What Do We Know About the Value of Owner Occupied Housing Services? Rental Equivalence and Other Approaches

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Owner-occupied housing represents about two-thirds of the housing units in the U.S. In other countries such ownership is even more prevalent. This fact alone implies that the treatment of housing is important in assessments of economic well-being. In these assessments many agree that a household or family occupying a mortgage-free home has a higher level of living than another who rents. However, this difference is often not well captured in measures of consumption expenditures; thus, distributions of economic well-being based on consumption expenditures and interpretations of who is poor based on such a measure can be distorted. One way to account for owner occupied housing in economic well-being measurement is to value the flow of services of owner-occupied housing.

Federal statistical agencies[1] have been involved in the production of values for the flow of services from owner-occupied housing for some time. Since the mid-1980's, the Bureau of Labor Statistics for the Consumer Price Index has been using rental equivalence, as reported by consumers participating in the Consumer Expenditure Survey who own their housing, to represent this value. For at least 20 years, the Bureau of Economic Analysis, for the production of the National Income and Product Accounts (specifically Personal Consumption Expenditures and National Income), has been creating an aggregate estimate of the value for all owner-occupied housing in the U.S. using rental property rents and property values from the Residential Finance Survey and owner-occupant property values from the American Housing Survey. For many years, the CE has been used for economic well-being measurement with consumption the underlying construct. For these measures, reported rental equivalence is used to value the

flow of owner-occupied housing services.   Recently there has been an increasing interest in including a value for the flow of services from owner-occupied housing in measures of income for economic well-being measurement but with the Current Population Survey as the basic survey for income data (e.g., National Academy of Sciences Workshop on Poverty Measurement, June 2004). However, the Current Population Survey only includes whether a housing unit is rented or owned. Thus data from another source would be needed to imputed "rents" for owners. Two likely sources of data for such imputations are the CE and AHS.

The primary purpose of this research is to compare reported rental equivalence from the CE with imputed "rents" for owners which are derived from the estimation of hedonic regression models using data from the CE and the AHS. Two hedonic models are used to impute rents for both the CE and AHS. For both models the same housing units characteristics are considered. For the first model, owners' property values and renters' rents are used to estimate implicit capitalization rates (the rent to value ratios) for each survey sample and for selected geographic areas. For the second model, renters' rents are regressed on housing unit characteristics. The estimated coefficients from this equation are applied to the owners within each survey to produce a renter-based imputed rent for owners. In addition, for the AHS, the coefficients from a regression of CE reported rental equivalence on housing unit characteristics are applied to AHS owners produce an expected reported rental equivalence in this survey. Data from 2003 are analyzed with imputed rents produced for twelve geographic areas (three Metropolitan Statistical Areas designations and the four Census regions). This study is exploratory and

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[1] Yates (1994) used unit record survey data for Australia to implement 1997 United Nations recommendations that imputed rent from owner-occupied housing be included in household income

represents the first work in the literature (that we could find) on rental equivalence and imputed rents comparing the CE and AHS.

As shown by other researchers who have produced geographic-specific capitalization rates (e.g., Phillips 1988), residential capitalization rates are not constant across place and thus the implicit rents for owners are location specific. Imputed rents based on the relationship between rents and housing unit characteristics result in values that are lower than those from the capitalization rate model and from reported rental equivalence. In part this difference is expected if, as many have suggested, the quality of owner-occupied housing is higher than that of renter housing. However, further research is needed to understand the differences resulting from the three approaches to value the flow of services from owner-occupied housing. Capitalization rates estimated from the AHS are higher for all geographic areas except for two in the Northeast (MSA Central City and not in a MSA). This result was not surprising. Although average rents and property values are higher in the AHS than in the CE, the differences are only slight for property values. Imputed rents based on renters' rents are also higher in the AHS. For most geographic areas, predicted rental equivalence from the CE, based on the regression of rental equivalence on housing unit characteristics, are higher than predicted rental equivalence values when the CE coefficients are applied to the AHS. This result suggests that owners are more different in the AHS and CE than would be expected from an examination of the means of the weighted survey sample of owners. More research is needed to try to explain this result.

The paper proceeds as follows. First the approaches used in this study to value the flow of services from owner-occupied housing are presented. These are the capitalization

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statistics collected for income distribution purposes. .

rate hedonic and renter hedonic approaches, and rental equivalence. A description of the data and more details regarding the methods is next, followed by the results and conclusion.

Valuing the Flow of Services from Owner Occupied Housing

Three approaches to value the flow of services from owner-occupied housing are used in this study. The first is to obtain estimates of residential housing capitalization rates (rent to value ratios) and then apply these to the reported market value of owned homes. The second is to use the coefficients from a hedonic regression of rents on housing or dwelling unit characteristics and apply these to owners. The third is to use rental equivalence reported in the CE and apply this, through the use of hedonic regression, to owners in the AHS.

Approach 1. Obtain estimate of residential housing capitalization rates (rent to value ratios) and apply these to reported values of owned homes.

The use of capitalization rates to derive flows of the value of owner-occupied housing is not new and is related to the user cost of capital approach to transform the asset value of housing into the flows of annual cost to the owner of the housing. Basically the user costs of capital or asset price of housing is based on the present discounted value of expected future net rental income. Green and Malpezzi (2003) define user cost as the cost to use a unit of housing capital each period. For a renter, the user cost is the rent he or she pays. For owners the estimation of the user cost is more complicated. Basically the user cost expression can be interpreted in terms of the

capitalization rate; that is the rate at which rents, R, are discounted into asset prices, V.

In the simplest form, the capitalization rate can be presented as C below:

$$C = \frac{R}{V},$$ (1)

where

C = capitalization rate

R = rent

V = property value.

Phillips (1988) and Crone et al. (2004) used basically the same approach to estimate implicit annual capitalization rates. The technique used by Crone et al. was developed in Linneman (1980), Linneman and Voith (1991), and Crone, Nakamura nad Voith (2000).

The capitalization rates in the Phillips (1988) and Crone et al. (2004) research were obtained by using a pooled-tenure hedonic model of the form

$$\ln Hprice = BX + \gamma Tenure + \varepsilon,$$ (2)

where

ln *Hprice* =log of the market value for owner-occupied units

and the log of rent[2] of rental units

X is a vector of dwelling attributes (e.g., structure type)

Tenure = 1 if the unit is owner-occupied

=0 if the unit is renter-occupied.

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[2] Phillips used the annual rent of renters while Crone et al. made the adjustment to annual in the calculation of the capitalization rate.

The focus on this analysis is the coefficient on *Tenure*, γ. This coefficient is the average percentage difference in *Hprice* between owner- and renter-occupied units, controlling for differences in specified dwelling characteristics. Capitalization rates are calculated as one over the antilog of the *Tenure* coefficient γ for each equation estimated (for example, for each year).[3] (The characteristics of the dwelling are the same ones that are used for Approaches Two and Three. However, these characteristics are not the focus of the capitalization rate hedonic approach and thus we chose to presented the characteristics in the next section of the paper where we describe Approach Two, the hedonic rent model.)

Two caveats of this method were highlighted by Phillips. First, this method of imputing average residential capitalization rates restricts implicit prices for various dwelling characteristics to be the same for owners and renters within each area or time period for which the equation is estimated except for the intercept. Thus, the capitalization rate is restricted to be constant for all structure types and locations within a geographic are, with the *Tenure* coefficient interpreted as a measure of average capitalization rate over all housing types. Second, "unspecified differences in average quality between owner-occupied and rental units are captured by the *Tenure* term, thereby biasing the capitalization rate estimates. Such omitted variable bias may account for some variation in measured capitalization rates between metropolitan areas but should

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[3] From Phillips (1988, p. 282): Note that if a unit is owner-occupied, then $\ln Value = \sum BX + \gamma + \varepsilon$ and if a renter-occupied $Ln \operatorname{Re} nt = \sum BX + \varepsilon$. Subtracting the two equations yields the following:

not obscure trends over time within individual cities given the durability of the housing stock" (p. 283).

Phillips (1988) imputed average housing capitalization rates for 12 metropolitan areas for the years 1974-1979 using the AHS. Capitalization rates ranged from 5.94 percent in 1974 to 8.19 percent in 1979 for Atlanta, for example, and 6.52 to 4.83 for Washington, DC during the same time period. Crone et al. (2004) produced capitalization rates for the U.S. as a whole using 1985, 1993, and 1999 AHS data. These researchers reported estimated capitalization rates of 8.1 percent to 9.0 percent for the AHS sample years.

For the purposes of this study, we point out that Phillips presented evidence of considerable inter-metropolitan variation in the rate at which rents are capitalized into residential asset values using housing data on contract rent and homeowners' estimates of the market value of their homes. In the second part of Phillips' study, she examined the variation in housing capitalization rates across time and place by regressing the estimated capitalization rates from the first part of her study on heat and utility costs, property tax rates, real after-tax mortgage rates, inflation rates, rental vacancies, and recent trends in housing resale values and residential rents for areas. Phillips found that capitalization rates, during the 1974-1979 period for the geographic areas under study, "demonstrates that house values and market rents were not in a fixed relationship with one another. Rather their relationship reflects a complex interaction between inflation, the cost of

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$\ln \mathrm{Re}\,nt - \ln Value = -\gamma$, which can be written as $Ln\left(\dfrac{\mathrm{Re}\,nt}{Value}\right) = -\gamma$. Taking the antilog yields the capitalization rate specified as $\left(\dfrac{\mathrm{Re}\,nt}{Value}\right) = e^{-\gamma}$.

capital, the tax treatment of residential property, future expectations, and local rent

control, among other factors" (p. 288).

Crown et al. reported that implied capitalization rates may reflect changes in the

user cost of capital and hence affect the inflation rates of owner-occupied.

housing services. Higher capitalization rates imply higher nominal valuations of owner-

occupied housing services and determine the size of the service flow of owner-occupied

housing relative to that of renter-occupied housing and other goods.

**Approach 2. Estimate coefficients from an hedonic models of rents and apply
these to owners with the same housing unit characteristics.**

The second option uses these same characteristics as used for the first option also

in a hedonic regression framework.[4] However in this case the contract rents paid by

renters are regressed on the characteristics of their rental dwellings. The estimated

coefficients are then applied to the characteristics of owned dwellings to produce a

predicted value of imputed rents of like owner-occupied dwellings. The regression

coefficients are estimates relating the implicit marginal prices of the dwelling

characteristics. Applying this approach results in an estimate of owners' rental

equivalence in an average community using the characteristics and rent paid by renters

with like housing and location. For this model, imputed owner rents are based on a semi-

log regression of renters' rents on selected housing characteristics. Malpezzi et al. (1998)

and others (see Gillingham 1975; Moulton 1995; Ozanne and Malpezzi 1985; Thibodeau

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[4] Another statistical approach that could be used is to impute rents to owners by matching the
characteristics of owned dwellings with those of rented dwellings and applying the rents from renters to
owners. Thus imputed rents are estimated through stratification of the data (favored by EUROSTAT).

1995) have found that a semi-log regression fits the hedonic price-characteristics relationship for housing fairly well.

Malpezzi (2000) notes that hedonic approaches to estimating rent for owner occupants have good theoretical and intuitive foundations. These are discussed in detail in Malpezzi, Ozanne, and Thibodeau (1980) but he notes that these approaches involve substantial data requirements and analytical work. Diewert (2003) has noted several problems with the hedonic approach. First he notes that that characteristics of the owner occupied housing market could be quite different from the characteristics of the rental housing market. In particular, he warns, that if the rental market for housing is subject to rent controls, this approach is not recommended. He also notes that hedonic regression models suffer from a lack of reproducibility in that different researchers will have different characteristics in the model and will use different functional forms. We address this concern by using the same housing unit characteristics and same functional form for both the CE and AHS models.

The housing unit characteristics selected for the model are drawn primarily from those presented in the literature (see e.g., Follain and Malpezzi 1981; Garner and Rozaklis 1999, 2001; Malpezzi et al. 1998; Ozanne and Malpezzi 1985; Moulton 1995; and Thibodeau 1995). General hedonic regression specifications include variables representing: structural characteristics of the dwelling, location characteristics, and contract characteristics. In this study, structural characteristics include the following: number of rooms not including baths, the number of full baths, the number of half baths, the dwelling age, whether the unit is a single family detached unit or a mobile home, or other type of dwelling, if the unit has off-street parking, central air-conditioning, and

window air-conditioning. Variation by geography is represented by the median owned home property value within the primary sampling unit (PSU) in which the housing unit is located. Contract characteristics include whether the rent covers energy utilities and whether the rent covers water and or trash removal. Often rental contracts are written such that a limited number of people can occupy the housing unit. We represent this with a variable we call "crowd." Crowd is defined as the number of people who live in the housing unit divided by the number of rooms.

In most other hedonic models of housing, particularly those estimated using the AHS, housing quality and neighborhood characteristics are included. However these data are not available in the CE. Since the same models are used for both the CE and AHS, no quality variables are included.

Approach 3. Use reported rental equivalence

- **Estimate coefficients from an hedonic models of rental equivalence from the CE and apply these to owners with the same housing unit characteristics from the AHS.**

- **For the CE, use the predicted rental equivalence rather than reported rental equivalence for comparison to the AHS.**

The rental equivalence approach values the services yielded by the use of the owned housing for a period by the corresponding implicit market rental value for the same housing for the same period of time. If owned housing and rental housing are the same in terms of characteristics and quality, this approach should yield estimates of imputed rent that are similar to those from the renter hedonic model since both approaches are used to produce imputed values at the individual housing unit level.

Reported rental equivalence could be based on the owner providing an estimate of how much he or she thinks the rent would be for the housing services provided by the owned unit. Another approach is that an interviewer, a housing expert or community leader assigns a value. An advantage of this approach is its simplicity. An owner occupant, for example, would be asked a question something like the following:

> *What would you say your dwelling would rent for without furnishings and*
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> *without utilities for a month?*

An interviewer could also be asked the same question about particular housing units. An examination of reported owner and CPI interviewer rental equivalences showed similar values by region, on average, in the U.S. (see Johnson, Shipp, and Garner 1997).

Owners can estimate rental equivalences even when there is no comparable rental dwelling in the area if they know of rents in other areas (for example if there is no rental housing in rural areas but there are rental units in nearby urban areas). The estimate might not be of lower quality compared to a statistics when a rental market exists exactly where the owners live, but owners, with the help of interviewers, can be walked through the steps needed to help them determine what they would be willing to pay to rent the own dwelling or alternatively what they might charge someone else to live there. Reporting what they would pay to live in their own dwelling could be a very good estimate of the true rent.

The CE is the only Federal survey that is used for statistical purposes in which a rental equivalence question is asked.[5] Responses to this question are used in the creation

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[5] Since the year 2000, the recommended World Bank Living Standards Measurement Study questionnaire includes questions for respondents to report rental equivalence values for owned housing. Several

of the owners shelter component of the CPI. Two other Federally funded studies that we know of in which a rental equivalence question has been asked is the General Population Rental Equivalecne Survey contracted to WESTAT by the Office of Personel Management (Heston et al. 2005) and the Federal Employees Survey of 1998 (Joel Popkin and Company 1998). The studies were slightly different. The one that is most relevant to this study is the one by Heston and colleagues who examine the relationship between rents and rental equivalence, with a particular focus on Federal employees, using a hedonic approach and controlling for housing unit characteristics. They found that the base (before taking into account the value of baths, size, etc.) rental equivalence was slightly higher than that of rents. They conducted their analysese at the city level.

In this study, we regress reported rental equivalence from the CE and produce predicted owner rents for the CE. We compare these predicted owner rents with predicted owner rents from the AHS. The predicted rental equivalence based owner rents are derived by applying the CE rental equivalence model coefficients to the owner housing unit characteristics.

Data and Methods

Data

Two data sets are used for this study: the CE and the AHS. Both surveys use addresses to collect data using personal interviews or by telephone. However, through the use of population weights the CE is made to represent the number of consumer units in the U.S. including urban and rural areas. Data have been collected on a continuing

countries have used the recommended questions and produced estimates of consumption that account for owner-occupied housing.

basis (data are collected each month in each calendar year) using the current design since the last quarter of 1979. In contrast, the AHS is weighted to represent the number of housing units in the U.S. with data collected once every two years. These are two differences between the two surveys.

Samples for the CE are national probability samples of households designed to be representative of the total U.S. civilian population. The population eligible for the sample includes all civilian non-institutional persons. The first step in sampling is the selection of primary sampling units (PSUs) that consist of counties or parts thereof or groups of counties. The set of sample PSUs used for the 2003 samples is composed of 105 areas. The sampling frame (that is, the list from which housing units were chosen) for the 2003 survey was generated using the following:

- the 1990 Population Census Bureau 100-percent-detail file

- the detail file was augmented with new construction permits and techniques used to eliminate recognized deficiencies in census coverage.

The CE Interview is a panel rotation survey. Each panel is interview for five consecutive quarters and then dropped form the survey. As one panel leaves the survey, a new panel is introduced.

In the second calendar quarter of 2003, the BLS introduced the use of computer assisted personal interviewing (CAPI). The use of CAPI has affected responses to the rental equivalence question in the CE. With the introduction of CAPI, the response rates to the rental equivalence question from previous quarters increased by about 20 percentage points (to over 80 percent). For consumer units who did not report rental equivalence and should have, imputed values are assigned by the BLS using a hot deck

procedure based on primary sampling unit, building type, number of rooms in the living quarters, size of rooms, number of complete baths, number of half baths, year built, and whether the unit has central air conditioning or a window unit (Keil 2004). Given the change in rental equivalence data collection and the improvement in reporting, we decided to limit our analysis to CE data collected in the first twelve months of CAPI data collection: 2003 calendar quarter two through 2004 calendar quarter one (2003Q2-2004Q1). The closest time period AHS data were collected in 2003.

CE data are from the Interview component alone. The Interview is designed to collect data from a consumer unit at five different time periods. Approximately 7,500 consumer units are interview each quarter of the calendar year. The first interview is a bounding interview with housing unit characteristics and property values collected. These are not asked again. The second interview takes place about one month later. This is the first time consumer units are asked to report rental equivalence values and rents. The consumer unit is asked the rental equivalence or and monthly rent question in three following quarterly interviews, spaced three months apart. Homeowners are asked to report rental equivalences as of the day of the interview. Renters are asked to report the rents paid in each of the last three months. The property value, rental equivalence, and monthly rent questions all refer to different time periods, thus differences in imputed rents based on monthly rents and property values can differ from reported rental equivalence in volatile markets. However, since we are using data over a 12 month period, we hope that the impact of the timing is not great.

Another restriction to the data is that the last interview in which the consumer unit participated is considered. This was to maximize the number of consumer units who

would have gained experience in answering the rental equivalence question. Examining the data from the 2003Q2-2004Q1 time period reveals that consumer were fairly equally distributed as to whether they were participating in their second, third, fourth, or fifth interview.

To be included in the CE sample, renters are identified as consumer units living in a sampled unit with positive rent payments in the previous three months, do not receive as pay, do not live in government subsidized or public housing, and do not live in student housing. The CE does not currently ask whether the rental unit is rent-controlled so we were not able to eliminate these units from our analysis. Owner-occupants are identified as owners living in a sampled unit and have a positive value for reported rental equivalence and property value.

The American Housing Survey (AHS) is a household survey that asks questions about the quality of housing in the United States. In gathering information, the Census Bureau interviewers visit or telephone the household occupying each housing unit in the sample. For unoccupied units, they obtain information from landlords, rental agents, or neighbors. The AHS is actually two surveys. The AHS conducts a national survey and a metropolitan area survey. Both surveys are conducted during a 3- to 7- month period. This study only uses the national survey.

The national survey, which gathers information on housing throughout the country, interviews about 55,000 housing units every 2 years, in odd-numbered years. A sample of housing units in all survey areas was selected from the decennial census. These are updated by a sample of addresses obtained from building permits (for new construction) to include housing units added since the sample was selected. The survey

goes back to the same housing units on a regular basis, recording changes in characteristics, adding and deleting units when applicable.

The Census Bureau has interviewed the current sample of housing units since 1985. The AHS sample consists of the following types of units in the sampled PSUs:

- Housing units selected from the 1980 census

- New construction in areas requiring building permits

- Housing units missed in the 1980 census

- Other housing units added since the 1980 census.

To be included in the AHS sample, renters are identified as households living in a sampled unit with positive rent payments, do not receive as pay, do not live in government subsidized or public housing, and do not live in student housing. The AHS collects data on rent-controlled units but since the CE does not, rent-controlled units were included in the analysis sample for the comparison of imputed rents. Owner-occupants are identified as owners living in a sampled unit and have a positive value for property value.

Methods

Imputed rents for owners were estimated using the three approaches outlines in section two. For each survey sample, capitalization rates using a pooled hedonic model were produced. Equation (2) was estimated for twelve geographic areas noted by the four Census regions (Northeast, Midwest, South, and West) and MSA status (MSA central city, MSA not central city, not in a MSA). The tenure coefficient was used to produce the capitalization rate based on annual rents and market values. The annual

capitalization rate, C, in percentage terms is equal to $(12 \times 100 \times \exp(-\gamma))$. The capitalization rate for each geographic area was applied to each property within that area to impute rents for owner housing.

The imputed rents for owners based on the renter hedonic regression is the same as that for the capitalization model with the exception that only the rents paid by renters are analyzed and the *Tenure* variable does not appear. Due to sample size limitations in the CE, the renter regression was run at the region level only. However, results are produced in the tables at the region-MSAstat level for comparison to the capitalization rate based imputed rents. The models were run independently for the CE and AHS. Due to the functional form of the model (semi-logarithmic) and Jensen's inequality, we used both the estimated coefficients and the estimated model variance to produce the estimated owner rents for owners.

Unlike for the two other approaches, rental equivalence is regressed on housing unit characteristics using a linear form. The linear functional form proved to be a better fit for the rental equivalence data. This is also the functional form that will be used by the BLS beginning in 2007 to impute rental equivalence when it is missing. Two additional variables are included in the rental equivalence model: property value and property value squared. The variables referring to whether utilities are included in the contract rent are not in the rental equivalence equation. Reported rental equivalence was regressed on characteristics. The predicted values from the CE are compared to the predicted values from the AHS that are drawn from the CE regression but AHS sample characteristics.

For each regression approach, regression outlier detection was used. Thus the sample sizes for the rent and owner samples combined may not equal the sample sizes of the two rent regression sample and owner regression sample within each survey.

Results *(more to come at the conference)*

Tables 1-6 show some descriptive statistics from the two surveys and summary regression statistics for the housing characteristic variables we will use in our analyses. There are some interesting differences between the two surveys.

Table 7 shows the owner coefficients from the capitalization hedonic regression and the implicit capitalization rates.

Table 8 includes median monthly implicit rents for owners using the three approaches.

Conclusions

There is much work still to be done to understand the differences in imputed rents that are obtained within and between surveys.

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