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CHARACTERISTIC PRICES OF HOUSING IN FIFTY-NINE METROPOLITAN AREAS

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PREFACE

This report is submitted as fulfillment of subtask 1.3 of task order 5 under Contract H-2882. The objective of task order 5 is to evaluate Fair Market Rents through application of hedonic index methodology to Annual Housing Survey data. Subtask 1.3 calls for the estimation and appraisal of hedonic indexes for all fifty-nine metropolitan areas included in the first three waves of the survey. The report contains this work. Following tasks will apply these estimates in the evaluation of Fair Market Rents.

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We wish to pay special tribute to James R. Follain who was the moving force behind our original study of hedonic methods using Annual Housing Survey data (see Follain and Malpezzi, 1980a). Readers who are familiar with that study will note a great deal of similarity between it and the present paper; this similarity is a measure of our respect for his work.

The present paper has also benefited from many discussions with John Weicher, who is engaged in similar work at the Institute; Edgar Olsen and David Rasmussen who reviewed the manuscript; and Daniel Weinberg, Terrence Connell and Mark Wynn who contributed to initial design of the study. Steven Gold provided several valuable references.

Christine Hodge prepared the original manuscript. The many pages of discussion and the extensive tables which accompany them attest to the long hours she labored over this paper. They don't reveal, though, the conscientiousness and cooperativeness with which she did her part, and for this we thank her doubly. Charlene Livingston deftly prepared the final version.

CHAPTER I: INTRODUCTION AND SUMMARY

To a large extent, housing market analysis consists of comparing different dwellings. For example, measuring inflation requires comparing the price of housing today to that of some base period; but in the interim the housing stock has changed, through new construction, rehabilitation, conversion and demolition, so that we necessarily compare two different groups of dwellings. Other examples abound: comparing the price of housing in different locations, measuring the effects of racial discrimination in housing, studying the effects of government subsidies and tax policies on how we are sheltered, all require that we compare different dwellings. Such comparisons are made daily, not only by researchers, but also by those interested in more effective government programs, and by bankers, developers, and landlords. In fact, each of us make such comparisons every time we move or consider moving.

Everyone interested in housing markets, then, faces a common problem: how to compare different dwellings. Housing is not a homogeneous good like wheat or oil, but can be thought of as a bundle of diverse characteristics such as a number of rooms, of certain types, in a particular location, of a certain age, and so on. These specific characteristics are more amenable to comparison, so one may compare dwellings by comparing characteristics. Most people agree that comparing the value of, say, two houses with the same number of rooms in nearby locations is easier than comparing two dwellings with unknown characteristics, even though the rooms themselves may differ in size, the proximate location may not reveal that one is next to a freeway, and so forth.

The method of hedonic equations is one way expenditures on housing can be decomposed into measurable prices and quantities so that a market analysis can proceed. A hedonic equation is a regression of expenditures (rents or values) on housing characteristics, and will be explained in detail in the next chapter. Briefly, the independent variables represent the individual characteristics of the dwelling, and the regression coefficients are estimates of the implicit prices of these characteristics. The results provide us with estimated prices for housing characteristics, and we can then compare two dwellings by using these prices as weights. For example, the estimated price for a variable measuring number of rooms indicates the change in value or rent associated with the addition or deletion of one room. It tells us in a dollar and cents way how much "more house" is provided by a dwelling with an extra room.

The method of hedonic equations has been applied many times, and often provides key insights into the workings of housing markets. The results can be used to predict rents and values for standard dwellings in different cities (Follain and Ozanne, 1980), or one can estimate price differentials for housing of constant quality by some variable of interest such as time (inflation), age of structure (depreciation), length of tenure, race or location (Follain and Malpezzi 1980b, 1980c, 1980d). Price and quantity indexes derived from the hedonic estimates can be used to study the supply and demand responses of housing markets (Ozanne and Thibodeau 1980). Past studes were often limited to one or a few markets, for example, St. Louis (Kain and Quigley, 1975) or New Haven (King and Miezkowski, 1973). These studies may give insights into

the workings of the particular market studied, but their general usefulness is limited. While markets work in similar ways, varying local conditions such as incomes and changes in population can produce different outcomes including the housing prices we and these earlier studies want to estimate.

The comparability of past studies is further weakened because different estimation procedures and different empirical specifications are usually employed. These differences make comparisons of the many hedonic studies quite difficult (Ball, 1973).

Past hedonic applications have been restricted by data availability to one time period and to one or a few markets. For example, multiple listing data were made available for 1967 in St. Louis (Kain and Quigley) and a mail survey was conducted in 1968 in New Haven (King and Miezkowski) Until recently, there simply has not existed a data set with enough coverage of both markets and dwelling characteristics to permit systematic estimation of a consistent, comparable equation in many markets. Now, however, such a data set exists--the Annual Housing Survey (AHS).[1] The metropolitan Annual Housing Survey presently covers fifty-nine large Standard Metropolitan Statistical Areas (SMSAs) and provides enough information on dwelling and neighborhood characteristics to make hedonic estimation feasible.

In 1978 we estimated an initial set of consistent hedonic equations for thirty-nine SMSAs covered in the first two years of the metropolitan AHS (Follain and Malpezzi, 1980a). The present work represents an extension of that earlier study: first, the indexes are estimated for the full

1. See U.S. Bureau of the Census (1976, 1977, 1978) for a description of the Annual Housing Survey. See, also, chapter 2.

59-area sample of the metropolitan AHS; second, an improved specification is employed. Both reports include renter equations (with rent as the dependent variable) and owner equations (with value as the dependent variable) in all SMSAs. Thus, this paper includes 118 hedonic equations.

The present hedonic equation estimates have been made as part of a larger project. The primary objective of that project is to construct price indexes which we can compare to Fair Market Rents (FMRs) used in the Department of Housing and Urban Development's Section 8 Housing Program. Briefly, FMRs are intended to represent the metropolitan area rent for dwellings that meet Section 8 quality and space requirements. The FMRs serve as rent ceilings and as the determinants of maximum subsidy levels. The FMRs are supposed to vary with market conditions, so they are set by market area and building type. The full hedonic equations reported here will be used to construct indexes of basic housing cost differences among the fifty-nine SMSAs. Both renter and owner cost indexes will be constructed. These indexes will be compared to FMR schedules to determine whether variation in FMRs reflects basic housing cost differences. The cost indexes will also be used in an analysis of the supply and demand factors causing the cost of housing to vary among SMSAs in an attempt to explain why FMRs should be expected to differ. Finally, specific hedonic coefficients estimated in the separate SMSAs will be examined to evaluate Section 8 mark-ups now used for additional bedrooms and elevator buildings as well as potential mark-ups such as for central city location. Comparable models are estimated in all SMSAs to make these analyses more manageable. If the project was instead focused on site-specific estimates of FMRs, then

comparability among sites could be sacrificed to obtain site-specific models with lower prediction errors.

Beyond the scope of the present project lie a host of other issues that can be addressed with the hedonic estimates presented in this report. Some of the most obvious are: do racial minorities pay more for housing? Are CPI measures of rent and house price inflation accurate? By how much do current depreciation write-offs exceed actual dwelling decay? Which central cities have higher housing prices than their suburbs and are these differences growing or declining? We draw preliminary implication about each of these questions in reviewing our hedonic estimates to show the directions in which further analysis might proceed.

Because of the multiple uses envisioned for the hedonic estimates, we review both overall equation fit and the estimated prices of individual characteristics in the present report. As part of the review we draw tentative implications concerning some of the issues raised above. Our findings about the quality of the estimates and their policy implications are summarized here.

Findings Relevant to the Quality of the Estimates

(1) The hedonic model succeeds in accounting for much of the observed variation in the log of rent and value. The median multiple correlation coefficient (R^2) is .61 for the 59 owner equations and .67 for the renter equations. Only the Honolulu owner regression performs poorly with an R^2 of .32. Other than this outlier, the R^2 for owners ranges from .49 for Providence to .74 for Memphis. For renters, R^2 ranges from .52 for Newark to .82 for Raleigh.

(2) The standard errors of the models are compared favorably with other hedonic studies on similar data. The standard errors of the owner regressions range from 20 percent

(Paterson) to 37 percent (Birmingham) of average value. Most (36) are less than 30 percent; and the average is about 29 percent. The dollar value of the average standard error evaluated at the average value, is roughly nine thousand dollars. The standard errors of the renter regressions are distributed similarly to the owner estimates, although the renter estimates are more tightly grouped below 30 percent. The range is from 19 percent (Las Vegas) to 35 percent (Honolulu). The average is about 25 percent. The dollar value of the average standard error is, roughly, $40 for a $160 predicted rent. Standard errors in Follain and Malpezzi (1980a) and Ozanne, Andrews and Malpezzi (1980) are slightly larger for comparable models.

(3) Most of the coefficient estimates are significant at any commonly used level of significance. For renters, 76 percent of the estimates have t-statistics greater than 1, 63 percent have t's greater than 1.64, and 48 percent have t's greater than 2.58. For owners the results are similar.

(4) The average estimates of the coefficients are almost always consistent with a priori considerations. For example, the average estimates of the coefficients of the number of baths, the number of rooms, and the number of bedrooms are positive. The average estimates of the coefficients of the house age, and the dummy variable measuring the presence of deteriorated housing are negative. Several variables have the unexpected sign more often than should be the result of chance. For example, for renters the coefficients of structure-type variables such as SFATT and SFDET (single-family attached and detached) have signs which indicate that these variables are probably picking up locational effects rather than structural effects.

(5) The distribution of the residuals conform to model expectations with one exception. The residuals (the difference between each observation's reported log rent or value and that predicted by the estimated equation) are primarily symmetric about zero with half the residuals typically clustered within a range of .263 for renters and .338 for owners. Since these ranges are centered on zero, this means that half the predicted values lie between a plus and minus 14 percent of rent and a plus or minus 17 percent of median value. The one exception to the expected pattern is the finding of several dwellings with extremely low reported rents and values in spite of

fairly common predicted rents and values. We hypothesize that the low reported rents and values do not represent full and current market amounts and if our hypotheses are correct, then the inclusion of these outliers will impart an unknown but probably small downward bias to predictions from the hedonic equations.

Findings Relevant to Policy Issues Include the Following

(1) The average estimated depreciation rate for the flow of rental services is a constant six-tenths of one percent per year. The estimated average depreciation rate for owner-occupied housing starts at nine-tenths of one percent in the first year and falls to three-tenths of a percent in the twentieth year. Estimated rates differ considerably among SMSAs but usually remain well below the 3 to 6 percent depreciation rates permitted on rental property for tax purposes.

(2) Black and Spanish households are estimated to pay less for comparable quality housing than whites. For blacks the average discount is estimated to be 8 percent in rents and 15 percent for house prices. For Spanish households the average discount is estimated at 4 percent in rents and 7 percent for house prices. The rates show considerable variation among SMSAs. However, the black differential is never significantly greater than zero and the Spanish differential is significantly positive in only two cases--both for renters.

(3) Estimated SMSA rent and house price inflation ranges from near zero to almost 15 percent in each of the survey years even though the average stayed between 5 and 8 percent. Therefore, variation among markets appears more important than changes over time or between owner and renters during the 1974-76 years.

(4) House values are estimated to be lower in the central city than the surrounding suburbs in three-fourths of the SMSAs, with the average discount being about 7 percent. Rents are on average about the same in central cities and suburbs, but this average masks large off-setting premiums and discounts in several SMSAs. The largest discounts for values and rents all occur in the older Northeastern cities. In spite of these existing differences most SMSAs are estimated to have similar rates of house price inflation in the central cities and the suburbs. The exceptions are

again concentrated in the older Northeastern cities. Suburban prices are rising relative to the central city in places like Pittsburgh, Rochester and Providence, but central city prices are gaining on the suburbs in Washington and New York.

(5) Rents that include heating costs are estimated to be rising about as rapidly as those where heating expenses are paid separately. This may indicate tenant conservation or landlord absorption of a part of the fuel cost increase.

In conclusion, the results of this work provide analysts with a valuable tool for the study of housing markets. The work is therefore technical, in a sense, but should also be of interest to policy makers because of the light it can shed on racial price differentials, inflation, and other issues. This paper is both documentation for those who use the results as inputs for other studies, and exposition for those who are interested in the implications of these estimates themselves for government policy.

The next chapter describes the method of hedonic equations, and the data, in some detail. The particular specification we employ is discussed, as well as how and why we chose it. The third chapter presents the estimated equations. First, we summarize the overall performance of each equation, and examine the distribution of the individual coefficients. An evaluation of the results includes whether they conform to expectations: whether they are stable, and of reasonable sign and magnitude; and whether they differ by SMSA. We briefly outline how some estimates shed light on current policy issues, but detailed work in this area is left for later papers.

Finally, in Chapter IV we present an analysis of the residuals in our estimated equations. The residuals are examined for additional

evidence on how well the data fit the model. Questions of symmetry, clustering, and outlying observations are considered for all equations. Suggestions from this investigation for specification and sample selection are then investigated for five cases.