Chapter 2
ACCOUNTING FOR HOUSING IN A CPI

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1. Introduction

Stephen Ceccheti (2007), a former Executive Vice President and Director of Research at the New York Federal Reserve Bank, writes that: "Price stability is about helping people make their long-term plans." The Consumer Price Index (CPI) produced by the U.S. Bureau of Labor Statistics (the BLS), is the most widely used measure of inflation. The Federal Reserve uses the CPI in various forms, along with various forms of the Personal Consumption Expenditures (PCE) price index,[2] in its efforts to achieve price stability. As Ceccheti also explains, the large expenditure share for owner occupied housing (OOH) means that the way OOH is accounted for in a price index makes a great deal of difference.[3] We note too that the large share for housing in consumer expenditure means that inflation in the cost of housing services greatly affects people's living costs and longer term plans.

The rental equivalency approach is used to account for the cost of OOH services in the CPI and in the PCE price index, including core and trimmed variants of these inflation measures. Poole, Ptacek and Verbrugge (2005) of the BLS explain that for renters, "rental equivalence" is easily measured as the amount of rent paid. For owners living in their owned homes --- i.e., for owner occupiers -- this cost is unobserved because owner occupiers, in effect, rent to themselves.

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[2] Mishkin (2007a) explains that the Federal Reserve also pays attention to the rate of growth of the core PCE price index, which excludes food and energy prices. Rich and Steindel (2007) evaluate four measures of core inflation. The authors find no compelling evidence for preferring any one of these to the others. Bernanke (2008) notes the continuing efforts of researchers to develop improved inflation measures and to better use these measures.

[3] McCully (2006) explains that the PCE price index re-weights and supplements price data the BLS uses to compile the CPI so as to better fit the scope, concepts, and methods used for the U.S. National Income and Product Accounts (the NIPAs) that are, in turn, used to produce measures of output and productivity for the national economy.

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Thus the BLS uses the rents of rental units in the same localities as the sampled owner occupied homes to compute the rental equivalence for owner occupied housing (OOH) services. This paper raises questions about, and suggests an alternative to, sole reliance on the rental equivalence approach for accounting for OOH in a CPI.

Bauer, Haltom, and Peterman (2004) with the Federal Reserve Bank of Atlanta argue that some of the observed post-2002 increases in rental vacancy rates were causally attributable to *increases* in the demand for owned homes. The belief is that rapid and sustained increases in the prices for housing in many localities led some renters who had planned on purchasing homes later to enter the housing market earlier for fear of being permanently priced out of the market if they did not do this. Behaviour of this sort would have helped sustain the increases in house prices while contributing to a softening in rental markets. Concerns as to how the treatment of owner occupied housing was affecting the movements of the CPI spilled over into the financial press. For example, in Market Watch, Robb (2006) wrote that:

> "The way the government computes the CPI has created a distortion that made inflation look tame when home prices were soaring, but is now making inflation look worse as price gains moderate. It's all because the government measures everyone's housing costs -- renters and homeowners by looking at rents, not at the cost of owning."

As Ceccheti explains, criticisms like those above led to arguments that OOH services should be priced more directly. Cecchetti (2007) notes that:

> "There is an argument that, rather than including observed rents, the existing price of a home should be in the consumer price index....
>
> Making this change in the consumer price index would make an enormous difference. To see how big, start with the fact that since 2000, the U.S. headline CPI has risen at an average annual rate of 2.75%, while the traditional core CPI has gone up 2.20% per year on average. If government statisticians had been using the price of homes sold rather than rents, consumer price inflation would have registered an annual increase of something like 4% per year – roughly one and one-quarter percentage points higher. And core CPI inflation would have been something like 3.8%; that's more than one and one-half percentage points above the official reading. Had these been the inflation readings, it's hard to imagine the Fed keeping their federal funds rate target below 2% for three years."

Direct inclusion of home prices in the CPI has been resisted by the BLS on the grounds that it is the dwelling services of OOH that the BLS is trying to price; not investment services. Nevertheless, there is no way of living in a home without investing in housing. Also, a homeowner with a mortgage cannot continue living in their home and cannot rent it out without keeping their mortgage payments up to date. Nor can they sell the home without discharging their mortgage. Thus concern has grown that the rental equivalency approach is not properly measuring inflation for OOH services. Verbrugge (2008) notes that:

> "Between 1995 and 2004, the owners-equivalent-rent (OER) subindex of the CPI rose by about 30%, but the Office of Federal Housing Enterprise Oversight (OFHEO) house price index rose by over 61%, a divergence which many commentators viewed as 'perverse' and unacceptable."

We argue that the shelter services provided by otherwise equivalent owned and rented accommodations are different products, just as owned and rented cars and fine art and party dresses and suits are different products. Moreover, since so many more households have opted to live in owned rather than rented accommodations in the United States, we argue that there is no

way of effectively monitoring inflation as experienced by households in a period like the post 2002 years without more directly accounting for the cost of OOH services.

In section 2, we take stock of how statistical agencies in different nations are currently accounting for housing in their CPIs. Of the four measures currently in use, the rental equivalence and user cost ones have been the favourites of economists. Both these approaches can be derived from the fundamental equation of capital theory, as outlined in section 3. This theoretical basis is not the only way of justifying these approaches, but it is the basis usually noted in the official statistics literature. However, because of the assumptions involved, the use of the fundamental equation of capital theory is on less firm ground in applications to housing than to financial asset markets. Also, there is empirical evidence for housing markets that conflicts with implications of the fundamental equation of capital theory. Concerns about these approaches are taken up in section 4.

In section 5, we argue that an *opportunity cost* approach is the correct theoretical framework for accounting for OOH in a CPI. This approach, first mentioned in Diewert (2006), is developed more fully here.[4] We explore the relationship of this new approach to the usual rental equivalency approach and to the way in which the user cost approach is implemented by Verbrugge (2008). The new approach leads to an Owner Occupied Housing Opportunity Cost (OOHOC) index that is a weighted average of the rental and the financial opportunity costs. In section 6, we outline some of the broader reasons for favouring the proposed new approach.

2. Different Concepts of the Cost of Owner Occupied Housing (OOH)

Here we briefly review the four main existing approaches for accounting of housing in official statistics: the rental equivalence, user cost, acquisitions and payments approaches.[5]

2.1 The Rental Equivalence Approach

The rental equivalence approach values the services yielded by a dwelling using the observed market rent for the same sort of dwelling for the same period of time (if such a rental value exists). Here we outline the implementation of this approach by the BLS for accounting for OOH in the CPI.[6] We then also examine the treatment of OOH services in the Personal Consumption Expenditure component of the National Income and Product Accounts (NIPAs) compiled by the Bureau of Economic Analysis (BEA) using data inputs from the Census Bureau.

The U.S. shelter index component of the CPI is the household expenditure weighted average of several components. The two main shelter index components are the Rent of Primary Residence Index, hereafter referred to as the *rent index*, and the Owners' Equivalent Rent of Primary Residence Index (hereafter referred to as the *rental equivalence index*). Both price observations and expenditure weights are needed for compiling the rent index and the rental equivalence index. Johnson (2006) of the BLS explains that the expenditure share weights are

[4] Diewert (2006) is published in this volume as Diewert (2009).

[5] See the ILO et al. (2004) CPI manual, Christensen, Dupont and Schreyer (2005) and Eiglsperger (2006).

[6] This section draws on the U.S. Bureau of Labor Statistics (BLS) (2007).

computed using Consumer Expenditure Survey (CES) data. Sampled census renters are asked the following about the dwellings they occupy:

> "What is the rental charge to your ... unit including any extra charges for garage & parking facilities? Do not include direct payments by local, state or federal agencies. What period of time does this cover?"

And owner occupiers are asked:

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

The CES information is used only for the CPI expenditure share weights and this is the only data used that is collected from owner occupiers as well as renters. In contrast, the price information for housing services is only collected from renters.

To determine housing price changes, the BLS first produces a sample of local area block groups. It is assumed that changes in owners' equivalent rent in small geographic areas (3-4 city blocks per block group) will be similar to the changes in actual rents for renters in those localities. Hence, each rental unit that is priced does double duty: it represents the renters within the block group, and it represents owner occupiers. Adjustments are made for landlord provided utilities and for the different effects of aging on owned versus rented housing.[7]

The main focus of this chapter is on the CPI. However, here we also some pay attention to the treatment of OOH in the U.S. National Income and Product Accounts (NIPAs). That treatment is what often is being referred to when mention is made that the U.S. uses the rental equivalence approach, but the details of how rental equivalence is implemented differ from the CPI case. Of course, if incorrect estimates of inflation are used in compiling the NIPAs, this can result in incorrect estimates of output and productivity growth. Many nations benchmark their productivity against the U.S. case, which makes the possibility that the U.S. productivity numbers are biased due to the U.S. price treatment of OOH a serious concern for many other nations as well. Also, the data sets used in accounting for OOH in the NIPAs are potentially useful as well for the new opportunity cost approach we suggest in section 5.

Housing services are a component of Personal Consumption Expenditures (PCE), and consequently are also part of the Gross Domestic Product (GDP) in the NIPAs. The rental value of tenant occupied housing and the imputed rental value of OOH are both included in the PCE housing services component. Mayerhauser and Reinsdorf (2007) explain that treating owner occupiers as renting from themselves is viewed as necessary in order for GDP to be invariant when housing units shift between tenant occupancy and owner occupancy.

Garner at the BLS and Short at the U.S. Census Bureau explain in detail how the gross rental value of owner occupied units is operationally imputed for the NIPAs and the PCE price index and how this process differs from the BLS methods for the CPI program. Garner and Short (2008) write that, first, rent-to-value ratios are computed from data collected in the decennial Residential Finance Survey (RFS).[8] The most recent Residential Finance Survey is the 2001 one.

[7] For historical specifics on the treatment of rental housing in the CPI see Crone, L.I. Nakamura, and Voith (2008).

[8] The Census Bureau has conducted the Residential Finance Survey (RFS) as part of every decennial census since 1950. The survey collects and produces data about the financing of nonfarm, privately-owned residential properties. More information can be found at http://www.census.gov/hhes/www/rfs/rfscollect.html.

For the 2001 RFS, a sample of about 50,000 addresses was drawn from the address file for the Census 2000.[9] Then questionnaires were mailed to a sample of property owners and to lenders who held mortgages on the sampled properties. The RFS provides a comprehensive view of mortgage finance in the United States, including information about loans and also demographic information about the property owners. Responding to the RFS is mandatory for those sampled. This is an important consideration for collecting information from mortgage lenders. The RFS is exempt from statutes prohibiting release of financial records by financial institutions.

The RFS-based rent-to-value ratios are applied to the mid-point market values of the owner occupied units within corresponding value classes, as reported in the American Housing Survey (AHS). The AHS collects data on the nation's rental and owner occupied housing, including apartments, single-family homes, mobile homes, and vacant housing units. National AHS data are collected biannually for about 55,000 homes. The survey is conducted by the Census Bureau for the Department of Housing and Urban Development.[10]

Total rental services are the product of the RFS-based value ratios in a benchmark year times the number of sample units in each value class as determined from the AHS. The average OOH equivalent value over all value classes provides an average rent estimate in a benchmark year. Between benchmark years, this estimate must be updated taking into account inflation as well as improvements in the quality of owned dwellings and any inflation in rents for dwellings of a given quality. The inflation factors are based on the OOH rent component of the CPI, while the quality change adjustment is based on estimated BEA adjustment factors.

2.2 The User Cost Approach

It is often stated that the user cost for owner occupied housing can be thought of as the cost to a household of purchasing a home at the beginning of a unit time period, living in it during the period, and re-selling it at the end of the period. Like the rental equivalence approach, the user cost approach is routinely used for a variety of assets other than housing. For example, the approach is used in the capital asset pricing literature, in production function studies, in the measurement of total factor productivity growth, and in the analysis of tax depreciation rules.

The *full ex ante user cost* consists of *normal maintenance expenditures* plus *property taxes* plus *depreciation expenses* (loss of value of the dwelling unit due to the effects of aging and wear and tear that is not offset by normal maintenance expenditures)[11] plus *waiting costs* (the costs of forgone interest due to the funds tied up in an owned dwelling) and *anticipated capital gains* or losses due to housing market specific inflation over the given time period. The

[9] These addresses were limited to counties and independent cities in the 394 sampling areas used for the Census Bureau's American Housing Survey National Sample.

[10] The BEA then uses the component measures compiled by the Census Bureau in producing the PCE component of the NIPAs. The Census Bureau also implements a different approximation of net rental income based on a return to equity approach presented in Smeeding et al. (1993). In that methodology, homeowners were assumed to have sold their homes and captured the equity from the sales, and are then assumed to have invested the equity and to have earned a given rate of return. This approach is referred to as the capital market approach.

[11] If the dwelling unit is remodeled or extensive maintenance expenditures have been undertaken, then there has been new investment added to the unit and the proper accounting treatment is more complex.

full ex post user cost is defined the same way except that ex post (i.e., actual) capital gains or losses are used in place of ex ante anticipated gains or losses.

Official statistics agencies that have adopted user cost approaches have so far adopted simplifications rather than the full user cost approach. Here we report on two nations that use simplified variants of the user cost approach.

2.2.1 The Canadian case[12]

Statistics Canada states that they use a modified user cost for OOH services. The Statistics Canada OOH measure is very different from the user cost as defined above, or in recent international manuals. The Statistics Canada measure includes the loss of value due to physical depreciation plus the following sorts of household operating costs: (a) the cost of ongoing maintenance and repairs and upkeep; (b) the cost of homeowners' insurance and property taxes; and (c) mortgage interest cost. This treatment of OOH *omits both* the waiting cost of foregone interest on funds tied up in an owned dwelling and also financial appreciation or depreciation. If the physical depreciation term were dropped from the Canadian treatment, this would be a variant of the payments approach (see section 2.4).

Baldwin, Nakamura and Prud'homme (2006, 2009) explain that the mortgage interest component of the official concept is intended to estimate price induced changes in the amount of mortgage interest owed by the target population on outstanding mortgages. The Statistics Canada practice is to hold the volume of mortgage loans, by age of mortgage, constant so that interest owed depends only on house prices and interest rates; not on the changes in lump sum payments or changes in the loan-to-value ratios or the amortization periods of the outstanding loans.[13]

Erdur and Prud'Homme (2007) note that data on house prices enter into five parts of the OOH component of the Canadian CPI: mortgage interest cost, replacement cost (without land), insurance, realtor commissions, and legal fees. Because of this, it is unfortunate that Statistics Canada has only been able to afford to collect *new* house price information. It is known that new house prices often move differently from prices for pre-owned homes. At least, however, the Statistics Canada treatment does use some direct evidence about house price movements.

2.2.2 The Icelandic case

Statistics Iceland labels the OOH component of their CPI as an "owner equivalent rent" index, but describes this as a simplified user cost, as Diewert (2003) defines this term.[14] Copies of all sales deeds for residential housing are filed with the Icelandic Land Registry. The deeds state the purchase prices of the properties together with the buyer liabilities and details of the interest and scheduling of payments on the debt. The Land Registry evaluates all these details and computes the present discounted value for the sale. The Icelandic owner equivalent rent is intended to reflect changes in market prices of housing and also financing costs and depreciation.

[12] The information in this section is mostly from Statistics Canada (2007) and Statistics Canada (1995). For more on the treatment of OOH in the Canadian CPI, see also Baldwin, Nakamura and Prud'homme (2006, 2009).

[13] See Statistics Canada (1995, pp. 113-117).

[14] Material in this section is based on Guðnason (2005a, 2005b), as well as Guðnason and Jónsdóttir (2009).

2.3 The Acquisitions Approach

For both durable and nondurable goods, the acquisitions approach charges the entire price of a purchase to the period of the purchase. The approach can potentially be applied to OOH. This approach is the one used by all official statistics agencies for all goods and services covered by a CPI (other than OOH services in the case of the nations like the United States that use other approaches for accounting for the cost of OOH). With this approach, the objective is to measure the average change in prices of the products acquired by households each period, irrespective of whether they were wholly or even partially paid for (e.g., credit purchases) or used in that period.

Only goods that the household sector purchases from *other* sectors are in scope with the acquisitions approach. For most products, the direct sales by households to other households are negligible. Thus, limiting coverage to purchases from other sectors makes little difference. However, when the acquisitions approach is used for OOH, the housing related expenditures that enter the CPI are mostly expenditures on new dwellings excluding land. This is because most second hand dwellings, and even most of the land used for new home construction, are excluded. The acquisitions approach is used by Australia and New Zealand (Statistics New Zealand 2006). This approach has also been tentatively chosen for the European Union's Harmonized Indices of Consumer Prices (HICPs), which is the euro area measure of consumer price inflation.[15]

2.4 The Payments Approach

The payments approach only measures actual cash outflows associated with OOH. Thus the consumption of OOH services gets very little weight from fully owned dwellings. When there is moderate or high general inflation, mortgage payments swell, but there is no offsetting benefit to the homeowner since the appreciation in the housing asset is ignored. The payments approach produces high values in periods of inflation: erroneously high values in our view.

The Central Statistics Office of Ireland (2003) uses the payments approach. For owner occupiers, the Irish CPI covers the costs for repairs and decorations and other home maintenance services; house insurance; local authority charges, and mortgage interest. Mortgage interest payments are measured using a fixed basket of mortgages up to twenty years in duration.

3. The Theory of Household User Costs

As noted above, no nation uses the full user cost approach. However, reports on the treatment of OOH in official statistics make ubiquitous reference to the shared theoretical underpinnings for the user cost and the rental equivalency approaches, and it is the full user cost that is relevant in that context. Hence here we consider the *full* user cost approach in fuller detail.

[15] As of now, however, OOH is still omitted from the HICPs. See the European Communities (2004). According to Eiglsperger (2006): "The Harmonised Index of Consumer Prices (HICP) plays a prominent role in the monetary policy strategy of the European Central Bank (ECB).... [M]ost of the expenditure of owner-occupiers on housing (OOH)... are not included in the HICP at present. This can be traced back to the different practices of treating OOH in national consumer price indices (CPIs)...."

Diewert (1974, p. 504) sets out the following user cost principles for consumer durables:

> "To form the rental price (or user cost) for the services of one unit of the nth good during period t, we imagine that the consumer purchases the good during period t and then sells it during the following period (possibly to himself). Then the discounted expected rental price for the nth consumer good during period t is given by the discounted cost of the purchase of the nth good during period t minus the discounted resale value of the depreciated good during period t + 1."

The "resale value of the depreciated good during period $t+1$" referred to in the above quotation includes not only the loss of value due to physical depreciation but also the waiting costs (i.e., the costs of forgone interest) and financial capital gains or losses.[16] Dougherty and van Order (1982) helped adapt and establish the user cost as a conceptual framework in the real estate literature. Bajari, Benkard, and Krainer (2003, p. 3) observe that:

> "Dougherty and Van Order (1982) were among the first to recognize that the user cost ... should be equal to the rental price of a single unit of housing services charged by a profit-maximizing landlord. Thus, the inherently difficult task of measuring an unobservable marginal rate of substitution is replaced by the much easier task of measuring rents."

Attention to timing matters. Realized prices are determined at points in time. Rates of interest are regarded as fixed at points in time. But rates of inflation are defined for time intervals. If there is inflation, money is less valuable when received at the end versus the beginning of a period. An end of period t value can be converted to its equivalent at the beginning of that same (*not* the next) period by discounting by $1+r^t$, where r^t is the period t nominal interest rate.

Katz (2009) reviews the theoretical framework that can be used to derive both user cost and rental equivalence measures from the fundamental equation of capital theory:

> "The 'user cost of capital' measure is based on the fundamental equation of capital theory. This equation, which applies equally to both financial and non-financial assets ... states that in equilibrium, the price of an asset will equal the present discounted value of the future net income that is expected to be derived from owning it."

The end of period t user cost for a durable that had already been used for v periods as of the start of period t is denoted by u_v^t. In box 1, the derivation of the user cost measure by Katz (2009, appendix A) is shown, recast using the notation for our paper.[17] We denote the value of a home that is v years old *at the start* of period t by V_v^t. Given only the information available at the start of period t, the *expected* price a home could be sold for *at the end* of period t, which is the start of period $t+1$, is denoted by V_{v+1}^{t+1}. And O_v^t denotes the *anticipated* operating costs, largely consisting of normal maintenance plus property taxes, that are treated as being paid at the end of the period. Katz explains that the traditional user cost measure is derived by assuming that

[16] Diewert (1974, 1980) followed Fisher (1897) and Hicks (1939) in deriving the user cost using a discrete time approach rather than the continuous time approaches used by Jorgenson (1963, 1967), Griliches (1963), Jorgenson and Griliches (1967, 1972) and Christensen and Jorgenson (1969, 1973). Recent related contributions include Hulten and Wykoff (1981a, 1981b, 1996), T.P. Hill (1999, 2000, 2005), Diewert and Lawrence (2000), R.J. Hill and T.P. Hill (2003), Corrado, Hulten and Sichel (2005), Diewert (2003, 2005a, 2005b) and Diewert and Wykoff (2009).

[17] Diewert (2005b) also carefully distinguishes between beginning and end of period user costs and recommends the use of end of period user costs since they are more consistent with financial accounting conventions.

flow transactions within a period actually occur at the end of the period. Thus he derives the following end of period user cost, shown in box 1 as equation (3-4):[18]

$$u_v^t \equiv r^t V_v^t + O_v^t - (V_{v+1}^{t+1} - V_v^t) .$$

Box 1. Derivation of the User Cost Measure from Katz (2009, Appendix A)

The user cost of capital measure provides an estimate of the market rental price based on costs of owners. It is directly derived from the assumption that, in equilibrium, the purchase price of a durable good will equal the discounted present value of its expected net benefits; i.e., it will equal the discounted present value of its expected future services less the discounted present value of its expected future operating costs. To see this, let V_v^t denote the purchase price of a v year old durable at the beginning of year t; let V_{v+1}^{t+1} denote the expected purchase price of the durable at the beginning of year t+1 when the durable is one year older; let u_v^t denote the expected end of period value of the period t services of this durable; let O_v^t denote the expected period t operating expenses to be paid at the end of period t for the v year old durable; and let r^t denote the expected nominal discount rate (i.e., the rate of return on the best alternative investment) in year t. Expected variables are measured as of the beginning of year t.

Assume the entire value of the durable's services in a year will be received at the year's end, and that the durable is expected to have a service life of m years. From the definition of the discounted present value, we have

$$(3\text{-}1) \qquad V_v^t = \frac{u_v^t}{1+r^t} + \frac{u_{v+1}^{t+1}}{(1+r^t)(1+r^{t+1})} + \ldots + \frac{u_{m-1}^{t+m-v-1}}{\Pi_{i=t}^{t+m-v-1}(1+r^i)} - \frac{O_v^t}{1+r^t} - \frac{O_{v+1}^{t+1}}{(1+r^t)(1+r^{t+1})} - \ldots - \frac{O_{m-1}^{t+m-v-1}}{\Pi_{i=t}^{t+m-v-1}(1+r^i)} .$$

When the durable is one year older, the expected price of the durable at the beginning of year t+1 is:

$$(3\text{-}2) \qquad V_{v+1}^{t+1} = \frac{u_{v+1}^{t+1}}{1+r^{t+1}} + \frac{u_{v+2}^{t+2}}{(1+r^{t+1})(1+r^{t+2})} + \ldots + \frac{u_{m-1}^{t+m-v-1}}{\Pi_{i=t+1}^{t+m-v-1}(1+r^i)} - \frac{O_{v+1}^{t+1}}{1+r^{t+1}} - \ldots - \frac{O_{m-1}^{t+m-v-1}}{\Pi_{i=t+1}^{t+m-v-1}(1+r^i)}$$

Dividing both sides of (3-2) by $(1+r^t)$ and subtracting the result from equation (3-1) yields

$$(3\text{-}3) \qquad V_v^t - \frac{V_{v+1}^{t+1}}{1+r^{t+1}} = \frac{u_v^t}{1+r^t} - \frac{O_v^t}{1+r^t} .$$

Multiplying through equation (3-3) by $(1+r^t)$ and combining terms, one obtains the end of period t user cost:

$$(3\text{-}4) \qquad u_v^t = r^t V_v^t + O_v^t - (V_{v+1}^{t+1} - V_v^t) .$$

Note that m in box 1 (above expression (3-1)) denotes the remaining service life of the durable measured in years. The estimated market value of a home a year later (V_{v+1}^{t+1}) is computed in the context that the home has a remaining service life for the homeowner of m years.

[18] So, unlike the home value variable where we need to refer to both the beginning and the end of period values, we only need to refer to the end of period values for the other anticipated variables and denote them simply using t as the superscript, as Katz does. And, unlike Katz, we also forego using a special designation for expected values.

4. Rental Equivalence, User Cost History, and the Verbrugge Variant (VV) User Cost

We begin in this section by briefly taking stock of efforts at the BLS and BEA to assess the user cost approach as a possible alternative to rental equivalence. A group of careful studies that have been specially influential on these topics have been conducted by Thesia Garner and Randall Verbrugge (2009), and by Verbrugge in his own work and with various other collaborators.[19] The second part of this section is devoted to the Verbrugge (2008) variant of the user cost approach.

4.1 Long Standing Interest at the BLS and BEA

Both the BEA and BLS have experimented over the years with the user cost as well as the rental equivalence approach. Already by 1980, the BEA had published a de facto satellite account for the services of consumer durables that is detailed in Katz and Peskin (1980). Also at the BEA, Katz explored the sensitivity of user cost estimates to alternative assumptions about expected rates of inflation and patterns of depreciation in a 1982 paper, and examined related theoretical and empirical issues in a 1983 paper. And prior to 1983, for the CPI, the BLS built up estimates of homeowner expenses by estimating individual user cost components. That approach, which Greenlees (2003) of the BLS terms an "ad-hoc user cost" approach, made use of data on home purchase prices, mortgage interest, maintenance, taxes and insurance. Gillingham (1980) describes the BLS' failed attempt to construct a user cost measure of housing services for the CPI. He became discouraged at being able to construct a usable measure and wrote that his results "…provide empirical support for the contention that it is impossible to construct a valid user cost measure which is consistent with the information provided by rent markets without either direct or, through direct measurement of the opportunity cost of equity capital, indirect use of that information."

Carson (2006) also explains that, in the early 1980s, there were serious problems with the quality of the available house price and mortgage interest data. These data were only available then for houses with FHA-insured mortgages: a small and shrinking share of the market for owner occupied housing. Also, the influential Stigler Report (Stigler 1961, p. 53) had come out two decades earlier strongly in favour of rental equivalency.[20] These factors led the BLS to switch in 1983 to the rental equivalence approach.[21]

When first introduced by the BLS, the rental equivalence index was produced by reweighting the rent sample to better represent the distribution of owner occupied units. Revised procedures for calculating a rental equivalence index were adopted in 1987 and used through 1997. For that period, BLS drew a housing sample that had both owner and renter occupied

[19] See also Crone, L. Nakamura, and Voith (2009).

[20] The Stigler Report (Stigler 1961, p. 53) states that: "The welfare of consumers depends on the flow of services from houses and not upon the stocks acquired in any given period." The report concluded that (p. 48): "If a satisfactory rent index for units comparable to those that are owner-occupied can be developed, this committee recommends its substitution in the CPI for the present series for the prices of new houses and related expenses."

[21] See Gillingham and Lane (1982). The rental equivalence approach was implemented for the CPI-U in January 1983 and for the CPI for Urban Wage Earners and Clerical Workers (CPI-W) in January 1985.

housing units. However, due to technical problems with the 1987 changes, in 1998 the BLS reinstated the 1983 variant of the rental equivalence approach that used price data only on rents to calculate both the rent index for renters and the rental equivalence index for OOH services.

Already in their 2005 paper, Poole, Ptacek and Verbrugge acknowledge that the rapid rise in housing prices over the preceding few years coupled with slow increases in the OOH component of the CPI had led to concern among many economic analysts about the treatment of OOH services in the CPI. In their 2005 paper, they also state that the user cost approach is the only serious alternative to rental equivalency. Poole, Ptacek and Verbrugge go on to identify problems with the user cost approach, a key one being that, as they implement the approach, it would not have mirrored the post 2002 increases in home prices, and hence would not have relieved concerns that the OOH component of the CPI had failed to reflect any positive impacts on the costs of OOH services during the post 2002 run-up of prices for owner occupied housing.

Mayerhauser and Reinsdorf (2007) offer a defence of the OOH component of the CPI that can easily be understood in the context of a user cost formulation like the Katz one summarized in box 1 or the user cost formulation of Poole, Ptacek and Verbrugge (2005). They point out that a current period rise in home values raises the wealth of homeowners and thus can be viewed as reducing the net cost of ownership. They argue that, because capital gains on residences were extraordinarily high in the post 2002 years and interest rates were low, the net cost of occupying an owned residence was truly low in those years for most homeowners. In other words, Mayerhauser and Reinsdorf argue that the rental equivalence results for OOH services in the post 2002 period mirror reality. The incongruity of this conclusion considered in the context of the reported rising financial stress for increasing numbers of homeowners over the post 2002 years caused us to look more closely at the specifics of the formulations that have been applied for the user cost of OOH.

4.2 The Verbrugge Variant (VV) of the User Cost Approach

The specification of the user cost implemented in Poole, Ptacek and Verbrugge (2005) is based on derivations presented in Verbrugge (2008), where alternative ways of handling the home value appreciation term are also investigated more fully. Here, we label the formulation of the user cost presented as equation (1) in Verbrugge (2008) as the Verbrugge variant, hereafter referred to for short as the VV user cost.

The VV user cost is derived by treating homeowners as though they costlessly sell and buy back their homes each year.[22] Stated using our notation, where V^t is the beginning of period value of the home ignoring, as Verbrugge does, the age of the home; r^t is a nominal interest rate; γ_H^t is a term which collects the rates of depreciation, maintenance, and property taxes; and $E[\pi]$ is an estimate of the rate of expected house price appreciation, the VV user cost formula is:

[22] This user cost variant follows naturally from application of the statement of the user cost approach given by Diewert (1974) in the opening quotation for section 3 about how a consumer is imagined to be buying their home and then selling it back each period -- "(possibly to himself)." We note that in section 6 of his paper, Verbrugge (2008) relaxes the assumption that there are no costs of buying and selling a house and he uses this fact to try to help explain the divergence between the rental price of a home and its user cost.

$$u^t = r^t V^t + \gamma_H^t V^t - E[\pi] V^t \quad (4\text{-}1)$$
$$= \text{forgone interest} + \text{operating costs} - \text{expected t to (t+1) change in home value.}$$

This is essentially formula (3-4) in box 1 of this paper.

Verbrugge experiments with a number of alternative ways of measuring the final term of (4-1) for the expected change in home value from the beginning to the end of year t, but his preferred forecasting equation includes a forecast of the home price change based on 4 quarters of prior home price information. With this setup, *changes* in home prices have an immediate within-year impact on the user cost. When home prices are rising, the final term of (4-1) serves to offset the contribution of the first term, $r^t V^t$.

4.3 Accepting the Verbrugge Verdict that User Costs and Rents Often Diverge

In the official statistics literature, the user cost and the rental equivalence approaches are usually positioned as arising from the same body of theory, as briefly outlined in section 3. That underlying theory yields some empirically testable predictions.

Capozza and Seguin (1995/1996) point out that under the assumptions usually made in deriving both the user cost and rental equivalency approaches from the fundamental equation of capital theory, we should observe gross and net rental yields that are invariant across and within rental housing markets. This is the same basic implication that follows from the theoretical framework Diewert (1974) provides for durable goods in general, and that Gillingham (1980) and also Dougherty and Van Order (1982) specialize for real estate markets.

Thus, the theory implies that, except as justified by departures from the maintained assumptions for the theory, rents should track user costs for observationally equivalent dwellings, and rent-to-value ratios should be constant over time and space. However, empirical efforts to confirm these theoretical implications have yielded mostly negative results. Verbrugge (2008) is very clear about the negative findings of his empirical investigations:

> "This paper demonstrates that, in the context of U.S. housing data, rents and ex ante user costs diverge markedly – both in growth rates and in levels – for extended periods of time, a seeming failure of arbitrage and a puzzle from the perspective of standard capital theory.... The divergence holds not only at the aggregate level, but at the metropolitan-market level as well, and is robust across different house price and rent measures."

Verbrugge shows empirically that, since 1998, his preferred VV user cost tracks neither rent nor house price movements. He takes this as evidence that the user cost approach should not be used.

Verbrugge's (2008) empirical exploration of the VV user cost caused us to notice something missing from the formulation that has thus far gone unnoticed, to which we turn our attention in section 5.

A number of others have also found results at odds with the stated theoretical predictions. For example, using another large U.S. dataset, Heston and Nakamura (2009) show that rent-to-value ratios differ by location and by the value of the property. Controlling for location, Heston and Nakamura find that the rent-to-value ratios fall dramatically in moving from relatively low to relatively high value homes.

Many factors have been suggested in the literature for why user costs might differ from rents in some places and times. One suggestion is that landlords change rents infrequently. Rental rate stickiness has been shown empirically to be particularly important for tenants continuing on from the previous year, which is the case for the majority of tenants.[23] A second factor that could cause rents and user costs to diverge in some situations is that owners and renters are subject to differing sorts of uncertainty regarding changes over time in household operating expenses. Sinai and Souleles (2003) note that, although owners face the risk of capital losses when they sell, the longer the holding periods, the more these future risks will be discounted. Moreover, owners often have some margin of control over the timing of when to sell.

A third factor is the thinness of the rental market for luxury homes. Most people have an apparent preference for living in owned housing. Higher income people are mostly in a position to indulge this preference even when they need to own and maintain multiple *de facto* "primary residences" in order to live under their own roof most of the time. Luxury homes tend to be offered for rent mostly under conditions that limit the options of a renter. Many of these rental arrangements involve house sitting responsibilities, or are very temporary. Moreover, to find renters, the owners of luxury homes must compete on price for tenants most of whom normally rent lower quality housing units and cannot afford to pay much more than what they normally would pay.[24]

Tax program rules that treat owner occupiers differently from landlords are a fourth factor that could cause user costs and rents to diverge. Wood, Watson and Yates (1998) find that differences in loan-to-value ratios are positively related to gross rent-value differentials, and argue that this outcome arises because federal government tax provisions make rental investments more attractive for highly leveraged investors at lower tax rates than would otherwise be the case. They also find that brokerage costs on the sale of rental properties are directly related to the size of gross rent-value differentials. Jud and Winkler (2005) point out that most past studies fail to incorporate refinancing options for homeowners. They suggest that during periods of falling interest rates, the ability to refinance is likely to generate substantial equity gains for homeowners. In their analysis, they explicitly consider refinancing options that homeowners exercise. In the following section, we build on these insights of Jud and Winkler.

We argue, moreover, that the fact that owner occupied and rental accommodation services are qualitatively different products is confirmed by the fact that owner occupiers and renters face different risks, the fact that rental markets become thinner for higher value homes, and the special tax provisions that have been enacted in the United States for owner occupiers. We believe that qualitative differences between otherwise similar owner occupied and rental accommodations are the main reason why most of the transitions between rented and owned accommodations is in the renter-to-owner direction.[25]

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[23] See Gordon and van Goethem (2004) and Genesove (2003). Also, Hoffmann and Kurz-Kim (2006, p. 5) report the following: "In our sample, prices last on average more than two years... but then change by nearly 10 %." And, Hoffmann and Kurz-Kim (2006) find German rents are changed only once every four years on average.

[24] It also seems likely to us that, moving up the value scale, an increasing percentage of homes offered for rent are, in fact, offered with the terms of payment including house sitting duties along with the monetary rent obligations. Situations like this should, of course, be caught by the questions asked as part of the collection of the rent data, but it seems likely that not all the cases like this are properly identified.

[25] See the Harvard University Joint Center for Housing Studies (2008).

5. Diewert's OOH Opportunity Cost Approach

The time has come, we feel, to accept the evidence of Verbrugge and others that user costs and rents do not reliably move together! This verdict implies we must rethink the approach for accounting for OOH in the price statistics of nations. We argue in the rest of this paper for a shift to the new opportunity cost approach for accounting for the cost of housing.

The term "opportunity cost" refers to the cost of the best alternative that must be forgone in taking the option chosen. Thus, we seek to compare implications for homeowner wealth of selling at the beginning of period t with the alternatives of planning to own a home for m more years and of either renting out or occupying the home for the coming year. This comparison is assumed to be carried out at the beginning of period t based on the information available then about the market value of the home and interest rates and the forecasted average increase per year in home market value if the home is held for another m years.

Refinancing can be viewed as a way of a homeowner selling or buying back a fraction of an owned home. In contrast to selling and buying titles to properties, financing and refinancing costs for mortgages and other loans secured by liens on property titles are quite low, in the United States at least. We imagine that a homeowner mentally notes at the start of each year the market price and the forecast for the annual average growth in value for a home that the owner expects to hold for m more years. The homeowner is presumed to use this information as input to decisions made at the start of the year on whether to adjust their debt for the coming year, whether to sell at the start of the year or to plan on continuing to own their home for m more years, and whether to rent out or occupy the home for the coming year if they continue to own it.

Owner occupiers in period t continue to own their homes with the chosen levels of debt, and to occupy rather than renting their homes out. Thus in choosing to own and occupy, they pass up the opportunity of selling at the start of the period, and also the opportunity of renting out their home that year. At the level of an individual homeowner, the opportunity cost approach amounts to treating the cost to the owner occupant of their housing choice as the greater of the foregone benefit they would have received by selling at the start of period t or renting out the owned home and collecting the rent payments.

The owner occupied housing opportunity cost index can now be defined as follows:

> For each household living in owner occupied housing (OOH), the *owner occupied housing opportunity cost* (OOHOC) is the maximum of what it would cost to rent an equivalent dwelling (the rental opportunity cost, ROC) and the financial opportunity costs (FOC).
>
> The OOHOC index for a nation is defined as an expenditure share weighted sum of a rental equivalency index and a financial opportunity cost index, with the expenditure share weights depending on the estimated proportion of owner occupied homes for which FOC exceeds ROC.

In sections 5.1 and 5.2, respectively, we focus on the ROC and then the FOC components of the index for an individual homeowner. Then in section 5.3, we address the issue of how to move from OOHOC values for individual homeowners to an OOHOC index for a nation. Finally, section 5.4 reviews key features of the proposed OOHOC index.

5.1 The Rental Opportunity Cost Component

The rental opportunity cost component is operationally equivalent to the usual rental equivalency measure introduced in section 2, but the justification for this component here does not rest on an appeal to the fundamental equation of capital theory and is not tied to the potential sale value for the home in the current or subsequent periods. In the present context, the ROC component is simply the rent for period t on an owned dwelling that the owner forgoes by living there that period. That is, it is the rent the owner could have collected by renting the place out rather than living there.[26]

We next turn our attention to the financial opportunity cost of the money tied up in an owned dwelling. A home, once purchased, can yield owner occupied housing services over many years. The user cost framework provides guidance on how to infer the period-by-period financial costs of OOH services using the observable home purchase data. We can use the user cost framework this way even in situations when the capital theory assumptions under which the user cost equals the expected rent are not satisfied.

5.2 The Financial Opportunity Cost Component

The user cost formulation we recommend for the FOC component of the opportunity cost is referred to here as the Diewert variant, or DV, user cost. For this specification, we let r^t denote the rate of return a homeowner could have received by investing funds that are tied up in the owned home. In addition, we take account of the fact that many homeowners have debt that is secured against their homes and must make regular specified payments on that debt to continue to be in a position to occupy or to rent out their homes.

Research has shown that owner occupied homes, on the whole, exhibit little physical depreciation over time given modern standards for home maintenance.[27] (This is in contrast to the situation for rental housing units that have been shown to lose significant value, on average, with increasing age.) Hence, since we are focusing on owner occupied housing here, we drop the dwelling age subscript v from this point on, as we did in introducing the Verbrugge variant (VV) user cost in equation (4-1).

We also take account of the fact that the vast majority of homeowners own their homes for many years. Indeed, if we take account as well of the phenomenon of serial home ownership, with owner occupiers rolling forward the equity accumulated from one owned home to the next, then the time horizon (given by m in box 1) should arguably be the entire number of years a homeowner plans to continue to live in owned housing. Many people move into their own owned

[26] Notice that, in computing the ROC component, we do not subtract the cost the owner would need to incur to live somewhere else if they rented the home out. The opportunity cost of living in an owned home, which is the maximum of the ROC and FOC components, is what the person would presumably compare with the costs of alternative housing arrangements in making their choice about where to live for period t. It does, however, make sense to think of the ROC value for an individual homeowner as a lower bound on the value they place on living in the home in light of the fact that most people, in the United States at least, seem to have a strong preference for living in owned accommodations.

[27] Here "normal maintenance" for owned homes is essentially being defined to include the amount of maintenance and renovation expenditures required to just maintain the overall "quality" of the home at a constant level.

homes as soon as they can afford to after reaching adulthood and die still owning their own homes. The expected remaining years, m, until a homeowner expects to withdraw all the equity they have in their home is an important parameter for determining the FOC component. However, if homeowner-specific information about m is lacking, perhaps m could be set at a value no lower than the median years that homeowners report having been in their present homes.

Having stated the above choices and views, we are now ready to specify the FOC component for an individual homeowner. Here we ignore the case of homeowners who have negative home equity: a more complex and obviously important case in the present circumstances which we are considering now in separate research with Leonard Nakamura. We also abstract from transactions costs and taxes: further complications that we are also considering in our new research with Leonard Nakamura.

As of the start of period t, a homeowner with nonnegative equity could sell, paying off any debt (D^t) in the process, and could collect the (non negative) sum of $V^t - D^t$. Or the homeowner could choose to continue owning the dwelling, in which case they must make payments on any debt they have, and must pay the normal home operating costs; they must do this whether they choose to live in their home or rent it out for the coming year. If they continue to own the dwelling -- either living in it or renting it out -- they will forego the interest they could have earned on the equity tied up in their home and will incur maintenance costs and carrying costs on any debt, but they will also enjoy any capital gains or incur any capital losses that materialize.

The financial user cost for owning the home in period t and living in it, discounted to the start of period t, is:

$$\text{(5-2a)} \qquad \frac{u^t}{1+r^t} \equiv [V^t - D^t] - \left[\frac{-r_D^t D^t - O^t + (\overline{V^{t+1}} - D^t)}{1+r^t} \right],$$

where $\overline{V^{t+1}}$ is the value of the home at the beginning of period t plus the expected *average* appreciation of the home value over the number of years before the homeowner plans to sell. Thus, the second term in square brackets is the forecasted expected value of the home as of the end of period t which is the beginning of period $t+1$ ($\overline{V^{t+1}}$) minus the period t debt service costs ($r_D^t D^t$) and operating costs (O^t) that must be paid in order to either occupy or rent out the dwelling for period t. If we multiply expression (5-2a) through by the discount factor, $1+r^t$, we now obtain an expression for the ex ante end of period user cost:

$$\text{(5-2b)} \qquad u^t \equiv r_D^t D^t + r^t (V^t - D^t) + O^t - (\overline{V^{t+1}} - V^t).$$

The importance of the debt related terms in (5-2a) and (5-2b) can be better appreciated by considering some specific types of homeowners. Consider a type A homeowner who owns their home free and clear. For them, the end of period user cost for period t, discounted to the start of the period, is:

$$\text{(5-3a)} \qquad \frac{u^t}{1+r^t}\Big|_{\text{typeA}} \equiv [V^t] - \left[\frac{-O^t + \overline{V^{t+1}}}{1+r^t}\right] = \frac{O^t + r^t V^t - (\overline{V^{t+1}} - V^t)}{1+r^t}.$$

The user cost considered as of the end of the period is found by multiplying (5-3a) through by $1+r^t$, yielding:

$$\text{(5-3b)} \qquad u^t\Big|_{\text{typeA}} \equiv r^t V^t + O^t - (\overline{V^{t+1}} - V^t).$$

Notice that this is essentially the customary user cost expression, as derived by Katz (2009) and others; e.g., see equation (3-4) in box 1 above. This is the same basic formulation used as well by Verbrugge; e.g., see (4-1) above.

Type B homeowners do not fully own their homes, but have positive home equity: the most prevalent case for U.S. homeowners. If the homeowner were to sell at the beginning of period t, the realized proceeds of the sale (after repaying the debt) would be $V^t - D^t$. The end of period user cost for period t for these homeowners, discounted to the start of period t, is:

$$\text{(5-4a)} \qquad \begin{aligned} \frac{u^t}{1+r^t}\Big|_{\text{typeB}} &\equiv [V^t - D^t] - \left[\frac{-r_D^t D^t - O^t + (\overline{V^{t+1}} - D^t)}{1+r^t}\right] \\ &= \frac{r_D^t D^t + O^t + r^t(V^t - D^t) - (\overline{V^{t+1}} - V^t)}{1+r^t}. \end{aligned}$$

The user cost, as of the end of the period, is found by multiplying (5-4a) through by $1+r^t$:

$$\text{(5-4b)} \qquad u^t\Big|_{\text{typeB}} \equiv r_D^t D^t + r^t(V^t - D^t) + O^t - (\overline{V^{t+1}} - V^t).$$

Type C homeowners have zero home equity. In this case, if the homeowner sells at the start of period t, we assume simply that they get nothing from the sale. And if they continue to own and live in the home, they do so without having any equity tied up by this choice and hence are not foregoing any earnings on funds tied up in their home. The end of period user cost for period t, considered as of the start of period t, is:

$$\text{(5-5a)} \qquad \frac{u^t}{1+r^t}\Big|_{\text{typeC}} \equiv -\left[\frac{-r_D^t D^t - O^t + (\overline{V^{t+1}} - D^t)}{1+r^t}\right].$$

The user cost considered as of the end of the period is:[28]

$$\text{(5-5b)} \qquad u^t\Big|_{\text{typeC}} \equiv r_D^t D^r + O^t - (\overline{V^{t+1}} - V^t).$$

[28] Note that in this zero equity case, it seems like the payments approach is justified at first glance. However, the payments approach neglects the expected capital gains term and during periods of high or moderate inflation, this term must be taken into account.

We next consider the extreme case in which the interest rate for borrowing equals the returns on investments (i.e., $r_D^t = r^t$). Now, (5-4a) and (5-4b) reduce to (5-3a) and (5-3b). That is, the expressions for the homeowners who have debt but still have positive equity in their homes reduce to the expressions for the user cost for the homeowners who own their dwellings free and clear. We see, therefore, that the traditional user cost expression, as derived by Katz, and the VV user cost implicitly assume that homeowners who have mortgages or other home equity loans are charged an interest rate on this debt that equals the rate of return on their financial investments.

Most well off households have mostly low cost debt whereas many poor households have mostly have high cost debt. The importance of this fact can be demonstrated using the end of period user cost for a type B homeowner. For a homeowner who has positive home equity and only low cost debt with $r_D^t < r^t$, expression (5-4b) can be written as:

$$
\begin{aligned}
u^t\big|_{\text{typeB}} &\equiv r_D^t D^t + r^t(V^t - D^t) + O^t - (\overline{V^{t+1}} - V^t) \\
&= r_D^t V^t - (r^t - r_D^t)D^t + O^t - (\overline{V^{t+1}} - V^t),
\end{aligned}
\tag{5-6}
$$

where the term $(r^t - r_D^t)$ is positive. Hence, for these homeowners, *higher debt reduces the financial cost of OOH services*. Indeed, this is a potential motivation for a Type B homeowner to increase their low cost borrowing to the greatest extent possible. The only rational constraint on doing this, from an economic perspective, is that higher debt can also bring a greater risk of home foreclosure or personal bankruptcy in the event of a downturn in the economy or personal problems such as job loss or illness.

The case of a homeowner with only high cost debt (i.e., with $r_D^t > r^t$) is different. Now (5-4b) reduces to:

$$
\begin{aligned}
u^t\big|_{\text{typeB}} &\equiv r_D^t D^t + r^t(V^t - D^t) + O^t - (\overline{V^{t+1}} - V^t) \\
&= r^t V^t + (r_D^t - r^t)D^t + O^t - (\overline{V^{t+1}} - V^t),
\end{aligned}
\tag{5-8}
$$

where $(r_D^t - r^t)$ is positive. So *now, higher debt means a higher financial cost of OOH services*. Most subprime loans are high cost, with interest rates at least three interest rate points above Treasures of comparable maturities.

We come now to the question of how the DV user cost would behave over a housing bubble. In this portion of our analysis, we use the general (5-2b) expression for the end of period user cost. Moreover, we will define $r_{H(m)}^t$ as the expected rate of home price change under the assumption a home will be held for m more years. Now, (5-2b) can be rewritten as

$$
\begin{aligned}
u^t &\equiv r_D^t D^t + r^t(V^t - D^t) - r_{H(m)}^t V^t + O^t \\
&= (r_D^t - r^t)D^t + (r^t - r_{H(m)}^t)V^t + O^t,
\end{aligned}
\tag{5-9}
$$

where $r_{H(m)}^t V^t = \overline{V^{t+1}} - V^t$. Hence the FOC for a household can be negative when, for example, the borrowing rate is less than the expected rate of return on financial assets, and the expected

rate of return on financial assets is less than the expected annual rate of return on housing assets. However, the OOHOC for a household will never be zero or negative because it is defined as the maximum of the ROC and the FOC, with the rental opportunity cost necessarily being positive.

Notice also that the FOC component will rise as home prices rise, and first and foremost, when the expected rate of return on financial investments (r^t) is greater than the expected rate of return on the housing asset ($r^t_{H(m)}$). Going into a bubble, the first term, $(r^t_D - r^t)D^t$, will be hard to forecast even in terms of sign, but we would expect the changes in this term to be small compared to the changes in the second term, $(r^t - r^t_{H(m)})V^t$. During the expansion phase of a bubble, home values, and hence V^t, will grow rapidly, but the longer run return on housing assets should not change as much and hence the financial user cost of OOH, given by equation (9), should increase. This result underlines the importance of incorporating longer run expectations into the user cost formula. Of course, when the bubble bursts, the financial user cost will rapidly decline, although the decline will be offset somewhat by the possible decline as well in $r^t_{H(m)}$.[29]

5.3 Moving to the National Level

To estimate the FOC and the corresponding rental opportunity cost (ROC) values, values are needed for the following financial variables: R^t and V^t for each sampled home, the rental value and the market value if the home were sold then; r^t, which is the average rate of return on household financial investments; and the amounts of low cost and of high cost household debt, by which we mean the amounts of debt at interest rates that are less than r^t and the amounts that are at interest rates that are greater than r^t.

In the United States, the needed information for compiling the FOC and ROC measures of the proposed new opportunity cost measures might be obtained by adding a small number of questions to the Consumer Expenditure Survey (CES). The Residential Finance Survey (RFS), and the American Housing Survey (AHS) might be used as well.

For each home of each type, the FOC and ROC values must be compared, and the OOH opportunity cost for the home must be set equal to the maximum of these values. The results of these comparisons would feed into the determination of the expenditure share weights needed for combining the FOC and ROC components of the OOHOC index. Our analysis suggests that the new OOHOC index will always be positive and will be only modestly more volatile than a conventional rental equivalency index.

[29] Locked in aspects of the financing arrangements of home buyers may also matter in this regard. We are exploring this issue now in a follow-up study.

5.4 Noteworthy Features of the OOHOC Index

We close this section on the new opportunity cost approach by noting some of its desirable features:

- In the post 2002 period, the Diewert variant (DV) user cost, which is one of the two components of the new opportunity cost approach for accounting for OOH in a consumer price index, would have risen in response to rising home prices, due to the prominent role played by the debt homeowners incurred to buy homes in the context of the steep run-up of home prices over the 2002-2005 time period.
- The DV user cost would not always track rents over periods like the post 2002 years when other evidence suggests that rents and the financial cost of OOH services were moving in opposite directions. More generally, there are strong reasons why the home rental and owner occupied housing services markets can, and often have, displayed quite different price behaviour. Under some conditions, formula (5-9) would also apply to the owner of a rental property who is thinking about what rent to set. In real life circumstances, however, we would expect that landlords will tend to treat sunk costs and year-to-year supply and demand conditions differently than owner occupiers. A landlord who builds or buys a rental property will want to set rents at least equal to the user cost. However, once the property is built or bought, the cost is sunk and supply and demand factors for rental properties may cause the market rents to diverge from the expected user costs. Evidence of this factor at work includes, in our view, cycles in the construction of rental units; when the user costs of landlords exceed market rents, new rental property construction slumps, and vice versa when the user costs of landlords are below current market rents.
- The problem of negative user costs would be eliminated, since the rental equivalent is the minimum value the new opportunity cost measure could take on for any given home.
- The new opportunity cost index would be far less volatile than the user cost measure investigated by Verbrugge (2008) and by Garner and Verbrugge (2009). One reason for the lower volatility is the use of the rental equivalent as a minimum for the opportunity cost for any one home. A second reason is the use of appreciation rates averaged over the expected number of future years the owner occupier will own and live in a home. And a third reason is the way in which debt is brought into the new measure.

6. Concluding Remarks

Our first main objective in this paper is to call attention to the need for more direct measures of inflation for owner occupied housing services. Our second main objective is to suggest a new approach -- the opportunity cost approach -- for accounting for OOH services in consumer price indexes.

In their paper, “Can Measurement Error Explain the Productivity Paradox?” Diewert and Fox (1999) write:

> "We believe that economic mismeasurement in general can help to explain the post-1973 productivity growth decline in OECD countries." (p. 3)

We believe that time and research will eventually prove that the above Diewert-Fox diagnosis of the post-1973 productivity growth decline applies, with different specifics, to the post housing bubble period. We believe that, in the context of strong and poorly measured inflation in the market for owner occupied housing, households, financial institutions, pension and other fund managers of many types, and regulators all were prone to making erroneous predictions that, in many cases, led to serious losses of economic value.

Farlow (2005) ventures the observation that house price booms, just like government budget deficits, are popular with older consumers and governments, both of which may benefit from 'borrowing' from future generations. In other words, Farlow suggests that some of those charged with management of the economy and some businesses and consumers stood to gain from, and hence may have welcomed, the price signal confusion caused by poor official statistics measures of OOH inflation.

However, it is clear by now that many people were greatly harmed by the steep rise and then collapse of housing prices in the post 2002 period. In addition to all the foreclosures, many of those having to switch from owned to rental housing following the burst of the bubble suffered, or will suffer, large losses. According to the Harvard Center for Housing Studies (2008), the owner occupiers who switch to renting mostly do so as part of coping with marriage breakdowns, job losses, and health problems (including age related disability conditions). Homeowners in the bottom income quartile were found to be three times more likely than those in the top income quartile to switch from owning to renting.[30]

Mishkin (2007b) argues that central banks with supervisory authority can reduce the likelihood of bubbles forming through prudential supervision of the financial system. But Girouard, Kennedy, van den Noord and André (2006) suggest that the reaction of central bankers to housing price inflation will necessarily usually depend on the treatment of housing costs in the inflation measures being used by central banks. Among other reasons, the official mandates of central banks typically focus on managing *measured* inflation.

In the past, house price bubbles tended to be mostly local. However, the central bank task of controlling housing market inflation has taken on international importance by now. Though there is little international trade in housing services, housing is part of household wealth which also comprises internationally traded assets. The IMF (2004, chapter 2) concludes that house prices became relatively more synchronized beginning in the 1990s. Estrella (2002) points out that a higher level of securitization linked the mortgage market more closely to broader capital markets. Shiller (2007) writes that, "While home price booms have been known for centuries, the recent boom is unique in its pervasiveness." If separate CPI components for rental and owner occupied housing were monitored on an ongoing basis, this would help identify aberrant housing market conditions.

Barack Obama and Joe Biden (2008, p. 13) have pledged to give the Federal Reserve greater oversight over a broader array of financial institutions. They write that the nature of such oversight should be commensurate with the degree and extent of taxpayer exposure and should

[30] See also Wolff and Zacharias (2008) regarding damage to lower income households with loans secured against their homes.

include liquidity and capital requirements. We believe that an important addition to this pledge should be to give the BLS, BEA and Census Bureau the funds and the mandate to aggressively develop proper measures of inflation for owner occupied housing services.

Central banks and national governments, in fact, already have many policy instruments at their disposal that they could use, in the future, to control inflation in housing markets. What they lack are appropriate *measures* of inflation in the market for owner occupied housing services. The proposed new opportunity cost measure builds on the achievements of the U.S. official statistics system in producing a high quality rental equivalence measure. Augmenting this measure as proposed for the new opportunity cost approach for accounting for OOH in a CPI will not be simple or cheap. However, the current financial crisis makes it clear that the costs of *not* having an adequate measure for inflation in the cost of owner occupied housing services can be far greater.

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