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Spatial Segmentation of the Urban Housing Market

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Neighborhood correlates of house price changes for the San Francisco Bay area are analyzed for the metropolitan area as a whole, and also for sub- markets defined on the basis of real estate board jurisdictions, the racial- ethnic composition of neighborhoods, and the average house price of neighborhoods. Regression analysis reveals different patterns of correlates for the market and submarket models, and an F-test indicates that the board of realtors submarket model is superior to the other models in accounting for variance in price change. These findings suggest that sub-market models should be used in the analysis of housing, but only if submarkets are carefully defined to bound areas which are likely to show discrete attribute-price structures.

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In recent years, increased attention has been given to the question of whether or not urban housing market is best conceptualized as an integrated whole or as a set of quasi-independent submarkets. Two questions underlie the debate on this topic: first, what is the appropriate level of aggregation for the study of housing, and second, if the metropolitan housing market is to be subdivided, what is the best means of delimiting submarkets. Several authors have argued that the classic models of urban land values based on metropolitan-wide patterns overbound the market. *H* this is the case, then doubt is cast on the accuracy of the numerous studies linking particular attributes such as air pollution or the racial composition of the neighborhood to house price levels. Further, it has been argued, the disaggregation of the metropolitan area into functional submarkets improves the over- all explanatory power of regression models linking dwelling unit and neighbor- hood attributes to house price levels.

The research reported here focuses on this issue of level of aggregation in house price studies. Two simple hypotheses were tested with data for the San Fran- cisco Bay area: first, that different pat- terns of correlates exist for house price changes when one disaggregates the metropolitan-wide patterns into approximations of housing submarkets; and second, that models for submarkets defined on the basis of exchange of information about housing perform better than models for submarkets delimited on the basis of economic or racial-ethnic characteristics.

Verification of these hypotheses is necessary if we are to make progress in the search for an understanding of the nature of the housing market, and there- by the mechanisms through which neighborhoods change. If the first hypothesis is confirmed, then there is reason to doubt the well-accepted contention that elasticities derived from hedonic price studies of housing for the metropolitan area as a whole are related to the utility functions of home buyers. Such a finding is suggested empirically from the work of Straszheim in the San Francisco Bay area *[30],* and theoretically from previous studies of market segmentation on the basis of race *[6; 11; 15; 16; 17; 26]* as well as real estate practices [*23].* If the first

hypothesis is accepted, it is obvious that future studies must give greater attention to the bounding of the study area, particularly if conclusions concerning buyer utility surfaces are to be drawn from data matching market price with housing and locational attributes.
The second hypothesis deals more directly with questions of how housing submarkets should be defined. If it is confirmed, then guidance is provided as to how submarkets may be pre-specified to yield more information about the relationship of market price and housing attributes.

THE DEBATE CONCERNING MARKET DISAGGREGATION

Several years ago, Straszheim [*31]* demonstrated that market disaggregation yielded significant reductions in the sum of squared errors in regression models of house prices and dwelling unit and neighborhood attributes. He suggested that much of the previous debate concerning the size and direction of beta coefficients for such variables as air quality and racial composition of neighborhoods foundered on the delimitation of meaningful submarkets: overbounded areas might yield unreliable measures of price-attribute relationships. In addition, disaggregation of the housing market into submarkets could throw into focus local supply-demand disequilibrium which might otherwise mask or distort price-attribute relationships [*19]*.

Rebuttals to Straszheim's findings have been presented by Schnare and Struyk *[27]* and Ball and Kirwan [*4]*. The Schnare and Struyk study considered hedonic models for thirteen municipalities suburban to Boston, stratified on the basis of average family income for census tracts, distance to employment centers, and average number of rooms in the dwelling unit. A comparison of the standard errors in the sample-wide model as compared with the submarket models showed only small differences. They concluded that be- cause the stratified model required a loss of data and thus a reduction in the reliability of estimates, and because the predictive power of the two models was essentially the same, their findings sup- ported the continued use of an unstratified model in house price studies. Ball and Kirwan have also presented evidence that submarket analysis lends no explanatory power to the metropolitan model in their study of "social areas" in Bristol. Not only did their regression equations fail to identify sharply varying attribute prices, but also an F-test failed *to* show sufficient reduction in error variance to reject the null hypothesis that submarkets provide no better explanation of house prices than the market model.

HOUSE PRICES IN THE SAN FRANCISCO BAY AREA

In the scores of econometric studies of house price levels [3; *8; 19],* the underlying model specifies that elasticities associated with the demand for space, accessibility, and other housing or neighborhood characteristics may be derived from studies of the expenditure of that portion of the household income allocated to housing consumption [*1; 21; 33*]. In the "hedonic price" studies, subset of the many characteristics which could be used to describe the housing bundle is fit, through multiple regression analysis, to the selling price [*14*]. In such studies, the relative contribution of neighborhood and dwelling unit characteristics, such as accessibility, square footage of living space, neighborhood quality, the physical environment, and the social environment are calibrated *[2;* 7; *25; 28; 29; 32].*
To test for the significance of submarket effects on the standard regression model, changes

in average house prices for census tracts were matched with some of the most commonly-used neighborhood variables. Average house prices were computed for small areas for the last six months of 1971 and the last six months of 1975. Areal units were defined on the basis of the map grid which was used as an atlas index by the Society of Real Estate Appraisers.1 Fifteen sales was set as the minimum number which a grid unit had to report for both time periods to qualify for further analysis. This minimum was selected to exclude those areas which would not produce re- liable average prices because of small numbers of sales, such as areas which were very stable, sparsely populated, or which were largely composed of non-residential property. Areas in which there had been major changes in the[1] average dwelling unit space were also eliminated: if the average square foot- age of dwelling units sold shifted by more than 500 square feet, frequently representing the sale of numerous condominium units in just one of the time periods, the grid was not considered in the subsequent analysis.

To permit the addition of census data to the analysis, the small map grids were matched with census tracts. The median price for the census tract for each of the six-month periods was calculated. The 1975 price was weighted by the change in the overall cost of homeownership as reported in the Consumer Price Index, converting 1975 prices into 1971 dollars. Finally, in order to eliminate any remaining aspect of price change ac- counted for simply by the average in- crease or decrease in the size of dwelling units sold, a regression of price change in 1971 dollars on absolute change in square footage was calculated. The residuals from this regression, rep- resenting the change in the average price of dwelling units sold weighted by the average change in dwelling unit space and expressed in 1971 dollars, became the dependent variable, PRCH (price change), in the subsequent analysis.

Twenty neighborhood variables, selected from those frequently used in previous studies of house price, were selected to describe neighborhood price trends (Table 1). Because several of the variables showed multi-collinearity, the twenty were reduced to twelve orthogonal dimensions through principal component analysis *[10; 18]*. The twelve dimensions accounted for 90.4 percent of the total variance (Table 2).

HOUSE PRICE TRENDS FOR THE·METROPOLITAN AREA AND SUBMARKETS

The first hypothesis poses that different patterns of correlates exist for house price trends in subsectors of the metropolitan area. This hypothesis was tested by the calculation of a set of

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[1] Data on sales price, mortgage type, and characteristics of the dwelling unit and lot were obtained from the Market Data Center of the Society of Real Estate Appraisers. Two methods of calculating price trends were considered. The first is the tracking of price changes for individual properties over a period of time, and has the advantage of holding dwelling unit characteristics constant. The second method involves computing average prices for small, homogeneous areas for two time periods and measuring the changes in average price. Although the second method has the disadvantages associated with studies of ecological relationships, it permits an increase in the number of observations possible at any time period, eliminates idiosyncrasies in property unkeep, and results in greater data manageability. For these reasons, the second strategy was selected to measure house price change.

multiple regression equations for the metropolitan area and for housing subsectors. If the hypothesis is to be accepted, the strength and direction of the beta coefficients should differ because of the importance of different sets of variables in accounting for price trends in particular subareas, and an F-test should show that the submarket models significantly reduce the squared error of the price change variable.

Subareas or submarkets for the San Francisco-Oakland SMSA were delimited on the basis of districts within which real estate agents exchange information on house listings. Realtors in the San Francisco Bay area are divided into seventeen Boards of Realtors, each with a separate Multiple Listing Service. Be- cause of cooperation among several of these boards, it is possible to aggregate them into seven larger districts which can be understood to circumscribe the information exchange among real estate agents, and which form the basis for sharply differing evaluations of housing opportunities in the metropolitan area *[23]*. The seven subareas or submarkets so defined were: Marin County, San Francisco County, San Mateo County, central Contra Costa County, west Contra Costa County, Oakland (including Berkeley and Alameda), and southern Alameda County.

TABLE 1
VARIABLES AND SOURCES OF INFORMATION

Variables	**Source**
Percentage of blacks Percentage Spanish-language Population Median years of school completed Professional-managerial workers Percentage single family dwellings Percentage owner-occupied dwellings Median age of housing Index of household diversity Percentage of commuters who drove an automobile to work Percentage of 1970 population who lived in the same house in 1965	U.S. Bureau of the Census, Census of Population and Housing: 1970, Census Tracts, Final Report PHC (1)-189, San Francisco-Oakland, Calif., SMSA, U.S. Government Printing Office, Washington, D.C., 1972
Population density	U.S. Bureau of the Census and Manpower Administration, Urban Atlas, GE 80-7360, San Francisco- Oakland, SMSA, U.S. Government Printing Office, Washington,

	1974.
Standardized reading scores for local elementary schools	California State Board of Education
Time-distance at peak traffic hours to San Francisco	Metropolitan Transportation Commission central business district
Air pollution	Bay Area Air Pollution Control District, Technical Services Division
Crime rates	Crime and Delinquency in California
Property tax rates	County taxpayers associations
Price of housing in 1971-2 and 1975 Square footage of dwelling space, 1971-2, 1975 Percentage of lots sold with "views Type of mortgage	Society of Real Estate Appraisers, Market Data Center

Eight regression equations, one for each of the subareas and one for the metropolitan area as a whole, were calculated from the component scores (Table 3). The results show marked variation in the strength and even the direction of association between neighborhood price trends and neighborhood characteristics. Although the overall social status of the neighborhood was positively related *to* relative house price in- creases in all subareas, it was statistically significant only in the SMSA, San Fran"- cisco, San Mateo, and Oakland equations. Other components were less consistently related *to* price trends. The crime-tax component was negatively related to price trends for the metropolitan equation and for San Mateo County; views were statistically significant in the metropolitan and west Contra Costa County equations, but the direction of the relationship differed, probably be- cause a "view" of the Bay in west Contra Costa County also includes a view of oil storage tanks, and thus has a negative effect on price trends; and accessibility was significant at a 0.05 level only within the metropolitan equation. Similarly, the presence of large numbers of

TABLE 2
DIMENSIONS OF HOUSING AND NEIGHBORHOOD CHARACTERISTICS

Component Label	Percent of Variance Explained	Variables with loadings of < 0.4	
Suburban, distance from San Francisco	27.4	Age of housing (high = new)	.538
		Commuter-drivers	.792
		Time-distance to S.F.	.796
		CBD Density (high low density)	.422
		Other non-white	-·.689
High property tax and crime rates	1.5.9	Property tax	.848
		Crime rate	.767
		Percent Black	.561
		FHA mortgages	.493
		Standardized reading scores	.452
Occupational and educational status	9.2	School years completed	.842
		Professional- managerial	.985
		FHA mortgages	-.442.
Air pollution	8.8	Air pollution	.875
Stable neighborhoods	5.5	Percent nonmovers	.799
Demographically homogeneous neighborhoods	5.2	Index of household diversity	
		Age of housing (high = new)	-.654
Chicano areas	4.3	Percent Spanish language	.750
Scenic views	3.7	Percent of lots with "views"	.642
Low density	3.3	Price in 1971	.613
New housing	2.8	Density	.540
Single-family, owner-occupied structures	2.2	Age of housing	.410
		Percent single-family dwellings	.537
		Percent owner-occupied	.460
FHA mortgages predominant	2.1	FHA mortgages	.408

TABLE 3

REGRESSION MODELS FOR THE METROPOLITAN AREA AND FOR BOARD OF REALTORS SUBMARKETS; SUBMARKETS AS DEFINED BY INCOME AND RACE OF RESIDENTS

Component Labels	SMSA	West Contra Costa	Central Contra Costa	San Francisco	Marin	San Mateo	Oakland	Southern Alameda
Occupational and educational status	2367.2* (235.8)	257.4 (895.4)	1181.1 (1579.9)	5482.2* (1465.5)	523.9 (2488.6)	2870.9* (596.4)	1742.9* (499.0)	812.1 (806.8)
High property tax and crime rates	-1205.1* (194.9)	300.9 (429.9)	344.2 (1393.5)	-13980.6 (9436.5)	3569.6 (3126.8)	-1742.7* (634.2)	-1074.5 (1445.3)	292.2 (480.2)
Scenic views	1312.5 (307.0)	-3113.7* (1264.8)	1577.3 (1449.6)	218.3 (2393.7)	1739.8 (3563.7)	824.5 (734.9)	513.1 (563.8)	1368.9 (1216.1)
Suburban, distance from San Francisco	-625.6* (240.1)	-177.1 (836.9)	-4010.5 (2015.2)	1211.7 (3029.7)	-1313.5 (5274.7)	844.9 (825.3)	-318.8 (1309.4)	316.7 (873.3)
New housing	579.7 (338.3)	1154.9 (759.7)	-1297.7 (1152.5)	1563.2 (2322.3)	-3594.1 (2155.1)	1029.4 (755.6)	-1396.3 (1324.9)	1115.1 (653.7)
Demographically homogeneous	-579.8 (316.8)	-383.9 (724.3)	183.0 (662.1)	5475.2 (3886.3)	-2829.9 (2293.3)	-806.7 (711.8)	-930.3 (1629.8)	-930.9 (631.9)
Chicano (Spanish- speaking)	-424.4 (260.6)	-160.9 (332.9)	199.3 (1046.8)	1068.9 (3872.4)	-2152.3 (1947.4)	-2428.9* (597.9)	-1172.3 (1005.6)	-2358.7* (849.6)
FHA mortgages	-356.0 (266.0)	-922.6 (592.6)	-1390.1 (1712.8)	-3119.3 (3022.0)	3171.3 (5856.9)	-2549.2* (601.5)	-224.4 (640.1)	254.4 (526.1)
Low density	352.1 (317.6)	2946.5* (622.8)	1218.2 (837.3)	2490.8 (3889.1)	1550.4 (3297.8)	-557.3 (566.6)	2305.6 (1043.5)	-145.4 (452.2)
Air pollution	-41.3 (115.9)	253.6 (205.3)	-710.3 (545.6)	4579.9 (7458.5)	-941.3 (2158.4)	-524.2 (256.4)	8.3 (483.1)	-210.8 (179.7)
Single-family, owner-occupied structures	-68.2 (307.9)	723.3 (452.3)	-788.2 (2205.2)	-814.6 (1343.5)	534.0 (3840.4)	667.1 (645.9)	6.7 (110.1)	1940.1* (844.1)
Stable neighborhoods	-44.8 (245.8)	-1193.6 (684.6)	-442.3 (810.7)	1298.6 (1338.8)	597.3 (2879.2)	-491.3 (377.7)	103.6 (945.9)	-442.1 (445.2)
CONSTANT	-236.0	-5294.5	2332.4	4117.8	-2593.1	767.2	1642.6	334.4
R^2	.408	.685	.717	.574	.618	.779	.578	.441
Adjusted R^2	.387	.528	.456	.410	.349	.608	.465	.298
Number in sample	344	37	26	44	30	89	58	60

Spanish-speaking persons was statistically significant only in those submarkets with large proportions of Spanish-speaking persons in single-family dwelling units in limited portions of San Mateo County. In San Mateo and southern Alameda counties, mortgage lending policies, indexed by the presence of FHA- insured rather than conventional mortgage loans, were a predictor of price trends only in those subsectors where the effects of the FHA 235 program were clearly in evidence.

The contention that the pattern of correlates for submarkets is a superior approximation of the relationships between the independent and dependent variables was supported by an F-test for the reduction in the sum of squared errors due to geographic stratification. The F-ratio was 2.56, significant at the 0.01 level, enabling one to reject the null hypothesis that there are no differences between the geographically stratified and the unstratified models. The board of realtors models are not only different from the unstratified model, but they also perform better in reducing the error variance.

The importance of particular components in the regression models seems to be a function of the peculiar makeup of the subsector or submarket and the perhaps unique character of housing ex- change rules within the subsector, rather than some general pattern which affects the entire metropolitan area. This suggests that there is no single housing market for the metropolitan area, but rather a series of submarkets which must be identified if one is to portray accurately the nature of housing exchange and neighborhood filtering.
The finding that subsectors vary from one another is significant within the framework of the current debate on the market-submarket issue, but is not surprising given the many factors at work to disrupt the equilibrium market condition which must obtain if no differences are to be found. Economic theory predicts that, ceteris paribus, market price rises where housing quality is good, municipal services are of high quality and low cost *[5; 12],* there are relatively few minority residents *[6],* and the neighborhood is accessible *to* places of work, shopping, or other amenities *[24].* Equilibrium conditions are likely to be disrupted within housing submarkets by (1) restriction of housing supply in the local area due to urban renewal, zoning regulations, or growth control policies, as well as the simple lag between demand and construction; (2) temporary and local inflation or deflation of demand related to changes in the age, racial, or economic composition of the population as neighborhoods experience rapid demographic changes and stresses are placed on a limited supply of housing; and (3) interference in the simple market process by such institutions as mortgage lenders and real estate agents whose actions may result in unexpectedly high or low prices as a result of speculative activity, the withdrawal of mortgage funds, and sales efforts from particular portions of the housing market, or simply the mismatch of buyers and sellers as a function of the information structure of the real estate industry. That such disruptions *to* market equilibrium exist in a large metropolitan area is highly likely. It is even more likely that disequilibrium, in the short-run at least, exists when functional submarkets are smaller in size-imbalances will be even more severely felt when it is the submarket rather than the metropolitan area which is the subject of analysis.

TABLE 4

COMPARISON OF SUBMARKET MODELS; SUBMARKETS AS DEFINED BY INCOME AND RACE OF RESIDENTS

Component Labels	SMSA	Chicano	Non-Chicano	Black	Non-Black	High House Price	Medium House Price	Low House Price
Occupational and educational status	2267.2 (235.8)*[1]	-710.3 (1192.8)	2282.4 (261.9)*	2605.7 (1136.6)*	2362.4 (296.1)*	1592.7| (1020.7)	3178.2 (595.5)*	1725.0 (395.9)*
High property tax and crime rates	-1205.1 (194.9)*	-1149.1 (590.5)	-1287.9 (212.0)*	-610.5 (849.0)	-1259.5 (228.3)*	-921.2 (871.1)	-1363.6 (485.8)*	-1048.2 (262.6)*
Scenic views	1312.5 (307.0)*	648.3 (403.8)	1766.8 (448.5)*	1192.9 (791.0)	1369.9 (453.3)*	697.7 (1165.6)	1048.6 (768.9)	886.9 (400.9)*
Suburban, distance from San Francisco	-625.6 (240.1)*	-427.1 (468.1)	-804.3 (281.9)*	-757.8 (1106.4)	-537.8 (260.7)*	-139.8 (808.1)	-1091.5 (405.5)*	-496.6 (318.2)
New housing	579.7 (338.3)	5.7 (923.8)	548.6 (376.2)	1126.3 (1459.0)	608.7 (368.8)	982.8 (805.1)	487.2 (557.4)	220.1 (546.2)
Demographically homogeneous	-579.8 (316.8)	2264.5 (961.9)	-567.3 (365.1)	-455.4 (2885.7)	-601.4 (347.1)	-1186.1 (817.7)	-224.2 (562.5)	-332.1 (593.9)
Chicano areas	-424.4 (260.6)	-3511.3 (1243.7)*	-222.7 (300.7)	-2294.6 (1520.9)	-330.5 (271.6)	290.5 (820.3)	-306.4 (389.6)	-512.7 (358.2)
FHA mortgages predominant	-356.0 (266.0)	-853.9 (557.5)	-431.2 (301.5)	-513.8 (692.5)	-359.2 (317.4)	42.7 (1437.7)	-136.8 (704.3)	-697.9 (333.6)
Low density	352.1 (317.6)	-359.1 (581.5)	577.7 (362.2)	3160.3 (1606.1)	196.7 (331.9)	369.4 (910.9)	-65.0 (494.3)	624.2 (469.9)
Air pollution	-41.3 (115.9)	-455.7 (286.9)	-63.9 (131.5)	416.3 (578.3)	-63.9 (124.4)	50.2 (460.4)	-13.9 (215.1)	-41.1 (143.8)
Single-family, owner-occupied structures	68.2 (307.9)	-225.6 (690.9)	-266.3 (363.7)	1452.5 (1618.0)	-31.4 (349.2)	-512.6 (990.5)	495.1 (612.5)	-159.9 (443.2)
Stable neighborhoods	-44.8 (245.8)	-1184.2 (621.3)	69.4 (384.7)	-879.5 (1095.7)	-59.7 (273.1)	4.9 (739.3)	258.9 (412.5)	-645.9 (404.4)
CONSTANT	-236.0	327.0	-135.1	635.5	-356.5	841.7	-412.5	-794.6
R^2	.408	.451	.414	.458	.341	.217	.282	.3.54
Adjusted R^2	.387	.263	.389	.187	.314	.096	.210	.281
Number in sample	344	48	296	37	307	91	134	119

*Significant at $p < .05$.

[1]Numbers in parentheses are t-values

COMPARISON OF SUBMARKET MODELS

Some of the difficulties involved in specifying appropriate submarkets for the study of urban housing are alluded to in the numerous studies in which sub- markets have been defined [8; 13; 15]. As Bourne has pointed out, a major weakness in most attempts at empirically delimiting submarkets is the failure to take into account the ways in which households acquire and use information about housing vacancies, and the ways in which they match themselves with these vacancies [8; 9]. A housing sub market may be defined as a collectivity of buyers and sellers with a distinct pat- tern of price-attribute valuations. In any market area, the outer boundary is de- fined as a given probability level that a unit from a particular origin will be ex- changed at a given destination, usually the marketplace. Although the housing market does not involve a centralized exchange, its boundaries are similarly defined by the probabilities that transactions will take place linking two housing units through sale, rental, or exchange. Similar units and similar locations are not necessarily those most intensively linked [20]. It is, therefore, important to define the housing market or submarket on the basis of the probable exchange of dwelling units rather than on the basis of an a priori categorization based on tenure or another characteristic which the researcher deems as a good basis of classification.

Housing submarkets were defined for the San Francisco-Oakland area on the basis of three criteria: information exchange units of cooperating boards of realtors; racial composition of neighborhoods; and economic characteristics of neighborhoods. The second hypothesis was that the first submarket classification, based on units within which in- formation about housing vacancies is exchanged, provides a better framework for predicting price trends than submarkets defined on the basis of non-spatial racial or economic characteristics. This hypothesis would be confirmed both by a better performance of the multiple regression equation (a larger coefficient of determination), and also by a larger reduction in error variance by the boards of realtors model than competing models.

Coefficients of determination varied greatly for the submarket equations (Table 4). The adjusted R^2 for the unstratified model was 0.387, but ranged from 0.608 for the San Mateo County board of realtors jurisdiction to a low of 0.096 for the submarket based on high house prices. With only two exceptions, the coefficients for the boards of realtors models were consistently higher than that for the unstratified model and those for submarkets defined by income and race of residents. Models which fell be- low an R^2 of 0.30 included the southern Alameda County board model, and the Chicano, Black, high house price, medium house price, and low house price models. Only the very large "nonblack" and "nonChicano" submarkets achieved coefficients approaching that for the metropolitan area, probably because these are not true submarkets and most of the census tracts in the unstratified model were included in the computations for these "submarkets." Coefficients of determination for the board of realtors districts were thus consistently higher than those for racial-ethnic or economically defined districts, indicating that the former were more effective overall in accounting for price change.

The F-ratios, comparing the reduction in error variance for the stratified and unstratified models, also indicate the superiority of the board of realtor regionalization. The F-ratios for

the Black, Chicano, and house price stratifications were not high enough to enable one to reject the null hypothesis that the reduction in error variance provided by these models compared to the unstratified model was different from zero at the 0.01 level of significance. For the Black-nonBlack stratification, the F-ratio was 1.03; for the Chicano-nonChicano stratification, it was 1.09; and for the house price stratification, it was 1.31.

From this evidence, one may conclude that the board of realtors submarkets are superior to the other submarket stratifications considered and also superior to the unstratified model. This finding indicates that caution must be used in the delimitation of submarkets: although it may be true that the housing market is compartmentalized on the basis of race, ethnicity, and income or house price, it is not necessarily true that all areas of similar racial or economic structure should be considered together as a single submarket. Not only must the interpretation of elasticities derived from the statistical analysis of the metropolitan area be evaluated with skepticism but also elasticities for demographically defined submarkets, unless these submarkets have also been delimited after a study of probable transactions. Neither the SMSA nor the easily-defined racially or economically-based regionalization of the metropolitan area should be accepted as equivalent to a "housing submarket" without verification that such units are indeed behaviorally appropriate.

CONCLUSIONS

The results of this analysis lead to several conclusions with respect to the spatial segmentation of the urban housing market:

1. Submarkets differ with respect to neighborhood correlates of house price trends. Since the bounding of study units in a functional analysis exerts a major influence on any observed relationships therein, it is obvious that one must exercise care in delimiting housing markets if the goal is the derivation of utility functions of buyers based on price-attribute relationships. In the San Francisco Bay area, it has been noted that certain neighborhood attributes exert a positive or negative effect on price trends only in limited regions. From this finding, one may conclude that over-interpretation of regression coefficients will continue to plague hedonic price studies unless greater care is taken in the bounding of the market region within which transactions take place and prices determined.

2. Submarket analysis may be evaluated on the basis of the extent to which submarkets approximate boundaries within which it is probable that housing is exchanged. In a large metropolitan area, it is unlikely that submarkets based simply on the racial or economic composition of destination neighborhoods comprise market exchange units, particularly if these neighborhoods are spatially disjunct. It is not surprising that submarkets based on factorial ecology procedures [*4]* or income and accessibility *[27]* fail to produce better explanations of house price levels than the metropolitan-wide model, for they have neglected information linkages and transaction probabilities. The empirical results of this study of the San Francisco area suggest that a first approximation of information and transaction-based submarkets may be the real estate industry jurisdictions within which listings on single-family dwellings are exchanged, and between which little information is available to buyers without the investment of relatively more time and effort.

3. Although the real estate board districts provide an approximation of the outer boundaries within which real estate exchanges take place, it is likely that they are over-bounded as study areas, since it has been noted that even within single board of realtors jurisdictions in a moderately large metropolitan area, real estate agents further segment the market perceptually and behavior- ally *[22].* If the submarket model in overbounded areas performs better than the market-wide model, it is also probable that sharp distinctions exist among the even more limited submarkets within which transactions actually take place. Because the functioning of the market cannot be understood without knowledge of the location and workings of submarkets, and yet the delimitation of submarkets requires an understanding of the market as a whole, it is difficult, to say the least, to predefine submarkets. It is suggested that further attempts at submarket delimitation begin at the level of empirically derived information constraints.

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