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THE IMPACT OF SUBURBAN LAND CONVERSION POLICIES ON LAND PRICE APPRECIATION

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Governments try to influence the location and quality of urban land use by controlling the conversion of land from rural to urban use at the growing edge of cities. Among the institutions used are land use controls such as zoning, provision of infrastructure and tax policy. This paper explores the interaction of some of these local government policies and the land conversion market and presents some empirical results from a model of that interaction.

These policies to control land use also impact on land values and appreciation. They may have the unintended effect of raising prices to consumers of housing. This paper looks at cross-sectional differences in building site prices and asks if they are related to land use control policies. If local governments are concerned about land and housing prices, they need to be aware of the impact of their policies such as zoning, sewer provision and pricing, and property taxes.

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Theoretical Model and Hypotheses

Two key concepts form the basis for this analyses; these are economic rent and profit. Economic rent is defined as the return above costs of production which result from a natural limitation in supply. The physical supply of a particular variety of land is fixed. (An example is land within a given distance of the city center.) Returns arising from non-natural limitations of supply are termed profits, excess profits, or quasi-rent. Normal profits, on the other hand, include the payments necessary to draw forth the required entrepreneurial and capital resources and are considered costs of production. The implication of economic rent is that, unlike profits, rent cannot be competed away. Factor ownership controls who gets rent. Increasing competition can, however, reduce profit. Inversely, government policies which limit supply can increase profit for at least some of the participants in the land conversion process.

Supply restricting policies could include limiting parcels of land to large sizes, controlling or limiting provision of water, sewer or transportation systems relative to demands, and public tax and pricing policies. Overt private supply restrictions, while potentially important, will not be considered in this article.

The proxy measures to be used for economic rent and profit are land value appreciation and the land site price. Site price includes development costs (clearing land, roads, services, etc.), agricultural opportunity costs and some variation in site size. Ideally, the price paid for land to be converted to urban uses should be used as the basis for calculating land value appreciation. However, data on the price paid for raw land are nearly non-existant, thus price of a residential site (ready for building) has been used as a proxy for raw land value. Variations in site prices across cities in the United States can be explained by agricultural values, lot size and quality, development costs or land value appreciation. If the variation is due to agricultural values, the implication is that agricultural opportunity costs are high and more land is being withheld from the market. If cross-sectional differences in prices are a result of differences in lot size and quality, then they just reflect differences in consumer preferences. If development costs have increased, then the sources of those increases, whether private or public, could be examined to see if any savings are possible. However, if appreciation has increased, the proxy measure for combined economic rent and profit, then the sources should be isolated and examined for possible policy action to control or redistribute the appreciation. Site price or land value appreciation is calculated as the percent appreciation over agricultural opportunity costs after development costs and agricultural opportunity cost, adjusted for site size, are deducted. This appreciation is then expressed as a percentage of the farm value.

Birmingham, Alabama, can serve to demonstrate the calculations. In 1969 the site price based on National Association of Home Builders (NAHB) data for Birmingham was \$5,451. Development costs are estimated as \$2,430 and the calculated agricultural opportunity cost was \$82. Development and agricultural opportunity costs are added together (\$2,512) and then subtracted from site price leaving a difference of \$2,938. Appreciation is then calculated with respect to development costs at 117 percent and agricultural opportunity costs at 3570 percent. Table 1 summarizes both site price and appreciation for the NAHB data. Another data set from the Federal Housing Administration was also used in the analysis to follow. The NAHB data generally include more expensive homes than the FHA data.

Table 1

SITE PRICE APPRECIATION ABOVE AGRICULTURAL OPPORTUNITY COST AND DEVELOPMENT COSTS, NAHB DATA, 1969 THIRTY-SIX CITIES

		A SITE PRICE ($)	B AGRICULTURAL OPPORTUNITY COSTS ($)	C DEVELOPMENT COSTS ($)	D AGRICULTURAL OPPORTUNITY COST + DEVELOPMENT COST (B+C) ($)	E APPRECIATION (A-D) ($)	F PERCENT APPRECIATION OVER COSTS (E)-(D)·100 (%)	G PERCENT APPRECIATION OVER AGRICULTURAL OPPORTUNITY COST (E)-(B)·100 (%)
1.	Birmingham	5451.	82.	2430.	2512.	2939.	117.	3570.
2.	Mobile	4507.	82.	2430.	2512.	1995.	79.	2423.
3.	Sacramento	5798.	183.	3960.	4143.	1655.	40.	906.
4.	San Francisco	10478.	183.	3960.	4143.	6335.	153.	3468.
5.	Denver	5877.	37.	2880.	2917.	2960.	102.	8102.
6.	Wilmington	8875.	153.	2610.	2763.	6112.	221.	3982.
7.	Tampa	4371.	122.	2610.	2732.	1639.	60.	1340.
8.	Atlanta	7281.	98.	2610.	2708.	4573.	169.	4681.
9.	Chicago	9847.	181.	3330.	3511.	6336.	180.	3505.
10.	Indianapolis	5897.	154.	3330.	3484.	2413.	69.	1564.
11.	Louisville	6543.	99.	2430.	2529.	4014.	159.	4061.
12.	New Orleans	7021.	146.	2160.	2306.	4715.	204.	3226.
13.	Baltimore	5931.	188.	2610.	2798.	3133.	112.	1662.
14.	Detroit	8172.	115.	3330.	3445.	4724.	137.	4110.
15.	Grand Rapids	4500.	115.	3330.	3445.	1055.	31.	917.
16.	Minneapolis	7240.	126.	2970.	3096.	4144.	134.	3295.
17.	Kansas City	5101.	93.	2970.	3063.	2038.	67.	2199.
18.	St. Louis	7027.	93.	2970.	3063.	3964.	129.	4277.
19.	Omaha	4918.	113.	2970.	3083.	1835.	60.	1623.
20.	Buffalo	5231.	115.	3240.	3355.	1876.	56.	1631.
21.	Cinnati	7781.	150.	3330.	3480.	4301.	124.	2860.
22.	Dayton	8227.	150.	3330.	3480.	4747.	136.	3156.
23.	Oklahoma City	5307.	84.	2160.	2244.	3063.	137.	3653.
24.	Tulsa	5275.	84.	2160.	2244.	3031.	135.	3615.
25.	Portland	5515.	156.	3960.	4116.	1399.	34.	896.
26.	Philadelphia	7068.	108.	3240.	3348.	3720.	111.	3429.
27.	Pittsburgh	7441.	108.	3240.	3348.	4093.	122.	3773.
28.	Knoxville	3117.	108.	2430.	2538.	579.	23.	533.
29.	Nashville	4384.	108.	2430.	2538.	1846.	73.	1702.
30.	Dallas	6410.	75.	2160.	2235.	4175.	187.	5538.
31.	Ft. Worth	3546.	75.	2160.	2235.	1311.	59.	1739.
32.	Houston	5428.	75.	2160.	2235.	3193.	143.	4235.
33.	San Antonio	3757.	75.	2169.	2235.	1522.	68.	2018.
34.	Salt Lake City	7034.	72.	2880.	2952.	4082.	138.	5676.
35.	Richmond	5663.	127.	2610.	2737.	2926.	107.	2305.
36.	Seattle	6274.	114.	3960.	4074.	2200.	54.	1926.

Sources: Site prices from FHA Data for Cities and States (1969).
Agricultural Opportunity Costs calculated as explained in Chapter IV and summarized in Appexdix C.
Development Costs estimates from NAHB sources is explained in Chapter IV.

It can be argued, at the general level, that the degree to which particular government policies restrict the supply of land for certain demanded urban uses will affect the price of the land sold and that part of appreciation in land value is attributable to monopoly profits. Zoning, sewer provision and pricing will each be discussed in turn.*

Zoning.

Zoning in the United States involves the designation of specific land use districts within which various regulations and restrictions apply, such as permitted uses, proportion and size of lot, maximum height and bulk requirements and population density limits. Zoning districts could be classified as residential, business, industrial, agricultural, recreational, unrestricted, etc. The residential classification can be further categorized as single family, multiple family, and apartment building districts. Zoning could be exclusive, allowing one use only, or cummulative zones which allow the previously defined uses in addition to its own designation. Implementation and form of these powers can vary between jurisdictions within a state and within a metropolitan area. Many rural jurisdictions do not have zoning and Houston, Texas, is a major U.S. city presently without zoning.

Zoning has not been considered to be successfully administered to control the speed, direction and final character of the land conversion process (Clawson, 1971). It is argued that the competition for economic rent places great pressure on the development plans of communities. Zoning has not been considered effective in keeping out land uses incompatible with plans of development. Those who compete for the gains from land use other than those permitted will attempt to change the zoning. There are also suburban jurisdictions

*For other perspectives on policy tools, see, Greene, Neeman and Scott (1974), Mills and Oates (1975), Portney (1976), Downing (1974) and Healy and Short (1981).

where low density residential zoning is strongly supported by local residents and public officials (Babcock, 1966).

Minimum lot size requirements can serve as an example of what can be expected from regulations designed to affect the size of lots. Some jurisdictions in a land conversion market might contribute to the withholding of land from the market. This reduces supply and raises prices above costs of production. For example, some communities purposely zone available sites only for large lots, hoping thus to reduce government costs in relation to revenues (Mills and Oates, 1975). The process puts a premium on areas that are open to small lot development or for multiple family housing. If too little land is zoned for small lot development, there could be leap frogging developments and a leap frogging pattern of land acquisition. Thus large lot zoning would not only use up more land and at a lower density, but it would also contribute to supply restrictions for other residential construction. This would increase the appreciation on high density zoned land and decrease the overall density of land. The large lots overzoned would be a differentiated product with higher quality (demanded) features which could potentially be sold by the developer to customers at a higher price.

Given that there is likely to be variation in the attitudes of jurisdictions in the same metropolitan land conversion market, the unfilled demand for a certain land use in one jurisdiction will move to another, less restrictive, jurisdiction which raises the price there. The result of this institutional interdependence is not only to affect the speed and direction of residential location and population growth, but, perhaps, keep the relative price difference between jurisdictions essentially unaltered. The degree of variation in policies followed across jurisdictions should also affect relative prices. If supply restricting policies are widespread, prices should be higher than when such policies are rare.

Therefore, it can be hypothesized that low density zoning will have the following relationship to site price and appreciation: *the greater the percentage of low density, residentially zoned land in the land conversion market, the greater will be the appreciation and site price in that market.* This hypothesis was examined in the comparative case study to be reviewed later.

Sewer Provision and Pricing.

Sewer provision and pricing could be similarly analyzed. Provision of sewered and zoned land for different uses at supply levels appropriate to demand should result in moderate prices. Over or under provision of sewered and zoned land in proportion to demand can result in similar leap frog land use patterns but different price structures. Restricted sewer supply should lead to higher prices and over supply should lead to lower prices.

The process could be described as follows: if sewers have been extended to large areas of undeveloped land, developers are likely to buy and construct on large tracts where land is cheaper. The resultant development will be a low gross density and probably a low net density. The rate of development and infilling will depend upon general and relative demand. However, if sewer provision is still further increased because of demands on other areas of the metropolitan area and fringe, complete infilling might never occur. The infilling would also relate to other issues including the zoning by a local jurisdiction. If a suburban jurisdiction is settled with a certain more or less homogeneous group, the zoning may reflect a desire to maintain that homogeneity. This may not be the case where communities on the fringe encourage development. A moderate level of sewer provisions might not have the same result. Supply of sewered lots would be somewhat restricted, therefore the price of a sewered lot is likely to be greater. Demand will determine the price and density. If demand is moderate, prices will not be as great, but density is likely to be lower, though not as low as with over-supply of sewers.

Finally, when much less sewer system is provided than is demanded, the land which is sewered will be highly priced. If the price is too great, developers may find cheaper land much further from the urban area where other alternatives such as privately provided package sewer plants or septic tanks are possible.

The general hypothesis is as follows: *the greater the percentage of land in the land conversion market where sewer provision is controlled or restricted, the greater will be the site price and appreciation.* However, it is necessary to differentiate between restrictions associated with too much or too little sewer provision. Restricted supply should increase appreciation while over-supply would increase site price because of the sewer component of development cost, but lower the appreciation component of the site price.

Another source of appreciation above agricultural opportunity costs occurs because sewers are provided at prices below costs. A proportion of the value of land is based on the availability of sewers. To the extent that the sewers are limited in supply and made available without or below costs, their value becomes capitalized into the value of the land. For example, sewer service may be provided to new areas at the same price as the central city area even though the cost may be higher. It is the owner of the sewered land who benefits because of the value of the sewer services are capitalized into land values. Therefore, the hypothesis is as follows: *the greater the percentage of subsidization of sewer services in a land conversion market, the greater will be the site price and appreciation.*

One caution will be mentioned at this point. Local government policy on septic tanks or other sewer alternatives may affect sewer policies. For example, if septic tanks are restricted, it may either increase density in the land conversion market or perhaps extend the boundaries of the land conversion market to areas where septic tanks are allowed. Subsidized provision of sewers might increase denisty if septic tanks are not a viable alternative. In addition, the over building of sewers combined with subsidization should also relate to any alternative waste disposal by making the use of sewers more attractive.

Property Taxes

The final local government policy to be considered is the ad valorum property tax. Property tax affects both the demand for more services and the ability of landowners to withhold land from the market.

From the point of view of the landowner, the property tax can affect the price of land through the present value (holding costs) and reservation price and, therefore, the supply of land at any given time. If the reservation price exceeds the market price, the owner can hold the land for further gains, though prospects may be uncertain. High property taxes can make it unprofitable to invest in land to hold for appreciation. It also should be noted that while a property tax increase can lower prices to lot consumers, it may not necessarily reduce the amount of appreciation above farm value. Since, if the property tax rate increase is general, the price of agricultural land could also be expected to fall. Therefore, the impact of a property tax increase is to reduce the reservation price of land being held for future gains. Lowering tax rates for agricultural land will result in raising present values and reservation prices for fringe land and could be expected to increase landowner gains. The research by Schwartz and Hansen (1975) on preferential taxation supports the analysis that expectations of gains by landowners are greater than the perceived tax benefits of such a policy. Deferred taxation as well as use value taxation also encourage land withholdings.

From the point of view of the property tax effect on housing values, it would be expected that high property taxes lower home values and, therefore, site values. The true value of a home includes site value plus construction costs which is a function of operating costs. Therefore, higher property taxes reduce the derived demand for homes but may decrease the costs of development.

To summarize, *high property taxes should increase holding costs of landowners and increase the supply of land for urban uses. The effect on appreciation depends upon the extent to which the high property taxes are applied to agriculture.* If there is preferential or deferred taxation for agriculture, while other property taxes increase, then appreciation could become greater.

The unit of analysis of this research is the land conversion market across cities in the United States. This metropolitan market will almost always consist of many local government jurisdictions, interacting with regional and national laws, which adds to both the complexity and richness of the model. Previous research has barely investigated the implications of economic and institutional interdependence within the land conversion market.

Model Specification

The independent variables used to explain site price and appreciation can be roughly categorized into three groups. The first group consists of general demand variables such as total population, change in population, and mean family income. Many of these variables were used successfully in previous research. The second group of variables is composed of characteristics implicit in the land site such as site size, development cost, and agricultural opportunity cost. These variables, as noted, are used in part to calculate an estimate of appreciation from site price data. The third group consists of the instrumental variables related to sewer provision and tax policies. The variables are instrumental in that these variables reflect policies subject to political decisions.

General demand characteristics are introduced into the model through the use of variables for total population, percentage change in population, mean or median family income and a binary variable to represent cities in California since it is such a special market.

Size of the metropolitan population encompasses several aspects of demand. Larger cities cost more to live in and often provide more amenities so prices in general are higher the greater the total population. Moreover, because of the generally larger area or increased congestion, some amenities such as schools, businesses, parks, and cultural activities will be spread further from a given location or site. On the other hand, the dispersal of amenities throughout a large metropolitan area will also disperse demand at the fringe or expand the area considered the fringe. The exact size and implications of this effect on site price or appreciation is unclear given interaction with other variables associated with total population such as income. Percent change in population can be viewed as both an indication of recent past increases in demand and as a portent for future growth. The greater the percentage increment in population the greater will be the demand and hence price for residential lots. The mean or median family income variable indicates by size the strength of demand or buying power of a region. People with higher incomes are able to pay or bid more for lots with more amenities or locational advantages.

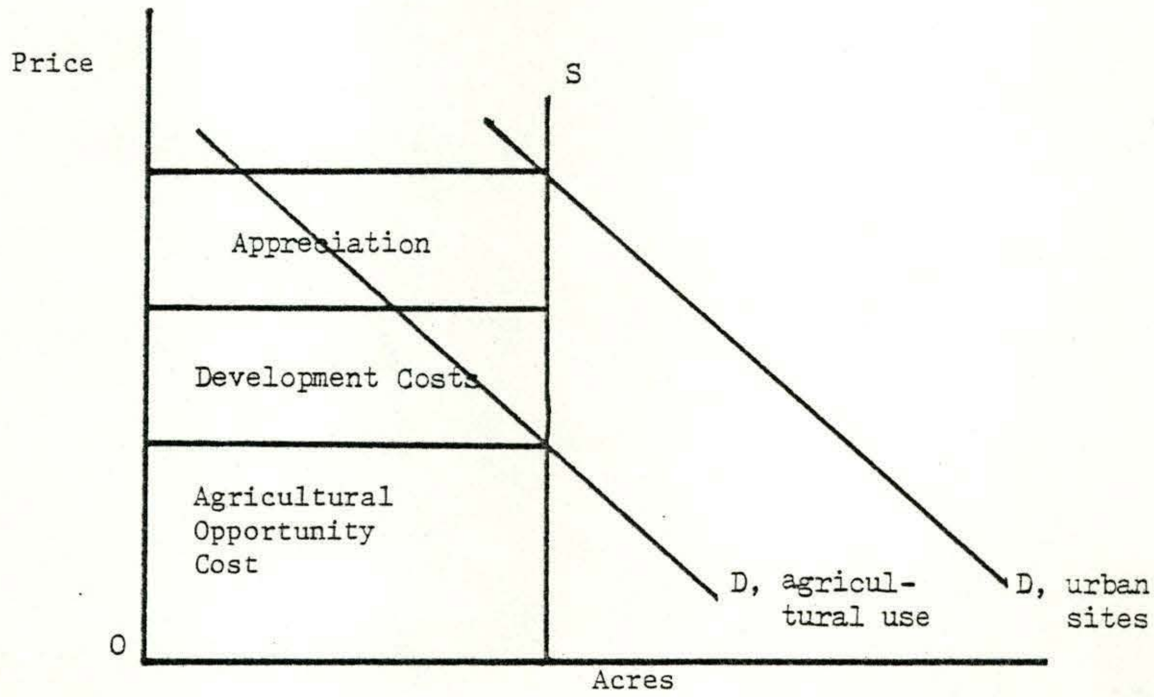
Regional variation in population growth, weather, or demography, could lead to variations in the dependent variables either through demand or development costs associated with weather, input costs, etc. Preliminary statistical analysis indicated the possibility of land market conditions in the State of California varying in size if not characteristically from the rest of the United States. Therefore, limited examination of regional variations was indicated by the use of a binary variable.

The second group of variables concern site characteristics and include development costs, agricultural opportunity costs, and site size.

It is assumed in this research that the supply of urban fringe sites is fixed and price is, therefore, demand determined. Appreciation is a residual affected by the size of development costs. Figure 1 demonstrates this assumption. The supply of sites is unaffected by development costs while appreciation is inversely related to development costs. Agricultural opportunity cost should be positively related to site price because of the higher price needed for urban uses in order to meet the offer price of the landowner to cover opportunity costs. If the variable definition has captured any demand characteristics, those characteristics will add to the positive relationship. Over time the size of a lot has decreased as the price of the site has increased.

Figure 1

Development Costs With The Supply of Sites Fixed



The instrumental variables include percent of all homes with public sewer, percent new homes with public sewer, the property tax proportion of general revenue (percent), the property tax range and the sewer capital outlay range. (Range refers to difference in values among local governments in the same metropolitan area.)

Percent all homes with public sewer could indicate the cumulative influence and historical policies of local jurisdictions while percent new homes with public sewers would indicate recent policy. The greater the percentage of either all or new homes with public sewers, the more likely the sewers are being supplied which require homes to be connected to the sewer. Site price and appreciation should be higher. On the other hand, liberal provision of sewer services when there is demand could describe the situation.

While the greater supply of public sewers could lead to scattered residential location as well as under supply, the raw land price might be less with over supply as the increased development costs show up in site price. But under supply also raises prices. Therefore, while either of these variables could indicate past sewer supply policies, the variables are somewhat ambiguous on price and appreciation. However, the role of sewer costs on site improvement might override the supply characteristics and indicate that a larger percent of lots with public sewer would lead to a higher site price.

The property tax proportion of general revenue is an indication of the importance of the property tax vis-a-vis other local government financing methods. The property tax is a less direct way of financing new infrastructure than connection fees or service charges so that the greater the use of the property tax the greater the raw land prices will be. But also note that high property taxes, per se, lower home values and, therefore, site values. Higher property taxes could thereby reduce derived demand for homes but decrease the cost of development.

The range of the average per capita tax can be indicative of two phenomena. First, the range may indicate the disparity between the central city and suburbs. If, as seems likely, the central city has the greatest average per capita property taxes paid, then the flight to suburbs could be indicated. This would indicate that the greater the range the greater the demand, hence, price. The range of the average per capita sewer capital outlay should indicate that, if the central city can be considered to be completely severed, then the greater the range, the greater the current outlay on sewers in the metropolitan fringe. Site price and appreciation should be greater.

A note of further caution is needed topoint to some of the interactions between the independent variables. For example, there should be a strong correlation between sewer supply variables and the total population of the metropolitan area. As population becomes greater and generally denser, the need for public sewers becomes greater because of the inability of the land to absorb waste with septic tanks or other techniques. Tax variables could be highly correlated with income. As population and income increase, the demand for services also increase, raising taxes. With a greater income range the variation in demand and tastes might also be reflected in the property tax and sewer range variables. To summarize the site price model is as follows:

Site Price = α

		Relationship Expected
β_1	Total Population (persons)	+
β_2	Change on Population (percent)	+
β_3	Mean or Median Family Income (dollars)	+
β_4	California Binary	+
β_5	Site Size (squire feet)	-
β_6	Development Costs (dollars per site)	-
β_7	Agricultural Opportunity Cost (dollars)	+
β_8	Property Tax Proportion of General Revenue (dollars)	+
β_9	Property Tax Range	+
β_{10}	Sewer Range	+
β_{11}	All or New Family Homes with Public Sewer (percent)	?

where

α = Constant to be Estimated

β_1 to β_{11} = Coefficients Associated with Specified Variables

The Appreciation model consists of variables β_1, β_2, β_3 and β_9, β_{10}, β_{11}. Site characteristic variables were not used to estimate appreciation because they were used to calculate appreciation. The California binary and the property tax Proportion of General Revenue were not statistically significant in the site price model and were not carried over into the appreciation model.

Empirical Results

The method used to test the theoretical model consisted of a series of cross-sectional multiple regression equations, pooled cross-sectional and time series equations, and a comparative case study of Lansing, Kalamazoo, and Jackson, Michigan, USA. The regression analysis explored demand variables, site characteristics, and the hypothesized relationship between sewer provision, pricing, and property taxation and the dependent variables. The comparative case study examined the geographical basis and dependent variable definitions of the regression work with more detail.

The comparative case study examined and compared the secondary data used in the econometric models with secondary data available for at least three cities but not available for a large enough sample for statistical or econometric analyses. In addition, region specific reports such as local land use studies combined with interviews with local land use planners and developers provided even greater understanding of the functioning of these land conversion markets. Zoning was explored more thoroughly in the comparative case study while sewers and tax policies received cursory treatment.

The results of both the econometric analysis and the comparative case study are now considered with respect to the zoning, sewer provision and pricing, and property tax hypotheses. The cross-sectional regression tables reported here contain all equations estimated. Not all results are discussed.

Equations were estimated sequentially to test relationships with the largest number of cases possible and thereby save degrees of freedom and also to examine issues raised in earlier econometric results. The reader can review the results for the demand and site characteristic variables from these tables.

Zoning

The results of examining normal zoning as well as comments from developers and planners suggested that other factors needed consideration in addition to nominal zoning. The effect of zoning on actual opportunities to build did affect the location decisions of developers. Developers also noted the increased pressures on land use planning when restrictions were considered severe. This behavior supports the concept of competition, through the political process, for economic rent and profit. Most important, however, was that differences on land values and appreciation between the three cities could be related to a holistic, qualitative, and quantitative measure of zoning variations.

If it were possible to aggregate various characteristics of zoning such as nominal zoning, nominal zoning changes, time and bureaucracy involved in zoning changes, and the uncertainty of the process, then this holistic variable might prove supportive of the hypothesis. But its interpretation would be difficult. The weight of the evidence suggests that zoning restrictions for certain uses, in the aggregate, do affect developer decisions, inter alia, and land value appreciation. Especially significant were developer and planner descriptions of jurisdictional attitudes on zoning and responses by developers in the entire land conversion market. Demand shifts as a result of developer decisions from one jurisdiction to another can lead to higher prices throughout the market. If there are product differentiating effects with respect to large lots, the aggregate price increases could be even larger.

Sewer Provisions and Pricing.

Similar behavioral patterns were seen with sewer provision and pricing. The weight of the research evidence suggests that local government policies regarding both sewer provision and pricing affect the supply of land for certain uses. While the econometric results were mixed, both the percent of all and new homes with public sewer were frequently statistically significant, at greater than the .01 level, in explaining site price or appreciation, especially with the NAHB data. Table 2 for NAHB site price data, presents two equations, Regression Three and Regression Four, with percent all homes with public sewer statistically significant with a positive sign at the .007 and .006 level, respectively. Table 3 also demonstrates positive results for the NAHB site price regressions while FHA site price regressions were weak, as demonstrated in Tables 3 and 4. The statistical significant level for all homes with public sewer in the cross-sectional appreciation regressions ranged from a low of .020 to a high of .001 across eight equations, presented in Tables 5 and 6. In the pooled cross-sectional time series regressions the percent of new homes sewered was statistically significant in both the site price and appreciation models. The results of the pooled regressions were encouraging and seem to indicate stability of the sewer variable over time.[1]

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[1]Because of space limitations the pooled regression equations are not reported here. They can be found in Johnston (1980).

Table 2

SITE PRICE REGRESSIONS, NAHB, 1969

Dependent Variable/ Regression Number	Independent Variables — Regression Coefficient, Standard Error In Parenthesis, Significance Level									Constant	R^2	$\bar{R}^2$	# of Cases
Site Price National Association of Home Builders 1969 (dollars)	Total Population 1970 (persons)	Change in Population 1960-1970 (percent)	Median Family Income 1970 (dollars)	Agricultural Opportunity Cost 1969 (dollars)	Development Costs 1969 (dollars)	California Dummy[1]	All Homes With Public Sewer 1970 (percent)	Property Tax Range[2] 1969	Sewer Range[3] 1969				
Regression One	.0008 (.0001) ≤.0001	3.3755 (4.7419) .478	.5033 (.0959) ≤.0001							-32.38 (892.51) .971	.42	.40	162
Regression Two	.0009 (.0001) ≤.0001	10.9242 (4.5213) .017		5.1526 (.8330) ≤.0001	.0529 (.2040) .796	-80.4584 (595.3595) .893				2837. (587.) ≤.0001	.46	.44	162
Regression Three	.0005 (.0002) .008	-4.6265 (12.7375) .718		8.7160 (1.7627) ≤.0001			44.3846 (15.6442) .007	2090.8625 (747.7128) .007	-2.5964 (127.697) .984	-1360. (1469.) .359	.57	.52	56
Regression Four	.0003 (.0002) .058		.4089 (.1569) .012	8.0282 (1.6658) ≤.0001			41.5794 (14.4458) .006	2117.0461 (701.0598) .004	-15.6855 (117.5362) .894	-5024. (1969.) .014	.62	.58	56

[1] Qualitative dummy variable where cities in the State of California were one and all other cities were zero.

[2] Calculated by subtracting low county average per capita property tax in SMSA from high county average per capita property tax in SMSA and dividing by the overall SMSA average per capita property tax thus resulting in a relative range. Where one county consists of entire SMSA the range is zero.

[3] Calculated the same as property tax range but uses the per capita sewer capital outlay high, low, and overall averages.

Table 3

SITE PRICE REGRESSIONS FOR THIRTY-SIX CITIES COMMON TO NAHB AND FHA FOR 1969

Dependent Variable/ Data Source/ Regression Number	Independent Variables: Regression Coefficient, Standard Error In Parenthesis, Significance Level								Constant	R^2	$\bar{R}^2$
Market Site Price 1969	Total Population 1970 (persons)	Median Family Income 1970 (dollars)	Mean Family Income 1970 (dollars)	Change in Population 1960-1970 (percent)	Agricultural Opportunity Cost 1969 (dollars)	All Homes With Public Sewer 1970 (percent)	Property Tax Range[1] 1969	Sewer Range[2] 1969			
NAHB Regression One	.00037	.2640			7.0689	51.3284	2574.6632	-49.8327	-4407.	.65	.58
	(.00017)	(.1960)			(2.0144)	(17.7735)	(863.4662)	(148.3422)	(2208.)		
	.041	.189			.001	.007	.006	.739	.055		
FHA Regression Two	-.0000798	.2194			5.1025	15.7572	225.0730	-25.0476	-1384.	.50	.40
	(.0001051)	(.1171)			(1.2040)	(10.6230)	(516.0842)	(88.6625)	(1320.)		
	.454	.071			≤.0001	.149	.666	.780	.303		
NAHB Regression Three	.00030		.4621		5.9807	43.1096	2426.4962	-91.2666	-5228.	.69	.62
	(.00016)		(.1993)		(1.9946)	(17.4170)	(816.4581)	(141.8646)	(1956.)		
	.059		.028		.006	.019	.006	.525	.012		
FHA Regression Four	-.00005653		.1806		4.8769	14.6529	134.1712	-38.6948	-802.	.48	.37
	(.00010638)		(.1289)		(1.2902)	(11.2657)	(528.1027)	(91.7611)	(1265.)		
	.599		.172		.012	.204	.801	.676	.531		
NAHB Regression Five	.000218		.5671	-20.06	5.3636	46.99	2547.		-6027.	.70	.64
	(.000182)		(.2181)	(16.30)	(2.0044)	(17.48)	(807.)		(2061.)		
	.241		.015	.228	.012	.012	.004		.007		
FHA Regression Six	-.00013		.2624	-14.56	4.4510	17.75	251.14		-1437.	.51	.41
	(.00011)		(.1395)	(10.42)	1.2821	(11.18)	(561.65)		(1318.)		
	.254		.070	.173	.002	.123	.631		.285		

[1] Calculated by subtracting low county average per capita property tax in SMSA from high county average per capita property tax in SMSA and dividing by the overall SMSA average per capita property tax thus resulting in a relative range. Where one county consists of entire SMSA the range is zero.

[2] Calculated the same as the property tax range but uses the per capita sewer capital outlay high, low, and overall averages.

Table 4

SITE PRICE REGRESSIONS, FHA, 1969

Dependent Variable/ Regression Number — Market Site Price, Federal Housing Administration 1969 (dollars)	Total Population 1970 (persons)	Change in Population 1960-1970 (percent)	Mean Family Income 1970 (dollars)	Agricultural Opportunity Cost 1969 (dollars)	Site Size 1969 (square feet)	Property Tax Proportion of General Revenue 1970 (percent)	New Homes With Public Sewer 1969 (percent)	All Homes With Public Sewer 1969 (percent)	Property Tax Range[1] 1969	Sewer Range[2] 1969	Constant	R^2	$\bar{R}^2$	# of Cases
Regression One	.00017 (.00004) ≤.0001	17.4863 (4.9861) .001	.1263 (.0926) .165	6.8838 (1.2670) ≤.0001	.0270 (.0320) .401	-2.1964 (2.9321) .456	10.0880 (3.9771) .013				-376. (899.) .677	.55	.51	104
Regression Two	.00014 (.00005) .019	18.8217 (12.0098) .125	.0382 (.1382) .783	6.6977 (1.6424) ≤.0001			5.9518 (5.8896) .318		73.3602 (244.4426) .766	-17.4390 (109.2112) .874	1017. (1190.) .397	.51	.42	50
Regression Three	.00014 (.00005) .001	19.6920 (11.4657) .093		6.8578 (1.5206) ≤.0001			6.3000 (5.6913) .274		74.5027 (241.7693) .759	-8.6257 (103.3488) .934	1304. (580.) .030	.51	.44	50
Regression Four	.00011 (.00005) .053	17.4078 (11.8067) .148		7.1571 (1.5028) ≤.0001				15.6648 (12.4014) .213	-3.1865 (244.2632) .990	-16.5633 (103.3439) .873	668. (995.) .488	.51	.44	50

[1] Calculated by subtracting low county average per capita property tax in SMSA from high county average per capita property tax in SMSA and dividing by the overall SMSA average per capita property tax thus resulting in a relative range. Where one county consists of entire SMSA the range is zero.

[2] Calculated the same as the property tax range but uses the per capita outlay high, low and overall averages.

Table 5

APPRECIATION REGRESSIONS, NAHB, FHA, 1969

Dependent Variable/ Data Source/ Regression Number	Independent Variables Regression Coefficient, Standard Error in Parenthesis, Significance Level						Constant	R^2	$\bar{R}^2$	# of Cases
Land Value Appreciation, 1969	Total Population 1970 (persons)	Change Population 1960-1970 (percent)	Mean Family Income 1970 (dollars)	All Homes With Public Sewer 1970 (percent)	Property Tax Range[1] 1969	Sewer Range[2] 1969				
NAHB Regression One	.0006152 (.0001497) ≤.0001	13.34 (5.35) .014	-.04516 (.10840) .678				1980. (1009.) .051	.13	.11	162
NAHB Regression Two	.0001382 (.0001610) .395	2.64 (13.02) .087		48.54 (15.53) .003	1731.67 (748.85) .022	226.94 (130.17) .087	-24.39 (12.06) .049	.39	.33	56
NAHB Regression Three	.00007141 (.00017120) .678		.1329 (.1689) .434	48.93 (15.22) .002	1765.90 (748.85) .022	232.07 (127.13) .074	-37.18 (20.34) .073	.40	.34	56
FHA Regression One	.000002063 (.000000857) .008	.3771 (.0885) ≤.0001	.0009521 (.0012540) .450				1.98 (11.50) .836	.24	.22	104
FHA Regression Two	.000002472 (.000000857) .006	.4272 (.1789) .021		.2163 (.0893) .020	3.8484 (3.7533) .311	-.76175 (1.60650) .638	-7.2617 (1.6065) .638	.32	.24	50
FHA Regression Three	.0000009083 (.0000008541) .291		-.001627 (.001955) .410	.8080 (.1985) ≤.0001	1.8240 (3.7225) .627	-1.0330 (1.6106) .525	-24.67 (19.22) .206	.34	.27	50

[1] Calculated by subtracting the low county average per capita property tax in SMSA from high county average per capita property tax in SMSA and vidi dividing by the overall SMSA average per capita property tax thus resulting in a relative range. Where one county consists of entire SMSA the range is zero.

[2] Calculated the same as the property tax range but uses the per capita sewer capital outlay high, low, and overall average.

Table 6

APPRECIATION REGRESSIONS FOR THIRTY-SIX CITIES COMMON TO NAHB AND FHA, 1969

Dependent Variable/ Data Source/ Regression Number	Independent Variables Regression Coefficient, Standard Error in Parenthesis, Significance Level						Constant	R^2	$\bar{R}^2$
Land Value Appreciation, 1969	Total Population 1970 (persons)	Mean Family Income 1970 (dollars)	All Homes With Public Sewer 1970 (percent)	Change in Population 1960-1970 (percent)	Property Tax Range[1] 1969	Sewer Range[2] 1969			
NAHB Regression One	.00000016 (.00000021) .462	-.0283 (.2480) .910	66.7646 (22.5632) .006		2714.17 (1073.78) .017	-.5059 (189.6) .998	-3671. (2568.) .163	.37	.27
FHA Regression Two	.00000071 (.0002133) .997	-.1901 (.2443) .443	83.8507 (22.2275) .001		1372.41 (1057.80) .204	-21.0500 (184.1186) .910	-3079. (2530.) .233	.35	.24
NAHB Regression Three	.0002216 (.0002439) .371	-.0868 (.2673) .748	63.59 (23.19) .010	11.18 (21.27) .603	2583. (1080.) .023		-3095. (2758.) .271	.38	.27
FHA Regression Four	.0000318 (.0002411) .896	-.1651 (.2643) .537	83.2854 (22.9342) .001	-5.7272 (21.0351) .787	1417.18 (1068.08) .195		-3333. (2726.) .231	.35	.24

[1] Calculated by subtracting low county average per capita property tax in SMSA from high county average per capita property tax in SMSA and dividing by the overall SMSA average per capita property tax thus resulting in a relative range. Where county consists of entire SMSA the range is zero.

[2] Calculated the same as the property tax range but uses the per capita sewer capital outlay high, low, and overall averages.

In addition, comments by planners and developers in the comparative case study supported the behavioral implications, in terms of developer location decisions, of sewer supply policies. Nevertheless, the difficulty in separating other policies from sewer use policies makes interpretation of support for the hypothesis cautious.

Sewer pricing policies were tested by the sewer range in both the cross-sectional analysis and the pooled regression analysis. With the exception of Table 5, in which the sewer range was significant at the .08 and .07 level in explaining appreciation, the sewer range was consistently insignificant. On the other hand, the comparative case study indicated a growing awareness of sewer user charges via-a-vis location decisions by developers and planners. Combined with sewer provision issues, sewer financing can limit residential growth in some areas and encourage residential growth elsewhere.

Property Taxes

The effect of property taxation was best tested by the property tax variable. This was especially the case with NAHB data as demonstrated in Tables 2 and 3 (site price) and Tables 5 and 6 (appreciation). The property tax range was generally insigificant in the FHA cross-sectional results. Since the pooled regressions used FHA data, it is not surprising that the property tax range continued to be insignificant in the pooled regressions. Developer comments in the comparative case study did not indicate much importance of property tax variations, per se, in location decisions. On the other hand, agricultural opportunity costs in part represent property tax effects on landowners ability to hold land.

If the range is large, agricultural land might be taxed closer to use rather than market value, thus increasing the agricultural opportunity cost and the ability to hold land. Agricultural opportunity cost was consistently statistically significant and positive. A comment by one developer substantiated concern over agricultural land taxation and its effects on land availability. Use value taxation, either dejure or defacto, is likely to delay and change the results of land conversion and raise prices and appreciation rather than achieve agricultural land preservation in the long run.

While the interaction between these government policies is complex, the conclusion is that they separately and jointly affect the supply of land and can be a source of appreciation and economic profit associated with land values.

Policy and Research Implications

What policies do individuals or groups support if they want to keep prices and appreciation down? Efforts to lower appreciation will require focusing on all of the governmental jurisdictions in the land conversion market. This research examined the instrumental policies of local governments and their impact on site prices and appreciation. The structure of local governments and its impact on those policies and, hence, site prices and appreciation can be discussed only when the role of the instrumental variables is reasonably clear. Tentative policy implications of zoning, sewer provision, and taxation are presented here with, however, some reference to government structure issues in order to present a range of institutional alternatives and to avoid leaping to conclusions often found in this research area.

As has been noted, zoning policies can increase appreciation which in turn can create further feedback pressures on land use policies such as zoning. Variations in the degree to which supply restricting zoning policies exist will affect both developer and consumer location decisions and, perhaps, speculative activity. The greater the aggregate restrictions relative to demand, the greater the appreciation. For those who would like to lower land values created by this interdependent zoning process, the increased values are a negative pecuniary externality or spillover. The commonly used Tiebout (1956) model assumes no intercommunity spillovers, since people can move to communities offering characteristics they want, without consequences for others. Zoning is one tool for this product differentiation.

If it can be assumed that information about the appreciation effects of restrictive zoning will not change behavior, given the interests vested in the current structure and competition (or economic rent and profit,) then some change in government structure is suggested. Jurisdiction by jurisdiction changes to make zoning less restrictive over the entire land conversion market are unlikely to occur because of the benefits gained by those jurisdictions not changing. Various other land use policy options, whether superceding or coinciding with zoning, must account for jurisdictional interdependence. Chinitz and Cowing (1977) have analyzed the argument that metropolitan government be created to internalize externalities and recognized the geographical difficulties and value conflicts inherent in such policy prescriptions. Institutional changes designed to lower land values and appreciation will affect other preferences; small, homogeneous or high income suburbs, for example.

Other institutional arrangements have been suggested. Transferable development rights, which are designed, in general, to eliminate competition and change the distribution of economic rent and profit by having the winners of the land conversion process compensate the losers by a bargained transaction rather than an administered (zoning) decision. These rights could be exchanged by local government jurisdictions or individuals across the land conversion market. Clawson (1960) suggested several large suburban development districts in a metropolitan area which could have broad planning and infrastructure powers. In the State of California a similar concept, spheres of influence, is used as a basis for a planning device and organization (Local Agency Formation Commissions). This structure has problems interacting with existant governmental jurisdictions which limit their effect (Eells, 1977). The merits of any institutional change should be evaluated on many criteria, recognizing many values, including demand articulation, production economies, as well as prices.

Many of the same issues arise with sewer provision. Tabors et al., (1976) argued that, "the stronger and more centralized the control of the institutions responsible for sewerage planning, the more effective the overall policy is likely to be." (p. 172). Sewer supply relative to demand and timing also need to be considered within the context of the land conversion market but where the authority is placed and who gets included in the decision process will determine the ultimate impact of any change. The impact of a decision by one jurisdiction to limit sewer supply has, perhaps, clearer implications than zoning on other, nearby jurisdictions. With added concern about the appreciation and land value effects, land conversion market jurisdictions could bargain within the context of metropolitan area planning agencies which are becoming more involved in public service supply issues as state and federal involvement increases.

Agricultural taxation issues might also vary within a land conversion market. The empirical results of this research for the property tax range and agricultural opportunity cost support conclusions by Schmid (1968), Schwartz and Hansen (1973), and McMillan (1973) that lower property taxes lead to capitalization of the lower taxes into the value of the farm. Policies which, therefore, tax agricultural land at use rather than market value are likely to lower uncertainty and allow for an increased short run ability to withhold land from the market and, hence, raise appreciation.

The complexity of the land conversion process argues for a complex model. The research indicates that the general directional consequences of the various public policies are as hypothesized; however, the relationships are complex and the results are no doubt affected by other factors and highly idosyncratic local situations.

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