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Micro and Macro Estimates of Owner-Occupied Dwelling Services in the U.S.: Can They Be Reconciled?

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I. Introduction

Within countries and cross-nationally there has been an increasing demand for better coherence between and within macro and micro statistics. Differences between macro and micro statistics can be reduced with increased harmonization of the methods used to produce these statistics. Research exists to reconcile general differences in micro household expenditures and macro national accounts estimates (e.g., Garner et al. 2006). Of particular interest in national and cross-national economic statistics is the value of owner-occupied housing services and the implicit net rental income from these services. However, little if any research exists to reconcile specific differences in the macro and micro estimates of these services and net implicit net rental income from such housing. The purpose of this paper is to fill that gap by examining and linking U.S. macro and micro estimates of owner-occupied dwelling services and implicit net rental income from owner-occupied dwelling services. Micro estimates are derived from two national household surveys and then compared to estimates from the U.S. National Income and Products Accounts (NIPA). The household surveys are the American Housing Survey from the U.S. Census Bureau and the Consumer Expenditure Survey is from the U.S. Bureau of Labor Statistics. The micro estimates are compared to NIPA data from the U.S. Bureau of Economic Analysis. It is not the aim of this paper to provide details regarding the methods used by the BEA to produce the NIPA aggregates for owner-occupied housing, but to review these briefly as background for the comparison of NIPA aggregate rents, expenses, and implicit net renal incomes to aggregates that are entirely micro-based.

In the next section of the paper, an overview of recent research and other activities related to valuing owner-occupied dwelling services internationally and nationally is presented. This is followed by a brief description of the treatment of owner dwelling services in the U.S. National Income and Product Accounts (NIPA). Next the AHS and CE, the sources of the micro data for this study, are described along with the methods used to produce the imputed rent for owner-occupants, expenses, and implicit net rental income. Aggregates rents, expenses and net implicit rental incomes resulting from aggregations of the micro data are next compared to the U.S. NIPA aggregates. A goal of this study is to take net implicit rental incomes as estimated in this study and distribute them, both positive and negative values, in an appropriate way, across U.S. households. This allows the possibility of estimating the well-being effects of the various approaches to value owner-occupied dwelling services using micro data. The final section concludes the paper and offers suggestions for future research.

II. Background

Dwelling services are produced from the stock of housing for consumption. Markets rents are a good approximation of the value of dwelling services for most rental housing. However, some households do not pay a market price for the accommodation that is consumed. These include households living in subsidized rental or rent-controlled units, and households living in owner-occupied dwellings. In the past few years, there has been increased research on valuing these services with a particular focus on owner-occupied housing.

The treatment of owner-occupied housing in macro statistics, the national accounts and price indexes, has been a topic for discussion for many years. In Europe, research has been in response to European Communities Commission Directives (89/130/EEC and 95/309/EC) specifying the principles for estimating dwelling services for the purpose of harmonized national

product accounts. During the past two IARIW conferences, paper on the treatment of dwelling services, with particular focus on owner-occupants, have been presented. In 2004, Sorensen summarized the System of National Accounts (SNA) 1993 and the Eurostat (2002) position on accounting for dwelling services in the national accounts with particular attention given to a Norwegian alternative and Norway's experience. Also at the 2004 conference, Verbrugge (forthcoming) focused his attention on user costs and rents in price indexes in the U.S. Two years later, Reich (2006) presented a discussion of the reasons why owner-occupied housing is included in the national accounts and highlights the importance of consistency in the accounts; Reich focused particularly on the SNA 1993. Approaches used to account for owner-occupied housing in price indexes have been the focus of other meetings as well including an ILO meeting (November 2003), CRIW Conference on Price Index Concepts and Measurement (July 2004), Ottawa Group meeting (May 2006), and OECD-IMF Workshop (November 2006). Additional macro work has been in response to Eurostat's Harmonized Index of Consumer Prices (HICP) project. Other recent meetings with sessions focused on macro and micro estimates of dwelling services include the 2006 and 2008 World Congress on National Accounts and Economic Performance Measures for Nations (for examples of papers prepared for these congresses, see Garner and Verbrugge 2008 forthcoming, Heston and Nakamura 2008 forthcoming, and Katz 2008 forthcoming).

For micro level economic statistics, in 2003 the ILO issued the *Report II: Household Income and Expenditures Statistics*. This report provided the first international guidelines on household expenditures and income statistics including guidelines for dwelling services. The ILO Report emphasized consistency with the System of National Accounts. The approaches outlined in the ILO Report include: rental equivalence, current market value approaches,

repayment methods and user costs. The report noted that rental equivalence can be based on imputations derived from rents for rental units or from responses provided by the interviewees and or interviewers. This section of the report provided guidance regarding how to obtain a consumption value for dwelling services and how to derive the implicit rental income from these services.

Based on our review of the literature, the most coordinated work at the micro level on imputed rents has been conducted in Europe under the auspices of AIM-AP (Accurate Income Measurement for the Assessment of Public Policies) in which the Household Budget Survey (HBS) and EU- Survey of Income and Living Conditions (SILC) data are used. In May 2006, Eurostat convened a meeting of the Working Group on Living Conditions to discuss imputed rent for the HBS and EU- SILC (Eurostat 2006). Since 2006, when the European Commission began funding the program, numerous papers for various countries have been generated in which methods to impute rent for non-market dwellings are presented along with results. The primary focus of the studies has been to examine the distributional impact of imputed rent for dwelling services for which households do not pay full rent. Studies have been produced for the following countries: Belgium (Verbist and Lefebure 2007), Germany (Frick et al. 2007), Greece (Koutsambelas and Tsakloglou 2007), and Ireland (Callan 2007), Italy (D'Ambrosio and Gigliarano (2007), The Netherlands (De Vos 2007), and the United Kingdom (Mullan et al. 2007)

In most of the research to date, little attention has been given to reconciling micro and macro estimates of owner-occupied housing. In the U.S. developing such linkages is in its infancy. Presented in this paper are discussions of the treatment of housing in the macro statistics of the U.S National Income and Product Accounts (NIPA) and in the micro statistics of the

American Housing Survey (AHS) and U.S. Consumer Expenditure Survey (CE). The paper reviews the methodologies used to measure and value housing services, expenses, and income. Three approaches to value dwelling services are compared at the micro level: the capitalization rate approach of Yates (1994), hedonic approach with sample selection, and reported rental equivalence. Reported rental equivalence is only available from the CE. Implicit net rental income from owner-occupied housing is produced for each approach and each survey population. Comparisons are made to aggregate values in the National Accounts with a discussion of possible sources of differences in the macro- and micro-based aggregates. The effects on income inequality are examined.

III. U.S National Accounts[1]

According to the U.S. Bureau of Economic Analysis, producers of the U.S. national accounts, the output of housing represents about 10 percent of total U.S. Gross Domestic Product (GDP) final expenditures and about 5 percent of total U.S. gross output. The term "housing" is used to represent the provision of shelter services by residential housing units and captures both tenant and owner-occupied residential units. As reported by Mayerhauser and McBride (2008), owner-occupied housing output is an abstract concept because there is no actual market transaction between two parties. In the National Accounts, owners are treated as both renters and as enterprises that produce services in the form of shelter. In their capacity as renters they pay a market rent for shelter services, but as enterprises, may earn a profit as income or experience a loss due to housing expenses. This profit is measured as the difference between imputed rental income and expenditures incurred in operating the rental unit. The result is referred to as the

[1] This section of the paper draws heavily from Mayerhauser and McBride (2008).

rental income of person living in owner-occupied housing by the BEA. In this study we refer to this as the net rental income for owner-occupants or homeowners.

To measure owner-occupied housing services requires a measure of market rent. Since this is not an actual transaction it must be imputed. Imputed rents for owner-occupied housing are the only imputed household services included in the NIPA's production boundary. BEA makes this imputation in order that economic growth is invariant to whether shelter is owned or rented. This imputation allows international comparability because home ownership rates differ significantly across countries.

The BEA produces estimates of the space or gross rent, expenses, and imputed rental income for non-farm owner-occupied permanent site housing, owner-occupied non-farm manufactured homes, and farm dwellings owned by farm operators. Owner-occupied permanent site housing includes dwellings that have been sold and are awaiting occupancy and dwellings held off the market for occasional use by the owner, "vacant reserves"; these are treated as if they have been occupied for the full year. Each year, BEA produces annual estimates for owner-occupied housing. Quarterly and monthly estimates of owner-occupied housing are based on trend extrapolation. Benchmark year estimates are in part based on micro data. For example, the Census Bureau's Census of Population and Housing, Residential Finance Survey, the Department of Energy's Residential Energy Consumption Survey (RECS), the American Housing Survey, Expenditures for Improvements and Repairs of Residential Properties, Survey/Housing Vacancy Survey for non-AHS years, owner-occupied portion of maintenance and repairs from the CE.

For the U.S., staff members of the BEA impute the gross rental value of owner-occupied units using a rent-to-value ratio approach for owner-occupied permanent-site dwellings and for

owner-occupied manufactured homes. This rent to value ratio is computed from data collected in the decennial Residential Finance Survey. The rent-to-value ratios are applied to the mid-point market value of the owner-occupied units within corresponding value classes as reported in the American Housing Survey. In this calculation it is not possible to exclude the amount paid for utilities or furnishings that might be imbedded in rents reported in the survey data. In between survey estimates BEA uses the BLS CPI for owners equivalent rent. For owner-occupied manufactured homes, the imputed rental value is based on a rental equivalence approach. For these types of home, the ratio of rooms-per-unit of tenant home to rooms-per-unit of owner homes from the Census of Housing is applied to the average rent of tenant-occupied manufactured homes. For farm owner-occupied housing owned by farm operators, the BEA uses the U.S. Department of Agriculture's (USDA) estimates of gross rental value of farm dwellings, which is a combination of tenant- and owner-occupied housing. BEA splits the rental value of operator dwellings between owner-occupied and tenant-occupied (which reflect dwellings for hired labor, etc) using tenure splits of farm dwellings from BEA's fixed assets accounts. These calculations and estimates are used to obtain an overall estimate of the market rent that owner-occupiers would pay to themselves if they were renting their own homes; this market rent, the gross rental value of the space, represents housing output.

The rental income of persons living in owner-occupied housing is measured as output less expenses plus subsidies. Expenses include intermediate consumption, taxes on production, mortgage interest, current transfer payments and consumption of fixed capital. Intermediate consumption includes expenditures on maintenance and repairs, property insurance, mortgage origination fees, other closing costs (such as title insurance, escrow fees, attorney fees), brokers commissions on land, condo and co-op fees, and imputed banking services. The BEA does not include property management fees within non-farm owner-occupied intermediate consumption, but

they capture tenant-occupied property management fees within the non-farm tenant-occupied intermediate consumption. Taxes on production paid by the housing sector are chiefly property taxes paid to local governments. During benchmark years, many of these expenses are based on survey or census data. Another element of housing services is housing subsidies. These are payments by the government to help renters pay for rental housing. Housing subsidies, in a national accounting framework, are equivalent to negative taxes on production because they act to offset some or all of the effects on gross operating surplus of the below-market rents charged by landlords for public housing or the operating expenses of property owners.

The aggregate rental income of persons is calculated as revenue from gross rents and subsidies less current operating expenses for the stock of housing that is owner-occupied. Capital gains (losses) are not included in the NIPA concept of saving because they represent changes in prices of assets and are not a source of funding for new investment.

IV. Going from Macro to Micro

A goal of this study is to take the concepts related to dwelling services as outlined for the NIPA and produce and distribute them, both positive and negative values, in an appropriate way, across households. This allows the possibility of estimating the well-being effects of the various concepts. In the case of housing, for example, there is an understanding that there are differential benefits (costs) available to homeowners relative to renters and that these benefits change over time and in conjunction with housing markets. Incorporating measures of housing into distributional measures of household economic well-being allows for more reasonable inter-household comparisons, as well as international comparisons, of economic well-being. This was the major aim of the AIM-AP studies. However, unlike the AIM-AP studies, the focus of this study is owner-occupied housing only.

For this purpose then we attempt to reconcile estimates of net rental income from the NIPA to a similar concept assigned at the household level. The Census Bureau currently implements an approximation of net rental income in its household income measures. This calculation is based on a return to equity approach following Smeeding et al. (1993). In that study, homeowners were assumed to have sold their homes and captured the equity from the sales. They invest the equity and earn as income a rate of return. This return represents the flow of services from owned home and results in shifting the relative standing of homeowners upward in a distribution compared with renters. This approach is referred to as the capital market approach in Frick and Grabka (2003) and in the AIM-AP studies. The capital market approach was preferred by Callan (2008) in estimating the impact of owner-occupied dwelling services in Ireland.

According to Short et al. (2007), this method has weaknesses. The selection of return rates is arbitrary and the result has been that the value of net rental income generally exceeds the comparable NIPA estimates. The Census Bureau reduces the overestimate by subtracting property taxes from the return to home equity. But the main expense that homeowners face is not property taxes, but rather, mortgage interest; this is an expense with a large life cycle relationship that is not captured by property taxes. The current method then, overestimates the net rental income of young families relative to older homeowners. The return to equity approach is also weak in capturing changes in housing markets. The NIPA net implicit rental income from owner-occupied housing was -$5,318 million for 2005 (McBride 2008); this suggests that expenses incurred by households or on behalf of households for owner-occupied dwellings exceeded the rent that could have been generated from owners renting their homes. Further, this reflects the very low rent to value ratios inherent in the housing markets during the mid-2000's in the U.S.

and the large interest expenses that households were assuming in anticipation of future appreciation of home values. These variations are not captured in the return to equity approach.

For this study, we produce gross rents, expenses and implicit net rental income from owner-occupied dwellings living in the U.S. Following the lead of the AIM-AP researchers, we apply different methods to value owner dwelling services. As did Mullan et al. (2007) in their national AIM-AP study for the United Kingdom, we produce rents and net rental income using data from two different nationally representative household surveys to provide a basic consistency check of the methods employed. Using different methods of valuation and micro data we compare the results to U.S. NIPA estimates. After producing the implicit rents and subtracting expenses, we distribute the implicit net rental income across all owners. Other income is not considered here, unlike in the AIM-AP studies.

A. Valuation Methods

There are several approaches taken in the literature to value imputed rents. The approaches that we use in this study are a capitalization rate approach, a hedonic model with sample selection, and reported rental equivalence. Frick and Grabka (2003) refer to the hedonic model as the opportunity cost approach; they refer to the use of reported renal equivalence as the self-assessment approach. We use the capitalization rate model proposed by Yates (1994). The return to equity approach (Smeeding et al., 1993), or capital market approach, that the Census Bureau currently uses in income calculations to account for implicit income from owner-occupied dwellings is described as a comparison.

Once we have estimated imputed rents, we subtract operating cost expenses that too are based on household survey data, to derive implicit net rental income. These calculations are done for each owner-occupied dwelling and are presented using data from the AHS and CE. Then

micro estimates are aggregated over all households to represent the gross rent and implicit net rental income concepts in the NIPAs as described above.

In the following, we review the valuation methods used in this study followed by descriptions of the American Housing Survey and the U.S. Consumer Expenditure Survey (CE). The results of applying the valuation methods to the AHS and CE are presented and contrasted to each other and to the NIPA values. Data and estimates for the year 2005 are used.

1. Capitalization Rate Approach

Several authors have suggested estimating $a = R_g/V$, the capitalization rate (Yates 1994, Phillips 1988, Crone et al. 2004; Frick and Grabka 2003) to represent the tradeoff between investing in one's own home or placing the capital in other investments that would yield a return in income flow over time. a represents the rate of return, R_g is the implicit rent and V is the market value of the home. This method is used to calculate a rent-to-value ratio (or rate of return) from various sources to transform the value of owned home into a market rent. The capitalization rate approach as described by Yates (1994) assumes a single rate across all geographic areas. Yet, Phillips (1988) noted that it is apparent that rent-to-value ratios vary considerably from place to place. Yates used the rent-to-value ratios implicit in the national product accounts for Australia to derive imputed rent and the employed micro data to compute and subtract associated costs. Using U.S. NIPA data published by BEA, this rate would be about 5.4 percent in 2005. Property taxes, maintenance costs, and other expenses would be subtracted from the gross rent to arrive at an estimate of net rental income.

One shortcoming of the Yates approach is that it only yields one capitalization rate for the whole U. S. The other two approaches, hedonic and reported rental equivalence, can be enhanced to vary geographically by housing supply, demand, and cost.

The Yates method is applied to the property value of owner-occupied dwellings as reported in the AHS and the CE. The rate of 5.4 percent is applied in all cases.

2. Hedonic Approach

One way of directly calculating implicit net rental income is by estimating gross rent with a hedonic regression model (Frick and Grabka 2003). That is, the hedonic equation

$$Y = X\beta + u_1 .$$

This model is estimated in a sample of renters and the model is then used to predict a market rent for homeowners in similar types of homes. The natural logarithms of the gross monthly rents of renters (*Y*) are regressed on renter consumer unit and housing unit characteristics based on a two-step Heckman approach. We control for selectivity bias in the renter regression model by adding an explicit selection equation to the model. The selection equation is specified as follows:

$$s=1[if\ Z\delta + u_2]\ (2), corr\ (u_1, u_2)\ > \rho$$

In the selection model, *Z* is the vector that contains variables relevant to the selection process. Some variables are common in both the rent determination equation and the selection equation.

Imputed rents for owners are estimated using the renter coefficients applied to owner characteristics. The predicted log rent value for each owner is transformed into a level variable by multiplying each predicted value by an adjustment factor just as Koutsambelas and Tsakloglou (2007) did in the AIM-AP study for Greece. Algebraically the adjustment is:

$$\hat{Y} = \exp(\hat{\sigma}^2 / 2) * \exp(\ln \hat{y}) .$$

Once predicted rents are available for homeowners, operating costs are subtracted to arrive at the net imputed rent that we require.

Hedonic models with selection are developed for both the AHS and the CE. Unlike the models used by Mullan et al. (2007) for the UK, these models do not include exactly the same

variables for both survey data sets. The goal was to include as many variables as possible to be the same but to also draw from the details about housing available in the separate data sets.

3. Reported Rental Equivalence

Reported rental equivalence is only available from the CE. During each of four quarters interviews, owner-occupants are asked the following question:

> *If someone were to rent your home today, how much do you think it would rent for monthly, unfurnished and without utilities?*

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 hedonic model since both approaches are used to produce imputed values at the individual housing unit level.

The CE is the only U.S. federal survey that is used for statistical purposes in which a rental equivalence question is asked. Responses to this question are used in the creation 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 Equivalence Survey contracted to WESTAT by the Office of Personel Management (Heston et al. 2005; Heston and Nakamura fothcoming 2008) 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.

The AIM-AP researchers for Belgium, Germany, Greece, and Italy also considered reported rental equivalence in their studies.

B. Data

Two household survey data sets are used for this study: the U.S. American Housing Survey (AHS) and the U.S. Consumer Expenditure Interview Survey (CE). These two surveys provide the most comprehensive data on renter and owner-occupied housing in the U.S. and thus were natural candidates for the micro-analysis.[2] As noted earlier, the aim in using both data sets was that they would provide a basic consistency check of the methods employed (similar to the approach taken by Mullan et al. 2007). However, since the surveys have different purposes, samples, and data collected, differences in estimated net rental income could result. For the micro-analysis, AHS data are from interviews conducted in 2005 while the CE data are from interviews conducted in 2005 calendar quarter two through 2006 calendar quarter one. .

The AHS is a household survey that asks questions about the quality of housing in the United States. The survey goes back to the same housing units on a regular basis, recording changes in characteristics, adding and deleting units when applicable. This cross-sectioning of the housing inventory gives a picture of houses and households as they change over long periods of time.

The CE is used to collect information from households and families living in the United States on their buying habits (expenditures), income, and household characteristics. Data are collected over time with interviewed households entering and leaving the sample on a regular basis. Data are collected using diaries and interviews. Only the interview data are used for this

[2] The new American Community Survey contains most of the housing data collected as part of the Census of Population and Housing. This survey contains information on acreage, number of bedrooms, condominium status and fees, contract rent, gross rent, heating fuel, insurance for fire, hazard, and flood, kitchen facilities, meals included in rent, mobile home costs, monthly housing costs, mortgage payment, mortgage status, occupants per room, plumbing facilities, real estate taxes, number of rooms, second or junior mortgage payment or home equity loan, tenure, units in structure, utilities, value, year householder moved into unit, and year structure was built.

study. Data from the CE are used in a number of different ways by a variety of users. One important use of the survey is for the periodic revision of the Bureau of Labor Statistics Consumer Price Index (CPI).

Regarding sampling and data collection, for both surveys, addresses of housing units are used in identifying the samples selected for each survey. Data are collected by personal interviews or by telephone. Through the use of population weights and information from the most recent Current Population Survey (CPS) and the Census Bureau's official population estimates, CE data are made to represent the U.S. non-institutional population. CE's non-response adjustments are done using region, race, housing tenure (own versus rent), family size; CE calibration adjustments are made considering region, race, housing tenure, age of the reference person, and urban versus rural location. In contrast, the population weights applied to the AHS result in the total number of housing units in the United States based on the 2000 Census. In addition, however, a demographic adjustment ensures comparability among the surveys for occupied units. Adjustments include Hispanic groups, region, race, housing tenure (rent vs own), husband-wife, other male householder, or other female householder, age of householder, and central city, suburb, or non-metropolitan area.

CE data have been collected on a continuing basis (data are collected each month in each calendar year) using the current design since the last quarter of 1979. In contrast, AHS data are collected once every two years. In the next section descriptions of the CE and AHS surveys and samples used for this study are presented in more detail.

1. American Housing Survey

We use the 2005 biannual American Housing Survey (AHS) for the analysis. The 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 is used to gather information on housing throughout the U.S. with 59,450 housing units selected to be interviewed in 2005. The national survey is conducted once every two years, in odd-numbered years. A sample of housing units in all survey areas was selected from the 1980 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 for 2005 sampled all occupied units in the U.S. The size of the sample was about 43,000 housing units. Of these, about 69 percent were owner-occupied units. The rental hedonic model applied in this study was estimated with housing units rented for cash; all owners were included in the selection model and received imputed rents. Outliers were excluded in estimating the hedonic part of the selection/hedonic model (the same was done for the CE). In order to control for variation in housing prices by geographic area, the 2-bedroom Fair Market Rents (FMRs) for counties were attached to each housing unit record in the AHS; these rents were categorized by decile in order.

The Department of Housing and Urban Developments (HUD) calculates FMRs to administer housing programs. Housing assistance payments are limited by FMRs established by

HUD for different areas. In the Housing Choice Voucher program, the FMR is the basis for determining the "payment standard amount" used to calculate the maximum monthly subsidy for an assisted family. In general, the FMR for an area is the amount that would be needed to pay the gross rent (shelter rent plus utilities) of privately owned, decent, and safe rental housing of a modest (non-luxury) nature with suitable amenities. The weighted mean characteristics of owners and renters in the American Housing Survey in 2005 are presented in Table 1. The variables included in the selection and hedonic models are identified. The coefficient for the Mills ratio was statistically significant suggesting that owners and renters are different with regard to their choice of housing.

2. U.S. Consumer Expenditure Survey

CE-based imputed rents, expenses, and implicit net rental incomes for owners in 2005 are based on data collected in 2005 quarter two through 2006 quarter one (2005Q2-2006Q1). The CE is composed of Interview and Diary data collections. Each has its own independent sample. The data for this study are from the Interview.

The 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 sampling frame (that is, the list from which housing units were chosen) for the used in this study was generated using the 2000 Population Census Bureau 100-percent-detail file, and 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.

CE 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, property values collected, and which major appliances were in the housing unit when the consumer unit moved in. 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.

For this study, data from the fifth interview were used. This was to maximize the number of consumer units who would have gained experience in answering the rental equivalence question and to be able to include an income variable in the regression model that refers to a period that overlaps rents and expenses. In addition, our original intention was to include asset and debt types of information in the probability of renter model; these data are asked in the fifth interview only. These variables were later dropped from the model due to impact of a single outlier. Examining the data from the 2005Q2-2006Q1 time period reveals that consumer units were fairly equally distributed across the four interview periods.

All owners and renters were included in the sample upon which the selection model for the first stage of the hedonic modeling was estimated. The monthly rent regression model included consumer units living in a sampled unit with positive rent payments in the previous three months, and did not live in government subsidized or public housing. The CE does not currently ask whether the rental unit is rent-controlled so we were not able to identify these units from our analysis. Owner-occupants are identified as owners living in the sampled units.

As noted above, the implicit rents, expenses and net rental income are produced for 2005; the situation in 2005 is approximated by data collected in the CE from 2005 calendar quarter two through 2006 calendar quarter one. To maximize sample size, an additional four quarters of data were used to estimate the Heckman 2-step model. For 2005, 7,759 consumer units were included in the analysis sample. The hedonic model was based on data from 14,794 consumer units. During 2005, approximately 66 percent of the weighted sample was represented by owners. The variables included in the selection and hedonic models based on the CE are presented in Table 1.

C. Results

The first step taken was to calculate imputed rents following Yates for the owned housing units in the surveys. As noted earlier, this was done by multiplying the value of each home by the rent to value ratio implicit in the national accounts figures. This yielded imputed rent based on the capitalization approach.

The next analyses conducted were the two-step Heckman models using data form the AHS and CE. For both survey samples, the coefficient of the Mills ratio was statistically significant suggesting that owners and rents in the U.S. are different with regard to their choice of housing. Additional details regarding the regression models are available from the authors.

The next step was to produce the implicit rents for owner-occupied housing from the hedonic models and compare these to the rents based on the Yates method and reported rental equivalence. Average annual rents for owner-occupants are presented in Table 2. Estimates vary widely. Using AHS data, the Yates method yielded average annual rents of $12,862 as compared to a lower annual rent estimate from the hedonic model. In contrast, using CE data, the Yates method resulted in the lowest rent ($12,529) of the three approaches considered followed by the hedonic model implicit rent. The highest implicit rents are based on reported rental equivalence. The relative average rents based on the Yates approach for the AHS and CE are consistent with relative average property values in the two surveys; AHS average property values are slightly higher than those from the CE.[3] Differences in the estimates for the AHS and CE resulting from using the selection/hedonic model are expected to be related to differences in the underlying samples and model specification. The AHS is designed to be representative of housing units while the CE is designed to be representative of consumer units (similar to households but with the additional requirement that they are to share major expenses). The details regarding the model specifications and estimated coefficients are not presented as delving into these was beyond the scope of this paper; yet, differences in model specification may also contribute to differences in the imputed rents for owner-occupied dwellings. Future research will include testing the same selection and hedonic models using data from the AHS and the CE. Mullan et al. (2007), in their selection/hedonic model of UK imputed rents used the same model specifications' for two different survey samples with differences in imputed rents resulting.

[3] The U.S. BEA uses average gross rents in their calculation of rents for non-farm owner-occupied permanent site dwellings and non-farm owner-occupied manufactured dwellings. These averages are used internally by the BEA to estimate aggregate space rents.

They surmised that the differences were due to sample size.[4] Our next step in moving from micro to macro was to produce aggregate gross rents, expenses, and implicit net rental incomes using the survey data and compare these to those from the NIPAs. Table 2 includes aggregate values for all owner-occupied housing in the U.S. using the NIPA, Yates method, selection/hedonic model, and reported rental equivalence. The gross aggregate space or implicit rents for owner-occupied dwellings is most similar for NIPA and the AHS Yates-based estimate: $959,345 million versus $960,696 million. This is expected since the rent-to-value ratios are applied to total housing wealth from the AHS for the NIPA figures. The table also shows aggregate gross rents based on CE reported rental equivalence.

In order to derive implicit net rental income from owner-occupied housing, operating and other expenses were subtracted. For the AHS and CE, some of these expenses were reported while others were derived using various assumptions. These costs include those for maintenance and repairs (referred to in the NIPA as "intermediate inputs"), mortgage interest ("net interest" in the NIPA), property insurance, the consumption of fixed capital, and closing costs. For the AHS and CE, expenses reported by survey respondents for maintenance and repairs, property taxes, and mortgage interest were aggregated. Property insurance premiums reported in the CE were also aggregated. The entry for the AHS for property insurance includes property insurance, homeowner association fees, condominium fees, and other miscellaneous expenses. The NIPA separates condominium and cooperative fees, swimming pool maintenance, and state and local documentary stamp tax, and other expenses. Expenses for these are included in the previously noted categories for the CE. However, we estimated values for the consumption of fixed capital, real estate brokers' commissions and origination fees for the AHS and CE. Other closing costs,

[4] However, when they applied a stratification model to the UK data sets, the imputed rents were nearly the same for the two survey samples.

not including origination fees, are collected in the CE and are used for that aggregate in Table 2. For the AHS and CE, the consumption of fixed capital was assumed to be one percent of the current market values of owner-occupied dwellings for the year**.** The origination fees for new mortgages and home equity loans were assumed to be one percent of the original value of the mortgage or home equity loan. Loan values were reported in the AHS and CE. Brokers' commissions were estimated to be 4 percent of the value of new home sales; new homes were defined to be not older than 2 years. Brokers' commissions for older homes were estimated to be 6 percent of home sales. These percentages underlie the estimates of brokers' commissions in non-benchmark years (Meyerhauser and McBride 2008). Our choice of 2 years as the break point between younger and older dwellings was based on our own judgment. Included in NIPA estimates and not the survey estimates are current transfers as an expense and subsidies as transfers. Although premiums for mortgage guaranty insurance are collected in the CE, they are grouped with other types of insurance and thus are not included among the CE expenses.

Table 2 shows the aggregate rents and expenses from the NIPA accounts compared to those based on the AHS and CE data. The aggregate expenses reported in the AHS and CE are lower than those subtracted in the NIPA except for property taxes. The only aggregate expenses that are close to those in the NIPA are those for mortgage interest and other closing costs as reported in the CE.

The gross rent figures from the Yates method applied to the AHS and CE closely replicate the NIPA figures; however, the resulting aggregate value of net rental income from NIPA using the BEA calculations is -$5,318 million, below the aggregate value from the estimates using survey data. The Yates estimates are shown here because the methodology assures that the gross imputed rent figure will closely approximate the NIPA figure. However,

since operating costs computed at the household level are much below the NIPA figures, the end result of net rental income is much different. It may be that applying a single rent-to-value ratio to all housing units in the U. S. overestimates the gross imputed rent for our sample of housing units.

The gross rents from the selection/hedonic models and reported rental equivalence result in even greater differences between estimates based on survey data and those from the NIPA. Results from a counterfactual using survey gross rents but NIPA expenses are presented on the first page, last row, of Table 2. Not surprisingly, this exercise results in the AHS-based estimates being negative, and greatly negative for the selection/hedonic estimates, and less positive when the CE-based imputed gross rents are assumed.

D. Distributional outcomes

This section describes the empirical results of accounting for implicit net rental income when measuring household well-being, something that can only be done with micro data. The analysis is restricted to owners and does not account for total household disposable income across all owners and renters in the U.S. population. The analysis is conducted for older and younger households as it is often assumed that that older households benefit more implicitly than younger households from home ownership. This is in part due to the fact that net rental income varies substantially for owners who have paid off their mortgage obligations, most likely elderly householders. Examining mean net rental income for age and income groups suggests that the method employed to estimate implicit rents for owner-occupied dwellings can affect resulting comparisons of inequality of income that include implicit net rental income.

Tables 3 and 4 show mean amounts of net rental income for households by income percentile (the means are those of households within ranges of before tax money income) and age of

householder using data from the AHS and CE respectively. Households represented by the top five percent of households are broken down into finer groups in order to identify differences across the methods and surveys due to differences among households in these upper groups. When examining the results in Tables 3 and 4 it is important to note that the rankings of income were calculated for each survey sample independently (see mean values of before tax money income for the AHS and CE in the last columns of the tables). Thus the level implicit net rental incomes across methods within a survey can be compared but levels across surveys cannot, as the cutoffs for the income groups vary by survey. For comparisons across surveys, trends are reported.

For the AHS (Table 3), the first distribution is based on a return to home equity minus property taxes, the method currently employed by the Census Bureau. The second column shows mean net rental income using the Yates approach and the third column values are based on the rent selection/hedonic model. It is clear that there are different outcomes across these methods. Imputed rental income, subtractions, property values, and before tax money income are shown as these underlie the imputed net rents shown in the first three columns. Table 4 includes results for the CE. Instead of return to equity as in the AHS, the CE results include estimates based upon reported rental equivalence.

Unlike for the Yates and selection/hedonic approaches, the AHS results using the return to home equity results are based on subtracting only property taxes (Table 3). Property taxes will generally be proportional to income, reflecting the correlation between incomes and property values by geographic area. This subtraction has the effect of lowering values for higher income households relative to lower income households but will not reflect any age differences in householders that will typically arise from mortgage payments.

The main difference in the two sets of numbers when comparing the return to home equity approach and Yates method is that the Yates method yields much lower net rental income for younger households. One observation from this comparison is that the return to home equity method is similar to the other methods for older households, but overestimates net imputed rent for younger households. This reflects the fact that younger households are expected to have very large mortgage interest costs compared with older households. It suggests further that the Census method, that subtracts property taxes only from return to home equity, overestimates net imputed income for younger households relative to older households because it takes no account of other operating costs that vary across the life cycle

For the AHS, the distribution of net imputed rent using the selection/hedonic method is different from the return to home equity approach in the same way as the Yates approach for younger householders, but there are other differences too. For older households there is a fairly uniform distribution of net implicit rental incomes across the income groups up to the 90th percentile, suggesting that rents may be under-predicted for higher value homes by this method. However, for younger households, net implicit rental income based on the selection/hedonic model becomes negative around the 50th percentile of young households.

Turning our attention now to the CE, Table 4 shows average imputed net rents using the Yates approach, applying the selection/hedonic model, and using reported rental equivalence. As with the AHS, for most of the distribution for older households, the Yates method results in a fairly uniform distribution with positive incomes. Both survey samples have higher net rents using the Yates method for the higher income groups. In contrast, for younger households, net implicit rental incomes based on the Yates method are negative over most of the income groups, the exception being for those in the lower two and higher two income groups. Comparing

selection/hedonic based net rents of older households with younger ones, we see again that older households gain more from owner-occupied dwelling services being valued than do younger households. For older households, net rents are fairly uniform through the 80th percentile and then climb as income climbs. For younger households, not until the 80th percentile does a distinct pattern emerge, with net rents basically rising over the remainder of the distribution. Net rents up to the 40th percentile are negative while those above are positive. This pattern is the complete opposite of that found using the AHS selection/hedonic model and data. Net rents up to the 40th percentile are positive and those after are negative.

Reported rental equivalence, from the CE, leads to the highest net rents for older owners for most of the income percentiles (through the 90th) when compared to results from the other methods and to results from the AHS. Net rental equivalence incomes for households between the 90th and 100th percentiles are lower than those from the selection/hedonic method for older households. These net rents follow approximately the same pattern as net rents based on the Yates method over much of the income distribution for older households; the reported rental equivalence based net rents are only marginally higher than those based on the Yates method for most older income groups. For younger households, net rents based on reported rental equivalence are highest for the lower and higher percentiles. These rents do not appear to follow any particular pattern. Net rents from rental equivalence are lower on average than those based on the selection/hedonic method.

Clearly, all methods show much larger flows from owned homes for older households than for younger households. In general, this results from the lower operating costs elderly householders face due to having paid off mortgages. This illustrates one main problem with the return to equity approach that the Census Bureau current uses in that it does not account for differential

costs between specific population subgroups. Among the other methods, the largest amounts come from the Yates method for the AHS. For the CE the highest net rents for older households are based on reported rental equivalence for those up through the 90 percentile; for younger households net rents from this approach are higher than from other methods up through the 80th percentile.

V. Conclusions

This paper has examined different methods for valuing net rental income for owner-occupiers at the household level. Several methods were examined. These methods were compared to aggregate estimates included in the NIPAs for the purpose of understanding differences in concepts and measurement. In general, it appears that imputed rent methodologies can replicate the national account estimates but that reported expenses for homeowners differ considerably. Questions remain about why the reported rental equivalence approach results in rents that are more than 20 percent higher than those from the NIPA. This has also been a focus of research by Garner et al. (2006). This issue is now being examined by staff members within the U.S. Bureau of Economic Analysis with assistance from Bureau of Labor Statistics staff (McBride 2008). These differences in results due to method and data to estimate implicit net rental income for the dwelling services of owner-occupied housing are important for distributional analyses. It was shown that some measures will have a more equalizing effect on extended income distributions that include net rental income than others. Overall, we have shown that care must be used in the application of these estimates to income distribution measures for populations and comparisons of economic well-being.

In examining data from the American Housing Survey and the U.S. Consumer Expenditure Survey and similar methods, we find that the value of imputed rents are quite sensitive to the

methods chosen and to the data used, just as in the AIM-AP United Kingdom study (Mullan et al. 2007). In future studies we plan to refine our selection/hedonic models and use additional data to reduce the impact of small sample sizes on our results. We also plan to consider the impact of what BEA refers to as "vacant reserves," like owner vacation homes. More attention also will be given to digging deeper into the methods used by the U.S. Bureau of Economic Analysis as we continue are goal to reconcile macro and micro estimates of dwelling services, for both renter and owner-occupied housing, in the United States.

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Table 1. Weighted Means of Characteristics of U.S. Owners and Renters and of their Housing Units: 2005

	American Housing Survey				Consumer Expenditure Survey[a]			
	Variable Included		Renter	Owner	Variable Included		Renter	Owner
	rent	selection	(n=10,005)	(n=29,507)	rent	selection	(n=2,516)	(n=5,243)
Rent or Value			$725	$237,845			$611	$232,016
Rooms including bedrooms					x	*	4.38	6.55
Rooms not including bedrooms	x	*	2.45	3.43				
Bedrooms	x	*	2.01	3.10				
Bathrooms	x	*	1.23	1.73	x	*	1.24	1.75
Halfbaths	x	*	0.15	0.40	x	*	0.14	0.37
Dwelling age (in years)	x	*	45	38	x	*	44	38
Dwelling age imputed					x	*	0.52	0.12
Rent includes fuel	x		0.28		x		0.32	
Rent includes water/trash	x		0.75		x		0.72	
Rent includes parking					x		0.64	
Rent reduced as pay					x		0.04	
Tenure duration	x		3.76	13.78				
Off street parking	x	*	0.87	0.97	x		0.76	0.84
Central air-conditioning	x	*	0.49	0.69	x	*	0.43	0.66
Housing includes major appliances[b]	x	*	0.34	0.47	x		0.25	0.13
Housing includes porch, balcony, patio					x	*	0.56	0.83
Single detached house					x	*	0.24	0.83
Not detached housing	x	*	0.70	0.10				
Mobile home	x	*	0.05	0.07	x	*	0.04	0.06
In MSA	x	*	0.84	0.75	x	*	0.88	0.71
South	x	*	0.35	0.37	x	*	0.33	0.37
Midwest	x	*	0.20	0.25	x	*	0.20	0.24
West	x	*	0.25	0.20	x	*	0.25	0.21
Public transport good	x	*	0.54	0.34				
Police good	x	*	0.88	0.89				
Schools good	x	*	0.22	0.22				
At least one housing problem	x	*	0.09	0.05				
Crime bothers	x	*	0.20	0.12				
Traffic bothers	x	*	0.33	0.23				
Fair Market Rent deciles								
Decile 1			0.07	0.11				
Decile 2	x	*	0.08	0.11				
Decile 3	x	*	0.10	0.10				
Decile 4	x	*	0.10	0.10				
Decile 5	x	*	0.10	0.10				
Decile 6	x	*	0.10	0.10				
Decile 7	x	*	0.10	0.10				
Decile 8	x	*	0.10	0.10				
Decile 9	x	*	0.12	0.08				
Decile 10	x	*	0.14	0.10				

Table 1 (continued). Weighted Means of Characteristics of U.S. Owners and Renters and of their Housing Units

	American Housing Survey				Consumer Expenditure Survey[a]			
	Variable rent	**Included selection**	**Renter** (n=10,005)	**Owner** (n=29,507)	**Variable rent**	**Included selection**	**Renter** (n=2,516)	**Owner** (n=5,243)
Median value of owned homes within the primary					x	*	$222,716	$201,442
Crowd (number of people per room)					x		0.54	0.41
Percentage of renters in Census tract (2000					x	*	0.45	0.28
Poverty rate of people in Census tract (2000					x	*	0.16	0.11
Worked		*	0.61	0.55				
Black		*	0.19	0.09		*	0.19	0.09
Hispanic		*	0.18	0.08		*	0.17	0.08
Household income	x	*	$38,167	$70,591	x	*	$33,549	$70,477
Received property income		*	0.15	0.32				
Received transfer income		*	0.04	0.01		*	0.13	0.03
Age of householder (years)		*	41	52		*	41	53
High school graduate to AA degree						*	0.59	0.56
Bachelors college degree		*	0.16	0.20		*	0.19	0.31
Not married		*	0.32	0.26				
Never married						*	0.40	0.11
Widowed						*	0.08	0.12
Divorced or separated						*	0.23	0.14
Children present		*	0.36	0.35		*	0.33	0.35
Consumer unit size						*	2.22	2.61
Number of adults 18+		*	1.68	1.98				
Time dummies for CE interview quarters					x	*		
Mills	x		0.627	2.065	x		0.497	2.000

[a] CE statistics presented are for 2005Q2-2006Q1 although the selection/hedonic analysis were based on data from 20052Q2-2007Q1.

[b] Major appliances include stove, refrigerator, dishwasher, and garbage disposal. For the CE, the appliances refer to those that were included in the owned home or rental unit at the first interview.

Table 2. Comparison of 2005 Imputed Rents and Implicit Rental Income for Owners Using the U.S. Income and Product Accounts, American Housing Survey, and the Consumer Expenditure Interview Survey

	BEA [a]	American Housing Survey			CE (2005 with data from 2005Q2-2006Q1)			
		AHS Population	Yates	Selection/ Hedonic	CE Population	Yates	Selection/ Hedonic	Reported Rental Equivalence
Nonfarm owner-occupied permanent-site housing Owner-occupied (including vacant reserves)								
Nonfarm manufactured homes, owner-occupied								
Farm dwellings owned by farm operators								
Total owner-occupied housing units *(thousands)*		74,690			77,667			
Average rent for alll owner-occupied housing units			**$12,862**	**$12,164**		**$12,529**	**$14,112**	**$15,043**
[Millions of dollars]								
Nonfarm owner-occupied permanent-site housing Owner-occupied (including vacant reserves)								
Nonfarm manufactured homes, owner-occupied								
Farm dwellings owned by farm operators								
Total owner-occupied housing units*average "rent"			$960,663	$908,529		$973,084	$1,096,065	$1,168,354
Aggregate annual rent for all owner-occupied housing units			$960,696	$908,595		$973,084	$1,096,065	$1,168,354
Less: rental of durables			$0	$0		$0	$0	$0
		AHS Estimates	Below use AHS aggregates for computations		CE Estimates	Below use CE aggregates for computations		
Space rent for all farm and non-farm owner-occupied housing units (including vacant reserves) exclusive of utilities	**$959,454**		**$960,696**	**$908,595**		**$973,084**	**$1,096,065**	**$1,168,354**
Less expenses	**$968,813**	**$871,949**	**$88,747**	**$36,646**	**$923,972**	**$49,111**	**$172,093**	**$244,382**
Plus: Subsidies	$4,041	$0	$0	$0	$0	$0	$0	$0
Equals: Rental income of persons with capital consumption adjustment (net rental income from all owner-occupied housing)	**-$5,318**		**$88,747**	**$36,646**		**$49,111**	**$172,093**	**$244,382**
Counter Factual Using BEA expenses subsidies.			*-$4,076*	*-$56,177*		*$8,312*	*$131,293*	*$203,582*

Table 2 (continued). Comparison of 2005 Imputed Rents and Implicit Rental Income for Owners

	BEA	American Housing Survey			CE (2005 with data from 2005Q2-2006Q1)			
		AHS Population	Selection/H Yates	edonic	CE Population	Selection/He Yates	donic	Reported Rental Equivalence
	BEA [a]	AHS			CE			
Space rent for all farm and non-farm owner-occupied housing units (including vacant reserves) exclusive of utilities	$959,454		$960,696	$908,595		$973,084	$1,096,065	$1,168,354
			The below are running subtotals starting with the aggregate rent and subtracting one expense at a time			The below are running subtotals starting with the aggregate rent and subtracting one expense at a time		
Less expenses	$968,813	$871,949	$88,747	$36,646	$923,972	$49,111	$172,093	$244,382
Intermediate inputs (Maintenance and repairs (includes ground rent))	$202,138	$69,682	$891,014	$838,913	$64,716	$908,367	$1,031,349	$1,103,638
Taxes on production and imports (Property taxes)	$139,213	$175,152	$715,862	$663,761	$172,605	$735,763	$858,744	$931,033
Net Interest (Mortgage interest)	$408,732	$330,722	$385,140	$333,039	$395,318	$340,445	$463,426	$535,715
Property insurance		$71,072 [f]	$314,068	$261,967	$37,226	$303,219	$426,200	$498,489
Current transfer payments	-$10,980							
Consumption of fixed capital	$229,710	$177,647 [c]	$136,421	$84,320	$180,201 [c]	$123,018	$246,000	$318,289
Closing costs, total	$55,366 [b]	$13,550	$122,871	$70,770	$33,090	$89,928	$212,909	$285,198
Origination fees	$32,992 [b]	$4,263 [d]			$11,036 [d]	$111,982	$234,963	$307,252
Other closing costs	$22,374 [b]	$9,287 [e]			$22,054	$89,928	$212,909	$285,198
Title insurance								
Title abstract and escrow fees								
Attorney fees								
Credit report								
Surveys								
Adjustment and collection services								
Engineering services								
Real Estate Brokers' commissions		$34,124	$88,747	$36,646	$40,816	$49,111	$172,093	$244,382
Condominiums and cooperative fees		included			included			
Mortgage guaranty insurance (private administration)		included			na			
Swimming pool maintenance			$0	$0	included			
State and local documentary stamp tax			$0	$0	included			
Others			$0	$0	$0	$0	$0	$0
Plus: Subsidies	$4,041		$0	$0	$0	$0	$0	$0
Equals: Rental income of persons with capital consumption adjustment (net rental income from all owner-occupied housing)	-$5,318		$88,747	$36,646		$49,111	$172,093	$244,382

[a] Space rent, expenses, and rental income are from the National Income and Produce Accounts (NIPA) Table 7.12. Imputations in the National Income and Product Accounts. The rental income of persons with capital consumption adjustment is equal to the rental income in NIPA Table 7.9. Rental income of Persons by Legal Form of Organization and by Type of Income.

[b] Unpublished aggregates supplied by Denise McBride from the BEA,

[c] Estimated to be 1.0% of market value of owned home

[d] Estimated to be 1.0% of the value of the original mortgage or home equity loan

[e] Estimated to be 3.0% of the value of the original mortgage or home equity loan

[f] Includes property insurance, homeowners association fees, condominium fees, and other misc expenses.

Table 3. Annual Means of Net Rental Income by Percentiles of Before Tax Money Income Percentiles for Households in the AHS 2005

	Reference Person Age 65 or Over (n=7,209)							
	Imputed Net Rental Income			Imputed Rental Income				
precentile	Return to Equity minus property tax	Yates	Selection/ Hedonic Model	Yates	Selection/ Hedonic Model	Subtractions	Property Value	Before Tax Money Income
10	$4,567	$2,968	$2,757	$8,292	$8,081	$5,324	$153,332	$3,477
20	$4,520	$3,196	$2,831	$8,431	$8,067	$5,236	$155,909	$10,146
30	$4,361	$3,063	$3,530	$8,013	$8,480	$4,950	$148,177	$14,119
40	$4,923	$3,494	$3,570	$8,938	$9,013	$5,443	$165,269	$18,610
50	$5,276	$3,514	$3,083	$9,836	$9,405	$6,322	$181,880	$23,719
60	$5,578	$3,946	$3,672	$10,267	$9,994	$6,322	$189,854	$29,884
70	$6,664	$4,989	$3,914	$12,002	$10,927	$7,013	$221,930	$38,028
80	$6,255	$4,212	$3,405	$12,347	$11,540	$8,135	$228,310	$49,595
90	$7,699	$5,492	$3,712	$14,818	$13,039	$9,327	$274,013	$67,104
95	$10,180	$7,129	$3,522	$19,070	$15,463	$11,941	$352,626	$92,301
96	$13,857	$11,276	$4,870	$24,030	$17,624	$12,755	$444,358	$113,385
97	$15,625	$10,152	$44	$28,444	$18,336	$18,292	$525,972	$127,423
98	$14,296	$10,062	$2,480	$27,847	$20,265	$17,786	$514,938	$152,498
99	$17,967	$14,013	$5,628	$32,896	$24,511	$18,883	$608,300	$250,137
100	$21,569	$17,855	$3,251	$41,543	$26,939	$23,687	$768,186	$395,375
percentile	Reference Person Age 65 Years of Age or Younger (n=22,298)							
10	$2,958	$664	$733	$7,686	$7,754	$7,021	$142,117	$10,083
20	$2,602	$92	$786	$7,789	$8,483	$7,697	$144,028	$26,953
30	$2,377	-$541	$44	$8,743	$9,328	$9,284	$161,671	$38,255
40	$2,775	-$345	$175	$9,695	$10,215	$10,040	$179,273	$48,447
50	$2,890	-$681	-$256	$10,424	$10,849	$11,104	$192,750	$58,571
60	$3,208	-$364	-$189	$11,768	$11,943	$12,132	$217,608	$69,444
70	$3,708	-$517	-$1,040	$13,603	$13,080	$14,120	$251,542	$82,343
80	$4,145	$96	-$530	$15,197	$14,572	$15,101	$281,024	$98,630
90	$5,460	$256	-$1,603	$18,885	$17,026	$18,629	$349,211	$123,949
95	$6,818	$1,147	-$1,547	$23,377	$20,683	$22,230	$432,267	$162,820
96	$7,669	$1,906	-$1,340	$26,079	$22,834	$24,174	$482,246	$197,703
97	$8,134	$2,685	-$198	$26,838	$23,954	$24,153	$496,269	$223,682
98	$11,861	$6,013	-$675	$32,465	$25,777	$26,451	$600,322	$284,009
99	$13,033	$5,023	-$5,498	$38,328	$27,807	$33,305	$708,743	$382,704
100	$15,541	$8,199	-$7,028	$40,907	$25,680	$32,708	$756,430	$528,310

Table 4. Annualized Means of Net Rental Income by Percentiles of Before Tax Money Income for Consumer Units in the CE Interview 2005Q2-2006Q1

	Reference Person Age 65 or Over (n=1,277)								
	Imputed Net Rental Income			Imputed Rental Income					
precentile	Yates	Selection/ Hedonic Model	Reported Rental Equivalence	Yates	Selection/ Hedonic Model	Reported Rental Equivalence	Subtractions	Property Value	Before Tax Money Income
10	$4,594	$2,066	$7,306	$8,666	$6,138	$11,379	$4,072	$160,480	$6,857
20	$3,032	$2,828	$4,879	$7,155	$6,950	$9,002	$4,122	$132,491	$12,481
30	$4,369	$3,270	$6,523	$8,969	$7,870	$11,123	$4,600	$166,099	$15,681
40	$2,879	$1,849	$6,366	$9,329	$8,299	$12,816	$6,450	$172,755	$19,680
50	$2,850	$2,069	$5,533	$9,788	$9,006	$12,471	$6,938	$181,252	$24,707
60	$3,190	$3,341	$6,018	$9,285	$9,436	$12,113	$6,095	$171,943	$29,523
70	$2,557	$2,868	$5,224	$9,146	$9,457	$11,813	$6,589	$169,369	$36,769
80	$3,313	$3,931	$6,954	$11,654	$12,273	$15,295	$8,342	$215,822	$47,855
90	$6,000	$5,547	$8,691	$14,637	$14,184	$17,327	$8,636	$271,052	$65,319
95	$3,617	$6,889	$4,729	$15,143	$18,415	$16,255	$11,526	$280,422	$89,550
96	$7,665	$10,424	$5,202	$19,704	$22,463	$17,241	$12,039	$364,889	$107,940
97	$2,069	$9,712	$3,255	$16,226	$23,869	$17,413	$14,157	$300,481	$116,698
98	$5,567	$12,323	$8,853	$19,153	$25,910	$22,439	$13,586	$354,690	$132,704
99	$9,690	$18,980	$11,946	$26,352	$35,642	$28,609	$16,662	$488,002	$160,392
100	$6,201	$22,620	$11,251	$34,141	$50,560	$39,191	$27,940	$632,239	$395,386
precentile	Reference Person Less Than 65 Years of Age (n=3,966)								
10	$673	-$138	$3,732	$6,824	$6,014	$9,883	$6,151	$126,373	$11,252
20	$210	-$33	$2,662	$7,443	$7,200	$9,896	$7,233	$137,841	$27,555
30	-$584	-$65	$2,987	$8,028	$8,547	$11,600	$8,612	$148,666	$38,192
40	-$1,815	-$1,110	$1,375	$9,278	$9,983	$12,468	$11,093	$171,817	$48,707
50	-$1,333	-$832	$1,895	$10,802	$11,304	$14,031	$12,135	$200,038	$58,962
60	-$514	$554	$2,500	$11,599	$12,667	$14,612	$12,113	$214,792	$69,824
70	-$1,633	$336	$2,452	$13,011	$14,980	$17,097	$14,644	$240,951	$82,311
80	-$1,344	$1,539	$1,605	$14,835	$17,718	$17,784	$16,179	$274,719	$98,174
90	$1,221	$3,158	$974	$21,118	$23,055	$20,871	$19,897	$391,073	$124,348
95	-$25	$8,093	-$168	$24,238	$32,356	$24,095	$24,263	$448,854	$167,321
96	-$1,091	$12,278	-$19	$25,764	$39,133	$26,835	$26,855	$477,112	$200,176
97	$2,341	$18,001	$1,751	$26,863	$42,523	$26,273	$24,522	$497,462	$217,513
98	-$672	$21,671	$1,581	$27,778	$50,121	$30,031	$28,450	$514,400	$244,851
99	$6,493	$28,904	$3,778	$29,414	$51,825	$26,698	$22,921	$544,703	$282,101
100	$9,187	$13,989	$4,913	$46,537	$51,339	$42,263	$37,350	$861,796	$630,035