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Land-Use Controls and Housing Costs: *An Examination of San Francisco Bay Area Communities*

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Land-Use Controls and Housing Costs: An Examination of San Francisco Bay Area Communities*

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This paper reports on our efforts to gauge the effects of land use controls on housing markets. We discuss how land use controls affect land and housing markets and explain why communities use such controls to restrict development. We present the results of an econometric model created to assess the inflationary effects of land use controls on housing costs. The model is based on data assembled in the San Francisco Bay Area. The model results indicate that density controls and land availability do systematically affect the price of new housing units.

INTRODUCTION

Confronted with continuing increases in the cost of new housing, city planners and urban economists now find themselves re-examining the validity of local land use and development controls. In California, the controversy over land use controls has raged for some five years, sparked to no small extent by housing prices

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which remain the nation's highest. In his widely-quoted 1979 work, *The Environmental Protection Hustle*, Bernard Frieden [1] concludes that in the case of the San Francisco Bay Area, unnecessary growth controls are adding thousands of dollars to the cost of constructing new housing. Perhaps a more important effect, Frieden notes, is that by constricting supply in the face of burgeoning demand, local land use controls fuel the flames of housing inflation. Moreover, those responsible for such restrictive controls often act entirely out of self-interest, for as the price of new housing rises, so too do the prices of existing housing—in the process providing existing landowners with windfall profits. Similar conclusions have been voiced by Gruen and Gruen Associates [2] in a study of the application of growth controls in Petaluma, California, and more recently, by Dowall [3] in a study of land use controls as administered in six representative Bay Area suburban communities.

Academics and consultants, however, are not the only observers to express alarm at the current situation; the State of California has also voiced concern. A recent survey of local land use planning in California, undertaken by the Governor's Office of Planning and Research [4], revealed that over 50% of the 93 cities in the San Francisco Bay Area were actively limiting population growth. To reduce excessive project approval times, the California Legislature in 1977 enacted AB 884, a bill requiring local governments to approve (or reject) major residential projects within one year of the initial submission date. But, because of a variety of loopholes, AB 884 has not been effectively enforced.[1] Most recently, in an attempt to break the housing supply deadlock, Sacramento legislators have moved to require that individual communities accept their "fair share" of new housing supply, and identify and remove local roadblocks to new construction.[2]

Despite the flurry of legislative activity to promote housing construction and facilitate the availability of affordable housing, little effort has been made to assess the cost and price-push effects of local land use controls on housing. The barriers to such a complete assessment are substantial and center on the lack of good quality land supply and price data, difficulties in delineating meaningful housing submarkets, and separating demand side forces from supply side constraints. This paper reports on our efforts to overcome these barriers and provide some further insights into the relationship between local land use controls and the operation of urban housing markets. The study region is the nine-county San Francisco Bay Area—a metropolitan area containing over 100 independent units of local government with widely divergent approaches to controlling development.

The second part of this paper presents a simple typology for understanding and organizing the effects of land use/development controls on housing markets, and within such a context, provides a further review of recent empirical work. Part three provides some additional insights into the various rationales behind the adoption of land use controls, and reasons why the Bay Area's housing supply

crunch has now reached crisis proportions. Part four presents the results of our empirical analysis of the effects of land use and development controls on new housing prices.

THE DIRECT AND INDIRECT EFFECTS OF DEVELOPMENT CONTROLS ON HOUSING PRICES

California cities and counties have a variety of techniques at their disposal for regulating the type, quality, and timing of new development. In addition to such traditional controls as zoning and subdivision restriction, cities may:

establish urban limit lines, or borders beyond which new development will not be allowed to occur—effectively setting vacant land supplies.

routinely bargain with builders to reduce densities and mitigate negative environmental impacts.

use slope-based/zoning, a technique for reducing hillside development densities.

together with willing farmland owners, establish 20-year agricultural preserves.

levy development fees and charges to pay for the construction of needed on-site infrastructure (sewer and water lines), and also to subsidize the purchase of parkland and the maintenance of local schools.

use growth management programs to directly limit development.

To summarize the range of effects of land use and development controls on new housing prices, we have identified four direct and two indirect sorts of effects. Presented in Exhibit 1, these effects are best considered generic; that is, their relative impact on housing prices will depend largely on the level and character of housing demand, the proximity of regulated communities to other jurisdictions, and the cummulative degree of restrictiveness generated by local land use policies.

Direct Effects

The most common way in which land use and development restrictions affect housing prices is by directly increasing builder costs—increases which under most circumstances are passed on to homebuyers in the form of higher prices.

EXHIBIT 1

Direct and Indirect Effects of Environmental Controls on Housing Costs

Effect on Housing Costs	Land-Use Controls Most Likely to Generate Effect
Direct Effects:	
Increase in Land costs	Zoning, urban limit lines, density constraints, growth-management timing ordinances and permit programs
Increase in lot-preparation costs	Subdivision requirements, growth-management timing ordinances, dedication requirements
Shifting development costs from public to project	Capital-budgeting programs, fees and development charges, dedication requirement subdivision requirements
Administrative and delay costs	All land-use controls to some extent. Costs increase with the relative complexity of the regulation
Indirect Effects:	
Facilitating monopoly power	Controls that restrict the number of developers operating in communities will allow builders to charge excess housing prices. Regulations act as barriers to market entry, reducing competition in the housing market
Market Reorientation	Restrictions on development often force developers to reorient their projects to higher-income customers

Reducing supplies of vacant land, or restricting the permissible intensity of residential development can substantially affect land costs. As Ohls, Weisberg and White [5] have illustrated, zoning regulations which restrict vacant land supplies below the levels which would normally be exchanged in the market tend to increase land costs. Stull [6] has shown that communities adopting policies which shift land away from residential uses and toward employment-generating uses can expect residential land prices to increase as employment growth accelerates the demand for housing.

Unfortunately, direct empirical estimates of the inflationary effects of zoning on housing prices are not widely available. Accordingly, Davies [7] has used a simulation model of the London, Ontario area to examine how municipal actions increasing the supply of developable lots would affect housing costs. For 1967, Davies tested an increase in the supply of lots equivalent to 50 units, or about 11%. The simulation results suggested a corresponding lot price reduction of about $200 per lot (4.5%). A second simulation experiment for 1973 revealed that the same absolute increase in land supply (250 lots) would generate a $244-per-lot decrease in price (3.4%). But although the effect on lot prices is significant in both cases, the effect on house prices is less than 1%.

Using housing price and land use data for suburban Boston communities, Stull [8] tested the relationship between land use controls and housing prices. After controlling for accessibility, housing stock characteristics and the quality of public services, Stull found that housing prices were lower in communities with greater proportions of vacant land.

In addition to reducing the supply of residentially developable land, zoning acts to restrict development intensity. While large-lot zoning, on the one hand, tends to reduce the per-acre price of raw land, such reductions in price may be offset by higher land requirements. Interpolating from Peterson's empirically determined land-price gradients for Fairfax County, [9] Virginia, illustrates the potential cost effect of large-lot zoning. At a distance of ten miles from the urban center, Peterson found that large parcels zoned ½, 1, 2 and 10 units per acre were selling for $5,800, $7,900, $13,700 and $32,000 per acre, respectively. Converting these acre prices to per-lot values, the prices implied by the ½, 1, 2 and 10 units per acre zoning are $11,600, $7,900, $6,850 and $3,200, respectively.

A second type of direct cost effect of development controls is the increase in the cost of lot preparation and home construction. Numerous estimates of the price effects of subdivision and building code requirements are available, some better than others. In a 1976 study of Jacksonville, Florida, the Urban Land Institute [10] found that locally mandated changes in water system design and street width requirements added $830 to the cost of producing a "finished" lot (1976 dollars). In an earlier study for the Kaiser Commission, Burns and Mittelbach [11] estimated the inflationary impacts of excessive subdivision and zoning requirements at 2 to 4% of the price of new housing. While it is difficult to differentiate between necessary and excessive requirements, available evidence suggests that some cost reductions might be attainable by reducing subdivision standards. Short-term cost reductions are unlikely in the case of building codes, however, as most builders have fully integrated building code requirements into their production technologies.[3]

A third direct cost effect of development regulation is generated when local governments attempt to shift the public service costs to new development back to private builders. Traditionally, municipal governments have shouldered the public service costs of new construction. Recently, however, an increasing number of communities have begun to impose additional fees, taxes and land dedication requirements on project developers. This trend was particularly noticeable in California following the 1978 passage of Proposition 13, which limits homeowner property tax payments to 1% of assessed value. A recent survey of Bay Area communities [12] revealed substantial increases in development fees and taxes following Proposition 13. For example, in 1976, prior to the passage of Proposition 13, development, utility and impact fees averaged $1121 for the standard single-family home. By 1979, mean fee levels, in nominal terms, had risen to $1907, an increase of 70%. After discounting for inflation, fees rose by some 35%. As in the case of subdivision requirements it is difficult to determine when fees and charges are excessive. Charges that reflect the actual costs of providing public services to new development are reasonable, equitable and desirable. However, in some instances, cost-shifting appears excessive—when revenues are used to provide services that benefit the general community.

The fourth direct effect of development regulation results from administrative delays associated with regulatory compliance. With the widespread use of fiscal and environmental assessments, particularly in California, the time required to obtain development approval has increased tremendously over the past decade. A national survey [13] of the time length of the development approval process found that in 1970, 72% of the developers interviewed obtained project approval in seven months or less. 97% obtained approval in on year or less. By 1975, only 15% of the survey respondents had obtained permits in less than seven months, and only 42% obtained development approval in one year or less. To be sure, the blame for such delay rests as much with builders who prepare improper submissions, as with overzealous reviewers. Regardless of fault, however, delays in the development review process generate economic costs—costs generally borne by consumers. Delays result in increased land-holding and overhead costs, development loan interest costs, exposure to inflation and opportunity costs of tying up capital. In a 1978 Rice University study of Houston area builders, [14] the overall costs of approval delays were estimated to add between $388 and $596 to the per unit cost of new housing. In California, delays associated with California Environmental Quality Act compliance were estimated to add between 4 and 7% to the selling price of new units (1974) [15].

Indirect Effects

In addition to the direct cost effects of land use regulations, community control over residential development often confers significant monopoly power on developers and alters marketing and pricing decisions. Monopoly power allows builders to charge excess prices for housing and increased production costs may force developers to reorient residential projects to high-income markets.

Regulation establishes monopoly power in a variety of ways. By restricting developable land supplies, the potential for market entry and the possibility of increased competition are reduced. Studying the Edmonton, Canada, housing market, Cook [16] found substantial concentration among developers operating in the city's six restricted development areas, with the four largest builders supplying 64% of the single-family lots produced between September 1973 and August 1976. A closer inspection of the six city-designated development areas indicates that each is controlled by one developer.

Land use regulations which rely on complex administrative procedures act as barriers to market entry. If the level of complexity is great, potential developers may be reluctant to enter a local market, particularly if they perceive that those builders who have already established good working relationships with local planners are more likely to obtain development permission. A study of two San Jose, California builders [17] found that between 1967 and 1976, after holding land and materials cost increases constant, and discounting for mandated increases in housing quality, the two builders had increased their profit margins by between 158 and 231% (constant 1976 dollars). The researchers concluded that such excess profits were partly the result of reduced competition.

The second type of indirect effect of land use regulation is the reorientation of residential projects. The previous discussion of monopoly suggests that developers may increase prices to merely match cost increases. However, there is another reason for rising prices. Often, builders find that project marketability declines as prices rise. By changing the product only slightly, many builders are able to reorient their projects toward higher-income consumers, a reorientation which increases profits. Development restrictions which limit residential densities and increase production costs often force builders to scrap plans for high-volume, affordable housing in favor of a more limited number of higher-priced units [18].

THE BAY AREA PERSPECTIVE

The production cost side is only half the development control story. The other half, as noted above, concerns the interplay of supply and demand; whether in the face of rising housing demand, development controls restrict the aggregate supply response, and in doing so, push housing prices upward. Although such a market dynamic is difficult to verify empirically (in part because of the aforementioned problems with identifying submarkets and pure-demand side effects), with respect to the San Francisco Bay Area, there is substantial evidence that such supply constraints are in fact contributing to the continuing climb of new and existing housing prices.

In 1978, the San Francisco Bay Area edged Washington, D.C. for the dubious distinction of having the highest housing prices of any metropolis in the United States. In 1981, the median sales price of a new home in the Bay Area stood at $114,000—a figure more than $30,000 above the national average, and representing a 269% increase over a ten-year period. [19] At the same time that prices have been rising, vacancy rates have been falling. According to a recent estimate from the Association of Bay Area Governments, in 1981, the average Bay Area vacancy rate stands at roughly 2%—down from the 5% vacancy rate of only five years ago. [20]

What combination of market factors explains these trends? Like many growing metropolitan regions, the Bay Area has faced considerable demand pressure from growing households and industries. The so-called baby boom generation has now reached prime house-buying age. Changing cultural and social values have dramatically increased the formation of households as more individuals seek separate residences. Employment growth and increased immigration to California and the Bay Area have further accelerated household growth. The demand for housing is strong in the Bay Area, but it only partially explains rapid housing price inflation and high prices. The other key ingredient is insufficient supply.

Unlike other high growth Sunbelt regions, the Bay Area is, relatively speaking, in short supply of developable land. Extensive land development since World War II, the increasing use of growth management controls, more restrictive land use and environmental regulations, and the "go-slow" development posture created by the passage of Propositions 4 and 13 have significantly affected land conversion in the region. Despite the existence of what in absolute terms is an enormous supply of vacant land, much of this total cannot be developed because of rugged topography or enviromental fragility. Other vacant lands that could be developed are restricted from use by local land use controls. A 1975 inventory of land use recorded that of the region's 4.5 million acres, only 350,000 acres were vacant and "developable." [21] If only the acreage zoned for residential development and likely to be serviced is considered, the total shrinks to 161,800 acres, a number which at prevailing densities (8.7 units per acre), would accomodate some 1.4 million additional housing units. But unfortunately, as ABAG points out, residential densities are falling, and rather rapidly. If present land conversion trends continue, the projected 1990 regional housing demand will not be accomodated—there simply will not be enough land for residential development. [22]

Are such trends truly worrisome? After all, as vacant land supplies diminish, land prices can be expected to rise, signaling to developers and planners that land use intensities must also rise. Unfortunately, there now appear to be substantial and permanent forces within the San Francisco Bay Area which will prevent a move to higher housing densities. Among these forces:

The Rise of Local Growth Controls: The pro-growth attitude of most Bay Area communities in past decades has been replaced by a slow-growth posture, brought on by rising fiscal worries generated by Proposition 13. Cities that once relished being regional growth centers now view growth with much skepticism. With the new fiscal calculus of Proposition 13, single-family development usually generates higher public sector costs than revenues.[4] This fact, in conjunction with a greater recognition of the environmental impacts of development, has led some communities to reduce the amount of land available for residential development. Coupled with the lack of developable land in older Bay Area cities, development opportunities are becoming scarce, and some builders are leapfrogging out to exurban agricultural areas.

Jobs, But No Housing: Another result of Proposition 13 has been that numerous communiites have altered their approach to land use planning and zoning. Caught in a fiscal squeeze, many towns have stepped up efforts

to increase their tax base by attracting more commercial, office and light industrial development. But while attempting to attract economic development, most communities have not concomitantly adjusted their zoning to provide housing for additional employees. As a result, new employees, particularly those just migrating into the region, may find it increasingly difficult to purchase their own homes, *even assuming that currently high mortgage interest rates abate somewhat.*

Increased Development Fees and Charges: In addition to limiting development of fiscally "unprofitable" housing, most Bay Area communities have dramatically increased the fees and charges they levy on developers. A recent ABAG study found that total development fees for single-family homes range from $800 to nearly $6,000 per unit. [23] Crucially, the ABAG study reveals that the twenty-two communities charging the highest fees (ranging from $3,000 to $6,000) are all located in the developing suburban reaches of the Bay Area—communities, which not coincidentally, boast some of the region's more affordable housing.

How have these various factors affected housing supply? Exhibit 2 shows that region-wide, new housing production dropped from 46,235 units in 1977, to 38,472 units in 1978, to 33,763 units in 1979. In contrast to the Bay Area experience, statewide housing starts in 1978 and 1979 were well above 1976 levels. What is perhaps more alarming than the decline in regional housing starts is the fact that the greatest absolute 1977-1979 declines occurred in the three counties —Contra Costa, Santa Clara, and Sonoma—which together contain the majority of the region's developable land supply.

Falling residential densities, growth controls, job growth at the expense of housing development, and the "obstructionist" attitudes of citizens and communities toward new development—all of these factors are acting to reduce the supply of vacant land available to housing development. How are these trends likely to affect housing costs? Economic theory suggests that if the current regime of local land use and development control policies remains unchanged, land and housing prices alike will continue in an upward spiral, placing extreme burdens on low and moderate-income households and ultimately slowing the region's economic growth rate. Higher land and housing costs may also act to push up wage rates, as workers struggle to pay higher housing costs. Carried to their logical extreme, higher land and wage costs may reduce the Bay Area's attractiveness to business and industry. Such concerns, which may seem excessively "long run" to economists, are nonetheless very real to Bay Area civic and business leaders.

EXHIBIT 2

COMPARISON OF BAY AREA LAND AVAILABILITY AND CONSTRUCTION LEVELS: 1976-1979

COUNTY	LAND AVAILABILITY[1] "Policy Prime Land-1975"		BUILDING PERMITS ISSUED[2]							
	Acres	%	1976	%	1977	%	1978	%	1979	%
Alameda	15,554	9.6	3,876	(10.3%)	4,710	(10.2%)	6,517	(17.0%)	6,343	(18.8%)
Contra Costa	40,236	24.9	7,148	(19.0%)	10,404	(22.5%)	6,688	(17.2%)	6,332	(18.8%)
Marin	9,197	5.6	1,245	(3.3%)	1,457	(.32%)	1,951	(5.1%)	694	(2.1%)
Napa	4,038	2.4	798	(2.1%)	1,072	(2.3%)	948	(2.5%)	372	(1.1%)
San Francisco	182	.1	1,622	(4.3%)	1,536	(3.3%)	2,045	(5.3%)	1,833	(5.4%)
San Mateo	10,649	6.6	2,885	(7.7%)	3,839	(8.3%)	2,658	(6.9%)	2,567	(7.6%)
Santa Clara	27,688	17.1	13,151	(34.9%)	12,927	(28.0%)	10,020	(26.0%)	8,031	(23.8%)
Solano	20,880	12.9	3,174	(8.4%)	5,418	(11.7%)	4,321	(11.2%)	3,518	(10.4%)
Sonoma	33,377	20.6	3,764	(10.0%)	4,872	(10.5%)	3,404	(8.8%)	4,060	(12.0%)
Bay Area Total	161,001	100.0	37,633		46,235		38,472		33,763	

Sources: 1. ABAG, 1979.
2. *California Construction Trends*, December, 1979.

EMPIRICAL MODELS AND VARIABLES

It is one thing to individually itemize the effects of specific land use controls on housing costs; it is another to assess such effects, *in situ*, in the context of a major metropolitan real estate market. To determine the extent to which local development controls affect the prices of new housing units in the San Francisco Bay Area, we developed simple partial models of price determination. Following the earlier work of Lafferty and Frech, [24], Stull, [25] Reuter, [26] and Crecine et al., [27] the principal method of analysis was multiple regression.

Data Issues

As in any econometric formulation, there are a host of data problems lying in wait for the unwary analyst. Our first problem concerns the way in which the observation set is derived. Ideally, we would like to be able to predict how land and development controls affect the sale prices of individual housing units. Unfortunately, this "disaggregate" approach poses major data acquisition, sampling and estimation problems. We chose instead to use city-wide averages as an "aggregate" basis of observation. On the positive side, many Bay Area communities, particularly those growing suburban cities in which much of the region's new housing is being constructed, are internally homogeneous—a finding which we believe makes the use of city averages a reasonable second-best approach.

Nor is the choice between aggregate and disaggregate observations the only data-related problem. As noted above, standardized land price data for the Bay Area is virtually nonexistent. As a result, we remain unable to test the relationships between land availability and land price.

Past efforts at estimating econometric models of the price effects of development controls have proven problematic because of poor quality, or insufficient data. Accordingly, special care was taken to construct reliable indicators. In addition, efforts were made to reconcile data from different sources—a step which resulted in our eliminating several Santa Clara County municipalities from the sample set.

In all of the following specifications, the dependent variable is the average price of new housing (NPRICE) in community j during year i. To synthesize the NPRICE variable we turned to housing sales records as compiled by the Society of Real Estate Appraisers (SREA). Raw transaction data for the nine-county Bay Area were obtained from the SREA and organized by community. Within each community, price, size and age averages were derived for both new and existing housing. Only single-family homes were considered; those communities with fewer than 50 housing transactions per calender year were deleted from the observation set. The sample price observations cover a two and one-half year period, from January, 1977 to June, 1979. The sample of communities is extremely diverse and includes many older, almost completely developed bay plain cities such as Berkeley, San Pablo and San Mateo, as well as the more rapidly growing suburban centers like Novato, Antioch and Vacaville. The sample includes upper income (Hillsborough, Atherton, Mill Valley), middle income (Concord, Fremont, Albany) and working class (San Bruno, Richmond, San Pablo) towns. Appendix A lists the communities which form the observation set.

We should note that the observations vary over time as well as space. Accordingly, the coefficient estimates will include a pure cross-sectional component and a time-series component. Before pooling the data and testing the model across the 1977-1979 period, we carefully estimated each model separately over each observation year (1977, 1978 and 1979). Only after determining the stability of the coefficients within each observation year did we undertake the pooling. Year-by-year comparisons of variable correlation coefficients are included in Appendix B.

The independent variables of greatest interest are of course those which measure the incidence of development controls. Three such measures were assembled for each community:

Land Availability (ACRES) The more developable land available, the lower should be land prices. Likewise, lower land costs should yield lower new house prices. Accordingly, measures of land supply should be negatively correlated with new home prices. The ACRES variable measures the number of acres remaining for development in each community. Base year estimates (1975) were provided by ABAG. [28] To determine vacant acreage in subsequent years, we multiplied the number of residential units constructed in the subsequent year by the average gross residential density and subtracted the product from the previous year's land supply.

Permissable Residential Density (DENSITY) As residential densities fall, each additional new home occupies a greater land area. Hence, the total land input (per unit) and total land cost rises. Thus we would expect housing prices to rise with falling densities. Our precise indicator of density (appropriately called DENSITY), is the average residential development density proposed by each community for its remaining portion of undeveloped residential land. These data were obtained from ABAG, [29] as well as the individual communities themselves.

Development Fees (FEES) Higher fees and charges should, in high demand housing markets such as the Bay Area, translate into higher new house prices. The FEES variable is the value of mean fees and charges levied by each community. It includes planning and subdivision fees, building permit fees, sewer and water hook-up charges, and specified school and park taxes. Data are from a 1980 Association of Bay Area Government survey, and a previous study by Gabriel et al. [30]

In addition to these three variables, we obtained from each community its minimum R-1 lot size—a measure which ranges from a low of 5000 square feet in older, urbanized areas, up to 44,000 square feet in wealthier, suburban enclaves. Initial model runs revealed lot size to be highly multicollinear with, and an inferior explanatory variable to, DENSITY. Accordingly, we discarded MINLOT from subsequent model runs.

Two additional independent variables were included to capture prevailing housing market conditions:

Changes in Housing Supply (CHHU) This variable measures the supply effect. All else being equal, the more new units constructed in previous periods, the lower should be the price of housing. CHHU measures the absolute change in housing (all types) constructed during the previous year for each community. Through initial testing, we found the total change in supply indicator to be superior to one which measured just the increase in single-family homes. The data were assembled from the State Department of Finance. [31]

Vacancy Rates (VAC-1) Low vacancy rates indicate a "tight" market, in which sellers are able to extract greater rents. Other things being equal, the lower the vacancy rate, the higher the price of both new and existing housing units. The VAC-1 variable is the percent of housing units vacant in each sample community, lagged one year. The data are from the State Department of Finance. [32]

A third set of variables captures key community characteristics:

Access to Employment Opportunities (ACCESS) According to conventional wisdom,[5] superior access to employment opportunities should boost the price of new and existing housing units. But since travel patterns in the Bay Area are not strongly monocentric, distance measures (to the central city) are likely to be inappropriate. In such cases, an index of each community's travel patterns is believed to be a better measure of accessibility. The ACCESS variable is the inverse of each community's average trip length of all work trips originating or ending in the community. The index was developed from the Metropolitan Transportation Commission's 1978 Travel Demand Study. [34]

Income (MEDINC) Most analysts would agree that housing is, in economic parlance, a "normal good." That is, as household income rise, additional housing services are demanded. Accordingly, the higher the economic status of a community, the higher should be housing prices. The MEDINC variable measures the estimated median household income of each sample community. 1970 Census estimates of median household income were updated using 1976-1980 income estimates prepared by Urban Decision Systems. [35] Income estimates are reported in thousands of dollars.

Property Tax Rate (TXRTE) Local property tax rates measure two offsetting effects. Presumably, localities with higher property tax rates also provide a greater menu of public services—an effect which should add to homes values. Offsetting this effect however, is the observation that most homeowners are strongly averse to local property taxes, believing that property tax revenues are disproportionately spent to be benefit of non-property owners. Thus the conventional wisdom[6] is that higher property tax rates are capitalized into lower housing prices. Or put another way, home prices should be highest in communities able to keep property taxes low by excluding lower-income residents. Note that the TXRTE variable measures the tax rate (average dollar tax levy per $100 of assessed valuation), and not average tax payments. One other effect should be noted. Because the sample set includes both pre and post-Proposition 13 observations, we would suspect, a priori, that the time-series component of any capitalization effect would far outweigh the cross-sectional effect. The data were compiled by the Center for Real Estate and Urban Economics.[7]

Including tax rates, or the cost side without including the benefit side, or measures of municipal service quality, will certainly tend to bias the TXRTE coefficient. The benefit side was omitted for two reasons. First and foremost, we lacked high quality, service quality data for most of the communities in our sample. Second, we are not persuaded that the various dimensions of public service quality can be adequately measured or compared across municipalities in an econometric specification. Given likely measurement errors, past studies which have incorporated such variables (typically, school quality, crime rate and public transit access) are not strongly convincing.

The final variable, NSQFT, measures the average size, in square feet, of new housing in a particular community for a particular year. Although there are substantial production economies-of-scale in building larger homes (particularly when lot sizes are not increased), other things being equal, we would expect square footage to be strongly correlated with price. Community size averages were assembled from SREA transaction files and scaled in hundreds.

The New Housing Price Model

Exhibit 3 presents coefficient estimates for the New Housing Price Model. Four specifications are included. The first is linear and the second, logarithmic.

As in most logarithmic specifications, the estimated coefficients can be interpreted as variable elasticities. The third and fourth specifications include two dummy variables, DY78 and DY79, respectively, which denote the observation year, and are intended to capture all of the time-series variance. All four forms were estimated using Ordinary Least Squares. For the simple linear specification, the coefficients are listed according to their contribution to the total explained price variance.

Considering that the observations consist of city averages, the overall model fits quite well. By far the most important independent variable is average home size, explaining 43% of the price variance in the linear model and 37% in the logarithmic specification. All of the variable coefficients are of the expected signs. In the linear specification, however, the coefficients associated with new supply, vacancy rates, access and the local property tax rate are not significantly different from zero at the .05% confidence interval of a two-tailed t-test. Each of the three land use control variables are significant, albeit in the case of vacant land supplies, marginally so. Why do tax rates, access and measures of the change in the supply of new housing do so poorly in predicting new home price variation? Note from the first column of Exhibit 3 (a listing of variable means), that accessibility, as measured, does not vary widely across communities. Likewise, historically there has been little cross-sectional variation in Bay Area tax rates; what variation is noted is time-series related—the result of post-Proposition 13 tax reductions. The insiginificance of the supply coefficient is somewhat more puzzling.

Specifying the New Housing Price Model in logarithmic form increases the overall fit from .65 to .67. Perhaps more importantly, the significance levels of the land use coefficients rise, in some cases dramatically. The coefficients for zoned density, marginally significant in the linear specification, become strongly significant in the log specification. Likewise, the coefficients for fees and vacant acreage are statistically significant in the logarithmic model. At the other extreme, the coefficient for MEDINC, the measure of average household income, decreases in significance, the dollar effects of the two latter land use control variables, FEES and ACRES, on new home prices tned to be small. For example, a 10% reduction in supplies of developable land (from an average of 1951 acres to 1756 acres), would be accompanied by an increase in the price of a new Bay Area home of less than $450. On the other hand, the possibility of reducing new home price by raising permissible density levels is substantial. For example, an increase in development density of 10% would reduce the average sales price of a new home by more than $1000.

One reason for prefering the logarithmic specification to the linear one is the possibility that many of the effects we are interested in are non-linear, and that market agents, particularly homebuilders, perceive thresholds. Thus reducing development densities from 6 to 4 units per acre may have only a moderate effect on new home prices, whereas a further reduction from 4 to 2 units per

EXHIBIT 3

Estimates of the Price Effects of Land Use Policies on New Home Prices
(Nine County San Francisco Bay Area: 1977-1979)

VARIABLE	VARIABLE MEAN (Standard Deviation in Parenthesis)		MODEL COEFFICIENT (t-Statistics in Parenthesis)							
			Linear Specification		Log Specification		Linear w/Time Series Dummy Variables		Log w/Time Series Dummy Variables	
Dependent:										
NPRICE/100	103.64	(53.09)								
Independent:										
NSQFT/100	17.54	(3.91)	7.11	(7.44)	1.057	(8.31)	7.22	(7.66)	1.04	(8.90)
ACRES/100	19.51	(19.46)	−.32	(−1.63)	−.0413	(−2.08)	−.25	(−1.33)	−.032	(−1.73)
CHHU/100	4.30	(11.11)	−.26	(−.81)	−.0003	(−2.45)	−.27	(−.88)	−.0003	(−1.97)
VAC(−1)	4.45	(2.06)	−3.08	(−1.43)	−.306	(−4.65)	−2.28	(−1.09)	−.252	(−4.11)
FEES/1000	2.03	(1.20)	5.31	(1.78)	.112	(2.01)	.93	(.27)	−.0026	(−.04)
ACCESS*/100	5.96	(2.32)	1.27	(.81)	.115	(1.93)	.59	(.38)	.078	(1.41)
DENSITY	4.63	(5.30)	−1.19	(−1.71)	−.153	(−4.83)	−.73	(−1.06)	−.122	(−4.11)
TXRTE	6.82	(4.60)	−.19	(−.22)	−.044	(−1.31)	.10	(.09)	−.050	(−1.42)
MEDINC/1000	24.52	(8.25)	2.15	(3.70)	.035	(.79)	2.04	(3.6)	.041	(1.02)
DY78	.38	(.49)					16.99	(1.6)	.101	(3.18)
DY79	.35	(.48)					29.21	(2.97)	.139	(4.46)
Constant			−64.56	(−2.13)	.841	(3.95)	−76.30	(−3.01)	.766	(3.93)
R^2			.65		.67		.69		.73	
Observations			97		97		97		97	

acre would be highly inflationary. Similar arguments for non-linearity can be made in the case of vacancy rates and the variable measuring the supply response (CHHU).

The third and fourth specifications, which include the two time-series dummy variables are equally interesting. We note that the estimated coefficients for DY78 and DY79 in the linear model are 16.99 and 29.21, respectively. These values translate into 1978 and 1979 housing price appreciation rates of 22% and 13*%, respectively—fairly close to actual appreciation rates. All coefficients are of the expected signs, and except for FEES, inclusion of the time-series dummy variables does not greatly affect the stability of the model coefficients. However, in both linear and log forms significance levels decline, in some cases dramatically. The less stable coefficients are those associated with variables which changed substantially between 1977 and 1979, namely FEES and TXRTE. The two specifications incorporating the time-series dummy variables help to clear up a few issues surrounding the development control variables. First, the time-series component of ACRES and DENSITY is found to be relatively small, indicating that cross-city new home price differentials do stem partially from development restrictions. By the same token, the upward shift in development fees has not been a major cause of housing inflation; after accounting for general inflation, an increase of $1 in local development fees adds only $1 to the price of a new home. We caution, however, that because none of the coefficients (in the linear model) associated with development restrictions are significant at the 95% confidence interval, the above conclusions must be regarded as tentative.[8]

It is also appropriate to look a little more closely at the price-density relationship. Does the estimated price effect occur for supply side reasons as we have maintained, or is it instead a demand side effect? In other words, are new home prices higher because of local government restrictions on densities, or alternately, because those households who purchase new homes demand larger lots? This issue cannot be resolved econometrically. We do note, however, that our chosen density variable does not measure current densities, but instead measures the densities prescribed for future construction. Thus density (or minimum lot size) enters the reduced form equation primarily as a constraint on builders, and only slightly as a reflection of demander preferences.

In summary, these results indicate that new home prices are higher in communities with low density development policies, limited supplies of vacant land and higher fees. However, after accounting for inflation, the price effects of such controls are far less than anticipated. For example, the linear form suggests that, other things being equal, new home prices in a community will be nearly $750 higher for each one-unit reduction in the permissible density of residential development. Similarly, for each one-acre reduction in the supply of developable land, new housing prices will increase by $2.50 per unit. Each additional square foot

* This estimate is for the first half of 1979 only.

of unit size will add $60-70.00 to the price of a new home, a result not out of line with actual construction costs.

Area Analysis

In clustering Bay Area cities into a single sample, we implicitly assume that all Bay Area communities are part of one large metropolitan area housing market, differentiated solely by the characteristics captured in the model variables. In fact, the Bay Area is composed of numerous housing submarkets, differentiated by dimensions of space, quality of life, access to services—dimensions largely ignored by the variables shown in Exhibit 3. In failing to adequately differentiate city types, we risk obfuscating the very relationships we are seeking to clarify. For example, the price effects of a vacant land shortage are very different in Redwood City, an urban and largely built-out community, than in Santa Rosa, a growing community at the northern fringe of the Bay Area. Similarly, high development fees may be unimportant in urban areas where the level of new construction is low, but significant in fast growing suburban cities.

To investigate how major differences in community "type" would affect the model coefficients presented above, we divided the 93 cities of the San Francisco Bay Area into four classifications based on dimensions of density, location and recent growth experience. The categories are:

Urban Stable Cities
Urban Growing Cities
Suburban Stable Cities
Suburban Growing Cities

To distinguish stable from growing cities we looked at population growth rates during the 1976-1980 period. Where this rate was in excess of 5%, the city was termed "growing." The distinction between urban and suburban was made largely on the basis of residential density: those communities with 1975 net residential densities in excess of seven units per acre were termed urban, those with less than seven were put in the suburban category.

The four groupings, listed in Appendix A, are relatively consistent. For example, the set of urban-stable communities include almost all of the region's oldest cities, as well as those with a large percentage of their housing stock consisting of rental units. At the other extreme, the 39 cities termed suburban-growing offer housing which is predominantly single-family in character. Moreover, 58% of the region's 1976-1980 housing stock growth occurred in those 39 cities. If unincorporated areas are included, the share of regional growth which occurred in suburban-growing cities was 51%.

Exhibit 4, which profiles the means of the model variables by community type, provides some interesting insights. For example, average new home prices

EXHIBIT 4

VARIABLE MEANS STRATIFIED BY COMMUNITY TYPE
(Standard Deviations in Parenthesis)

Model Variable	Community Type: Urban Stable		Urban Growing		Suburban Stable		Suburban Growing	
NPRICE/100	125.78	(54.5)	88.0	(15.60)	147.81	(86.87)	90.22	(33.6)
NSQFT/100	17.58	(4.26)	16.42	(1.56)	17.69	(6.50)	17.78	(3.24)
FEES/1000	1.22	(.99)	1.53	(.81)	2.33	(1.69)	2.29	(1.02)
MEDINC/1000	25.99	(8.12)	23.21	(1.58)	30.51	(5.89)	22.97	(8.99)
DENSITY	2.93	(3.41)	16.67	(7.33)	2.31	(2.55)	3.89	(3.15)
ACRES/100	3.03	(4.99)	8.29	(12.90)	16.52	(15.73)	26.89	(20.61)
ACCESS	8.08	(4.24)	7.31	(.71)	5.67	(.89)	5.38	(1.55)
TXRTE	6.83	(5.15)	5.45	(5.08)	6.38	(3.60)	7.68	(4.40)
CHHU/1000	.078	(.07)	1.66	(3.38)	.042	(.035)	.454	(.39)
VAC-1	3.66	(1.63)	4.67	(2.36)	2.82	(1.11)	5.07	(2.11)
Sample Size	14		9		16		54	

together with median household income estimates are highest in the set of exclusive suburban-stable communities. As expected, housing in urban communities is somewhat older and smaller on average, than housing in suburban cities. The access measure is higher in urban cities than in suburban ones, however the spread is not that great—one indication of the multinucleated character of the San Francisco Bay Area. As expected, there is a sharp split in the variable measuring housing supply between stable and growing communities. Turning to the three development policy indicators, we note that fees are substantially higher in suburban communities than in urban ones. This is primarily due to the higher sewer and water hook-up fees which are charged in suburban areas—fees necessary to finance expanding infrastructure. In an effort to preserve their exclusivity, many of the suburban-stable communities of Marin and San Mateo Counties have zoned their remaining supplies of vacant land below two dwelling units per acre. Some suburban-growing communities also have zoned for large lot sizes, although not to the extent of their more stable counterparts. When coupled with estimates of vacant land reserves, we conclude that many of the suburban-stable communities are not unable to grow, but that they *prefer* not to grow, and use land use policy toward such ends.

Because of an insufficient number of new housing starts, we were unable to test the New Housing Price Model for any of the city subsamples except the set of suburban-growing cities. Instead, dummy variables were used to denote city type. Exhibit 5 summarizes the model results for five specifications; all are logarithmic in form. The first is over the entire sample. A second specification includes dummy variables denoting city-type as defined above. The third model

EXHIBIT 5

Estimates of the Price Effects of Local Land Use Policies on the Price of New Housing: Comparison by City Type

Dependent Variable: Log (Average Sale Price of New Single Family Homes/1000)

Independent Variable	Full Sample	Full Sample w/City Variables	Full Sample w/City and Time Variables	Suburban Growing Cities	Suburban Growing Cities w/Time Variables
Log (NSQFT/100)	1.057	1.13	1.113	1.28	1.165
Log (ACRES/100)	−.0413	−.016*	−.021*	−.027*	−.026*
Log (CHHU)	−.0003	−.0003*	−.0002*	−.049	−.058
Log (VAC-1)	−.306	−.198	−.173	−.135*	−.062*
Log (FEES/100)	.112	.117	−.004*	.144	−.067*
Log (ACCESS/100)	.115	.074*	.052*	.038*	.046*
Log (DENSITY)	−.153	−.131	−.104	−.108	−.096
Log (TXRTE)	−.044*	−.041*	−.036*	−.047*	−.046*
Log (MEDINC/1000)	.035*	.035*	.042*	.038*	.047*
D (Urban Stable)		.092	.044*		
D (Urban Growing)		.082	.047*		
D (Suburban Stable)		.112	.098		
DY78			.849		.147
DY79			.127		.176
Constant	.84	.636	.605*	.449*	.489
R^2	.67	.71	.76	.69	.86
No. of Observations	97	97	97	54	54

* indicates variable is insignificant at the 95% confidence interval.

incorporates both city-type dummy variables and time-series variables denoting the year in which the observation occurs. The fourth model was calibrated solely over the set of suburban-growing cities. The fifth and final specification is also just for suburban-growing cities, but includes the time-series dummy variables DY78 and DY79. As before, the variable coefficients can be interpreted as point elasticities.

Differentiating between city types improves the overall explanatory power of the general model only slightly. Note that when "city-type" dummy variables are included in the specification, the coefficients of two of the three land use control measures, zoned density and available acreage, decline in importance—one indication that our community stratification captures the land availability

dimension. (In fact, when city-type dummy variables are included, the coefficient for vacant acreage is not significantly different from zero.) At the same time the coefficient for fees increases slightly. Relative to price levels in suburban-growing communities, housing prices in the other three city types are consistently higher, even after factors such as unit size, income and access have been accounted for.

Adding time-series dummy variables to the second specification (which already includes city-type dummy variables), although increasing the explanatory power of the model slightly, renders insignificant the coefficients of most of the policy variables.

How do we interpret these results? First, it seems that new home prices are systematically higher in stable communities than in growing cities. One reason for the observed differences could be higher land prices in the more urban and stable communities, an effect not wholly captured by the access or acreage variables. A second reason might be that consumers place a premium on living in more established areas, a premium not solely based on access to work. A third explanation, one we favor, is that because the general level of new home construction is lower in the set of stable communities (see Exhibit 3), the level of price competition is comparably lower. Accordingly, developers who do gain access to buildable lots in the set of "stable" communities are in a position to set higher prices.

Calibrating the model solely with observations from suburban-growing communities yields more predictable results. Fees increase slightly in importance, even though many suburban communities continue to subsidize new construction by setting planning and utility hook-up fees below marginal cost. Because vacant land supplies are not yet a constraint on construction in many of the cities we have identified as suburban growing, the coefficient for acreage is small and insignificant. The coefficient for zoned density, on the other hand, is significant and is also of a magnitude consistent with the model run on the entire Bay Area sample. This finding confirms expectations that allowable density levels, as set by local governments, are crucial to a determination of developer profits, and thus price levels. Not only is the coefficient for new supply significant (in both the fourth and fifth specifications), it is also substantially larger in the suburban sample than in the entire Bay Area sample. This is but one indication of the contribution of new home construction to holding down suburban home prices. Conversely, in the set of suburban areas, vacancy rates as indicators of market tightness seem to decline in importance. In summary, we note that while land use controls do *directly* affect the prices of new housing, with the exception of reduced development densities, such effects tend to be small and widely varied across different housing submarkets.

CONCLUDING COMMENTS

While it is widely agreed that land use regulations contribute to housing price inflation, little supporting empirical evidence is available. Although tentative, the results of this paper illustrate that density controls and land availability do systematically affect the price of new housing units. However, our research also indicates that the direct cost effects are not as great as some critics of land use controls allege. For example, according to econometic estimates of new housing prices, the combined effect of increasing development densities by one unit per acre, reducing development fees by 50%, and doubling supplies of vacant land—all drastic steps—would be to lower the sales price of a new home by $6,000. This estimate amounts to roughly 6% of the average price of a new Bay Area home in 1979. New homes prices in growing suburban communities are less sensitive to limits on development densities and vacant land supplies and slightly more sensitive to increasing development fees. Our results also support the contentions of suburban builders who report that planning and development fees are added to the price of new housing on a one-to-one basis. In other words, for every one dollar increase in fees, the list price of a new home increases by one dollar. However, we note that land costs are more important to builders, and accordingly, density limits become critically important in determining project selling prices and profit. To the extent that builders can distribute higher land costs, as well as infrastructure costs, over a greater number of constructed units, higher single-family housing densities are crucial for holding down selling prices while maintaining profit levels.

The importance of the suburban housing market in acting as a relief valve for Bay Area housing demand is implied by Exhibit 5. Although changes in supply do not greatly affect housing prices in the region as a whole, the flow of new units onto the market is a major determinant of housing prices in expanding suburban markets. For example, a 500-unit increase in the flow of new homes into a suburban market would imply a decline in all suburban home prices of nearly $6,000. Thus policies which greatly restrict new construction and/or densities in active suburban communities are found to be inflationary. A logical extension of this finding is that if local governments in the San Francisco Bay Area are committed to reducing housing costs, they should consider loosening density restriction or other controls which inhibit the flow of new housing onto the market.

It is important to be careful in drawing rigorous conclusions from the results of partially specified econometric models, particularly when the observation set consists of city averages instead of well-defined economic agents. And because the significance levels of the estimated development policy coefficients vary depending on how the models are specified, the link between development controls and higher home prices must still be regarded as unproven. Nonetheless, the results presented here are surprising for their consistency, and their agreement

with expectations. They suggest that the housing price effects of pursuing restrictive growth control policies in expanding urban areas, far from being small and localized, are significant and widespread.

NOTES

1. Frequently, communities circumvent the intent of AB 884 by requiring builders to sign a waiver exempting the city from complying with AB 884.

2. Senate Bill (SB) 2853, was enacted by the legislature in 1980. It mandates that regional councils of government (COGs) allocate new housing construction to cities on the basis of projected growth and land availability. Initial allocations for the San Francisco Bay Area were to be published during the summer of 1981.

3. According to a recent survey by the National Association of Homebuilders, [37] when asked to list major construction problems, responding homebuilders listed building codes eighth—well behind increased labor, materials and land costs. Moreover, only 1.3% of those responding listed building codes as their "most significant" construction-related problem.

4. Whether or not new residential construction does or does not "pay its own way" will depend on a number of factors, including the existence of excess capacity in public services, the level of demand for such services by new residents and prevailing tax rates. In California, where Proposition 13 limits yearly property tax payments to 1% of assessed value, municipalities continue to experience substantial revenue short-falls. In the San Francisco Bay Area, Proposition 13 has led numerous communities to examine the net fiscal costs of new development through the use of CRIS (Cost-Revenue Impact Study), a municipal finance model developed by the Association of Bay Area Governments. In most of the cities in which CRIS has been used, new single-family development was found to generate insufficient tax revenues to cover the accompanying increase in public service costs.

5. The extent to which households trade between access to employment and land and housing prices is the basis of much of contemporary urban economics. For the basic exception, see Edwin S. Mills [33].

6. This argument, first offered by Tiebout (1956), is best presented in Wallace Oates [36].

7. Data were provided by Professor Kenneth Rosen, Director of the Center for Real Estate and Urban Economics, University of California, Berkeley.

8. The use of time-series dummy variables is not without drawback. Although we argue that the variation in new home prices attributable to increasingly stringent (across time) land use controls is far less than the price variation attributable to cross-community land policy differences, the time-series effect is not insignificant. By using single-time dummy variables (and thus lumping together the time-series variance of all the independent variables), we sacrifice the ability to identify precisely these time-series effects and bias the resulting yearly price indices.

An alternate method for estimating time-series hedonic price indices, one which partially obviates the problem of time-series dummy variables, has been suggested by Griliches [38], and more recently by Palmquist [39]. In the present case, the technique consists of:

> Estimating the New Housing Price Model for each sample year (1977, 1978, 1979) in both linear and logarithmic form.
>
> Inserting the mean values of the independent variables for the base year (1977) into the separate equations estimated for 1978 and 1979.

Comparing the estimated values of the dependent variable (NPRICE) for 1978 and 1979 to the base year 1977. The resulting ratios are quality-controlled time-series indices.

In the table below, the indices derived using the Griliches/Palmquist technique are compared with the hedonic indices derived through the use of time-series dummy variables. In neither the linear case or the logarithmic case does the Griliches/Palmquist index seem reliable. We offer two reasons for the discrepancy. First, the observations are not individual home transactions (as Palmquist suggests is appropriate), but instead are city-wide averages. Second, the estimated coefficients vary widely when separate year models are attempted, in part because we lack a sufficient number of yearly observations.

Year	Time-Series Dummy Variable		Quality-Controlled Hedonic Index	
	Linear	Log	Linear	Log
1977	1.00	1.00	1.00	1.00
1978	1.16	1.26	1.33	1.98
1979	1.28	1.38	1.31	1.19

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APPENDIX A

Model Sample by Community Type

Urban Stable	Suburban Stable	Suburban Growing	Urban Growing
Alameda	Livermore	Newark	Albany
Berkeley	Belvedere	Pleasanton	San Leandro
Piedmont	Tiburon	Union City	Belmont
Richmond	Corte Madera	Concord	Brisbane
San Pablo	Fairfax	Hercules	Foster City
Sausalito	Mill Valley	Martinez	Redwood City
Burlingame	Ross	Larkspur	San Carlos
Menlo Park	San Anselmo	Woodside	San Mateo
Millbrae	San Rafael	Portola Valley	S. San Francisco
San Bruno	Atherton	Campbell	Mt. View
Palo Alto	Los Altos	Cupertino	Santa Clara
El Cerrito	Pinole	Los Alto Hills	Sunnyvale
Daly City	Pacifica	Los Gatos	Hayward
		Milpitas	
		Monte Sereno	
		Fairfield	
		Antioch	
		Pittsburg	
		Morago	
		Pleasant Hill	
		Clayton	
		Novato	
		Morgan Hill	
		Benecia	
		Vacaville	
		Vallejo	
		Santa Rosa	
		Petaluma	
		Sonoma	
		Walnut Creek	
		Napa	
		Gilroy	
		Saratoga	
		Suisun City	
		Sebastopol	
		Fremont	
		Cotati	
		Rohnert Park	

APPENDIX B

Correlation Coefficients by Year
(Correlations Coefficients With NPRICE)

Variable	1977	1978	1979	Full Sample
NSQFT	.83	.79	.60	.69
MEDINC	.79	.64	.51	.61
FEES	−.34	−.27	.01	.002
ACRES	−.24	−.16	−.15	−.16
DENSITY	.02	−.23	−.19	−.20
ACCESS	.41	−.25	−.16	−.09
TXRTE	−.43	−.54	−.17	
CHHU	−.22	−.17	−.34	
VAC-I	−.26	−.36	−.43	
Observations	.26	.37	.34	.97