 1979–88 growth–control measures	R^2
Rented units	1614.88 (4.37) ****	1.09 (155.04) ****	−0.15 (−1.78) n.s.	−403.83 (−2.63) **	0.981
Owned units	2 103.36 (3.72) ***	1.02 (74.22) ****	−0.12 (−0.97) n.s.	−383.11 (−1.63) n.s.	0.922
Families	2 309.99 (3.25) **	1.06 (85.92) ****	−0.12 (−0.75) n.s.	−633.03 (−2.14) *	0.940
Median rent level	−12.59 (−1.31) n.s.	2.14 (59.93) ****	0.005 (4.33) ****	5.14 (2.59) **	0.888
Median ownership value	−53 751.21 (−14.85) ****	2.75 (76.13) ****	4.28 (8.17) ****	2 359.60 (2.43) *	0.928
Median household income	−5 182.76 (−8.44) ****	2.22 (82.33) ****	−0.01 (0.16) n.s.	319.04 (2.26) *	0.933
Householder in same house five years earlier	3 202.99 (2.17) *	1.07 (77.02) ****	0.19 (0.58) n.s.	−1 138.42 (−1.85) n.s	0.927

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$. n.s. = not significant.

Table 7. Models of change in population characteristics (coefficients, *t*-values and significance levels of models; $N = 490$ jurisdictions)

1990 dependent variable	Constant	1980 value	1980 density	Number of 1979–88 growth–control measures	R^2
Population	7698.50 (3.35) **	1.15 (122.00) ****	−0.47 (−0.92) n.s.	−2217.78 (−2.32) *	0.970
White population (non-Hispanic)	7405.33 (5.91) ****	0.95 (98.12) ****	−1.08 (−3.92) ***	−788.37 (−1.51) n.s.	0.954
Non-White population	4182.78 (1.81) n.s.	1.36 (70.82) ****	0.61 (1.19) n.s.	−2186.82 (−2.28) *	0.915
Asian population	1500.06 (4.07) ***	1.74 (86.85) ****	0.003 (0.03) n.s.	−240.36 (−1.57) n.s.	0.944
American Indian population	−40.29 (−0.28) n.s.	1.58 (17.56) ****	−0.06 (−1.79) n.s.	122.82 (2.04) *	0.408
Black population	1044.23 (2.06) n.s.	0.93 (74.06) ****	0.11 (0.98) n.s.	−519.35 (−2.49) *	0.921
Hispanic population	1547.89 (0.94) n.s.	1.51 (58.89) ****	0.36 (0.98) n.s.	−1600.97 (−2.32) *	0.882
Senior population (age 65 +)	1301.94 (5.04) ***	1.10 (109.52) ****	−0.11 (−1.96) *	−168.17 (−1.56) n.s.	0.963

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.0001$. n.s. = not significant.

high. Secondly, the 1980 value is positive and highly significant in all eight models. Thirdly, 1980 density is significant in two of the models. Lower densities are associated with greater increases in the White population and in the senior population. Fourthly, five variables are significantly associated with the number of growth-control measures enacted between 1979 and 1988. Jurisdictions that enacted more measures showed:

(1) A smaller increase in population between 1980 and 1990—about 2218 fewer persons per enacted measure.
(2) A smaller increase in the total non-White population—about 2187 fewer persons per enacted measure.
(3) A smaller increase in the American Indian population—about 123 fewer persons per enacted measure.
(4) A smaller increase in the Black population—about 519 fewer persons per enacted measure.
(5) A smaller increase in the Hispanic population—about 1601 persons per enacted measure.

Many of these effects can be understood in terms of the reduction in rental housing units that are caused by the enactment of growth measures. Lower-income and minority populations tend to concentrate in rental housing. Also, these effects are averages, across all jurisdictions. The volume effects will clearly vary by jurisdiction size, with larger jurisdictions showing greater absolute change. It is also likely that different measures will have different effects. It is beyond the scope of this analysis to examine how individual measures impact the housing and population characteristics of the population. Nevertheless, there are substantial effects that are seen.

Conclusion

This paper has examined the impacts of local growth-control measures on net housing production in California between 1980 and 1990. There are three general conclusions. First, some of the growth-control measures—those removing land from development, or at least requiring less intense development, and those down-sizing existing development densities—definitely have effects in reducing both rental housing and ownership housing. The reduction has most likely been a shift towards less-controlled jurisdictions rather than an absolute decrease in housing units. These controls have particularly impacted rental housing. It was estimated that almost one-third of new rental housing was displaced during the 1980s by these measures. On the other hand, the other types of growth-control measure that have been adopted, such as infrastructure adequacy requirements, urban limit policies or political controls, do not appear to affect housing production to the same extent, at least in the time-period analysed. However, over a 20-year or 30-year period, they may very well limit the amount of new housing.

Secondly, the effects of displacing the growth of new housing, particularly rental housing, have impacted certain populations who are more dependent on rental housing—low-income households and minorities in general. During the 1980s, there was a very rapid movement of minority populations away from the metropolitan areas, certainly to a much greater extent than had occurred previously. While some of this might be considered socially desirable (i.e. breaking up high concentrations of minority populations), it is likely that it was a search for available housing that motivated the movement.

Thirdly, growth-encouragement policies do not seem to have had the same effect in increasing housing production as growth controls have in reducing (or displacing) it.Neither growth-encouragement policies nor policies aimed at increasing affordable housing are significantly related to net housing change. The restrictions appear to be more powerful policy mechanisms in affecting housing production than the range of encouragements.

Future Research

This is the not the venue to discuss the policy

implications of these results. Instead, the focus has been on understanding the consequences of local growth controls on new housing construction. However, future research might explore whether these policies have long-term consequences on housing production, particularly rental housing, and whether they exacerbate regional economic stratification by shifting lower-income and minority populations to more peripheral, less-controlled jurisdictions. There needs to be more research on the effect of commercial development restrictions on housing construction. The data that have been presented suggest that the two are related, but it is not clear why the association exists. In addition, research needs to be directed at understanding the spatial consequences of these measures. The data suggest that the growth-control measures have exacerbated the population dispersion, helping to accelerate metropolitan dispersion and their consequent environmental stresses. The measures have shifted new housing in more controlled jurisdictions to jurisdictions with fewer controls; the latter are typically in the rural areas or in the peripheral parts of metropolitan areas. Whether suburban growth will continue to expand spatially to the same extent or, conversely, whether constraining the more strict local growth controls would lead to more compact metropolitan growth, needs to be better understood.

Notes

1. It was necessary to make adjustments to allow common comparisons between 1980 and 1990. Of the 34 cities which were incorporated between 1 April 1980 and 1 April 1990 (census collection days), 27 were defined as census places for the 1980 census. Thus, the 1980 data do not include these jurisdictions as part of the unincorporated areas. However, almost all of these had the same growth-control policies as the counties they are located within so the effect of this error is negligible. The remaining seven cities were not identified in the 1980 census but were included in the totals for the unincorporated areas for the three counties within which they fell (Los Angeles, Riverside, Sonoma). To avoid overestimating the impact of growth control on housing change, they have been added back into the county unincorporated totals for 1990. Hence, this approach is conservative as any estimated reduction in county housing because of growth controls will be minimised by their inclusion.
2. The 25 jurisdictions which completed the 1988 survey, but not the 1992 survey, were asked about only 14 different growth-control measures plus a miscellaneous category, compared to 17 plus a miscellaneous category for the 1992 survey. However, only two of these jurisdictions had another type of growth control in 1988. Thus, the number of measures that was documented in the 1988 survey is very close to the number that was actually enacted between 1979 and 1988 for these jurisdictions.
3. For example, jurisdictions which were located 40–80 miles away from their nearest metropolitan centre showed large increases in roadway expenditures between 1982 and 1992.
4. Other variables that are proxies for land values were tried, such as 1980 median ownership value, 1980 household income and distance from the nearest metropolitan centre, but they did not produce significant coefficients. Consequently, 1980 density was chosen as a control variable.
5. The correlation between 1980 density and the number of 1980 housing units was 0.12 and the correlation between 1990 density and the number of 1990 housing units was 0.10. The corresponding correlations with population sizes are about the same. Further, the correlation between 1980 density and the number of growth-control measures enacted between 1979 and 1988, the key independent variable, was -0.01.
6. For example, for jurisdictions with a population density less than 1500 persons per square mile in 1980, the correlation between 1980 density and the growth rate of housing units over the next decade (1980–90) was 0.0001, whereas for jurisdictions with a population density greater than or equal to 1500 persons per square mile in 1980, the correlation was -0.37 (≤ 0.0001). For all jurisdictions, the correlation between 1980 population density and the 1980–90 growth rate of housing units was -0.30 (≤ 0.0001).
7. The equation was estimated without the constant term and the results were similar. However, the conventional use of having it in the equation is taken since the residual errors are greater without a constant.
8. The relationship between the estimated coefficient of model (1) and the true growth rate can be shown. If there are no other

variables in the equation, then there are two equations which are equivalent

$$Y = \alpha + \beta_1 X_1 \text{ (with constant)}$$

$$Y = \beta_2 X_1 \text{ (without constant)}$$

where, Y is the number of 1990 units in the jurisdiction; X_1 is the number of 1980 units; α is the constant; β_1 is the estimated change coefficient for the model with a constant; and β_2 is the coefficient for the model without a constant and is the true growth rate. Since Y is constant in the two equations,

$$\beta_2 X_1 = \alpha + \beta_1 X_1$$

$$\beta_2 = \frac{\alpha}{X_1} + \beta_1$$

Thus, the true growth rate over the decade is the estimated coefficient of the model with the constant plus the proportion of the number of 1980 units that the constant represents. With other variables in the equation, similar adjustments can be made.

9. The change index is for *net* change—new units added minus units demolished.
10. The actual number of units that were displaced would be larger since there were 10 jurisdictions lacking complete 1980 and 1990 housing data, and there were an additional 60 jurisdictions which did not complete the 1992 survey.
11. Median home value was measured by the census. It is a perception by the householder of the value of the home. Most likely, it was an exaggerated estimate compared to actual home sales.
12. The correlation between the 1980–90 annual rate of change in median household income and the total number of growth-control measures enacted was 0.20 (≤ 0.001).

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