Quality Measures

The last category of structural coefficients corresponds to the variables describing the quality of the dwelling. The NORAD variable indicates whether the dwelling has any rooms without heat. The POOR variable provides information on units where water is absent, sewers are absent, there is no bathroom, there is no heat, or whether the unit is shared. The NOPRIVCY variable indicates whether the occupant must pass through a bedroom to reach the bathroom, and NOUT indicates rooms without electrical outlets. BADHALL is a linear combination of several indicators of public hallway condition in rental units only, e.g., hallways with poor lighting. The DFECT variable provides information on a number of nuisances like whether the roof leaks. Finally, the variable COOKE in the owner equation indicates the presence of an electric stove. As expected the coefficients of the POOR, NOPRIVCY, and NOUT variables are rarely positive and statistically significant while these variables are negative and statistically significant 59, 37, and 30 times, respectively, in the renter equation and 45, 39, and 39 times in the owner equation. In addition, COOKE is positive and statistically significant 55 times. The coefficients of BADHALL and DFECT are negative and statistically significant a total of 15 times and positive and statistically significant a total of 7 times.

The reduction in rents and values associated with POOR is much larger than the reductions associated with the other indicators of inferior dwellings. The average estimated coefficients of POOR are -0.25 and -0.17 in the renter and owner equations. The quality coefficients next largest in absolute value are the estimated coefficients of NOUT, -0.07 and -0.10 in the renter and owner equation respectively.

The outlying estimated coefficients in the distribution for structural quality variables in the renter distributions are the estimated coefficients for POOR in Honolulu (-0.50), and NOPRIVCY in Rochester (0.06). The outlying estimated coefficients in the owner distribution are the estimated coefficients for POOR in Paterson (0.40), and NOPRIVCY in Anaheim (0.21).

Summary of the Structural Coefficient Estimates

This concludes our discussion of the various categories of estimated coefficients relating to structural variables. The categories of estimated coefficients in this group are the dwelling size coefficients, the dwelling type coefficients, the dwelling age coefficients, the dwelling equipment coefficients, and the dwelling quality coefficients.

The distributions of coefficients associated with the dwelling size variables were the most stable distributions in the set. The estimated coefficients for the number of bathrooms, number of rooms and bedrooms, garage and basement are almost always statistically significant and have the anticipated sign. The structural type variables are not good proxy variables for lot size or the amenities of low density living. The distributions for dwelling age estimated coefficients show a tendency for the signs of estimated coefficients to oscillate, but taken together, they are consistent with slow depreciation of rents and values. In the dwelling equipment category the airconditioning variables provided the most explanatory power. The coefficients of ROOMAC and CENTAC were nearly always positive and statistically significant. The POOR coefficients in the dwelling quality category were negative and statistically significant more than BADHALL, NOUT, NORAD and NOPRIVACY, the other variables whose coefficients were expected to be negative. In addition, the average discount associated with POOR was greater, in absolute value, than any other average discounts for quality variables.

The discussion of the estimates continues with the neighborhood variables. This is followed by a discussion of the contract condition variables, and the chapter ends with measures of price inflation.

SECTION 3.3: NEIGHBORHOOD COEFFICIENTS

The preceding section emphasized the importance of a dwelling's structural characteristics. However, it's also true that structures have to be somewhere, and housing services are provided by locale as well as structure. For example, location provides access to employment, education, shopping, and recreation. The surrounding locale, or neighborhood, provides such satisfaction as can be derived from its perceived cleanliness, quiet, safety, and feeling of community. Government services, and the prices paid for them, also vary by location.

All these should be related to a dwelling's rent or value. Unfortunately, these neighborhood or location effects are difficult to quantify in a manner suitable for hedonic index construction. In addition, some locational information from the Annual Housing Survey which would be useful is not available because of Census confidentiality requirements.

Still, the AHS data permits us to construct several variables measuring neighborhood or locational effects. The variables describing the neighborhood in which the unit is located are the race variables (BLACK, SPAN), the condition of the neighborhood (ABANDON, LITTER), the residents opinion of the neighborhood (EXCELN, GOODN, POORN), the lack of convenient shopping (NOSHOPS), the central city indicator variable (CC1), and several county location variables.

Neighborhood Conditions

ABANDON, EXCELN, GOODN, POORN, LITTER, and NOSHOPS are included under this rubric. The first four variables are included in both the renter and owner models. The latter two are included only in the renter model, because they were insignificant in preliminary owner regressions.

ABANDON is an indicator variable for the existence of abandoned housing in the neighborhood. The individual coefficients are negative and statistically significant more often in the owner equation (42 times) than in the renter equation (38 times). The estimated coefficients for ABANDON in the Albany renter (-0.20), San Diego renter (-0.20), and Honolulu owner (-0.44) distributions appear as outliers. Philadelphia shows a large discount in neighborhoods with abandoned housing in both the renter (13 percent) and owner (23 percent) models.

The EXCELN, GOODN, and POORN variables represent the respondent's answer to the question "In view of all the things we have talked about, how would you rate this neighborhood as a place to live--would you say it is excellent, good, fair, or poor?"[1] The respondents who described

1. AHS question 104a. (U.S. Bureau of the Census, 1979). The 1974 survey asks the respondent to rate the street rather than the neighborhood.

their neighborhood as fair are the omitted category included in the intercept. The estimated coefficients for these variables usually have the anticipated sign and, with the exception of POORN, are often statistically different from zero.

The variable NOSHOPS, included in the renter model only, is an indicator variable for the absence of convenient shopping. The estimated coefficient for NOSHOPS is negative and significant in 15 regressions, and positive and significant in 3. The indicator variable for LITTER is negative and significant in 12 SMSAs, and positive in one.

The Hedonic Model and Race

The hedonic regressions include two variables constructed from the race or ethnicity of the respondent. BLACK and SPAN are dummy variables for black and Spanish heads of household, respectively. The coefficients for these variables are interpreted as the prices faced by the families, relative to white and oriental families, after adjusting for differences in housing quality. We think of them as neighborhood variables, because we believe the continued existence of housing segregation makes the racial composition of the family highly correlated with the racial composition of the neighborhood. The Annual Housing Survey does not identify neighborhoods, so we cannot test this hypothesis directly, but its reasonableness stems from recent evidence that racial segregation in housing markets continues in the face of increased incomes for minority groups and other social changes.[1]

The persistence of segregated housing has engendered much interest in, and several studies of, racial differences in the price of housing.

1. See Ann Schnare (1978).

That segregation exists is not in doubt, but its effects on housing prices are. Studies by John Kain and John Quigley (1975), John Yinger (1975), and Thomas King and Peter Mieszkowski (1973) have lent support to the idea that blacks pay more for housing. However, much recent work has provided evidence that ghetto housing is actually cheaper. Examples of these studies include Martin Bailey (1966), Brian Berry and Robert Bednarz (1975), Sally Merrill (1977), Ozanne, Andrews and Malpezzi (1979), and Follain and Malpezzi (1980b). Surveys of these and other studies can be found in Follain and Malpezzi (1980d) and Peter Mieszkowski and Richard Syron (1980).

Space precludes a comprehensive discussion of the effects of race on housing prices, but the salient points are these:

1. Either premiums or discounts for blacks can be consistent with segregation.

2. Empirical work has not yet provided conclusive evidence on the existence of premiums or discounts for ghetto housing.

3. Evidence exists that relative prices in the ghetto change significantly over time.[1]

Earlier studies have been limited by data availability. With the exception of Follain and Malpezzi (1980d), previous studies have been limited to one or a few cities. Several key studies used data from a decade or more ago. If diverse housing markets yield different premiums and discounts, and prices change over time, generalization from these market specific studies will be difficult, especially if the data are not recent.

With this as background, we present the estimation results for our racial coefficients BLACK and SPAN.

1. See Ann Schnare (1978).

The hedonic approach provides a straightforward way to adjust for quality differences between non-white and white housing, permitting a well-controlled test for racial price differentials. Note that the question is a narrow one, do non-whites and whites face the same prices for housing of similar quality? Broadly, racial discrimination has other deleterious effects; for example, non-whites may be restricted to certain low-quality ghetto dwellings. But so long as whites who live in similar quality dwellings face similar prices for housing with the same attributes (even if few whites live in such low quality dwellings) no price differential will be evident.

The hedonic approach has many advantages in studying racial price differentials. Data on the household level eliminate well-known problems of bias in aggregate studies. The reasonableness of the overall results, as discussed in section 3.1, makes us confident that the hedonic equation does a good job of standardizing for housing quality.

Our model includes two variables which measure ghetto price differentials, BLACK and SPAN. These are indicator variables for black and Spanish head of household, respectively. Earlier studies have focused exclusively on black ghettos, but the growing Spanish population in the southwestern United States faces discrimination as well. Omitting SPAN in SMSAs with large Spanish populations will also bias the results for BLACK. If SPAN is included, it measures the price of Spanish housing, and BLACK the price of black housing, relative to non-Hispanic white housing. Without SPAN, the hedonic yields no information on Spanish ghettos, and understates the black ghetto differential because much Spanish ghetto housing will be included with non-Hispanic white housing.

For renters, the average coefficient of BLACK is -.080, and of SPAN, -.039. But this result, that on average black housing rents for 8 percent less than white, and Spanish 4 percent less, masks the variability of the results. BLACK is negative in 50 regressions, but positive in 9, ranging from -.184 in Atlanta to .082 in Salt Lake City. However, none of the positive BLACK coefficients are statistically significant, while 39 of the negative estimates are. SPAN is positive in 15 cities (2 significant) and negative in 44 (22 significant).

For owners, the average coefficient of BLACK is -.148, ranging from -.006 in Oklahoma City to -.386 in Milwaukee. The Milwaukee estimate is an outlier; no other discount is greater than 29 percent. Note that there are no estimated premiums for black owners, and the discount is significant in 51 SMSAs. The average coefficient of SPAN in the owner equations is -.070, ranging from -.411 in Pittsburgh to .214 in Providence. The estimates were negative and significant in 26 regressions, and never positive and significant. Many SMSAs have few Spanish homeowners, leading to occasional large coefficients with large standard errors. The Pittsburgh owner sample contained only six Spanish owners; the Providence sample, three.

These results are consistent with those previous studies which found that ghetto housing is cheaper, after controlling for housing quality differences. Most estimates imply that blacks and Spanish pay less for housing of comparable quality than non-Hispanic whites, although Spanish renters pay premiums in a few cities. The results support the hypothesis that whites pay a premium for housing in predominantly white neighborhoods.

Present AHS data do not permit distinguishing the race or ethnic background of a respondent from that of his or her neighbors. Such information could be provided by the Annual Housing Survey at a reasonable cost, and without violating confidentiality requirements, by averaging the responses to race questions by neighborhood without explicitly identifying the location. We could then estimate ghetto prices without the bias introduced by having blacks and Spanish who don't live in the ghetto included with those who do.

The range of the results suggests that racial price differentials vary from city to city. Studies which rely on data from one or a few cities may then give conflicting results, but the advantage of this diversity is that we may construct a model which explains the variation in ghetto price differentials. This work can proceed now that we are provided with an extensive set of comparable estimates.

Location

The Annual Housing Survey contains several kinds of locational information. Respondents may live inside or outside the central city of an SMSA; they may have their county identified; and if the SMSA contains more than one central city, or spans more than one state, these locations may be identified. However, because of confidentiality requirements, surveys of smaller SMSAs contain little or no locational information. Sixteen of the fifty-nine SMSA surveys contain no locational information; twenty-five only identified the respondent as living inside or outside the central city (CC1); and seventeen have some additional information on counties, states, or a second central city. The Allentown SMSA has a county variable but none for central city.

All locational variables are indicator variables which take the value one if the respondent resides in that location. They are constructed to be mutually exclusive, i.e., if an identified county contains the central city, the county variable identifies county residents not living in the central city. They are labelled with a mnemonic for the county or state name. All these variables are listed in the data appendix available from the authors. The New York survey contains the most locational information; we were able to construct seven central city and county variables.

For many purposes it would be useful to have some locational variable which could be compared across SMSAs. Exhibit 10 presents the coefficient for inside/outside central city for the forty-three cities for which we have locational information. The coefficient is adjusted so that it reflects the discount or premium for the central city vis-a-vis a population weighted average of prices in the rest of the SMSA. The adjustment is as follows:

$$P^* = P_o - \frac{\sum_{i=1}^{n} P_i X_i}{1 - X_o}$$

where P^* = adjusted coefficient,

P_i = coefficient for the i th location,

X_i = proportion of the sample in the i th location,

and $i=0$ = signifies the central city,

$i=1,\ldots, n$ signifies other locations.

The first thing to notice about these estimates is their variation. For renters, estimates range from -18.9 percent (Paterson) to 19.3 percent (Honolulu). Half the estimates are of each sign. The average differential is -0.5 percent for renters; that is, central city rental units are about the same price as comparable suburban units, on average, but the estimates vary widely from city to city.

For owners, the pattern is similar, although the owner differentials show a more persistent negative tendency. The average differential is -6.7 percent and three-fourths of the SMSAs have negative differentials. The variation of the owner differentials is greater than that for renters. Estimates range from -35.5 (Newark) to 11.2 percent (Honolulu) The standard deviation is also greater for owners (11.1 versus 8.7).

Since some SMSAs have several locational variables, and others only one, Exhibit 10 also presents the results of an F-test for the hypothesis that the joint effect of all of the locational variables (central city, county, and state) is zero. The number presented is the probability that an F-statistic as large as the sample value would be observed, given that the null hypothesis is true. A low value for this probability means that it is likely the locational variables do affect rents or values.

Not surprisingly, the F-test usually indicates that location affects rents and values. Miami, San Bernardino, and Oklahoma City are exceptions, with probabilities exceeding .1 for both tenure groups. Four other renter equations, and eight owner regressions, exhibit large probabilities. Of course, this does not mean that location has no effect on rents and values in these cities, but that the central city-suburb distinction is too gross to pick up locational effects.

SECTION 3.4: CONTRACT CONDITIONS

The estimated coefficients that price contract conditions are the length of tenure coefficients, the crowding coefficient, and the coefficient of variables that adjust contract rent for utilities and other services. Each group will be discussed in turn.

Length of Tenure

Both the owner and renter models contain variables constructed from the occupant's length of tenure, CLOT. CLOTSQ is CLOT squared, and DLOT is an indicator variable for the oldest class of tenants, those who moved in prior to 1950. The construction of these variables is very similar to the age of structure variables described in section 3.2.

While the construction of these variables is the same for owners and renters, their interpretation is very different. It is plausible that owners who have not moved recently fail to keep up with changing (and usually increasing) market values. It follows that such errors would be greater for long term owners than relatively recent movers. The owner length of tenure variables are intended to measure the average error in reported value arising from this source. The owner coefficients are not really discounts, but an adjustment to reported values.

Long time renters, on the other hand, have a precise idea of their rent, since it is almost always paid monthly. Long time renters receive discounts for at least three reasons. First, there may be lower supply costs for landlords renting to tenants who are a known quantity, and are often at least perceived as being more stable than many prospective new tenants. Second, it is easier for landlords to raise rents as new tenants move in. Such raises are often customary to recoup the costs associated with the search for a new tenant. Third, tenants have an incentive to remain longer than usual in dwellings which rent for less than market value.

The individual estimated coefficients for CLOT are mostly positive, for CLOTSQ are mostly negative, and are both positive and negative for DLOT in both the renter and owner models. The estimated coefficients for CLOT and CLOTSQ are statistically significant in nearly every case for the renter equations and in about half of the owner equations.

The individual length of tenure coefficients are not as easily interpretable as their combined effects. Exhibit 11 displays plots of the average discounts for length of tenure, for owners and renters, over the 59 SMSAs. The most obvious point is that renter discounts are much larger than the value adjustments. This is true for each individual SMSA as well as the average.

An F-test for the hypothesis that the joint effect of all length of tenure variables is zero is rejected in 58 renter regressions and 38 owner regressions (significance level = .1). On average, renters receive a 3 percent discount per year for the first six years, declining to less than 1 percent per year after the tenth year. The owners' value adjustment is much smaller. The annual adjustment is typically about one-half of a percent per year for the first few years, decreasing to a tenth of a percent or so after a decade. Note that although the value adjustment is small in magnitude, it is statistically significant in most SMSAs.

Crowding

The variable CROWDS is a continuous measure of the number of persons per room. It is included in the hedonic regressions because we hypothesize that crowded dwellings depreciate faster and require more maintenance. If this hypothesis is true, crowded dwellings will command higher rents, as landlords recoup their higher supply costs but lower values, since faster depreciating dwellings will be worth less.

The average renter coefficient for CROWDS is .027, ranging from -.050 in Raleigh to .088 in Newark. Sixteen estimates have the wrong sign (negative) but only two of these are statistically significant. Of the 43 estimates with the correct sign, 16 are significant. That is, most (but not all) results are consistent with the hypothesis that crowded dwellings command higher rents because of increased supply costs.

The average owner coefficient is -.047, ranging from -.117 in San Diego to .042 in Spokane. Only 7 cities exhibit the wrong sign (positive), and all are statistically insignificant. Fifty-two estimates are negative, and 37 of these are significant. The results are again consistent with our hypothesis: crowded dwellings depreciate faster and are therefore worth less.

Adjusting Rents for Utilities and Services

Contract rent includes payment for structure and location, but some renters receive additional services and utilities, while other renters pay separately. In order to properly compare contract rents, the hedonic model must include adjustments for utility payments and other services. We also estimate a rent differential for multi-unit dwellings where the landlord lives on-site. Five variables are in this category There are indicator variables for units that have heat included in rent (HEATINC), parking facilities included (PARKINC), furniture included (FURNINC), a non-heat utility included (NHUINC), and an indicator variable that identifies units in buildings where the landlord also resides (LLBLG).

In general, these estimates usually exhibit the proper signs and are statistically significant. Renters pay an average of 8 percent more for dwellings with heat included in contract rent. The range of the estimates for HEATINC is rather large--from a 27 percent premium in Springfield to a 34 percent discount in Honolulu. The large discount in Honolulu appears to be an outlier; the next largest discount is 15 percent in Sacramento. The coefficient of HEATINC is positive and significant in 44 SMSAs, and negative and significant in 4. The four cities with significant discounts, Miami, San Bernardino, San Francisco, and Sacramento, all have moderate climates.

Tenants whose rent includes utilities other than heat pay 4 percent premiums, on the average. Twenty-four estimates of the coefficient of NHUINC are positive and significant; four are negative and significant. Once again, the four negative and significant estimates are for warmer cities: Miami, San Diego, Birmingham and Honolulu.

The service variables PARKINC and FURNINC also conform to expectations. Renters pay an average premium of 9 percent for parking and 5 percent for furniture. PARKINC is positive and significant in half of the regressions, and never has the wrong sign when significant. FURNINC exhibits the correct sign in 35 of the 39 markets in which it is statistically significant.

Landlords who reside in their buildings have an incentive to exercise more care in the selection and retention of tenants. One way to retain desirable tenants, and attract a greater number of prospective tenants when vacancies occur, is to offer cheaper rents. LLBLG, the indicator variable for landlord living in the building, measures these discounts. The average estimate of this discount is 3 percent, ranging from a 12 percent discount to a 5 percent premium. The coefficient is negative and significant in a third of the regressions; it has the wrong and significant sign in one SMSA.

Summary

By and large, the coefficients for the contract condition variables are well behaved. That is, they are usually of the correct sign, reasonable magnitude, and are often significant. In addition, there seems to be a relationship between utility price estimates and climate.

SECTION 3.5: MEASURING HOUSING PRICE INFLATION

Recent acceleration in housing prices has focussed public attention on housing market inflation. Despite this attention, there are few alternatives to the Consumer Price Index (CPI), which is available for only 25 SMSAs.[1] SMSA specific measurement of housing price inflation is important because these markets are heavily influenced by local conditions, and broad regional aggregates may mask real differences among markets. Further, estimation of many SMSA rates is the first step in explaining inflation rates in terms of local market conditions.

1. The CPI was available for only 23 SMSAs during the 1974-77 AHS survey years used in this report.

Besides its limited availability, the CPI has other potential shortcomings. The method used to compute rent inflation for the CPI is to return to the same unit several times a year and inquire about current rent. Changes in quality are also inquired about so that rent changes are not attributed to inflation if the unit is substantially changed. Researchers have speculated that the index may understate price increases because gradual depreciation is not accounted for and rent increases accompanying substantial rehabilitation but in excess of the rehab costs are omitted. Also, the CPI rent index averages contract rents, some of which include utility costs, others of which do not. It is therefore impossible to identify separate utility and shelter cost increases, which is of increasing interest given the acceleration in utility costs since 1974.

The homeowner component of the CPI measures changes in the outlays necessary to purchase and operate a home. It is a function of movements in interest rates, utilities, and other cost elements faced by homeowners, as well as house values. Consequently, changes in this index do not necessarily match the movements in the value of constant-quality housing--a subcomponent of significant interest. Once the subcomponent is identified, there remain problems with its construction. CPI measurement of house price inflation relies on data from homes purchased with FHA insured mortgages. During the 1974-77 years covered in this report the FHA homes made up a much smaller and less representative sample than that available from the AHS.

Hedonic Estimates of Inflation

The hedonic method allows alternative measures of rent and house price inflation to be calculated. The inclusion of a time trend (variable Q) in the hedonic equations generates estimates of price change after correcting for changes in quality over time, including depreciation. The coefficient of Q in our models measures the average monthly percentage change in rents or values, after standardizing for quality. The average annual rate of inflation, compounded monthly, is:

$$([1 + \hat{\beta}_1]^{12} - 1) \times 100$$

where $\hat{\beta}_1$ is the estimated coefficient of Q. The coefficient of Q is positive and significant in 37 renter regressions and 48 owner regressions.

Two other variables, QHEAT and FORAY, permit the estimation of inflation differentials for rental units with heat included in rent, and owner units in the central city, respectively. QHEAT is an interaction term between Q and HEATINC (heat included in rent); FORAY is an interaction between Q and CC1 (central city dummy). Of course, FORAY is used only in the 42 SMSAs which have their central city identified.

With QHEAT included in the renter model, the coefficient of Q measures rent inflation for dwellings excluding most utilities. We identify this as the shelter component of rent inflation. The inflation rate for dwellings which include heat costs in rent is obtained from the sum of the coefficients of Q and QHEAT. On an annualized rate this gross rent inflation is

$$([1 + \hat{\beta}_1 + \hat{\beta}_2]^{12} - 1) \times 100$$

where $\hat{\beta}_1$, and $\hat{\beta}_2$ represent the estimated coefficients for Q and

QHEAT. The difference between the present and preceding expressions gives the differential inflation rate of the utilities component. The sign of the QHEAT coefficient tells the direction of the differential. If the differential is negative, then the utilities cost component is rising less rapidly than the shelter component; if the differential is positive then the utilities component is outpacing the shelter component.

The coefficients of QHEAT are about evenly divided between positive and negative values, and except for a negative outlier in Honolulu the monthly inflation rate differential for including utilities lies between a plus and a minus 0.2 percent. Five of the negative coefficients are significant (including Honolulu) and 8 of the positive ones are significant. These numbers suggest that inflation rates for the shelter and utilities components have been about the same. If our estimates are accurate they suggest that the large utility price increases of 1974-77 may have been offset in their effects on rents through conservation or through landlords absorbing a share of the increase. Additionally, the shelter component of rent may have been rising faster than suspected.

For owners, Q measures SMSA-wide inflation for cities whose central city is not identified. If the central city <u>is</u> identified and FORAY included in the model, then Q measures suburban inflation, and the sum of the coefficients of Q and FORAY yields our estimate of central city inflation. The SMSA-wide average is a weighted sum, calculated as

$$([1 + \hat{\beta}_1 + \hat{\beta}_3 c] - 1) \times 100$$

where $\hat{\beta}_1$ and $\hat{\beta}_3$ are the coefficients of Q and FORAY, respectively, and c is the proportion of the sample living in the central city.

The estimated coefficients for FORAY are split with about 40 percent being negative and 60 percent positive. Only 3 negative coefficients are significant and only 5 positive ones are significant. Thus, while there is a significant differential in central city inflation in a few markets, most SMSAs show no significant difference between central city and suburban house price changes.

Exhibit 12 contains the hedonic estimates of annual shelter rent and house price inflation for each SMSA. The house price represents an average of central city and suburban rates where they were separately estimated. The exhibit also reports the differential from inclusion of utilities for renters and between central city and suburb for owners. All figures are calculated as described above.

Average inflation rates and average differentials for utilities and central city location are summarized in Exhibit 12. Each wave is presented separately to observe changes in these rates over time. In addition to average rates, the maximum and minimum values are included. The price of rental structure increases by an average of about 5 percent per annum for the first wave, and 7 percent for the second and third. Owner occupied house values go up by an average of 8, 6, and 8 percent in each respective wave.

Several patterns are evident in Exhibit 12. First, the variation in inflation rates among SMSAs within each year is much greater than the average change from year to year. For both renters and owners, the standard deviations of the estimates (by year) are large enough that we cannot reject the hypothesis that the average rates of inflation are the same for all three years. Second, note the wide variance in the estimated differentials for utilities and location. The largest and smallest utility differentials are all in warm SMSAs. The largest positive central city inflation differentials (by wave) are in Washington, New Orleans, and New York; the largest negative differentials are in Pittsburgh, Rochester and Providence. This is suggestive of strong central city demand fueling inflation in the first three, and weak demand tempering inflation in the latter three. Future work with these estimates can provide more systematic explanations.

In summary, our inflation estimates indicate that, although housing price inflation in pervasive, using a single national estimate to measure inflation is misleading. Future work can use these estimates to explain variation in inflation rates.