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Owner Occupied Housing

Notes on the Treatment of Housing in the National Accounts and the ICP

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1. Introduction

Derek Blades (2009) has written an excellent overview of the problems associated with the measurement of housing services in ICP (International Comparison Program) 2005 and he provided a road map for the way forward for ICP 2011. I am in general agreement with his analysis and his suggested way forward. However, he does not discuss one important aspect associated with the valuation of residential housing services which is that housing services are made up of *two main components*: the services of the structure and the services of the land which lays under the structure and surrounds it. Thus his discussion of housing services implicitly focuses on structure services and does not discuss the problems associated with the valuation of land services. It seems useful to review some of the recent theories which deal with this composite good problem and look at possible ways of moving forward in the next ICP round.

There are two generally accepted methods for valuing the services of Owner Occupied Housing (OOH): the *rental equivalence method* and the *user cost method*. The rental equivalence method values OOH services by the market rent that could be obtained for the dwelling unit. The user cost method for valuing OOH services looks mainly at the financial opportunity costs associated with owning and living in the dwelling unit.

In section 2, we will briefly review user cost theory for a general consumer durable.

In section 3, we consider the specific problems associated with constructing user costs for a dwelling unit. These user costs are more complicated than garden variety user costs for two reasons: (i) dwelling units tend to be *unique goods* and so finding the price of a corresponding comparable new dwelling unit may not be an easy task and (ii) as mentioned above, the services of a dwelling unit are really a *composite* of structure services and land services.

In section 4, we note that there is a third approach to the valuation of OOH services: namely, the *opportunity cost approach*. In this approach, the opportunity cost is set equal to the *maximum* of the rent that the property could generate and the user cost. In this section, we discuss the circumstances under which rent is equal to user cost and hence is equal to opportunity cost.

In section 3, we suggested that the value of a residential property can be decomposed into the sum of a structures part and a land part. In section 5, we indicate that a hedonic regression on readily available real estate data can accomplish this decomposition.

In section 6, we note that the problems associated with constructing housing price comparisons are more difficult in the context of across country comparisons than they are in the context of normal time series comparisons for dwelling units within a country.

Finally, in section 7, we draw on the material in the previous sections to suggest a way forward to make better international comparisons of housing services for ICP 2011.

2. Durable Consumer Goods and User Cost Theory

In this section, we lay out the elements of user cost theory for a durable consumer good. The essence of durability is that it provides some sort of service for the purchasing household over many accounting periods. Thus for many purposes (including the valuation of household consumption expenditures on owner occupied housing services), it is not appropriate to charge the entire purchase cost of the durable to the initial period of purchase. Thus it is appropriate to spread the purchase cost over the useful life of the durable good. The question is: how exactly should this intertemporal cost allocation be done?

As mentioned in the introduction, there are two main approaches to pricing the period by period services of an owner occupied dwelling unit: the *rental equivalence approach* and the *user cost approach*. The user cost approach is important in its own right (i.e., when only a few dwelling units in a country are rented, it is not possible to value the services of Owner Occupied Housing (OOH) using the rental equivalence approach) but it also is important as a way to explain how landlords might set their rents for rental dwelling units. However, pricing the services of houses is more difficult than pricing the services of say a standard model automobile or a piece of furniture because housing services are much more complex.¹ Thus in this section, we will first look at the problems of pricing the services of an *ordinary consumer durable good* (that is available in the marketplace in the same form over many periods) before tackling the complexities of housing in the following section.

The user cost approach to the treatment of durable goods is in some ways very simple: it calculates the cost of purchasing the durable at the beginning of the period, using the services of the durable during the period and then netting off from these costs the benefit that could be obtained by selling the durable at the end of the period, taking into account the interest forgone in tying up one's capital in purchasing the durable. However, there are several details of this procedure that are somewhat controversial. These details involve the treatment of depreciation, interest and capital gains or holding gains.

Another complication with the user cost approach is that it involves making distinctions between current period (flow) purchases within the period under consideration and the holdings of physical stocks of the durable at the beginning and the end of the accounting period. Normally in the System of National Accounts, all prices and quantity purchases are thought of as taking place at a single point in time, say in the middle of the period

¹ In particular, housing services provide the joint services of the structure and the land that the structure sits on which is one complication and another major complication is that houses are generally unique goods.

under consideration, and consumption is thought of as taking place within the period as well. Thus, in this case where the commodity is entirely consumed within the purchasing period, there is no need to consider the valuation of stocks of consumer durables that households may have at their disposal. The rather complex problems involved in accounting for stocks and flows are unfamiliar to many price statisticians and so it may be useful to describe these problems in some detail.

To determine the net cost of using a particular durable good during say period 0, assume that one unit of the durable good is purchased at the beginning of period 0 at the price P^0 . The “used” or “second-hand” durable good can be sold at the end of period 0 at the price P_S^1 . It might seem that a reasonable net cost for the use of one unit of the consumer durable during period 0 is its initial purchase price P^0 less its end of period 0 “scrap value” or market opportunity selling price, P_S^1 . However, *money received at the end of the period is not as valuable as money that is received at the beginning of the period*. Thus in order to convert the end of period value into its beginning of the period equivalent value, it is necessary to *discount* the term P_S^1 by the term $1+r^0$ where r^0 is the beginning of period 0 nominal interest rate that the household faces. Hence *period 0 user cost* u^0 for the consumer durable² is defined as

$$(1) u^0 \equiv P^0 - P_S^1/(1+r^0) .$$

There is another way to view the user cost formula (1): the consumer purchases the durable at the beginning of period 0 at the price P^0 and charges himself or herself the rental price u^0 . The remainder of the purchase price, I^0 , defined as

$$(2) I^0 \equiv P^0 - u^0$$

can be regarded as an *investment*, which is to yield the appropriate opportunity cost of capital r^0 that the consumer faces. At the end of period 0, this rate of return could be realized provided that I^0 , r^0 and the selling price of the durable at the end of the period P_S^1 satisfy the following equation:

$$(3) I^0(1+r^0) = P_S^1 .$$

Given P_S^1 and r^0 , (3) determines I^0 , which in turn, given P^0 , determines the user cost u^0 via (2)³.

Thus the user cost approach to pricing the services of a durable good for a period has an investment aspect to it. Note that the user cost approach is also an *opportunity cost approach*; i.e., we take into account the opportunity cost of the financial capital that is tied up in the purchase (or continued holding) of the durable good. Finally, note that user costs are not like the prices of nondurables or services because the user cost concept involves pricing the durable at *two* points in time rather than at a single point in time. Because the user cost concept involves prices at two points in time, money received or

² This approach to the derivation of a user cost formula was used by Diewert (1974) who in turn based it on an approach due to Hicks (1946; 326). Note that we will later interpret this user cost as a beginning of the period user cost since all costs are discounted to the beginning of the period.

³ This derivation for the user cost of a consumer durable was also made by Diewert (1974; 504).

paid out at the first point in time is more valuable than money paid out or received at the second point in time and so *interest rates* creep into the user cost formula.

Because the user cost concept involves prices at two points in time, *expected prices* can be involved if the user cost is calculated at the beginning of the period under consideration instead of at the end. Thus the price statistician has two options for the choice of P_S^1 :

- Use the *expected price* of the durable at the end of the period from the perspective of the beginning of the period or
- Use the *actual market price* of a similar second hand durable at the end of the period (if such a market price exists).

The use of an expected price leads to an *ex ante user cost* and the use of an actual market price for the used durable at the end of the period leads to an *ex post user cost*. Which concept should be used in practice? In the present context, we would argue for the use of the ex ante concept for two reasons:

- The ex ante user cost concept is likely to be closer to a rental price of the durable good (if it exists)⁴, which many price statisticians would regard as a preferred price for the services of the durable during the period and
- The ex ante user cost is closer to the purchaser's *expected cost* for using the durable during the period; i.e., the purchaser cannot know exactly what the end of period price will be and hence must form expectations about the end of period price of the durable, which leads to the ex ante user cost charge as the expected cost for using the services of the durable during the period. Thus the ex ante user cost is likely to be the charge for the services of the durable that motivates consumer behavior.

We will return to the issue of how exactly are we to form expectations for the selling price of a used durable later when we specifically discuss housing.

With all of the above complications, it is no wonder that many price statisticians would like to avoid the using user costs as a pricing concept. However, as we shall see, the use of user costs seems to be unavoidable in the context of making international comparisons of housing services.

The user cost formula (1) can be put into a more familiar form if the end of period 0 *economic depreciation rate* δ^0 and the period 0 *asset inflation rate* i^0 are defined. Define the end of period one *depreciation rate* δ^0 by:

$$(4) (1 - \delta^0) \equiv P_S^1/P^1$$

⁴ Thus if a company is in the business of leasing the services of an automobile for a certain period, that company has to form *expectations* about the price of its used autos at the end of the leasing period in order to calculate its schedule of rental or leasing prices for its stock of automobiles.

where P_s^1 is the price of a used asset at the end of period 0 and P^1 is the price of a new asset at the end of period 0.⁵ The *period 0 inflation rate* for the new asset, i^0 , is defined by:

$$(5) 1+i^0 \equiv P^1/P^0 .$$

Eliminating P^1 from equations (4) and (5) leads to the following formula for the end of period 0 used asset price:

$$(6) P_s^1 = (1 - \delta^0)(1 + i^0)P^0 .$$

Substitution of (6) into (1) yields the following expression for the *period 0 user cost* u^0 :

$$(7) u^0 = [(1 + r^0) - (1 - \delta^0)(1 + i^0)]P^0/(1 + r^0) .$$

Note that $r^0 - i^0$ can be interpreted as a period 0 *real interest rate* and $\delta(1+i^0)$ can be interpreted as an *inflation adjusted depreciation rate*.

The user cost u^0 is expressed in terms of prices that are discounted to the *beginning* of period 0. However, it is also possible to express the user cost in terms of prices that are “antidiscouted” or “appreciated” to the *end* of period 0.⁶ Thus define the *end of period 0 user cost* p^0 as:

$$(8) p^0 \equiv (1 + r^0)u^0 = [(1 + r^0) - (1 - \delta^0)(1 + i^0)]P^0 = [r^0 - i^0 + \delta^0(1 + i^0)]P^0$$

where the second equation follows using (7). If the real interest rate r^{0*} is defined as the nominal interest rate r^0 less the asset inflation rate i^0 and the generally small term $\delta^0 i^0$ is neglected, then the end of the period user cost defined by (8) reduces to⁷

⁵ If the durable that was purchased (or held) by the household at the beginning of the period was a used durable, then interpret P^1 as the second hand market price of a used durable that is in the same condition as the initially held durable.

⁶ Thus the beginning of the period user cost u^0 discounts all monetary costs and benefits into their dollar equivalent at the beginning of period 0 whereas p^0 accumulates or appreciates all monetary costs and benefits into their dollar equivalent at the end of period 0. This leaves open how flow transactions that take place within the period should be treated. Following the conventions used in financial accounting suggests that flow transactions taking place within the accounting period be regarded as taking place at the end of the accounting period and hence following this convention, end of period user costs should probably be used by the price statistician. For additional material on beginning and end of period user costs, see Diewert (2005; 485).

⁷ If we take the ratio of the approximate rental price for the durable good, p^0 , to its asset value, P^0 , we obtain the *rent to value ratio* $p^0/P^0 = r^{0*} + \delta^0$, which is equal to the sum of the appropriate *real interest rate* r^{0*} plus the appropriate depreciation rate δ^0 . Since real rates of interest and depreciation rates are approximately constant over time, the rent to value ratio will also be approximately constant over time and hence a historical rent to value ratio times a current asset price index will generally give an adequate approximation to an imputed rental rate for the consumer durable. In the housing literature, a rent to value ratio is often called a *capitalization rate*; e.g., see Garner and Short (2009; 237) or Crone, Nakamura and Voith (2009; 70).

$$(9) p^0 = (r^{0*} + \delta^0)P^0 .$$

Abstracting from transactions costs, it can be seen that the end of the period user cost defined by (9) is an *approximate rental cost*; i.e., the rental cost for the use of a consumer (or producer) durable good should equal the (real) opportunity cost of the capital tied up, $r^{0*}P^0$, plus the decline in value of a new asset over the period, δ^0P^0 . Formulae (8) and (9) thus cast some light on what are the economic determinants of rental or leasing prices for consumer durables.

If the simplified user cost formula defined by (9) above is used, then forming a price index for the user cost of a durable good is not very much more difficult than forming a price index for the purchase price of the durable good, P^0 . The price statistician needs only to:

- Make a reasonable assumption as to what an appropriate monthly or quarterly real interest rate r^{0*} should be;⁸
- Make an assumption as to what a reasonable monthly, quarterly or annual depreciation rate δ^0 should be;⁹
- Collect purchase prices P^0 for the durable and form the user cost.

There are some additional difficulties associated with the user cost approach to measuring the services of a consumer durable. The above discussion deals only with the formation of a user cost for a newly purchased consumer durable. It is necessary to extend the analysis to price out the services of used units of the consumer durable as well. In order to price out the services of a used durable good, it is necessary to make assumptions about the form of depreciation of the good; i.e., does the service flow that the good gives to the consumer remain constant throughout the useful life of the durable good or does it decline as the good ages? If the service flow remains constant, then we have *one hoss shay* or *light bulb depreciation* whereas if the service flow declines at a constant linear or geometric rate, then we have *straight line* or *geometric depreciation*. For descriptions of how to construct user costs by the age of the asset for each of these depreciation models, see Diewert and Lawrence (2000) or Diewert (2003) (2005; 506-521).

How can we tell whether we have one hoss shay or geometric depreciation for a particular consumer durable? The two patterns of depreciation (and user valuation) can be distinguished if we have *cross sectional information on rentals* of the consumer durable

⁸ This is not completely straightforward. It is difficult to determine exactly what the appropriate household nominal opportunity cost of capital should be and even if we come to agreement on this point, there will be difficulties in estimating expected inflation rates. In the end, it may boil down to picking a somewhat arbitrary real interest rate in the 2% to 5% range (for annual rates), depending on the recent experience of the country under consideration.

⁹ The geometric model for depreciation requires only a single monthly or quarterly depreciation rate. Other models of depreciation may require the estimation of a sequence of vintage depreciation rates. If the estimated annual geometric depreciation rate is δ_a , then the corresponding monthly geometric depreciation rate δ can be obtained by solving the equation $(1 - \delta)^{12} = 1 - \delta_a$. Similarly, if the estimated annual real interest rate is r_a^* , then the corresponding monthly real interest rate r^* can be obtained by solving the equation $(1 + r^*)^{12} = 1 + r_a^*$.

by the age of the rented asset. If there is one hoss shay depreciation, then the rental rates for the consumer durable at a given point in time should be approximately constant for all ages of the durable good whereas if there is geometric depreciation, then the rental rates for the good should decline at a geometric rate according to the age of the used durable good. Thus the various patterns of depreciation can in theory be distinguished if rental markets for used durables exist. In a similar fashion, if we have *cross sectional information on the prices of used units* of the consumer durable, then again alternative patterns of depreciation can be distinguished.¹⁰

3. The User Cost of Owner Occupied Housing

Owner occupied housing is different from a normal consumer durable good because it is an example of a *unique* consumer durable good so that it is difficult to use information on used asset prices in order to determine the pattern of depreciation, which is information that is required in order to form a user cost for an owned dwelling unit. A particular dwelling unit in a particular country is unique for a number of reasons:

- The *location* of each dwelling unit is unique and location will affect the price of the housing unit.
- Over time, the dwelling unit *depreciates*; i.e., unless there is one hoss shay depreciation, the utility that a particular dwelling generates for the occupying household will tend to decline over time due to the effects of the aging of the structure.
- On the other hand, the effects of depreciation can be offset by *renovation expenditures*, which increase the utility of the dwelling unit.

Thus over time, the services that a particular dwelling unit generates are not exactly comparable.

There is an additional complication: owner occupied housing is also an example of a *composite* good; i.e., two distinct commodities are bundled together and sold (or rented) at a single price. The two distinct commodities are:

- the structure and
- the land that the structure sits on and the land surrounding the structure.

The decomposition of housing into structure and land components is important for the System of National Accounts, since these two components are treated differently in the SNA. But it is also important for ICP purposes to distinguish the two components of

¹⁰ In the housing context where each house can be regarded as a unique asset, we need to make some additional assumptions in order to identify the form of depreciation. The extra assumptions are of the following type: it is assumed that all housing units in a certain class of structures have a similar pattern of depreciation. Using this type of assumption, empirical evidence suggests that one hoss shay depreciation is unlikely in the housing market since renters are generally willing to pay a rent premium for a new unit over an older unit of the same type. For empirical evidence of this age premium, see Malpezzi, Ozanne and Thibodeau (1987; 378) and Hoffman and Kurz (2002; 19).

housing services, since different countries will have different mixes of land and structures in their housing services consumption aggregate and thus it will be difficult to compare like with like across countries unless we control for the quantities of land and structures in the housing services aggregates in each country.

To model the fact that housing is a composite good situation, consider a particular newly constructed dwelling unit that is purchased at the beginning of period 0. Suppose that the purchase price is V^0 . This value can be regarded as the sum of a cost of producing the structure, $P_S^0 Q_S^0$, where Q_S^0 is the number of square meters of floor space in the structure and P_S^0 is the beginning of period 0 price of construction per square meter, and the cost of the land, $P_L^0 Q_L^0$, where Q_L^0 is the number of square meters of the land that the structure sits on and the associated yard and P_L^0 is the beginning of period 0 price of the land per square meter.¹¹ Thus at the beginning of period 0, *the value of the dwelling unit* is V^0 defined as follows:

$$(10) V^0 = P_S^0 Q_S^0 + P_L^0 Q_L^0 .$$

Suppose that the anticipated price of a unit of a new structure at the beginning of period 1 is P_S^{1a} and that the anticipated price of a unit of land at the beginning of period 1 is P_L^{1a} . Define the *period 0 anticipated inflation rates for new structures and land*, i_S^0 and i_L^0 respectively, as follows:

$$(11) 1 + i_S^0 \equiv P_S^{1a}/P_S^0 ;$$

$$(12) 1 + i_L^0 \equiv P_L^{1a}/P_L^0 .$$

Let δ^0 be the period 0 depreciation rate for the structure. Then the anticipated beginning of period 1 value for the structure and the associated land is equal to

$$(13) V^{1a} = P_S^{1a}(1 - \delta^0)Q_S^0 + P_L^{1a}Q_L^0 .$$

Thus the anticipated value of the dwelling unit at the end of period 1, V^{1a} , is equal to the anticipated price (per unit of new structure of the same quality) at the end of the period, P_S^{1a} , times one minus the period 0 depreciation rate, $(1 - \delta^0)$, times the quantity of structure purchased at the beginning of period 0, Q_S^0 ,¹² plus the anticipated price of land at the end of period 0, P_L^{1a} , times the quantity of land that the structure associated with the structure, Q_L^0 .

¹¹ If the dwelling unit is part of a multiple unit structure, then the land associated with it will be the appropriate share of the total land space.

¹² Thus the period 0 depreciation rate δ^0 is an *end of period anticipated cross sectional depreciation rate*; i.e., we define δ^0 by the equation $(1 - \delta^0) = V_S^{1a}/P_S^{1a}Q_S^0$, where V_S^{1a} is the anticipated market value of the (depreciated) structure at the end of period 0 and $P_S^{1a}Q_S^0$ is the anticipated end of period 0 value of a newly constructed structure with floor space area Q_S^0 .

Now calculate the cost (including the imputed opportunity cost of capital r^0)¹³ of buying the dwelling unit at the beginning of period 0 and (hypothetically) selling it at the end of period 0. The following *end of period 0 user cost or imputed rental cost* R^0 for the dwelling unit is obtained using (11)-(13):

$$\begin{aligned}
 (14) \ R^0 &\equiv V^0(1+r^0) - V^{1a} \\
 &= [P_S^0 Q_S^0 + P_L^0 Q_L^0](1+r^0) - [P_S^{1a}(1-\delta^0)Q_S^0 + P_L^{1a}Q_L^0] \\
 &= [P_S^0 Q_S^0 + P_L^0 Q_L^0](1+r^0) - [P_S^0(1+i_S^0)(1-\delta^0)Q_S^0 + P_L^0(1+i_L^0)Q_L^0] \\
 &= p_S^0 Q_S^0 + p_L^0 Q_L^0
 \end{aligned}$$

where separate period 0 *user costs of structures and land*, p_S^0 and p_L^0 , are defined as follows:

$$(15) \ p_S^0 = [(1+r^0) - (1+i_S^0)(1-\delta^0)]P_S^0 = [r^0 - i_S^0 + \delta^0(1+i_S^0)]P_S^0 ;$$

$$(16) \ p_L^0 = [(1+r^0) - (1+i_L^0)]P_L^0 = [r^0 - i_L^0]P_L^0 .$$

Note that the above algebra indicates some of the major determinants of market rents for rental properties.¹⁴ The user cost formulae defined by (15) and (16) can be further simplified if the same approximations that were made in section 2 above are made here (recall equation (9) above); i.e., assume that the terms $r^0 - i_S^0$ and $r^0 - i_L^0$ can be approximated by a real interest rate r^{0*} and neglect the small term δ^0 times i_S^0 in (15). Then the user costs defined by (15) and (16) simplify to:

$$(17) \ p_S^0 = (r^{0*} + \delta^0)P_S^0 ;$$

$$(18) \ p_L^0 = r^{0*}P_L^0 .$$

The above exposition of user cost theory has neglected two other sources of period 0 cost associated with owning a dwelling unit:

- Various maintenance and insurance costs that are associated with the ownership of a dwelling unit and
- Property taxes that may be payable by the owner to local or state governments.

We will assume that period 0 maintenance and insurance costs, M_S^0 , are mainly associated with the structure rather than the land under the structure. We suppose that these costs are paid at the end of period 0. These costs can be converted into a *per unit structure charge* μ_S^0 as follows:

$$(19) \ \mu_S^0 \equiv M_S^0/P_S^0 Q_S^0 .$$

¹³ More elaborate discussions on how to choose the appropriate opportunity cost of capital when the owner of a dwelling unit has a mortgage on the unit can be found in Diewert and Nakamura (2009), Diewert, Nakamura and Nakamura (2009) and Garner and Verbrugge (2009b; 176).

¹⁴ Looking at (16), it can be seen that the land user cost defined by this equation could be negative if the anticipated rate of land price appreciation, i_L^0 , is greater than the beginning of the period opportunity cost of capital, r^0 . We will discuss possible solutions to this complication below.

We suppose that the property taxes that fall on the structure, T_S^0 , and the property taxes that fall on the land under the structure, T_L^0 , are paid at the end of period 0. Then the period 0 structure and land property tax rates, τ_S^0 and τ_L^0 , can be defined as follows:

$$(20) \tau_S^0 \equiv T_S^0/P_S^0 Q_S^0; \tau_L^0 \equiv T_L^0/P_L^0 Q_L^0.$$

We need to add on these additional maintenance and property tax costs to our old imputed rental cost for using the dwelling unit R^0 . Thus (14) now becomes:

$$(21) R^0 \equiv V^0(1 + r^0) - V^{1a} + M_S^0 + T_S^0 + T_L^0 \\ = p_S^0 Q_S^0 + p_L^0 Q_L^0$$

where the new separate period 0 *user costs of structures and land*, p_S^0 and p_L^0 , are now defined as follows:

$$(22) p_S^0 = [r^0 - i_S^0 + \delta^0(1 + i_S^0) + \mu_S^0 + \tau_S^0]P_S^0;$$

$$(23) p_L^0 = [r^0 - i_L^0 + \tau_L^0]P_L^0.$$

Thus *the imputed rent for a dwelling unit* using the user cost approach to the valuation of housing services is made up of six main costs:

- The real opportunity cost of the financial capital tied up in the structure, $(r^0 - i_S^0)P_S^0 Q_S^0$;
- The real opportunity cost of the financial capital tied up in the land, $(r^0 - i_L^0)P_L^0 Q_L^0$;
- The depreciation cost of the structure, $\delta^0(1 + i_S^0)P_S^0 Q_S^0$;
- The maintenance and insurance costs associated with the structure, $\mu_S^0 P_S^0 Q_S^0$;
- The property taxes associated with the structure, $\tau_S^0 P_S^0 Q_S^0$ and
- The property taxes associated with the land underneath and surrounding the structure, $\tau_L^0 P_L^0 Q_L^0$.

The above user cost approach to pricing the services of a dwelling unit in period 0 can be applied to various *housing strata*; i.e., dwellings can be grouped into:

- detached dwellings;
- row houses or duplexes or town houses and
- apartment blocks.

For the last two types of dwelling units, the land component for each individual dwelling unit needs to be constructed; i.e., if there are 20 dwelling units in an apartment block, then the land share of each individual dwelling unit is only 1/20th of the total land area that the apartment block occupies.¹⁵

¹⁵ This is not completely straightforward to allocate the common land shared by the dwelling units into individual shares; i.e., instead of an equal division of the land, we could use the relative floor spaces of each apartment as the allocator. There are also problems associated with the relative height of the

Dwelling units should also be grouped according to their construction, which could be primarily:

- wood;
- brick;
- concrete or
- “traditional”.

If a country’s national statistical agency produces national balance sheet estimates for the country, then information on the total value of residential land and residential structures should be available. However, information on the total quantity of residential land may not be available although in the time series context, the quantity of residential land in use will typically not change much over time. Estimates of the country’s total real stock of residential structures can be obtained by deflating the balance sheet estimate of the value of residential housing by the country’s corresponding investment price deflator for residential housing. However, the resulting estimates of the real stock of residential structures for a country will not be suitable for ICP use because the *quality* of construction will differ markedly across countries. Thus for some countries, the majority of dwelling units will be traditional, whereas for other countries, most dwelling units will use primarily wood and other countries will use bricks or concrete as the primary building material. Thus in order to make meaningful across country comparisons in the ICP, it will be necessary to have estimates of the country’s housing stock broken down into strata that are at least somewhat homogeneous (and thus comparable) across countries. Obtaining estimates of country housing stocks in relatively homogeneous strata will be a challenge for ICP 2011.¹⁶

There are at least two uses for the above user cost approach to pricing the services of housing:

- The user costs can be compared to market rents for dwelling units that are actually rented during the period under consideration and
- The user costs can be used to value the services of owner occupied housing.

If user costs approximate market rents for dwelling units that are actually rented, then this will give us some confidence that user costs can be used to value the services of owner occupied dwelling units. As will be seen later in this section, it turns out that user costs do approximate market rents (in the US at least), provided expectations of future inflation in house prices are formed in a certain way and provided that we are dealing with lower quality housing strata.

individual apartment units; i.e., an apartment on a higher floor will typically rent for more than an apartment on a lower floor.

¹⁶ In constructing stock estimates for housing structures by strata for a country, it would be useful to have a common depreciation methodology across countries; i.e., should these housing stock estimates by strata be constructed using the one hoss shay model for depreciation or geometric or straight line depreciation?

As mentioned in the introduction, there are *two main methods for valuing the services of owner occupied housing* that have been suggested for national income accounting purposes:¹⁷

- The user cost approach just explained above and
- The rental equivalence approach.

The rental equivalence approach is straightforward; for owner occupied houses in a certain strata, we look for similar rented dwelling units in the same strata and impute the market rental to the corresponding owner occupied house. In many countries, the rental equivalence approach works well but it does not work well if rental markets are thin or if there are price controls on rents.

If user costs are used to value the services of owner occupied dwelling units in a country, then the maintenance and insurance rate term μ_S^0 in the user cost of structures formula (22) should be dropped from the formula, since maintenance and insurance expenditures for owner occupied houses will generally be captured elsewhere in the household expenditure accounts.

The simplified approach to the user cost of housing explained above in equations (17) and (18) can be further simplified by assuming that the ratio of the quantity of land to structures is fixed and so the aggregate user cost of housing is equal to $[r^{0*} + \delta + \mu + \tau]P_H^0$, where P_H is a quality adjusted housing price index that is applicable to the country's entire housing stock (including both structures and the underlying land) for the period under consideration and δ , μ and τ are respectively a depreciation rate, a maintenance and insurance rate and a property tax rate that applies to the composite of household structures and land. If we apply this simplified approach to value the services of owner occupied housing, then as was seen in the last paragraph above, we should drop the term μ from the simplified user cost. The resulting *simplified approach* is used by Iceland; see Gudnason (2003; 28-29) and Gudnason and Jónsdóttir (2009).¹⁸ This simplified approach is also used in some European countries; see the detailed exposition of the method by Katz (2009).¹⁹ A variant of this approach is used by the Bureau of Economic Analysis: Lebow and Rudd (2003; 168) note that the US national accounts imputation for the services of owner occupied housing is obtained by applying *rent to value ratios* for tenant occupied housing to the stock of owner occupied housing with the

¹⁷ Some additional approaches are discussed in Diewert (2002) and in Garner and Verbrugge (2009b) but they are not very satisfactory.

¹⁸ The real interest rate that is used is approximately 4% per year and the combined depreciation rate for land and structures is assumed to equal 1.25% per year. The depreciation rate for structures alone is estimated to be 1.5% per year. Property taxes are accounted for separately in the Icelandic CPI. Housing price information is provided by the State Evaluation Board based on property sales data of both new and old housing. The SEB also estimates the value of the housing stock and land in Iceland, using a hedonic regression model based on property sales data. The value of each household's dwelling is collected in the Household Budget Survey.

¹⁹ Katz (2009) and Garner and Verbrugge (2009b; 176) give further references to the literature on the simplified user cost method.

same characteristics as the rented property.²⁰ The rent to value ratio can be regarded as an estimate of the applicable real interest rate plus the depreciation rate plus a maintenance and insurance rate plus the property tax rate, $r^{0*} + \delta + \mu + \tau$.²¹

We return to the issue of how exactly should we estimate the real interest rate, r^{0*} . One possible method is to just make a reasonable guess:²²

“The remaining question was what value of the real rate of return is appropriate? Evidence was presented to the task force that suggested that, at least in Western European countries, the appropriate real rate of return for owner-occupied dwellings was lower than that for other durables, perhaps in the 2.5 to 3.0 percent range. It was the consensus of the task force that given the actual situation in the CCs [Candidate Countries from Eastern Europe], real rates of return on both dwellings and land should be assumed to be 2.5 percent.” Arnold J. Katz (2009; 46).

A second method is to use applicable mortgage interest rates as estimates for the nominal opportunity cost of financial capital tied up in housing and to use econometric forecasting techniques to estimate predicted house price inflation rates (and then the real interest rate can be set equal to the nominal interest rate less the predicted house price inflation rate). Several variants of this second approach have been implemented by Verbrugge (2008) and Garner and Verbrugge (2009a) (2009b) using US data. However, as these authors show, this approach was not successful, in that the resulting user costs were extremely volatile (and frequently negative) and not at all close to corresponding market rents.

A third approach to the determination of an appropriate real interest rate to be used in a user cost formula for housing services was implemented by Garner and Verbrugge (2009b) using US data. They used applicable mortgage interest rates as estimates for the nominal opportunity cost of financial capital and they used current period estimates of Consumer Price Index inflation as their estimate of expected house price appreciation. Much to their surprise, they found that the resulting user costs tracked market rents rather well.²³ Our conclusion at this point is that either making a reasonable guess for the real interest rate or using CPI inflation as a proxy for expected house price inflation will give rise to reasonable user costs that are likely to be fairly similar to market rents, at least for relatively inexpensive housing units.

It is evident that the main drivers for the user costs of structures and land are price indexes for new dwelling construction, P_S^t , and for residential land, P_L^t . Most statistical

²⁰ See also Crone, Nakamura and Voith (2009) and Garner and Short (2009; 237) for a description of this *capitalization method* for determining rental prices for housing units from estimates of the corresponding asset values. It can be seen that this method is actually a method for implementing the rental equivalence approach to valuing the services of owner occupied dwelling units.

²¹ If an owned dwelling unit has the value V^0 and a rented dwelling unit with the same characteristics has the rent to value ratio $\gamma = r^{0*} + \delta + \mu + \tau$, then the imputed rent for the owned dwelling unit is set equal to $(\gamma - \mu)V^0 = (r^{0*} + \delta + \tau)V^0$, since insurance and maintenance expenditures on the owned dwelling will be recorded elsewhere in the System of National Accounts.

²² The Australian Bureau of Statistics assumes a constant real interest rate equal to 4% per year when constructing its estimates of capital services.

²³ Using this approach, Garner and Verbrugge (2009b; 179) also found that there were no negative estimated user costs in their US data set.

agencies have a constant quality price index for new residential structures, since this index is required in the national accounts in order to deflate investment expenditures on residential structures. This index could be used as an approximation to P_S^t .²⁴ However, this index will not be suitable for purposes of making international comparisons because the average quality of the stock of residential construction will differ markedly across countries; i.e., when making time series comparisons of the price of residential construction, the average quality of the houses constructed will not change much over time but this conclusion does not hold for making cross country comparisons.

This completes our overview of the user cost approach to pricing residential housing services. In the following section, we will review another approach to pricing the services of Owner Occupied Housing which has been suggested recently: the *opportunity cost approach*.

4. The Opportunity Cost Approach to the Valuation of Owner Occupied Housing Services

As noted in the previous section, there are two main methods for valuing the services of Owner Occupied Housing:

- The rental equivalence approach and
- The user cost approach.

Thus using the rental equivalence approach, an owner of a dwelling unit who chooses to live in it (or at least not rent it out to someone else) values the services of the dwelling by the market rent which is foregone. This is a very *direct opportunity cost* of using the dwelling unit. On the other hand, the user cost approach to valuing dwelling services is basically a *financial opportunity cost* of using the services of the dwelling unit during the period under consideration. At the OECD-IMF Workshop on Real Estate Price Indexes held in Paris, November 6-7, 2006, Diewert suggested that the true opportunity cost of using the services of an owned dwelling unit is the *maximum of the rent foregone and the user cost*:

“We conclude this section with the following (controversial) observation: perhaps the ‘correct’ opportunity cost of housing for an owner occupier is not his or her internal user cost but the *maximum* of the internal user cost and what the property could rent for on the rental market. After all, the concept of opportunity cost is supposed to represent the *maximum sacrifice* that one makes in order to consume or use some object and so the above point would seem to follow.” W. Erwin Diewert (2009; 113).

Diewert and Nakamura (2009) pursued this opportunity cost approach to the valuation of Owner Occupied Housing services in more detail but it can be seen that this approach seems to be a valid one. Moreover, it has the advantage of eliminating the problem that the user cost approach by itself has: namely, that the user cost approach can generate *negative* user costs if ex post or forecasted housing inflation rates are used in the user cost formula..

²⁴ This index may only be an approximation since it covers the construction of rental properties as well as owner occupied dwellings.

In practice, the opportunity cost approach to pricing OOH services may not be all that different from the rental equivalence approach, provided that expected inflation in the user cost formula is set equal to CPI inflation, since Garner and Verbrugge (2009b) show that for most low end rental properties, the rental equivalence and user cost approaches give much the same answer, at least in the US. However, there is some evidence that user costs may be considerably higher than the corresponding market rentals for high end properties. The following Table 1 is taken from Heston and Nakamura (2009a; 113) (2009b; 277) and it shows average market rent to market value of rental properties in various regions; i.e., it shows capitalization ratios as a function of the value of the rental property. Table 1 is based on a survey of US federal government employees conducted as part of a Safe Harbor process regarding the Cost of Living Allowance (COLA) program administered by the United States Office of Personnel Management. This program began in 1948 and pays an allowance above the federal salary schedule in three geographic areas²⁵ (Alaska, the Caribbean and the Pacific) based on prices in these COLA areas relative to the Washington D.C. housing area.

Table 1. Estimated Rent to Value Ratios as Percentages (Capitalization Ratios)

Value(\$)	Renter			
	Alaska	Wash D.C.	Carib	Hawaii-Pacific
	(1)	(2)	(3)	(4)
50,000	13.0	8.9	6.3	6.9
100,000	12.0	8.2	5.8	6.4
200,000	10.2	6.9	4.9	5.4
500,000	6.2	4.3	3.0	3.3

Two facts emerge from the above Table:

- Capitalization ratios differ substantially across regions²⁶ and
- As we move from inexpensive properties to more expensive properties, the capitalization ratio for the high end properties is about one half the ratio for low end properties for all regions.

The second point listed above also emerges from the much more extensive US data on annual rents for the years 2004-2006 as a function of the corresponding home values that may be found in Figure 1 in Garner and Verbrugge (2009b; 178). For a \$100,000 home, the corresponding average annual rent was about \$10,000 whereas for a \$900,000 home, the corresponding average annual rent was about \$30,000. Thus the capitalization ratio

²⁵ This program is directed at comparing the costs of living for federal employees in the non-continental United States to Washington D.C. area. Housing is one of the most important and most difficult of the comparisons required under this program. The COLA areas include Alaska, Guam, Hawaii, Puerto Rico, and the U.S. Virgin Islands: a very diverse range of climates and housing needs.

²⁶ The relatively high capitalization ratios for Alaska may be due to the inclusion of heating services in the rent.

fell from about 10% to about 3.3% as the home value increased from \$100,000 to \$900,000.

What factors could explain this dramatic drop in the capitalization ratio as we move from inexpensive properties to more expensive properties? As was indicated in the previous section, the rent to value ratio can be regarded as an estimate of the applicable real interest rate plus the depreciation rate plus the property tax rate, $r^{0*} + \delta + \mu + \tau$, and these rates should not be all that different for properties of differing value. There are at least three possible explanations:

- High value properties may have a much higher proportion of land and hence the depreciation rate δ , regarded as a decline in value of the property due to aging of the structure, will be smaller as the land to structure ratio increases.²⁷
- A substantial fraction of a landlord's monitoring, accounting and billing expenses may be in the nature of a fixed cost and hence these costs will drop as a fraction of the rent as the value of the property increases.²⁸
- Rentals of high value residential properties are not made on a commercial basis; i.e., they may be made on a temporary basis, with the renters serving as "house sitters", and thus, they pay somewhat subsidized rents as compared to the owner's financial opportunity cost.

It seems unlikely that the imperfect determination of the depreciation rate can explain the dramatic decline in capitalization ratios as the value of the property increases due to the fact that estimates of housing depreciation rates are generally in the 1 to 2% per year range.²⁹ These depreciation rates are too low to fully explain the declines in the capitalization ratios. Similarly, the costs of maintaining and insuring a rental property that are collected in the term μ are likely to be relatively small and thus are unlikely to fully explain the phenomenon. Thus it may be that the third explanation is an important explanatory factor. If this is indeed the case, then the opportunity cost approach to the valuation of OOH services would give a much higher valuation to OOH services than the rental equivalence approach. This observation should be kept in mind when making international comparisons of housing services across countries.³⁰

The above material shows that it is of some importance to be able to distinguish the value of residential land from the value of residential housing structures, since depreciation, insurance and maintenance expenditures apply primarily to the structures part of property and not to the land part. In the following section, we show how estimates of these two

²⁷ This explanation was suggested by Garner and Verbrugge (2009b; 182).

²⁸ Thus the maintenance and insurance term μ falls as the value of the property increases. This explanation was made in Diewert (2003).

²⁹ Garner and Verbrugge (2009b; 176) and Garner and Short (2009; 244) assume that annual depreciation rates (as fractions of the value of the property including both structures and land) is 1% per year.

³⁰ Thus the discrepancy between the rental equivalence approach to the valuation of OOH services and the opportunity cost approach may not be very important in the time series context because both measures may move in tandem. But in the context of making international comparisons, this argument will not be applicable due to the fact that the percentage of owner occupied dwelling units differs substantially across countries.

value aggregates, along with the corresponding quantity or volume aggregates, can be obtained using a hedonic regression approach to real estate sales of residential properties.

5. The Decomposition of Residential Property Values into Land and Structures Components using a Hedonic Regression Model

Diewert (2009; 105-106) suggested some possible hedonic regression models that would lead to additive decompositions of an overall property price into land and structures components. Diewert, Haan and Hendriks (2010) implemented this approach with a few modifications using some Dutch real estate sales data.³¹ We will briefly outline this approach.

If we momentarily think like a property developer who is planning to build a structure on a particular property, the total cost of the property after the structure is completed will be equal to the floor space area of the structure, say Q_S square meters, times the building cost per square meter, β say, plus the cost of the land, which will be equal to the cost per square meter, α say, times the area of the land site, Q_L . Now think of a sample of properties of the same general type of construction, which have prices v_n^t in period t ³² and structure areas $Q_{S_n}^t$ and land areas $Q_{L_n}^t$ for $n = 1, \dots, N(t)$, and these prices are equal to costs of the above type plus error terms η_n^t which we assume have means 0. This leads to the following hedonic regression model for period t where α^t and β^t are the parameters to be estimated in the regression:³³

$$(24) v_n^t = \alpha^t Q_{L_n}^t + \beta^t Q_{S_n}^t + \eta_n^t; \quad n = 1, \dots, N(t); t = 1, \dots, T.$$

Note that the two characteristics in the above very simple model are the quantities of land $Q_{L_n}^t$ and the quantities of structure $Q_{S_n}^t$ associated with the sale of property n in period t and the *two constant quality prices* in period t are the price of a square meter of land α^t and the price of a square meter of structure floor space β^t . Finally, note that separate linear regressions can be run of the form (24) for each period t in the sample of sales.³⁴

³¹ Another recent study that attempted to implement Diewert's hedonic approach to the separation of the land and structures components of housing is Statistics Portugal (2009). This is a very interesting paper but their implementation of Diewert's approach was not successful whereas the implementation made by Diewert, Haan and Hendriks (2010) was successful, perhaps due to the fact that the latter paper allowed for depreciation of the structure part of the property and DHH also imposed some monotonicity restrictions which led to sensible estimates for the price of land and structures.

³² Note that we have labeled these property prices as v_n^0 to emphasize that these are *values* of the property and we need to decompose these values into two price and two quantity components, where the components are land and structures.

³³ In order to obtain homoskedastic errors, it would be preferable to assume multiplicative errors in equation (24) since it is more likely that expensive properties have relatively large absolute errors compared to very inexpensive properties. However, we think that it is preferable to work with the additive specification (24) since we are attempting to decompose the aggregate value of housing (in the sample of properties that sold during the period) into additive structures and land components and the additive error specification will facilitate this decomposition.

³⁴ Note that a time dummy approach to a hedonic regression model would not be suitable in this context because we expect that the price of land and structures will move differently over time.

The hedonic regression model defined by (24) is the simplest possible one but it is a bit too simple since it neglects the fact that older structures will be worth less than newer structures due to the depreciation of the structure. Thus suppose in addition to information on the selling price of property n at time period t , v_n^t , the land area of the property Q_{Ln}^t and the structure area Q_{Sn}^t , we also have information on the age of the structure at time t , say A_n^t . Then if we assume a straight line depreciation model, a more realistic hedonic regression model than that defined by (24) above is the following model:

$$(25) v_n^t = \alpha^t Q_{Ln}^t + \beta^t (1 - \delta^t A_n^t) Q_{Sn}^t + \eta_n^t ; \quad n = 1, \dots, N(t); t = 1, \dots, T$$

where the parameter δ^t reflects the (straight line) *depreciation rate* as the structure ages one additional period. Thus if the age of the structure is measured in years, we would expect δ^t to be between 1 and 2%.³⁵ Note that (25) is now a nonlinear regression model whereas (24) was a simple linear regression model. Both models (24) and (25) can be run period by period; it is not necessary to run one big regression covering all time periods in the data sample. The period t price of land will be the estimated coefficient for the parameter α^t and the price of a unit of a newly built structure for period t will be the estimate for β^t . The period t quantity of land for property n is L_n^t and the period t quantity of structure for property n , expressed in equivalent units of a new structure, is $(1 - \delta^t A_n^t) Q_{Sn}^t$ where Q_{Sn}^t is the floor space area of property n in period t .

Diewert, Haan and Hendriks (2010) implemented the above model (25) using real estate sales data on the sales of detached houses for a small city (population is around 60,000) in the Netherlands, City A, for 10 quarters, starting in January 1998.³⁶ The resulting parameter estimates for the price of land and structures (and the depreciation rate) were not credible. However, when the model was rerun with restrictions that did not allow the price of land or structures to fall in any quarter,³⁷ the resulting estimates for the quarterly land and structures prices and the depreciation rate were very reasonable. The same restricted model was rerun using monthly data for the same period and very similar results were obtained.

The tentative conclusion that we can draw from the recent work of Diewert, Haan and Hendriks is that it is possible to use real estate agency data on sales of homes in order to determine reasonable estimates of the value of land and structures separately in a region or country along with a corresponding net depreciation rate³⁸ for the structures. However, real estate data on sales of homes will be required for a number of years in order to obtain reliable estimates.

³⁵ This estimate of depreciation will be an underestimate of “true” structure depreciation because it will not account for major renovations or additions to the structure.

³⁶ Actually, a generalization of (25) was run that allowed for possible nonlinearity in the price of land as the lot size changed.

³⁷ It was known that there was a property boom in the Netherlands during this period.

³⁸ The estimated depreciation rate will only be a net depreciation rate; i.e., we need to add to this net rate an additional rate that reflects an estimate of average annual housing renovation expenditures in order to obtain the gross depreciation rate, which is the correct rate to use in a user cost formula.

6. Implications for the ICP

Given the above review of methods for valuing the services of owner occupied housing, what are the implications for comparing housing services across countries in ICP 2011?

The first implication is that we need to work closely with the national statistical agencies in the countries participating in 2011 round of the International Comparisons Program in order to determine exactly how they form their estimates for the services of Owner Occupied Housing. Blades (2009) presented fairly convincing evidence that many countries are not measuring housing services well at present in their own System of National Accounts. Thus I agree with Blades that it would be useful for the ICP to suggest a *common methodological approach* to the valuation of housing services in the SNA and for Owner Occupied Housing services in particular. As indicated in the above sections, one can estimate the value of OOH services using either the rental equivalence method or the user cost method. Blades noted that for many countries, the user cost method was the only realistic method that could be applied:

“When too few dwellings were rented or when those that were rented were only located in a few parts of the country or when they were mainly rented by expatriate workers, it was recommended that rents for owner-occupiers should be estimated by the user-cost method.” Derek Blades (2009; 8).

In order to apply the user cost method to value the services of OOH, we first require an estimate of the total value of OOH for the country under consideration for the reference year. This is *Problem 1*: such estimates may not exist.

Assuming that we have an estimate for the *value* of the *stock* of Owner Occupied Housing for the country c in the reference year, say V^c , then the super simplified approach to the user cost of housing explained above in section 3 tells the aggregate *value* of OOH *services* is equal to $[r^{0*} + \delta + \tau]V^c$, where r^{0*} is an appropriate real interest rate, δ is an appropriate composite depreciation rate that applies to both residential land and structures and τ is a property tax rate that applies to the composite of household structures and land. *Problem 2* is that it may be difficult to choose the appropriate rates r^{0*} , δ and τ .³⁹

Now we encounter *Problem 3*; namely that housing services are a *composite* of structure and land services. This composite good problem is not such a big problem in the time series context since the ratio of housing land to housing structures does not change very much over time but in the context of international comparisons, it will be a big problem since the ratio of residential land value to residential structure value will differ enormously across countries. Thus the above simplified user cost approach to valuing the services of OOH will not work well in the international context, since we will not be comparing like with like when the residential structures-land ratio differs across countries. To deal with this problem, we need to decompose the aggregate value of the OOH stock, V^c , into the sum of a land component, V_L^c , and a structures component, V_S^c . In addition,

³⁹ This is not likely to be a huge problem in the end.

we require estimates of the total quantity of OOH residential land, say Q_L^c , and the total quantity of structures, say Q_S^c , where these quantities are measured in square meters of residential land and of residential floor space, where the floor space estimates are quality adjusted for depreciation; i.e., these quantities are measured in units of newly constructed floor space. Once we have estimates for V_L^c , V_S^c , Q_L^c and Q_S^c , we can calculate the corresponding stock prices for land and structures, P_L^c and P_S^c , as follows:

$$(26) P_L^c \equiv V_L^c/Q_L^c ; P_S^c \equiv V_S^c/Q_S^c.$$

The corresponding user costs for the services of OOH structures and land services, p_S^c and p_L^c can be obtained by adapting (22) and (23) to the cross country context:⁴⁰

$$(27) p_S^c = [r^c - i_S^c + \delta^c(1 + i_S^c) + \tau_S^c]P_S^0 \cong [r^{c*} + \delta^c + \tau_S^c]P_S^0$$

$$(28) p_L^c = [r^c - i_L^c + \tau_L^c]P_L^0 \cong [r^{c*} + \tau_L^c]P_L^0$$

where r^c is an appropriate (nominal) opportunity cost of capital tied up in residential housing in country c during the reference year, i_S^c and i_L^c are appropriate anticipated inflation rates for residential structures and residential land in country c , δ^c is an appropriate (gross) depreciation rate for structures in country c and τ_S^c and τ_L^c are appropriate country c property tax rates on the value of residential structures and land in country c during the reference year. The approximate equalities in (27) and (28) replace the terms $r^c - i_S^c$ and $r^c - i_L^c$ by a real interest rate r^{c*} and the small term $\delta^c i_S^c$ in (27) is ignored in the approximate equality in (27). Thus if we can form estimates for all of the above variables, then the price and quantity of residential structures services in country c for the reference year will be p_S^c and Q_S^c and the price of residential land services in country c will be p_L^c and Q_L^c . *It is likely that the quality of housing services comparisons across countries will be higher if we decompose the owner occupied housing services Basic Heading into two subheadings: structure services and residential land services.* As noted in the previous section, it seems to be possible to break the value of the residential housing stock into sensible land and structures components and if this can in fact be done, then the above recommended treatment of OOH housing services into two components could be implemented. In principle, the same decomposition of residential housing rents into the sum of a structures component and land component should be done for residential rents⁴¹ and then comparisons across countries could be made comparing these separate components. However, it may be that the proportion of land in rented dwelling units is so small that it is not necessary to carry out this refinement.

The above material raises an issue for the ICP; i.e., should we try to implement this decomposition approach to housing services for the next round of the ICP?

There is one remaining problem which needs to be discussed and it is a big one. The above discussion implicitly assumes that the *quality of construction* for residential

⁴⁰ Note that we have dropped the term μ_S^0 which was present in (22) from (27) since maintenance and insurance expenditures on OOH are typically captured elsewhere in the SNA.

⁴¹ The same hedonic regression model that was explained in the previous section could be used in the rent context as well with market rents replacing the selling price of the property.

properties is the same across countries; i.e., one square meter of residential construction in a highly developed country is roughly equivalent in quality to one square meter of construction of a “traditional” dwelling unit in a less developed country. This implicit assumption is obviously false. Thus our *Problem 4* is how can we adjust for differences in the average quality of structures across countries?⁴² This is not a huge problem in the time series context because the average quality of structures within a region or country does not change much going from one time period to the next. But in the international context, differences in average quality can be massive. In principle, this problem can be dealt with by stratification of the housing stock into cells where the quality of construction is relatively homogeneous. Thus as was noted in section 3 above, dwelling units could be grouped according to their construction, which could be primarily:

- wood;
- brick;
- concrete or
- “traditional”.

Dwelling units could also be grouped according to their general type; i.e., dwellings could be grouped into:

- detached dwellings;
- row houses or duplexes or town houses and
- apartment blocks.

Even with the above very coarse classifications, we would have 4 times 3 or 12 types of housing. Thus the value of a country’s existing residential housing stock would need to be decomposed into a fairly large number of housing types that would be roughly comparable across countries. Then we would require estimates for the values of the stocks of the various types of housing for each country in the reference year along with either prices or depreciation adjusted quantities for each type of housing—a rather big task. If complete price and quantity information for each housing stratum (both for land and structures in the stratum) could be built up for all countries in a region, then the EKS multilateral method could be used in order to construct housing PPPs across the countries in the region. A less accurate method could be used which would require less information. This less accurate method would attempt to construct builder’s prices per meter squared for each type of dwelling unit (in our strata of types of dwelling units) in a particular country for those strata which actually exist in the country. These country prices for individual types of housing could then be used as item prices in a Country Product Dummy regression which would construct housing PPPs across countries for the structures part of residential housing. These stratified builder’s prices would presumably tie in with the country’s construction prices; i.e., we could attempt to integrate the

⁴² We might also think about making adjustments for the average quality of land across countries. At this stage of our knowledge, I do not think we should attempt adjustments for the quality of land across regions and countries. There is no agreed upon list of quality determining factors so any adjustments would be somewhat arbitrary.

collection of construction price statistics across countries with the construction of residential housing PPPs.

The above four practical problems would need to be solved in an operational manner in time for the next ICP round. It would not be an easy task to do this but it would not be an impossible task.

The most controversial aspect of the measurement agenda that is outlined above is the suggestion that rents and housing asset values be decomposed into structural and land components. Suppose that this decomposition is not undertaken but we do have information by country on residential asset values by say 12 types of housing. Then the simplified user cost approach outlined in section 3 could be applied to each of these strata without too much difficulty. The resulting cross country comparisons of housing services would be quite meaningful, provided that the average ratio of land quantity to structure quantity is approximately constant across countries within each of these strata. It may be that lack of information on land area by type of construction will force us to use this simplified user cost approach.

7. The Way Forward

The discussion in the previous section lists the problems but does not offer a clear way forward. For the sake of having a concrete discussion on how to proceed, I will suggest a possible path forward.

1. Calculate an estimate of the total value of the residential housing structures stock using national information on investment in residential structures. The usual perpetual inventory method would be used to construct this estimate.⁴³ For less developed countries, I agree with Blades (2009) that rough and ready opportunity cost estimates should be made for the value of “traditional” dwelling units. Country experts within the World Bank or national statistical agencies for the countries would construct these estimates.
2. Calculate an estimate of the country’s total value (both land and structures) of the residential housing stock at the middle of 2010 (or whatever point in time we want our ICP comparisons to take place conceptually). This information may be readily available from the country’s national balance sheets. However, most countries do not have national balance sheets so in this case, it will be necessary to for the World Bank in conjunction with national statistical agencies to form estimates of the total value of the housing stock. This might be done by using information on property tax assessments or by using real estate sales data on individual properties and forming national estimates of the value of residential property. This task is probably the most challenging one.
3. From step 1 above, we obtain an estimate of the value of structures for country c , say V_S^c for the reference year. From step 2 above, we obtain an estimate of the total value of the housing stock including land for country c , say V_H^c . Using these two estimates, we can form an estimate of the value of residential land by

⁴³ The depreciation rates assumed for this exercise should be used in the subsequent user costs.

- subtraction; i.e., we have the imputed value of residential land for country c , V_L^c , equal to $V_H^c - V_S^c$. For step 3, we need to form an estimate of the area occupied by residential land in country c , say Q_L^c . Forming this estimate will be another challenging task. If data on housing sales are available for the country, then this information can be used to form estimates for the total quantity of residential land in square meters. Other methods of estimation could be used. This will be another important task for the World Bank in conjunction with national statistical agencies.
4. Once estimates for the value of residential land by country, V_L^c , and for the quantity of residential land, Q_L^c , are known, then an average price for residential land for each country c can be formed as $P_L^c = V_L^c/Q_L^c$. This is the stock price that would be used in forming the user cost of land for country c according to formula (28); i.e., we would set the user cost of residential land for country c , p_L^c , equal to $[r^{c*} + \tau_L^c]P_L^c$ where r^{c*} is an appropriate real interest rate for country c and τ_L^c is an appropriate annual average property tax rate on residential land for country c . The basic heading price and quantity for residential land for country c would be p_L^c and Q_L^c . Notice that we make no attempt to quality adjust the quantity of land across locations within a country or across countries.
 5. The perpetual inventory method used to construct the value of residential structures in country c , V_S^t , will also give us an estimate of the quantity or volume of structures, Q_S^t , expressed in units of equivalent new structures and so using these estimates of the value and quantity of residential structures, we could form an estimate for the price of residential structures in country c , $P_S^c = V_S^c/Q_S^c$. This could be the stock price that could be used in forming the user cost of structures for country c according to user cost formula (27); i.e., we could set the user cost of residential structures for country c , p_S^c , equal to $[r^{c*} + \delta_S^c + \tau_S^c]P_S^c$ where r^{c*} is an appropriate real interest rate for country c , δ_S^c is an appropriate gross depreciation rate for structures in country c and τ_S^c is an appropriate annual average property tax rate on residential structures for country c . The basic heading price and quantity for residential structures for country c could be set equal to p_S^c and Q_S^c . Unfortunately, while this strategy would work reasonably well in the time series context, it will not be satisfactory in the context of making cross country comparisons due to the fact that the average quality of construction will differ tremendously across countries. At this point, I suggest that we attempt to integrate our ICP construction price program with the dwelling price comparison program.
 6. The World Bank construction price experts would construct a list of say 10 to 30 types of residential construction that would cover the main methods of residential construction across the world. For each country, they would determine that the price of a square meter of construction of type n in country c in 2010 cost P_{Sn}^c in local currency units. Only representative types of construction would be priced in each country.⁴⁴ Using these data, we would run a country product dummy model for this residential structures component of the ICP using the representative prices

⁴⁴ Some concrete rule would be needed to determine whether a particular type of construction n in country c was representative or not.

P_{Sn}^c . This CPD model would generate country PPPs, say α_S^c for each country c in the region. Now set the constant quality price of residential construction for country c , P_S^t equal to α_S^c and set the constant quality quantity of residential construction for country c , Q_S^t , equal to V_S^t/α_S^c . Now set the user cost of residential structures in country c as in step 5 above, i.e., we set the user cost of residential structures for country c , p_S^c , equal to $[r^{c*} + \delta_S^c + \tau_S^c]P_S^c$.

There are at least two important implications of the above strategy:

- Note that we have converted the single basic heading for the services of housing in the ICP into two separate basic headings: the services of residential land and the services of residential structures. Of course, these two basic headings can be aggregated at a later stage.
- We have made no attempt to separately compare the services of OOH and rental housing; i.e., all housing services are combined in the above strategy. The reason for this is that investments in residential housing are not usually broken up into two components: one for owner occupied housing and one for rental housing. Thus it will be difficult to apply the perpetual inventory method to construct separate housing stocks for OOH and rental housing. Similarly, it will be difficult to break up the total quantity of residential land into rental and owned components.

I believe that the above strategy is reasonable and that it is at least somewhat “practical”.

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Verbrugge, R. (2008), "The Puzzling Divergence of Aggregate Rents and User Costs, 1980-2004", *The Review of Income and Wealth* 54, 671-699.

On your survey paper, I did realize that was for your coming ICP TAG meeting. That's why I tried so hard on that -- that TAG meeting affects the future of the ICP, and also the materials for the TAG meeting are of interest to lots of statistical agency people. That's why I thought that two sorts of additions are very important to the potential further use of two really great paper ideas you've had:

(1) If you read the Bank of Canada attempt to implement the opportunity cost approach, you'll see what goes wrong if the readers don't have a bit more guidance on HOW to implement that approach.

The resulting index has very different properties depending on whether one depending on whether one first calculates rental equivalence and user cost indexes at the macro level, and then switches between those two macro indexes, one period to the next, to produce the opportunity cost index -- a recipe for getting a seriously volatile index, which is why the Bank of Canada then recommends against the opportunity cost approach in their paper VERSUS taking a weighted average of conventional rental equivalence and user cost indexes, with the weights depending on the proportion of homeowners for whom one would expect the micro level rental versus the user cost index to be higher (which we should have some empirical evidence on by this time next year -- that's what the new data that Leonard is spending lots of money on at the Philly Fed will be really useful for looking at). There are surely some very good, and forecastable, reasons why the proportion of homeowners for whom the rental equivalent or the user cost of their housing services will be higher.

That paragraph I added from the Diewert-Nakamura paper in volume 1 of the Vancouver Volumes, which you were already citing, is the most important of the additions I made.

(2) The reason for the other addition I made is so that the readers could more easily see the relationship between the new method that you and your Dutch colleagues introduced and the repeat sales method. Like you, I think that new method is neat, but realized that I at least needed the stuff you'd created before on the relationship between the hedonic and the repeat sales methods to be able to understand why that new method you and your Dutch buddies made is so interesting. If you end up wanting to keep that longer addition I made, then I need to fix up the notation in what I added just a bit -- I thought that the small differences in notation wouldn't bother you for reading through to evaluate whether the addition of that stuff was worthwhile. I was able to add that material without disrupting the flow of the paper, or even the way the sections are numbered, but I realize that, for whatever reasons, you still might not want that added stuff.

From my perspective, those TAG meetings for the ICP are among the most important meetings that take place on the planet for the measurement community. The PPPs enter all sorts of desperately important government and business world decision making processes, but I don't feel that the PPP program has the resources it needs in even a wealthy nation like the US.

Bill Alterman told me that the production of the PPPs is something he's constantly asked to make "budget savings" on. It's a huge public service to the world that you're chairing the PPP TAG.

Regards, Alice