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Dwelling Services

Alan Heston

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Introduction

Household dwelling service expenditures consist of market rented housing and imputations for non-market rents and owner occupied housing. Estimation of these expenditures is treated in Chapter 3 on the framework of expenditures on GDP. As will become clear in this chapter and in Chapter 3, it is essential to have dwelling expenditures that embody the average rents of the dwellings/floor area of specified types of dwellings common in a country. Section 1 of this chapter will briefly describe the two main methods used in estimating the PPPs and volumes of dwelling services and their relationship to the expenditure estimates. Section 2 discusses the three methods to develop the dwelling service estimates actually used in the 2005 ICP in the six regions. This variety of methods posed a major problem of linking the regions, a subject treated in Section 3. Section 4 concludes with the lessons learned from the 2005 experience and a discussion of plans for the 2011 round.

It should also be noted that there is a very large literature associated with the issues discussed in this chapter. The papers associated with the meeting of the 2011 TAG meeting in January, 2010 deal with estimation of house rents in both temporal and spatial comparisons by some leading experts in the field. These are posted on the World Bank ICP website under Technical Advisory Group (

1. Methods of Estimation of Estimating Dwelling Rents

The Technical Advisory Group recommended that the regions use one or both methods that the European Union (EU) and OECD used in their comparisons. The method originally employed by the EU collected rents from surveys of different housing types of varying sizes, age and amenities. PPPs were obtained

by averaging price relatives (in this case rent relatives) for identical, or very similar, dwellings in each country. This will be termed the *direct rent* method. There is more than one way that rent surveys can be analyzed including estimation of hedonic regressions, which is also discussed. Also discussed under direct rents is the application of user cost to obtain rent estimates for particular types of dwellings.

As the EU expanded it was found that in a several of the new members rental markets were either very limited or the rents were highly subsidized. In this case, the EU and OECD introduced a *direct volume* method that indirectly estimated PPPs by dividing expenditures by the number of dwellings adjusted for size and some amenities, including central heating. A continuing theme of the chapter is that the *direct rent* method is the other way of saying the *indirect volume* method; and conversely the *direct volume* method can also be termed the *indirect rent* method. Each of these methods will be discussed in more detail.

1.A. Direct Rent Approach

1.A.1 The Direct Rent Approach Using Stratified Samples by Dwelling Type

Dwelling rents are unlike many services because location is such a key price-determining feature. This is less important for those who are actual renters because they can change their location more easily than owners. Homeownership has some benefits not enjoyed by renters, but the value of the dwelling services that owners receive are not so easily measured. However the SNA calls for statistical agencies to include the explicit dwelling services of renters and the implicit dwelling services of owners including both the site rent and rent of the structure. Statistical agencies in the different OECD countries have used different approaches for imputing dwelling services of owner occupied housing, the most common being equivalent rent. Diewert (2009) has provided a

thorough discussion of a number of OECD methods of imputation including some important measurement issues that arise in implementation.[1]

The practice of EU for purpose of estimating PPPs has been to use a sample of rental housing stratified by location within countries and by character of dwelling (apartment or house, size, central heating).[2] Rent per m^2 by strata is then compared across countries. The rental parities are aggregated using as weights the number of owner-occupied units by strata to obtain the PPPs for non-renters. This was the method recommended for the 2005 ICP for countries with national housing surveys where a substantial number of units were rented at market rates.

1.A.2 Use of Random Rental Surveys to Estimate Rental Cells

The EU/OECD practice of building up rent comparisons for different strata of dwellings can be achieved by purposeful sampling of average rents of each rental cell. Or from a national survey, average rents can be calculated for those cells given enough observations. An alternative for countries like the US where there is a regular national sample of rental units, is to use the coefficients from a hedonic rent regression to fill in the cells. In the 1975 ICP there were 61 rental cells or a potential of 2074 (34*51) average rents, of which 615 were important enough in the housing censuses of the 34 countries to warrant a rental estimate. As to framework for estimation of these rents, 21 (10 EU) of the 34 countries provided estimates of average rent for those cells that were important in their housing censuses. The other 13 countries provided rent samples permitting

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[1] Some countries use the increase in replacement value of quality adjusted housing as a measure of the services of owner-occupied housing, and some use a form of user cost. In rental equivalence the concept of dwelling services is gross rent on the expenditure side while the landlord must deduct costs like maintenance, insurance, and depreciation in arriving at rental income on the income side of the accounts.

[2] Both the direct rent and direct volume methods are described more fully in a handbook (EUROSTAT-OECD 2005, pp. 80-84), including the 48 strata of rental housing. The rental equivalence approach has been subjected to criticism in the United States because it is thought that rented units tend to be of lower quality and understate dwelling services of higher value owner-occupied units. In particular it is felt that the substantial decline in ratio of rent to price of houses as the price of the dwelling is not adequately taken into account.

estimation of coefficients on the various characteristics that determine rent, like rooms or an area measure, electricity and flush toilet.[3] These coefficients were used to estimate rents for the relevant cells for these 13 countries.

The general framework in the ICP 2005 for the direct price approach is to produce estimates of average rent for cells that are important in the housing stock of each country. As noted this is similar to the approach used in earlier rounds of the ICP. However, in the EU/OECD approach the matrix of rent cell information is aggregated using the EKS/GEKS method, whereas it is also possible to use a CPD weighted by housing quantities in aggregation as was done in the 1975 ICP. The weighted CPD aggregation permits estimation of the quality of the housing stock of each country, a feature that will be discussed below in the section on direct volume measures.

1.A.2 An Alternative Direct Rent Estimates Applying User Cost

Economists generally regard user cost as the preferred model of the flow of services from any durable asset, including housing. Diewert (2009) and elsewhere has been an advocate of this approach but has also set out some the problems of implementing user cost estimation of the services of owner-occupied housing, especially as a basis for CPIs. In the 2005 and 2011 ICP user cost is the recommended method of estimating total expenditures on owner-occupied housing. If user cost is the recommended basis for estimation of dwelling service expenditure, should it also be the basis for estimation for PPPs for dwelling services, at least for owner occupied housing?

User cost was used as a basis for estimating rental cells in the 1975 ICP for certain types of rural specifications, for example a 400 m^2 dwelling, no piped water, electricity or toilet, mud brick or wattle type exterior, and weight bearing

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[3] This discussion is based on Kravis, Heston and Summers (1982, pp. 54-59), hereafter KHS. The rent samples varied in size from a few hundred to over 10,000. It is important to note that even a non-random sample may produce unbiased regression coefficients on the most important rent-determining features like floor area and baths, though not necessarily and unbiased estimate of the average rent level. However, so long as one has a reasonable estimate of the difference between say capital city and other city rents, one can use a rent sample from a capital city to approximate all cities.

roof of local materials. The key variables would be current cost of construction, expected service life, annual maintenance costs, and opportunity cost of investment capital. The last was typically taken as rate that could be earned on postal savings and the like, not the borrowing cost, and is assumed to 5% in the example. To illustrate suppose a minimal rural structure cost $1000 including imputed wages of family labor used in construction and was expected to last 5 years. Suppose the structure was put up on January 1 of 2010. On Dec 31, 2010 the remaining value of the structure would be $800. User cost would be: $1000 – 800/1.05 = $238. In words the owner used up the depreciation of the structure, and the lost income to obtain the flow of dwelling services from the structure.[4]

To move from the user cost of a specified structure in current prices to the average rental of all such structures in a country, it is necessary to make some adjustment for the average age of the stock of this specification. However, if straight line depreciation is used in our example, then the user cost will be independent of the age of the structure, and like the one horse shay, the walls will come crumbling down at the end of the 5th year. The main point is that user cost can serve as a useful check on specific rent cells that may not be available from rental surveys. And also serve as a check on indirect rent for types of dwellings from the direct volume method, the next subject for discussion.

1.B. Direct Volume Method

1.B.1 Number of Structures By Type and Location

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[4] Here it is assumed the structure required no maintenance and that contrary to fact the land value is not be included in the above illustration. Diewert (2009, Section 8.4) provides a detailed discussion of how maintenance versus renovation should be treated. Typically, recurring maintenance is a current consumption item so is not part of the user cost of a structure, while a renovation with a life of over a year would be capitalized and a user cost estimated. The alternative, which in many ways is conceptually clearer, is to treat the annual maintenance as a necessary rate of expenditure associated with the normal depreciation of a structure. However, for illustrative purposes it is simpler to treat maintenance as a current expenditure. With respect to land value, this should be included in the calculation of user cost even if the service life of land is infinite because the owner could have received the opportunity cost of the land value.

In ICP 2005 it was anticipated that in some regions there would not be adequate rental markets and/or not enough rental survey information available to pursue the direct survey approach. As their organizations accommodated the diverse economic structures of some of their new and associate members the experience of the EU and OECD has served as a guide to the alternative direct volume approach. The handbook (EUROSTAT-OECD, 2005, pp.83-4) provides a short exposition, and Sergueev (2004) presented a paper to the TAG describing the approach in more detail including the experience in the 2000 EU-OECD comparisons. However, many of these countries had very different climates and building practices compared to the new EU-OECD countries so it was necessary for ICP 2005 to develop a special questionnaire for the direct volume approach.

The direct volume approach requires census type information on the number, location and type of structure. Definitions of urban and rural areas differ across countries but typically structures are enumerated by rural and urban areas and by political division in larger countries. Distinctions between building type may include significant detail, like high-rise, walk-up and garden apartments, attached or single family houses, and traditional and modern stuctures, temporary buildings, trailer homes and the like. Sometimes type of exterior wall, and type of floor or roof will be part of the stratification, with groupings as in India as to *pucca* and *kutcha* housing, the former meaning of good and the latter of less durable materials.

1.B.2 Quality Indicators for Dwellings

In the EU-OECD methods the number of structures were adjusted for the availability of water, electricity and flush toilets in a structure as well as to availability of central heating. In the 2005 ICP questionnaire for other regions it was felt that central heating and air conditioning were not generally available in housing census information so these items were not included. Table 1 illustrates the quantity method with the 2005 South American data. This region was chosen for several reasons, but mainly because they actually applied the method to all of their countries. Rows 1-4 provides the data using the recommended method for

2005. The geometric mean of the percent of dwellings with electricity, water and inside plumbing is given in Row 4 and is the quality measure used to adjust the quantities. In a section 3 the merits of equal weighting of the three components as opposed to giving more weight to indoor toilet that is likely to also be a proxy for many other indicators of quality will be discussed.

Chile has the highest quality indicator at almost 93% while Bolivia has the lowest, less than 44%, so the range is fairly large. Information on number of dwellings, number of rooms, and total area were requested, but countries in South America generally only had bedrooms as a size measure of dwellings. Rows 5-7 provide some information on number of bedrooms per dwelling and density of housing; some measure of living density is to be an additional variable to be included with other quality indicators in 2011. Row 8 gives expenditures at exchange rate of households on rented and owner occupied housing from the national accounts.

There are two ways to use this quantity and expenditure information to obtain the same results. We can either begin with a direct volume index or a unit value index, both deriving from the basic identity: $EXPD_A = PD_A * QD_A$, where EXPD is expenditure on dwelling rents and PD and QD are price and quantity of dwelling services in country A. Comparing country B with A one gets: $EXPD_B / EXPD_A = PD_B / PD_A * QD_B / QD_A$. We observe the expenditure and quantity ratios. Dividing the expenditure ratios by the quantity ratios yields the price ratios. And if we divide the expenditures by the individual quantities we get unit values that form the numerator and denominator of the price ratio. This simple identity underlies most ICP calculations and also reinforces the desirability of having independent observations on both prices and quantities as mutual checks on each other. These two ways are illustrated in the remaining rows of Table 1.

First, row 9 provides the per capita bedrooms quality adjusted, the number for Argentina being .512 bedrooms per capita. This is obtained by taking the reciprocal of persons per bedroom in row 7 times the quality factor as a fraction, that is .512 = 1/1.622 * .8309. The housing index in row 10 puts the per capita adjusted bedrooms on an index with Argentina = 100. The price level for

housing in row 12 (Argentina =100) is then derived by dividing the per capita expenditures in row 8 by the volume index in row 10.

Method 2 begins by asking what are housing expenditures per quality-adjusted bedroom. This is given in row 12 and is obtained by dividing row 8 by row 9. Again dividing each element in row 12 by the value in Argentina as a percent, we obtain an alternative way of deriving row 11, the price level of housing. And from the price level we can easily derive the volume index given in row 10, again using the basic ICP identity.

Having reviewed the mechanics of the direct volume method what can we say about the results in Table 1? In general the direct volume method produces plausible results for South America, though one could raise several questions. Are housing services in Colombia really more than Venezuela? And is Uruguay more than in Chile? Again if there are errors, they can be due to expenditure data being to low in Chile and Venezuela for example, or quality measures overstated in Colombia. We will return to this when the procedures used in other regions are discussed in Section 2.

I.B.3 Heterogeneity of Quantity Indicators Across Countries and Regions

The South American case illustrates several of the problem areas in making comparisons of dwellings including the non-uniformity of housing data across countries. South America chose as its quantity indicator, the number of bedrooms, which was not originally requested from countries. Rather the manual and other documents of the 2005 ICP sought square meters of internal living space as the preferred indicator. Even this indicator is difficult to define given the flexible use that can be made of balconies, verandas, non-covered courtyards and the like in countries with mild temperatures much of the year. Some affluent countries like the United States only collect rooms, not area, as their principal measure. As will be described in Section 3 on linking the regions, the only quantity indicator available in all countries where data was available to the global office in 2005 was number of dwellings. Number of rooms was next in frequency and square meters last of the items initially requested. Bedrooms were clearly

the fewest, a situation brought about in part because South America was completing its comparison while other regions were processing their responses to the questionnaire. For purposes of linking the regions it was necessary to collect some additional data on bedrooms from some countries outside the South American region.

Not only did lack of uniformity of housing censuses introduce problems of linking regions, there was also uneven availability and quality of dwelling quantity measures within regions. For example, how should outliers be treated if these were the official figures that countries used in their publications?[5] And how should the indicators be combined when there are many missing values? The usual approach in the ICP is to use a multilateral method like CPD or GEKS, which in fact is what was done to link the regions. Before turning to linking, the methods used in the 2005 ICP will be discussed.

2.   Comparisons of Dwelling Services: The 2005 Experience

The quantity method used in the South American region has already been set out in Table 1. We will return to Table 1 after discussing the Asia and the Pacific region, where the decision was made to use neither the direct quantity or the direct rent method. The African countries elected to follow Asia and the Pacific and use what we will term the consumption equivalent method (CEM). We will then compare the CEM method for the countries in South America with their results using the quantity method. We will then discuss the regions using some combination of the direct quantity and the direct rent methods, namely Western Asia and the OECD. The CIS countries are a special case.

2.A. The Experience in Asia-Pacific and Africa

All regions face the problem that expenditures on dwelling services are estimated by different methods yielding totals that are often not comparable across countries. Further there are reasons to believe there is a tendency for the expenditures on dwelling services to be systematically understated in lower

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[5] An important illustration is China, which publishes average floor area per person for the population that appears very high by international standards

income countries with a low percent of rental dwelling and a high percent of traditional dwellings. These problems are more fully discussed in Chapter 3. The result affects the estimation of indirect volumes where the direct rent approach and indirect PPPs where the direct quantity approach is used, assuming both the direct approaches are close to the truth.

However, if the direct rent or quantity estimates are themselves also in doubt, then we are at sea without a rudder unless other independent data can be used as a check. This is the situation that the Asia-Pacific region faced. Their validation of the national accounts led to some questions about the expenditures on dwelling services of some countries in the region. And as mentioned the quantity information in some countries was in doubt, part of which is probably due to the lack of clarity in the survey questions. In contrast to regions that chose to use different methods for different countries Asia and the Pacific wished to apply one method to all countries, namely the CEM method.

How does the CEM work? The fundamental assumption is that the volume of rental services in an economy rises with the volume of private individual consumption (PIC) less rents. Thus, the share of rents to private individual consumption will be the same across all countries in a region. The CEM can also be thought of as a method that chooses to use a reference volume to measure rental services. One clear problem of using the method is that it tells the user nothing about the true volume of housing services in a country, so that it is not comparable across the regions. Further, if the expenditures on housing services are doubtful in some countries, the indirect PPPs for housing may strain credibility. This proved to be the case in Africa, which as Deaton (2010) has pointed out had unfortunate consequences when the results were not correctly applied in the estimation of world poverty.[6]

For the South American countries it is simple enough to compare the CEM approach with the quantity results in Table 1. This exercise is set out in Table 2.

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[6] Briefly the problem arose because several of the poorest countries appropriately enough were used to establish a world poverty line for 2005. But several of these countries, like Mali, had estimates of expenditures on housing services

Row 1 of Table 2 expresses the basic volume comparison in row 10 of Table 1 as an index with the average of all the South American countries as 100. An index of private individual consumption (PIC) from the 2005 ICP with South America as 100 is given in row 2. The assumption of the CEM approach is that the index of the volume of rents per capita in row 1 would be the same as PIC in row 2. The index of rent volumes divided by PIC, normalized to SA = 100 is given in row 3. Examination of the indexes in row 3 reveals only 3 of the 10 countries is the direct volume approach within 15% of the CEM result, while another 3 are in the 15-25% range. The departure of direct quantity and CEM results for the remaining 4 countries are above 25%, not an encouraging finding. However, there does not appear to be any pattern of differences associated with per capita GDP, so at least for volumes there does not to appear to be any bias in the CEM approach. However, the large departures from 100 in row 3 are enough to question how reliable would be comparisons of housing volumes of countries in Africa and Asia and the Pacific with countries in different regions.

Expenditures on dwelling services as a percent of consumption of the South American countries are given in row 4 of Table 2.   The range is from under 5% to over 12% in a moderately homogeneous region. Across the range of countries in the 2005 ICP it ranged from under 2% to over 20%, so actual and imputed rents is a very important expenditure heading with greater reported than actual variance. This is because there is a pattern that low-income countries tend to under-estimate dwelling services.

Another check on the results in Table 1 is provided in Table 2; this illustration compares indirect price levels with some available direct price levels, which were examined but not used in the South American comparison.   The indirect price and price levels are given in rows 5 and 6, and their ratio as an index in row 7. Even if the direct quantity ratios are reliable the indirect price ratios may be too high or too low if the expenditures are too large or too small as is the case for Brasil, Peru, and Uruguay.

Another way to use the direct rent comparisons is derive indirect volumes, which are given in row 8. An index of the indirect to direct volumes is given in row 9. The index in row 9 reveals quite large differences for Ecuador, Peru, Paraguay and Uruguay, which again may be partly due to inaccurate expenditures. Certainly if one had only to choose between the direct volume or direct rent method for South America, the decision taken in favor of direct volumes is the appropriate choice. But what about applying a combination of the two approaches? We have noted that Uruguay appears high using direct volumes but it is even higher in the direct rent approach, so nothing is gained there. But certainly Colombia looks more plausible using the indirect rather than the direct volume method. This is not the place to recommend any particular combination of the methods, only to suggest that more regions give this approach consideration for 2011.

2.B. The Experience in Western Asia and the OECD

There is ample documentation of the use of both direct and indirect volume approaches in manuals on OECD practice (see EU/OECD 2005 and Sergueev 2006) and they will not be repeated here. The main point is that as the number of associate and full members of the EU-OECD increased, there were a number of countries that did not have an adequate survey of rental housing at market rates to provide comparable inputs to the original rental classification. A direct quantity approach was used in countries where it did not seem appropriate to launch a rent survey. The linking was done through countries that carried out both approaches.

Several countries in Western Asia had limited quantity and quality information about their housing stock, several had doubtful expenditures, and several had both problems. The countries had consumer price information on rents from their CPIs so they chose 3 types of rentals and also conducted a direct rent comparison for all their countries except Lebanon. Estimated rent levels were developed using both weighted and un-weighted CPD equations. These two CPD estimates were very similar and the geo-mean is provided in column 2 of

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Table 3 where the countries are ordered by their per capita domestic absorption (DA) in column 1.[7]

Two indirect rent indexes were also estimated, one of which used the same approach as Table 1 illustrated for South America. The second quality measure assigned amenities 2/3 of the weight and average size of dwelling 1/3 of the weight. This adjustment is further discussed in section 3. Other than Jordan, these two measures were within 10% of each other; their geo-mean is given in column 3. The final estimated price level of market and owner occupied dwellings for each country was the geo-mean of the direct and indirect estimates. The price level for Lebanon clearly looks out of line most likely because expenditures on dwelling services have been underestimated. Availability of direct rent observations would have yielded more reasonable rent estimates for Lebanon, but perhaps at the expense of reasonable volume estimates. Given the possible errors in expenditures, and both direct and indirect rents, the final choice in West Asia to use the estimates in column 4 appeared less subjective than making judgments about the data submissions of each country. And it probably reduced errors on average over all of the countries.

3. Linking the Regions: The 2005 Experience

Unlike many consumption basic headings it was agreed that quantity information would be supplied to the global office by all countries as well as the Ring countries. This recommendation was after the regional protocols were in place, so initially only three regions, Africa, South America and Western Asia provided data for all countries to the global office. No quantity information was available for CIS countries and only for ring countries in Asia. Subsequently the EU-OECD supplied quantity information for all of their countries for which it was available. The problem was how to put the regional results in a form they could be linked to other regions.

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[7] More detail is given in Heston and Hamadeh (2010). Domestic absorption is referred to as in the SNA. It is the sum of domestic expenditures excluding the net foreign balance and therefore differs from GDP.

In the work reported here there are 106 countries of which 103 responded to the questionnaire, the 3 additional countries, Mexico and the United States were directly obtained from national sources that also had bedrooms to overlap with South America. China was added because of the sparseness of Asian data, its size and the ready availability of published data on rural and urban housing stock. Responses by the countries to the housing questionnaire facilitated adjusting measures of housing volume for quality based on shares of water, electricity and indoor toilet in country dwelling stocks. However, the data submissions included many gaps including the basic quantity measures themselves. While all countries provided the total number of residential units, the other volume measures were often sparse. The situation in South America has been discussed. For other regions the number of rooms and floor area were requested but supplied by about half the countries.

Clearly gaps in the data must me addressed if comparisons are to be made. The approach used is multilateral in nature as this appeared to be an objective way to deal with the gaps in the quantity data. In this approximation the Ring countries were treated like any other country, in part because the data gaps in the Ring countries were also significant. And as mentioned available data from national sources were also used to improve the overlap of the country and volume coverage.[8]

Columns 1-3 in Table 4 provide the numbers submitted by the first ten countries alphabetically with 3 of them reproducing the South American entries in Table 1. Column 4 provides quality measure introduced in Table 1, namely the geometric mean of columns 1-3, to obtain Quality I (Q1). The way in which the quality measure is applied in Table 1, if a country reported a 0 share for any amenity, then the geo-mean would be 0.0 and the quality adjusted quantity would

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[8] As mentioned national sources were used for Mexico and the United States in order to overlap bedrooms with South American countries. Further supplementary household survey data were used for Bangladesh, Benin, Bhutan, Bolivia, Niger, and Peru to fill gaps in questionnaire responses on number of rooms, share of traditional and rural housing, and related information. This was particularly important for South America, where had information on number of bedrooms was available from their regional comparison. And finally China was added because of its importance and ready availability of its data

be 0.0. While an unlikely occurrence it is not a conceptually clean measure. Further studies suggest that amenities add at least double the value to a dwelling compared to its size in rooms or floor area. To roughly allow for this effect, Quality measure 2 (Q2) gives space 1/3 and amenities a weight of 2/3 and is given in column 5.[9] It can be seen that the two quality measures approach each other moving from lower to higher measures of Quality 1.

As noted, only a few countries provided number of rooms or area in square meters. Another ten-country illustration of the dwelling data is presented in Table 5 that provides a sense of the gaps in response. Column 1 provides the number of dwelling units and columns 2 and 3 persons per dwelling and dwelling per person. Unfortunately the persons per dwelling differences do not tell us whether houses are bigger in some countries or that there is simply less space per person. For example Bhutan has almost double the number of persons per dwelling as Argentina, 7.3 versus 3.8. Is this because housing is more crowded in Bhutan or because their dwellings are larger? Unfortunately, this cannot be determined on the basis of amenities and dwelling numbers alone. Columns 4-6 indicate by an *x* whether a volume measure is available for a country in addition to total number of dwellings. Nigeria for example only provides number of dwellings. As noted it was possible to obtain total rooms for a few South American countries like Peru.

To deal with the incomplete data a form of the CPD (country-product-dummy) approach of the following form is estimated.

(1) $\text{Ln (Exp/Q}_{ij}) = \alpha + \beta_i \, R_i + \delta_j \, VT_j + \lambda \, (M_k)$,

where ExpQ_{ij} is the quality adjusted volume of housing of a country in region *i* of per unit of volume measure type, *j*. There are 106 countries and 4 types of housing measures; units, number of rooms, number of bedrooms and floor area. The total number of observations in the estimation was 230, slightly more than half the potential of 424 (4*106) observations. To illustrate Nigeria and Saudi Arabia in Table 4 each would be just one observation, housing expenditures per

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[9] The calculation of the second quality measure is: Q2 = (1 + 2*Q1))/3. For example Benin is (1 + 2*.086)/3 = 1.172/3 or .391.

quality-adjusted dwelling. The remaining countries in Table 5 would have two observations except Peru with three.

Equation (1) is semi-log with 3 dummy or class variables on the right hand side, R for each of the 5 regions, VT for volume type, and M_k, where $_k$ indexes countries into 1 of 3 groups based upon the modernity of the stock of dwelling in each country derived from a combination of survey responses. The equation parameters and statistics are given in Table 6. When there is an intercept one of each class is assigned the value 0.0 because the equation is not otherwise defined. Most of the variation in the dependent variable is explained by differences in unit values (expenditure per) dwelling type the highest, per bedroom, per room and lowest per square meter.   For this reason the VT class variable gives rise to the relatively high value of R^2.

The modernity classification attempts to capture survey responses to several questions. Countries were asked the share of dwellings that were modern or traditional, the share in urban and rural areas, the share rented, and the like. The large number of gaps meant that using these variables individually would substantially reduce the number of observations for any regression equation. It was   decided to make a grouping of countries into low, medium and high based upon partial responses would measure features of housing stocks that would not be captured in the three amenity variables, water, electricity and toilet. The coefficients on the modernity measure are significant and the signs are sensible. The coefficients on the unit value types are also in the expected direction being highest per dwelling and least per square meter. The coefficient on bedrooms is not statistically significant, which is probably explained by the fact that there are so few observations.

The significance of the equation as a whole is weak as measured by the high RMSE of .977. An identical equation was estimated using country in place of region and the RMSE is .290 and R^2 .991, a seemingly preferable equation. However, the primary concern in linking the regions is to obtain low standard errors of the regional coefficients. It turns out that if a regional effect is identified in an equation also including countries, the standard errors of the regional

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coefficients are much higher than those in Table 6. So for the purpose of linking the choice was made to use linking factors similar to Table 6.[10] With EU-OECD as 100, these were 20.6 for Africa, 42.7 for Asia-Pacific, 34.0 for South America and 67.6 for Western Asia. It seems likely that the Asia-Pacific number is high relative to the South American index. This is likely the result of the small overlap of the volume measure of the South American countries with other regions; and with the relatively small number of countries from the Asia-Pacific region represented in Table 6.

To summarize, the linking of the regions described above will be much improved if all the countries provide fuller responses to the requests for information. Hopefully this will be a learning experience that will improve the quantity and quality of information received from the ICP 2005 countries and the newly participating countries in 2011. However, comparisons across regions will only be as good as the country comparisons within regions, and as good as the comparability of the direct rent and direct volume methods.

4.   Moving on to 2011 based on ICP Experience

Making good comparisons of dwelling services is difficult for individual countries over time and even harder for different cities or regions of the same country.   So it is not surprising that the ICP has also faced problems in comparing this single most important expenditure heading within household consumption. There seem to be two messages flowing from the experience in previous ICPs. First there are the efforts carried out by the EU and OECD in linking their new and associate and member countries where it was not feasible to carry out rental surveys comparable to older member countries.   Secondly, a case is made for supplementing surveys using the direct volume approach with as much direct rent information as may be available from other sources.

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[10] Because a data for additional countries became available after the linking was completed, the equation reported in Table 6 contains more observations than were actually used for the report.

4a.   Using the Direct Volume Approach for All Countries

It is already planned to ask all countries to respond to a direct volume questionnaire as part of the 2011 ICP data collection process. In addition these responses should be made available to the global office for all countries. Because the EU-OECD operates on a schedule that is at least one year in advance of the global comparison, whatever estimates they make using the direct volume linking for come of their countries will have been completed before the other regions. For the other regions the global office should receive the responses from all the regions as by the end of 2011 at the same time that other consumer heading prices are being collected. Further, it is proposed that the global office begin processing at the start of the validation procedure, not after it is done in the regions.

Since this is a departure from previous practice a justification is appropriate. In the 2005 round the questionnaires were received after regional validation.   While the global office raised a number of questions about country responses with the regions, the regional coordinators were not able to elicit country responses to the queries. Because many of the questions arise from anomalies that show themselves in comparisons across regions it is important that these be raised while countries are still receptive to queries relating to validation. This proposal also puts pressure on the global office to process the direct volume questionnaires in a prompt fashion so if necessary other options can be considered.

In section 3 the attempt to link the regions for 2005 was described.   It is proposed that some version of this approach should be implemented as part of the 2011 ICP.   With direct volume data from all the countries it would be possible to straight forwardly estimate a transitive set of basic heading parities across the countries. This would serve two purposes. First, it would directly provide regional linking factors since the link would be the same whether a country or country average served as the numeraire for a region. The EU-OECD will want to preserve their regional results and this is easily done. For regions that have yet completed their own regional comparison there is a second option.

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The second choice is that regions simply use some or all the multilateral indirect rental parities for their own countries. For example, regions like West Asia that used some direct rent and some indirect rent parities this would remain an option. And if regions had already completed their own comparison for dwelling services they could choose to use these results in the manner of the EU-OECD. And finally, regions could examine the multilateral results and then decide whether to carry out and use their comparison of dwelling services. In short, our view is that the global office will be doing a multilateral comparison of direct volumes in any event and doing as early as possible has a number of advantages for the regions as well as the global office.

4b.   The Advantages of Also Collecting Direct Rent Data

The experience in ICP 2005 made clear the desirability of improving estimates of expenditures on dwelling services of owner occupied units. Even if direct volume estimates are accurate, indirect PPPs will be too small if the expenditures are underestimated. And conversely even accurate direct rent estimates will lead to indirect volumes that are too low if expenditures are underestimated. This is one reason that great emphasis is being given in 2011 to improving the expenditure estimates for dwelling services and several other difficult basic headings.

Even if it is planned to go with direct volume approach one advantage of having both direct rent information is as a further check on expenditures. But there is another more important consideration namely that direct volume measures do not capture enough important quality features of housing. To illustrate this point, consider first a study of rents for Germany reported by Claudia Kurz and Johannes Hoffmann of the Deutsche Bundesbank (2004), which also is instructive with respect to rental equivalence. The data are collected annually as part of the German Socio-Economic Panel (GSOEP). Each year responses from about 2500 renters and 1600 owners are received. The characteristics of the dwellings are fairly detailed as to location by region, size of city as well as four neighborhood groups.

Table 7 presents some summary statistics for renters and owners based on the 1998 survey. Rents of owner-occupied units are estimated by the owner, a survey practice that is fairly common though often questioned. In many respects owners live in different places and in better accommodation than renters as can be seen by the share of each group in different neighborhoods and different sized cities (rows 5-10 in Table 7).

Rows 2-3 provide basic rent statistics for renters and owners and one surprising feature is that rent per M^2 is higher for owners than renters. This is surprising on several accounts. First, renters are more concentrated in large cities and in the central area of cities (49 versus 19%), where rents are typically higher. Second, rents per M^2 typically decline with size of dwelling for a number of reasons. However, this is not the case in Table 7 where average rent is rising slightly more than average size. One quality characteristic is given in Table 7, namely row 4 on the share of units with a garden and here owners are more than twice as likely to have a garden. For other survey indicators of quality, renters are similar to owners. The conclusion drawn is that there are dimensions of quality that are not captured in the measures collected in the direct volume approach, but are present in more complete rent surveys.

Kurz and Hoffman also estimate a hedonic regression showing the systematic decline in rents by size of city, dwelling type, size, age and availability of gallery/garden, plumbing, and heating. The coefficient on log of rent rises less than proportionately than size of dwelling, and declines with age. In the first ICP report (KKHS, 1975, p. 122), a similar hedonic equation was estimated for the US using a sample of 39,100 renters from urban locations of the BLS for 1967. While many years ago, the relationships of the German and US hedonic regression are similar; that is the log of rent rises with size of urban center, with number of rooms, number of bathrooms, and declines with age and condition of structure.

A feature of the BLS sample deserves special mention, namely it provides number of baths, and in 1967 5 percent of the sampled units had no bath or

shared bath. Increments were half-bath, full bath, one and a half baths and 2 or more. The coefficients are respectively 0.065, 0.227, 0.406 and 0.665 and all different from zero at   the 1 percent level. These coefficients indicate that given other features of a unit rents rise by roughly 6 percent for a half-bath, to 66 percent for 2 or more baths. Why such a large effect for number of baths? We suggest it is because they represent other rent-determining qualities of a dwelling that are not otherwise measured. However, such quality effects are not captured in the adjustments made in the direct volume approach. In the above example, presence of a full bath added 23% to rents, roughly one-third of the rental increment of 2 or more baths.

The general point is that most housing censuses in lower income countries provide data on a limited number of rent determining characteristics of housing. With limited information available the direct volume approach can only measure a small part of the quality differences of the housing stock between low and high- income countries. For most countries using the direct rent approach, the level of detail on their housing stock is also more detailed, but that does not help in comparisons with countries where there is less detail. In short, linking via the direct volume approach reduces the comparison to a very small number of rent determining characteristics.

Another window on this problem from a previous ICP round is provided in Table 8. Some partial hedonic regression results are reported for selected 1975 ICP countries ranging in income from India to the United States as given in line 9. Row 1 provides the base rent of a dwelling in US$ at exchange rates that is 35 M^2, with water and electricity built in the 1945-59 period. Line 2 is the rent with water electricity and flush toilet, the quality adjustment factors for the direct volume approach. Line 3 is the ratio of a dwelling with water, electricity and flush toilet to the base rent, except for the US for which the base rent could not be estimated for lack of relevant rental units. For the remaining countries, except Thailand, the addition of a flush toilet adds much more to the rent than would be called for if these three quality indicators were of equal importance, a point made earlier in this chapter and in this section.

Line 4 gives the average rent of all dwellings in the samples, except for Korea, the consequence of the simpler and time consuming computing capacity of the period. Line 5, which gives the ratio of the average to the line 2, reinforces the point of this section. The average dwellings in the higher income countries have much higher rents compared to the quality-adjusted volume as usually estimated in the direct volume approach. This means that effectively using the direct volume method to link higher to lower income countries does not capture this effect.

Charts 1 and 2 illustrate the effect for this small sample of countries from a generation ago. Chart 1 simply plots the two scatters and slopes of the average rent and rent with just electricity, water and toilet against per capita GDP. The blue dots show how the rent PPPs would move using the direct volume method and the orange squares the same relationship using the direct rent approach. As can be seen the slopes of the two lines are very different, the direct rent gradient being much steeper. Chart 2 plots the ratio of average rent to rent with just electricity, water and toilet against per capita GDP.   Since the intercept in Chart 2 is essentially 1.0, the relationship says that moving from a country with 5 percent to a country with 80 percent of the PCGDP of the US would lead to a difference of 83 percent difference in the estimated price level of rents, the direct volume method being lower. (That is [.0244 * (80-5)] -1 as a percent). This is a large effect that would make a difference in consumption of 3 or 4 percent, even for countries report rents as only 5 percent of individual consumption.

There is no reason to believe the 1975 relationship is not present today, but that does not make the above quantitative illustration necessarily a guide to exactly what should be done in the ICP 2011. However, serious consideration needs to be given to the issue raised here. It should be possible to analyze more recent data for more countries to consider whether some systematic adjustment is required when linking groups of countries using the two different methods.

References

European Communities/OECD (2005 edition) <u>Methodological Manual on Purchasing Power Parities</u>, 2005 Edition, Luxembourg.

Heston, Alan and Nada Hamadeh (2010) "Owner Occupied Housing in Western Asia," Paper 01.02, Technical Advisory Group Meeting, Feb 17-19, 2010, International Comparison Program, World Bank.

Kravis, Irving, Zoltan Kennessey, Alan Heston and Robert Summers, (1975), <u>A System of International Comparisons of Gross Product and Purchasing Power</u>, World Bank and Johns Hopkins Press, Baltimore.

Kravis, Irving, Alan Heston, and Robert Summers (1982), *World Product and Income*, World Bank and Johns Hopkins Press, Baltimore.

Kurz, Claudia and Johannes Hoffmann (2004) "A rental-equivalence index for owner-occupied housing in West Germany 1985 to 1998", Discussion Paper Series 1: Economic Studies from <u>Deutsche Bundesbank</u>