Dwelling Services

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Household dwelling service expenditures consist of market-rented housing and imputations for nonmarket rents and owner-occupied housing. Estimation of these expenditures is treated in chapter 3 on the framework of expenditures on the gross domestic product (GDP). As will become clear in this chapter and in chapter 3, it is essential that dwelling expenditures embody the average rents of the dwellings/floor area of specified types of dwellings common in a country.

Comparison of housing across countries is difficult because of the varying mix of owner-occupied versus rented dwellings, which can also be affected by various forms of subsidies. As explained in chapter 3, there are different ways to estimate the overall expenditures on housing for the national accounts. The methods used to estimate purchasing power parities (PPPs) are dependent on how the underlying national account expenditures are computed. Table 12.1 is an overview of the methods used to estimate expenditures and PPPs for rental and owner-occupied housing.

The first section of this chapter briefly describes the rental survey and the quantity or direct volume methods used in estimating the PPPs and volumes of dwelling services and their relationship to the expenditure estimates. The second section discusses these methods, as well as the consumption equivalent method used to develop the dwelling service estimates actually used in the 2005 round of the International Comparison Program (ICP) in the six ICP regions. This variety of methods posed a major problem of linking the regions, a subject treated in the third section of this chapter. The chapter concludes with the lessons learned from the 2005 experience and a discussion of plans for the 2011 round.

A very large set of literature is associated with the issues discussed in this chapter. The papers related to the February 2010 meeting of the ICP's 2011 Technical Advisory Group (TAG) deal with the estimation of housing rents in both temporal and spatial comparisons by some of the leading experts in the field.[1]

TABLE 12.1 Overview of Data Sources for Expenditures and PPPs for Rental and Owner-Occupied Housing

Housing classification	Expenditures	PPPs
Rental	Rentals	Rental surveys by size and type of housing
Owner-occupied	Rental equivalents	Rental surveys
	User cost	Quantity or direct volume method
All housing	Rental equivalent and user cost	Consumption equivalent method (CEM)

Source: Adapted from http://siteresources.worldbank.org/ICPINT/Resources/270056-1255977007108/6483550-1257349667891/6544465-1272763721734/03.01_ICP-TAG03_DwellingServices-N.pdf.

Methods of Estimating Dwelling PPPs

The Technical Advisory Group recommended that the regions use one or both of the methods utilized by the European Union (EU) and the Organisation for Economic Co-operation and Development (OECD) in their comparisons (hereafter referred to as the Eurostat-OECD comparison). The method originally employed by Eurostat-OECD required 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 method is called here the *direct rent* method (see next section). Table 12.2 illustrates the stratification used for flats (the terms *flat* and *apartment* are used interchangeably in this chapter). A similar stratification was used for single-dwelling housing. Rental surveys can be analyzed in more than one way, including estimation of PPPs using hedonic regressions, which is discussed as well in the following section on direct rents. Also discussed in that section is the application of user cost, as described in chapter 3, to obtain expenditures for particular types of dwellings.

TABLE 12.2 Criteria Used in the 2002 Eurostat-OECD Round of Comparisons

Type of housing	Age in years	Number of rooms	Total size of dwelling (m^2)	Reference size (m^2)	Central heating
Flat	> 49	1–2	25–75	50	No
Flat	> 49	1–2	25–75	50	Yes
Flat	> 49	3	70–150	110	No
Flat	> 49	≥ 3	70–150	110	Yes
Flat	24–49	1–2	25–75	50	No
Flat	24–49	1–2	25–75	50	Yes
Flat	24–49	≥ 3	70–150	110	No
Flat	24–49	≥ 3	70–150	110	Yes
Flat	< 24	1–2	25–75	50	No
Flat	< 24	1–2	25–75	50	Yes
Flat	< 24	≥ 3	70–150	110	No
Flat	< 24	≥ 3	70–150	110	Yes

Source: Eurostat and OECD 2006, 82.

As the EU expanded, it was found that in several of the new member countries rental markets were either limited to capital cities or the rents were highly subsidized, or both. In these cases, Eurostat-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 this chapter is that the *direct rent* method is the other way of saying the *indirect volume* method. Conversely, the *direct volume* method can also be termed the *indirect rent* method. Each of these methods is discussed in more detail later in this overall section.

Direct Rent Approach

This section is an overview of the direct rent approach, first using stratified samples by dwelling type and then using random rental surveys to estimate rental cells.

Direct Rent Approach Using Stratified Samples by Dwelling Type

Dwelling rents are unlike many services because location is such a key price-determining feature. Location is less important for 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 is not so easily measured. The *System of National Accounts* calls for statistical agencies to include in their estimates of expenditures the explicit dwelling services of renters and the implicit dwelling services of owners, including both the site rent and the rent of the structure (Commission of the European Communities et al. 2008). Statistical agencies in OECD countries have used different approaches for imputing the dwelling expenditures associated with owner-occupied housing, the most common being equivalent rent. This method assumes that the rental rates for rented dwellings by age, size, and amenities can be applied to similar types of owner-occupied housing. Diewert (2009) has provided a thorough discussion of a number of OECD methods of imputation, including some important measurement issues that arise in implementation.[2]

Eurostat-OECD estimates rental PPPs using a sample of rental housing stratified by location within countries and by character of dwelling (apartment or house, size, central heating).[3] Rents per square meter by strata are 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 nonrenters. This was the method recommended for the 2005 ICP for countries with national housing surveys in which a substantial number of units were rented at market rates.

Use of Random Rental Surveys to Estimate Rental Cells

The Eurostat-OECD practice of building up rent comparisons for different strata of dwellings can be achieved by purposeful sampling of the 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 such as the United States, 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 2,074 (34 * 61) average rents, of which 615 were important enough in the housing censuses of the 34 countries to warrant a rental estimate. As for the 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 estimation of coefficients on the various characteristics that determine rent such as number of rooms or an area measure, electricity, and flush toilet.[4] These coefficients were used to estimate rents for the relevant cells for these 13 countries.

The general framework in the 2005 ICP 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 Eurostat-OECD approach, the matrix of rent cell information is aggregated using the Gini-Éltetö-Köves-Szulc (GEKS) method, whereas it is also possible to use a Country Product Dummy (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 is discussed in the section on direct volume measures.

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) has been an advocate, but also has set out some of the problems of implementing user cost estimation of the services of owner-occupied housing, especially as a basis for consumer price indexes (CPIs). Some countries are unable to use rental equivalence to estimate expenditures on owner-occupied housing because of inadequate rental surveys—generally there is a lack of a rental market other than for high-income households in the capital or other large cities. In such cases, countries were advised for the 2005 and 2011 ICPs to implement the user cost method to estimate total expenditures on owner-occupied housing. If user cost is the recommended basis for estimating dwelling service expenditures, can it also be the basis for estimating 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-square-meter dwelling with no piped water, electricity, or toilet, with a mud brick or wattle type exterior, and with a weight-bearing 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 a rate that could be earned on postal savings and the like, not the borrowing cost, and is assumed to be 5 percent in the example. To illustrate, suppose a minimal rural structure cost $1,000, including the imputed wages of the family labor used in construction, and was expected to last five years. Suppose the structure was put up on January 1, 2010. On December 31, 2010, the remaining value of the structure would be $800. User cost would be $1,000 – 800/1.05 = $238. In other words, the owner used up the depreciation of the structure and the lost income (the opportunity cost) to obtain the flow of dwelling services from the structure.[5]

To move from the user cost of a specified structure in current prices to the average rental cost 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 my 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 fifth 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. It also can serve as a check on indirect rent for types of dwellings from the direct volume method, the next subject for discussion.

Direct Volume Method

This section provides an overview of the quantity or direct volume method of estimating PPPs for housing.

Number of Structures by Type and Location

In the 2005 ICP, it was anticipated that in some regions there would not be adequate rental markets or not enough rental survey information available to pursue the direct rent approach. Because 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 *Eurostat-OECD Methodological Manual on Purchasing Power Parities* (Eurostat and OECD 2006, 83–84) provides a short exposition, and Sergeev (2004) presented a paper to TAG describing the approach in more detail, including the experience in the 2000 Eurostat-OECD comparisons. However, many of these countries had very different climates and building practices compared with the new EU-OECD countries, and so it was necessary for the 2005 ICP to develop the special questionnaire shown in the annex to this chapter for the direct volume approach.

The direct volume approach requires census-type information on 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 details such as high-rise, walk-up, or garden apartment; attached or single-family house; traditional or modern structure; temporary building, trailer home, or the like. Sometimes, the type of exterior wall and type of floor or roof are part of the stratification. In India, for example, there are groupings for *pucca* (good) and *kutcha* (less durable) housing.

Quality Indicators for Dwellings

Eurostat-OECD used the number of structures adjusted for the availability of water, electricity, and flush toilets in a structure, as well as the availability of central heating. In the 2005 ICP questionnaire for other regions, these items were not included because it was felt that central heating and air-conditioning were not generally available in housing census information.

Table 12.3 illustrates the quantity method using the 2005 data for the South America region. This region was chosen for several reasons, but mainly because it actually applied the method to all of its countries. Rows 1–3 provide the data using the recommended method for 2005. The geometric mean of the percentage of dwellings with electricity, water, and indoor plumbing is given in row 4; it is the quality measure used to adjust the quantities. In the third section of this chapter, the discussion covers the merits of equal weighting of the three components as opposed to giving more weight to the presence of indoor toilets, which is likely to also be a proxy for many other indicators of quality.

Chile has the highest quality indicator at almost 93 percent, while Bolivia has the lowest, less than 44 percent, so the range is fairly large. Information on number of dwellings, number of rooms, and total area was requested, but countries in South America generally only had available the number of bedrooms as a size measure of dwellings. Rows 5–7 provide information on number of bedrooms per dwelling, persons per dwelling, and persons per bedroom, which are measures of living density. (Living density will be included with other quality indicators in the 2011 ICP round.) Row 8 gives the per capita expenditures (at exchange rate) of households for rented and owner-occupied housing from the national accounts. These expenditures are put on a base of Argentina equal to 100 in row 9.

There are two ways to use this quantity and expenditure information to obtain the same results. One can begin with either 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 the price and quantity of dwelling services in country A. Comparing country B with A, one gets $\frac{EXPD_B}{EXPD_A} = \frac{PD_B}{PD_A} * \frac{QD_B}{QD_A}$. Now observe the expenditure and quantity ratios. Dividing the expenditure ratios by the quantity ratios yields the price ratios. And if one divides the expenditures by the individual quantities, one gets 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.

TABLE 12.3 Direct Volume Method of Estimating Rental Services: South America, 2005

		Argentina	Bolivia	Brazil	Chile	Colombia	Ecuador	Paraguay	Peru	Uruguay	Venezuela, RB
1	% electricity	95.4	64.4	94.5	97.1	95.4	73.4	89.2	72.0	95.9	96.8
2	% piped water	84.1	33.5	73.0	91.0	86.1	56.7	52.6	60.0	87.8	85.5
3	% private bath	71.5	38.9	62.7	90.4	87.2	55.3	58.8	56.1	78.7	78.0
4	Quality, 0–100%	83.1	43.8	75.6	92.8	89.5	61.3	65.1	62.3	87.2	86.4
5	Bedrooms per dwelling	2.3	1.7	2.0	2.4	2.3	1.6	1.9	1.9	2.2	2.2
6	Persons per dwelling	3.7	4.2	3.8	4.0	4.3	4.4	4.7	4.6	3.4	4.7
7	Persons per bedroom	1.6	2.5	1.9	1.7	1.9	2.7	2.5	2.4	1.5	2.1
8	Housing exp., PC$ @ XR	341.4	49.8	360.0	445.7	204.1	169.9	108.0	50.5	489.8	244.2
9	Index of per capita exp.	100.0	14.5	105.4	130.6	59.8	49.8	31.6	14.8	143.5	71.5
10	PC bedrooms, adjusted	0.512	0.176	0.396	0.561	0.480	0.224	0.263	0.259	0.573	0.404
11	Volume index, Argentina = 100	100.0	34.3	77.4	109.5	93.7	43.7	51.3	50.5	111.9	78.9
12	PL = PPP/XR of housing	100.0	42.5	136.3	119.2	63.8	113.8	61.7	29.3	128.2	90.7
13	Exp. per adj. BR, $XR	666.4	283.4	908.3	794.2	425.0	758.1	411.4	195.5	854.1	604.2

Source: Derived from data processed by Statistics Canada for the 2005 ICP.
Note: PC = per capita; XR = exchange rate; BR = bedroom.

These two ways are illustrated in the remaining rows of table 12.3. First, row 10 provides the per capita bedrooms, quality-adjusted; Argentina has 0.512 persons per bedroom. This number is obtained by taking the reciprocal of persons per bedroom in row 7 times the quality factor as a fraction—that is, $0.512 = \frac{1}{1.622} * 0.8309$. The volume index in row 11 puts the per capita–adjusted bedrooms in an index with Argentina equal to 100. The price level for housing in row 12 (Argentina = 100) is then derived by dividing the index of per capita expenditures in row 9 by the volume index in row 11.

The second method begins by asking: what are the real housing expenditures per quality-adjusted bedroom? These are given in row 13, and are obtained by dividing row 8 (nominal expenditures for total housing) by row 10 (the implied PPP based on the direct volume comparison using persons per bedroom, adjusted for quality). Again, dividing each element in row 13 by the value in Argentina as a percentage, one obtains an alternative way of deriving row 12, the price level of housing. And from the price level one can easily derive the volume index given in row 11 (row 9 divided by row 12 as an index), again using the basic ICP identity.

Having reviewed the mechanics of the direct volume method, what can one say about the results in table 12.3? 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 in República Bolivariana de Venezuela? And are those in Uruguay more than in Chile? Again, if there are errors they could be due to expenditure data being too low in Chile and República Bolivariana de Venezuela, for example, or quality measures being overstated in Colombia. I will return to this when the procedures used in other regions are discussed later in this chapter.

Heterogeneity of Quantity Indicators across Countries and Regions

The South America case illustrates several of the problem areas in making comparisons of dwelling expenditures, including the nonuniformity of housing data across countries. South America chose as its quantity indicator number of bedrooms, which was not originally requested from countries. Rather, the ICP manual and other documents of the 2005 ICP sought square meters of internal living space as the preferred indicator. But even this indicator is difficult to define because of the flexible use that can be made of balconies, verandas, noncovered courtyards, and the like in countries with mild temperatures much of the year. Some affluent countries such as the United States use only the number of rooms, not area, as their principal measure. As described later in this chapter in the section on linking the regions, the only quantity indicator available in all countries where data were available to the ICP Global Office in 2005 was number of dwellings. Number of rooms was next in frequency, and area in square meters was the last of the items initially requested. The number of bedrooms was the only indicator provided by South America, a situation brought about in part because that region 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 numbers of bedrooms from some countries outside the South America region and to add some data on total rooms for several countries.

Not only did lack of uniformity of housing censuses introduce problems of linking regions, but there was also the 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?[6] 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 such as the CPD or GEKS, which in fact is what was done to link the regions. But before turning to linking, a discussion of the methods used in the 2005 ICP is in order.

Comparisons of Dwelling Services: The 2005 Experience

The quantity method used in the South America region has already been set out in table 12.3. This table will be considered again after discussing the Asia-Pacific region, where the decision was made to use neither the direct quantity nor the direct rent method. Instead, it used the consumption equivalent method (CEM). The Africa region elected to follow the Asia-Pacific region and use CEM as well, which is compared with the quantity method used in South America. That comparison is followed by a discussion of the regions that used some combination of the direct quantity and the direct rent methods: Western Asia and Eurostat-OECD.

The Experience in the Asia-Pacific and Africa

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

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

However, if the direct rent or quantity estimates are themselves also in doubt, then one is at sea without a rudder unless other independent data can be used as a check. This is the situation faced by the Asia-Pacific region. Its 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 was probably due to the lack of clarity in the survey questions or the lack of time for countries to provide the data and for the regional office validation. In contrast to regions that chose to use different methods for different countries, the Asia-Pacific region wished to apply one method to all countries—CEM.

How does 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. CEM can also be thought of as a method that chooses to use a reference volume to measure rental services. The PPP for housing was the PPP for individual consumption expenditures by households (excluding expenditures for housing). This neutral approach meant that housing had no effect on the overall PPP for individual consumption. One obvious problem of using the method is that it tells the user nothing about the true volume of housing services in a country, and so it is not comparable across regions. Furthermore, 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.[7]

For the South American countries, it is simple enough to compare the CEM approach with the quantity results in table 12.3. This exercise is set out in table 12.4. Row 1 of table 12.4 expresses the basic volume comparison in row 11 of table 12.3 as an index, with the average of all the South American countries as 100. An index of private individual consumption 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 that in only three of the 10 countries is the direct volume approach within 15 percent of the CEM result, while another three are in the 15–25 percent range. The departures of direct quantity and CEM results for the remaining four countries are above 25 percent—not an encouraging finding. However, there does not appear to be any pattern of differences associated with per capita GDP, and so, at least for volumes, there does not appear to be any bias in the CEM approach. However, the departures from 100 in row 3 are large enough to question the reliability of comparisons of housing volumes of countries in Africa and the Asia-Pacific with countries in different regions.

Expenditures on dwelling services as a percentage of consumption of the South American countries are given in row 4 of table 12.4. The range is from under 5 percent to over 13 percent in a moderately homogeneous region. This same range across all countries in the 2005 ICP went from under 2 percent to over 20 percent, and so actual and imputed rents are a very important expenditure heading, with greater reported variance than actual variance because there is a pattern of low-income countries tending to underestimate dwelling services.

Meanwhile, table 12.4 provides yet another check on the results in table 12.3. This illustration compares indirect price levels with some available direct price levels that were examined but not used in the South American comparison. The indirect and direct price levels are given in rows 5

TABLE 12.4 Comparisons of the Direct Quantity Approach with CEM and Direct Rents: South America, 2005

		Argentina	Bolivia	Brazil	Chile	Colombia	Ecuador	Paraguay	Peru	Uruguay	Venezuela, RB
1	Direct volume index, SA = 100	133.2	45.7	103.0	145.8	124.8	58.2	68.3	67.2	149.0	105.1
2	Real PIC per capita, SA = 100	94.5	59.8	120.5	128.8	100.8	91.4	97.5	70.2	117.3	119.3
3	Direct volume/ PIC, SA = 100[a]	143.2	77.6	86.8	115.1	125.8	64.8	71.1	97.3	129.1	89.5
4	Housing as % of consumption	11.5	7.4	12.4	10.5	11.3	9.3	6.1	4.9	13.3	9.5
5	Indirect PL rents, SA = 100	113.0	48.0	154.0	134.7	72.1	128.5	69.7	33.1	144.8	102.4
6	Direct PL rents, SA = 100	96.2	75.3	124.3	128.9	92.1	61.8	163.2	61.6	82.7	114.5
7	Direct/indirect rents, SA = 100[a]	72.0	132.5	68.2	80.9	108.1	40.7	197.8	157.1	48.3	94.5
8	Indirect volume index, SA = 100	111.2	60.4	117.3	98.9	74.0	196.8	40.5	51.0	165.7	84.7
9	Indirect/direct volume, SA = 100[a]	75.1	118.9	102.4	61.0	53.3	303.8	53.3	68.2	100.0	72.5

Source: Derived from data processed by Statistics Canada for the 2005 ICP.
Note: SA = South America; PIC = private individual consumption; PL = price level.
a. Because the average of ratios is not the ratio of the averages, the indexes are based on the ratios divided by the average ratio.

and 6, respectively, and their ratio as an index appears 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 Brazil, Peru, and Uruguay.

Another way to use the direct rent comparisons is to derive indirect volumes, which are shown 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 method and the direct rent method for South America, the direct volume method is the appropriate choice. But what about applying a combination of the two approaches? As noted, Uruguay appears high using direct volumes, but it is even higher using 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, but only to suggest that more regions consider this approach for the 2011 ICP round.

The Experience in the Eurostat-OECD and Western Asia Regions

Eurostat-OECD

There is ample documentation of the use of both the direct and indirect volume approaches in manuals on Eurostat-OECD practice (see Eurostat and OECD 2006 and Sergeev 2004), and it will not be repeated here. The main point is that as the number of associate and full members of Eurostat-OECD

increased, some countries did not have an adequate rental market to survey rental housing at market rates in order to provide comparable inputs to the original rental classification shown in table 12.2. A direct quantity approach was used in countries in which it did not seem appropriate to launch a rental survey. The linking was carried out through countries that carried out both approaches.

Table 12.5 does not take up the linking, but it does illustrate the country groups within the EU by whether they had rental surveys or used the direct quantity approach. Of more interest, table 12.5 makes the same comparison of the PPPs based on the CEM imputation for 33 countries in the EU that was made for the 10 countries in South America.[8] The first 22 countries used rental surveys to indirectly measure volumes, and the remaining 11 countries used the direct volume approach. Column (1) of table 12.5 provides the CEM volume index and column (2) the indirect and direct rent volume indexes, both based on EU33 = 100. Column (3) expresses the difference of (1) – (2) as a percentage of column (2).

The standard deviation of the direct rent differences is 27.1, with an average of 8.3. For the direct volume countries, the corresponding numbers are 18.8 and –19.4. Clearly, the large standard deviations suggest the high variability across countries on how well CEM proxies the volume of rental services. But of more interest is the average direction of the differences. The relative volume of rental services is less than the remainder of household consumption for many EU countries using the rental survey. And the opposite is true for those countries using the direct volume approach. This result is counterintuitive because most of the direct rent countries have substantially higher incomes than those using direct volumes. Normally, lower-income-per-capita countries will have a lower share of consumption devoted to dwelling services, whereas the opposite appears to emerge from table 12.5. An explanation of this finding is that the direct quantity approach tends to overstate dwelling services compared with direct rent surveys for countries at the same level of income. The reason for this is that direct rent surveys are better at holding housing quality constant compared with the direct quantity method. Further support for this conjecture is provided in the concluding section.

Western Asia

Several countries in Western Asia had limited quantity and quality information about their housing stock, several had doubtful expenditures, and several had both problems. All the countries in Western Asia obtained consumer price information on rents from their CPIs, and so they chose three types of rentals and also conducted a direct rent comparison for all, except Lebanon. Estimated rent levels were developed using both weighted and unweighted CPD equations. These two CPD estimates were very similar, and the geometric mean appears in column (2) of table 12.6, where the countries are ordered by their per capita domestic absorption (PCDA) in column (1).[9]

Two indirect rent indexes were also estimated, one of which used the same approach that table 12.3 illustrated for South America. The second quality measure assigned amenities two-thirds of the weight and average size of dwelling one-third of the weight. This adjustment is further discussed in the next section. Other than Jordan, in all countries these two measures were within 10 percent of each other; their geometric mean is given in column (3). The final estimated price level of market and owner-occupied dwellings for each country was the geometric 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. Because of the possible errors in expenditures, and both direct and indirect rents, the final choice in Western 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.

TABLE 12.5 Comparisons of the Direct Quantity Approach with CEM: European Union, 2005

	Countries, direct rents	Real PIC per capita, EU = 100 (1)	Indirect volume (2)	Percent difference (3)
1	Germany	126.0	130.6	−3.5
2	Belgium	121.9	107.7	13.2
3	Denmark	112.6	125.8	−10.4
4	Greece	119.9	84.8	41.3
5	Spain	127.1	71.7	77.3
6	France	125.7	120.2	4.5
7	Ireland	116.0	107.1	8.3
8	Italy	123.3	104.0	18.6
9	Luxembourg	251.3	191.9	31.0
10	Netherlands	126.7	105.0	20.7
11	Austria	146.7	135.0	8.7
12	Portugal	98.6	65.8	49.9
13	Finland	101.1	122.0	−17.1
14	Sweden	100.9	150.4	−32.9
15	United Kingdom	143.8	145.4	−1.1
16	Cyprus	136.4	130.4	4.6
17	Czech Republic	70.4	96.9	−27.3
18	Hungary	63.7	81.6	−22.0
19	Malta	105.3	82.0	28.5
20	Iceland	135.0	128.5	5.0
21	Norway	120.3	170.7	−29.5
22	Switzerland	148.5	129.8	14.4
23	Estonia	58.7	64.5	−8.9
24	Latvia	50.0	59.8	−16.4
25	Lithuania	62.8	60.0	4.6
26	Poland	54.6	65.1	−16.1
27	Slovak Republici	60.7	77.3	−21.5
28	Slovenia	90.3	82.8	9.0
29	Bulgaria	39.8	63.9	−37.8
30	Romania	38.6	43.9	−12.1
31	Turkey	31.3	65.9	−52.5
32	Croatia	60.3	74.7	−19.3
33	Macedonia, FYR	31.6	54.9	−42.4
		2,838.7	3,019.9	
		86.0	91.5	

Note: PIC = private individual consumption.

TABLE 12.6 Direct Quantity and Direct Rent Indexes: Western Asia, 2005 (Western Asia = 100)

Country	PCDA (1)	Direct rent price level (2)	Indirect price level (3)	Combined (4)
Yemen, Rep.	11.4	35.2	22.3	28.0
Iraq	15.9	29.3	27.7	28.5
Syria	20.1	46.6	26.5	35.1
Jordan	21.3	53.1	84.9	67.1
Egypt, Arab Rep.	25.0	8.5	11.5	9.9
Oman	101.0	74.1	115.3	92.4
Saudi Arabia	105.4	65.1	87.6	75.5
Bahrain	135.4	163.1	162.5	162.8
Kuwait	223.3	171.6	123.3	145.5
Qatar	341.1	349.7	337.8	343.7
Lebanon			8.5	

Note: PCDA = per capita domestic absorption.

Linking the Regions: The 2005 Experience

Unlike for many consumption basic headings, it was agreed that the ICP Global Office would receive quantity information on housing from all countries, as well as the Ring countries (see chapter 8). This recommendation was made after the regional protocols were in place, so initially only three regions—Africa, South America, and Western Asia—provided data on all countries to the Global Office. No quantity information was available for the Commonwealth of Independent States (CIS) and only for Ring countries in Asia. Subsequently, Eurostat-OECD supplied quantity information for all countries for which it was available. The problem was how to put the regional results in a form in which they could be linked to other regions.

In the work reported here, there are 106 countries, of which 103 responded to the questionnaire in the annex to this chapter. Mexico and the United States were added; the data were obtained from national sources that also included number of bedrooms in order to overlap with South America. China was added as well because of its size, the sparseness of the Asian data, 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 toilets in country dwelling stocks. However, the data submissions had many gaps, including the basic quantity measures themselves. Although 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 were supplied only by about half the countries.

Clearly, gaps in the data must be addressed if comparisons are to be made. The approach used is multilateral in nature because it 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 earlier, the available data from national sources were also used to improve the overlap of the country and volume coverage.[10]

Columns (1)–(3) in table 12.7a provide the numbers submitted by the first 10 countries, with three of them reproducing the South American entries in table 12.3. Column (4) is the quality

TABLE 12.7a Illustration of Quality Measure Estimates in Estimation of Regional Linking Factors: Selected Countries, 2005

	Water share (1)	Electric share (2)	Toilet share (3)	Quality 1 (4)	Quality 2 (5)
Argentina	0.841	0.954	0.715	0.831	0.887
Bahrain	1.000	1.000	1.000	1.000	1.000
Bangladesh	0.311	0.068	0.143	0.145	0.430
Benin	0.226	0.100	0.028	0.086	0.391
Bhutan	0.411	0.586	0.143	0.325	0.550
Bolivia	0.340	0.640	0.389	0.439	0.626
Botswana	0.226	0.210	0.384	0.263	0.509
Brazil	0.730	0.950	0.627	0.758	0.838
Brunei Darussalam	0.935	0.982	0.914	0.943	0.962
Central African Republic	0.060	0.603	0.133	0.169	0.446

Source: Derived from data provided by countries to the ICP Global Office.

measure introduced in table 12.3—namely, the geometric mean of columns (1)–(3) to obtain quality measure 1 (Q1). If a country reported a 0 share for any amenity, then the geometric mean would be 0.0 and the quality-adjusted quantity would be 0.0. Although 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 with its size in rooms or floor area. To roughly allow for this effect, quality measure 2 (Q2) gives space a weight of one-third and amenities a weight of two-thirds; this measure is given in column (5).[11] It can be seen that the two quality measures approach each other, moving from lower to higher measures of Q1.

As noted, only a few countries provided number of rooms or area in square meters. Another 10-country illustration of the dwelling data is presented in table 12.7b, which provides a sense of the gaps in response. Column (1) is the number of dwelling units, and columns (2) and (3) are persons per dwelling and dwellings per person, respectively. Unfortunately, the persons per dwelling differences do not tell one whether houses are bigger in some countries or there is simply less space per person. For example, Oman has almost double the number of persons per dwelling as Singapore, 7.395 versus 4.109. Is this because housing is more crowded in Oman or because its 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 the total number of dwellings. Nigeria and Saudi Arabia, for example, only provided the number of dwellings. As noted, it was possible to obtain total rooms for a few South American countries such as Peru, giving them three space measures. Most countries in table 12.7b and in the whole sample have just two space measures.

To deal with the incomplete data, a form of the CPD approach is estimated as

$$\text{(12.1)} \qquad \ln \text{ (indicating log)} \left(\frac{\text{Exp}}{Q_{ij}}\right) = \alpha + \beta_i R_i + \delta_j VT_j + \lambda(M_k)$$

where $\frac{\text{Exp}}{Q_{ij}}$ is the quality-adjusted volume of housing of a country in region *i* per unit of volume measure type *j*. There are 106 countries and four types of housing measures: number of units, number of rooms, number of bedrooms, and floor area. The total number of observations

TABLE 12.7b Density per Dwelling and Availability of Space Measures: Selected Countries, 2005

	Number of dwellings	Persons per dwelling	Dwellings per capita	Rooms	Bedrooms	Area
Nepal	4,161,000	6.521	0.153	x		x
Nigeria	28,000,000	4.693	0.213			
Oman	347,134	7.395	0.135	x		x
Pakistan	23,000,000	6.842	0.146	x		
Paraguay	1,098,005	5.609	0.178		x	
Peru	5,926,821	4.719	0.212	x	x	
Philippines	17,000,000	5.002	0.200			x
Qatar	126,203	6.441	0.155	x		
Saudi Arabia	3,991,783	6.156	0.162			
Singapore	1,059,000	4.109	0.243	x		

Source: Derived from data provided by countries to the ICP Global Office.

in the estimation was 230, which is slightly more than half the possible 424 (4 * 106) observations.

Equation (12.1) is semi-log with three dummy or class variables on the right-hand side: *R* for each of the five regions, *VT* for volume type, and M_k, where the subscript *k* indexes countries into one of three groups based on 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 12.8.

TABLE 12.8 Log Unit Values on Region and Quality

Measure	Variable	Parameter estimate	Standard error	t-value
Quality-adjusted unit value measure	Intercept	7.374	0.184	40.02
	Area	−4.334	0.171	−25.34
	Room	−1.081	0.162	−6.68
	Bedroom	−0.445	0.339	−1.31
	Dwelling	0.000		
Modernity measure	High	1.075	0.166	6.48
	Medium	0.000		
	Low	−1.115	0.185	−6.04
Region	AFR	−1.579	0.237	−6.67
	ASIA	−0.852	0.205	−4.17
	LAC	−1.080	0.272	−3.96
	WASIA	−0.392	0.240	−1.63
	Eurostat-OECD	0.000		

Source: Estimated from country submissions for the 2005 ICP.
Note: RMSE = root mean square error; AFR = Africa; LAC = Latin America and the Caribbean; WASIA = Western Asia; Eurostat-OECD = European Union–Organisation for Economic Co-operation and Development. RMSE = 0.977.

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), with dwelling type the highest, followed by per bedroom, per room, and lowest per square meter, in that order. 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 for the shares of dwellings that were modern or traditional, the shares 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 group countries into low, medium, and high, based on partial responses that 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 were so few observations.

The significance of the equation as a whole is weak as measured by the high root mean square error (RMSE) of 0.977. An identical equation was estimated using country in place of region, and the RMSE was 0.290 and R^2 was 0.991, 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 coefficients are much higher than those in table 12.8. So for the purpose of linking, the choice was made to use linking factors similar to those in table 12.8.[12] With Eurostat-OECD equal to 100, these were 20.6 for Africa, 42.7 for Asia-Pacific, 34.0 for South America, and 67.6 for Western Asia as shown by the anti-log (e^x) of the respective parameter estimates. It seems likely that the Asia-Pacific number is high relative to the South American index. This is probably the result of the small overlap of the volume measure of the South American countries with those of other regions, and with the relatively small number of countries from the Asia-Pacific region represented in table 12.8.

To summarize, the linking of the regions just described will be much improved if all the countries provide more complete responses to the form in the annex to this chapter. It is hoped this will be a learning experience that will improve the quantity and quality of information received from the 2005 ICP 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.

Moving On to 2011 Based on the ICP Experience

Making good comparisons of dwelling services is difficult for individual countries over time and even harder for different cities in 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. Two messages seem to be flowing from the experience in previous ICP rounds. First, there are the efforts carried out by Eurostat-OECD to link their new associate and older member countries when the new countries are not able to carry out rental surveys. Second, 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.

Using the Direct Volume Approach for All Countries

Plans have already been made 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 Eurostat-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 some of their countries will have been completed before those of the other regions. For the other regions, the Global Office should receive the responses from all the regions by the end of 2011—that is, at the same time the other consumer heading prices are being collected. Furthermore, it is proposed that the Global Office begin processing at the start of the validation procedure, not after it is carried out in the regions.

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

The previous section described the attempt to link the regions for 2005. It is proposed that some version of this approach be implemented as part of the 2011 ICP. With direct volume data from all the countries, it would be possible to straightforwardly estimate a transitive set of basic heading parities across the countries. This approach would offer two choices. First, it would directly provide regional linking factors, because the link would be the same whether a country or a country average served as the numeraire for a region. Eurostat-OECD will want to preserve their regional results, and this is easily done.

For regions that have not yet completed their own regional comparison, there is a second choice: they could simply use some or all of the multilateral indirect rental parities for their own countries. For example, this would remain an option for regions such as Western Asia that used some direct rent and some indirect rent parities. And if regions had already completed their own comparisons for dwelling services, they could choose to use these results in the manner of Eurostat-OECD. Finally, regions could examine the multilateral results and then decide whether to carry out and use their comparison of dwelling services. In short, there are a number of advantages for the regions as well as for the Global Office if it undertakes a multilateral comparison of direct volumes in any event and does so as early as possible.

The Advantages of Also Collecting Direct Rent Data

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

Even if the ICP plans to go with the direct volume approach, one advantage of having both direct and indirect rent information is as a further check on expenditures. But there is another more important consideration: 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) that is also instructive about rental equivalence. The data are collected annually from about 2,500 renters and 1,600 owners as part of the German Socio-Economic Panel (GSOEP). The characteristics of the dwellings are fairly detailed as to location by region, size of city, as well as four neighborhood groups.

Table 12.9 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 12.9).

Rows 2–3 provide the basic rent statistics for renters and owners, and one surprising feature is that the rent per square meter is higher for owners than for renters. This is surprising on several counts. First, renters are more concentrated in large cities and in the central areas of cities (49 versus 19 percent), where rents are typically higher. Second, rents per square meter typically decline with size of dwelling for a number of reasons. However, this is not the case in table 12.9, where the average rent is rising slightly more than average size. One quality characteristic appears in table 12.9—see 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 that are present in more complete rental surveys.

Kurz and Hoffmann 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 the log of rent rises less proportionately than size of dwelling and declines with age of dwelling. In the first ICP report (Kravis et al. 1975, 122), a similar hedonic equation was estimated for the United States using a sample of 39,100 renters from urban locations compiled by the Bureau for Labor Statistics (BLS) for 1967. Although the U.S. sample is from many years ago, the relationships of the German and U.S. hedonic regressions are similar—that is, the log of rent rises with size of urban center, number of rooms, and number of bathrooms (or baths), and declines with the age and condition of the structure.

TABLE 12.9 Rent Sample: Germany, 1998

	Germany	Renters	Owners
1	Average rent	793	1,362
2	Size (m^2)	70.6	116.2
3	Rent per m^2	11.2	11.7211704
	Share of sample		
4	With garden	0.28	0.88
5	Residential area	0.68	0.80
6	Mixed area	0.29	0.18
	By city size		
7	> 500,000	0.57	0.34
8	100,000–500,000	0.13	0.08
9	50,000–100,000	0.03	0.04
10	50,000–20,000	0.10	0.18

Source: Adapted from Kurz and Hoffmann 2004.

A feature of the BLS sample deserves special mention: it provides number of baths, and in 1967, 5 percent of the sampled units had no bath or a shared bath. Increments are half-bath, full bath, one and a half baths, and two or more. The coefficients are, respectively, 0.065, 0.227, 0.406, and 0.665, and all are 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 two or more baths. Why such a large effect for number of baths? I 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 example just given, the presence of a full bath added 23 percent to rents, or roughly one-third of the rental increment of two or more baths. Similar studies are done annually using U.S. data in which there is a single bathroom coefficient. For 2008 and 2009, the coefficient is 0.18 in separate regressions for renters and homeowners, all estimated with over 27,000 observations. This implies that two bathrooms add 36 percent to rent and two and a half bathrooms add 45 percent.[13] These effects are still large, though somewhat less than 40 years earlier.

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 measure only 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 greater, but that does not help in comparisons with countries for which 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 12.10. Some partial hedonic regression results are reported for selected 1975 ICP countries ranging in

TABLE 12.10 Rent Equations Based on National Relationships: Selected Countries, 1975

		Colombia	India[a]	Japan	Korea, Rep.	Malaysia[b]	Thailand	United States[c]	Uruguay
1	Base rent	13.17103984	2.409307876	13.50067385	18.79545455	8.604166667	14.66045142		3.552173913
2	Water, elec., toilet	30.78072012	5.616096659	23.53167453	32.76047727	19.29054167	19.79160942	52.17	10.86254783
3	(Water, elec., toilet)/base	2.337	2.331	1.743	1.743	2.242	1.35		3.058
4	Average rent, $ @ XR	49.8218335	3.332935561	47.36859838		27.27916667	22.2767419	174.7	37.77826087
5	Average/ (water, elec., toilet)	1.618605195	0.593461218	2.012971849		1.414121342	1.125564952	3.348667817	3.477845297
6	Sample size	2,707	17,326	4,048	1,970	3,061	1,814	9,995	1,161
7	RMSE	0.555	0.71	0.422	0.363	0.591	0.438	0.311	0.218
8	R^2	0.62	0.441	0.624	0.606	0.693	0.443	0.585	0.814
9	Per capita GDP PPPs	1,609	470	4,907	1,484	1,541	936	7,176	2,844

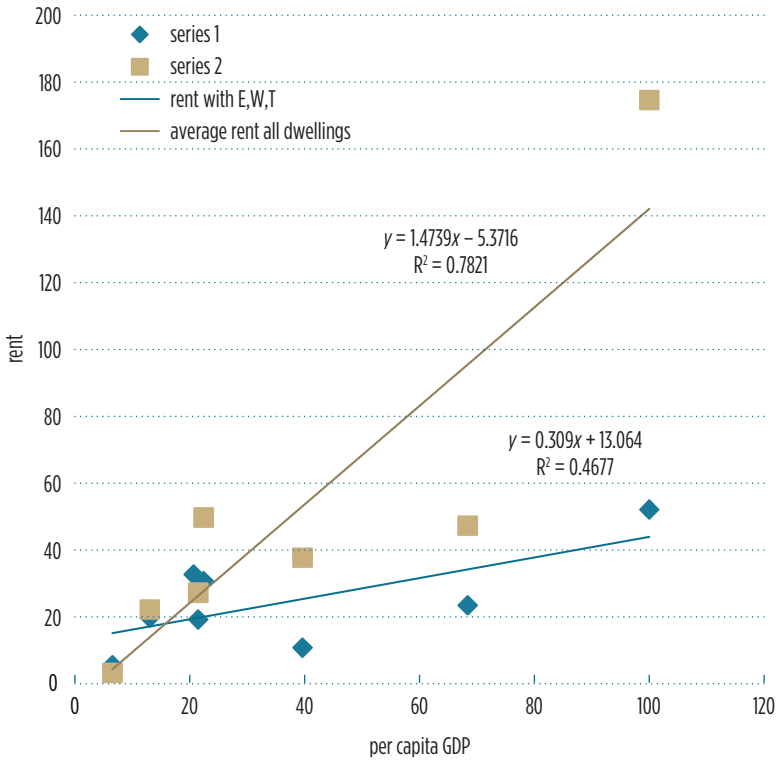
Source: Kravis, Heston, and Summers 1982, table 2-9, 56.
Note: Base rent refers to a unit built in 1945–59, 35 square meters in size, with water and electricity. XR = exchange rate; RMSE = root mean square error.
a. Row 4 is approximated for India.
b. The numerator was approximated for Malaysia.
c. The base rent could not be estimated for the United States because there were too few observations.

income from India to the United States as given in row 9. Row 1 provides the base rent in U.S. dollars at exchange rates of a dwelling that is 35 square meters, with water and electricity, and built in the 1945–59 period. Row 2 is the rent with water, electricity, and flush toilet—the quality adjustment factors for the direct volume approach. Row 3 is the ratio of a dwelling with water, electricity, and flush toilet to the base rent, except for the United States 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.

Row 4 gives the average rent of all dwellings in the samples except for the Republic of Korea, the consequence of the simpler and time-consuming computing capacity of the period. Row 5, which gives the ratio of the average to row 2, reinforces the point of this section. The average dwellings in the higher-income countries have more unmeasured elements of quality and much higher rents compared with the quality-adjusted volume as usually estimated using the direct volume approach.

Figure 12.1 illustrates two plots of points with the per capita GDP of each country (US = 100) on the horizontal axis and the rent per month on the vertical axis. The upper line of squares (series 2) shows how the plot of average rents of dwellings with water, electricity, and flush toilet of a given size (square meters) rises with the per capita income of the countries, not controlling for other amenities. The set of diamonds (series 1) shows how rent rises per dwelling of a given size in the same countries for a dwelling identified using the quantity method—that is, a dwelling with water, electricity, and a flush toilet but no other amenities.

FIGURE 12.1 Plot of Rents against Per Capita GDP (United States = 100)



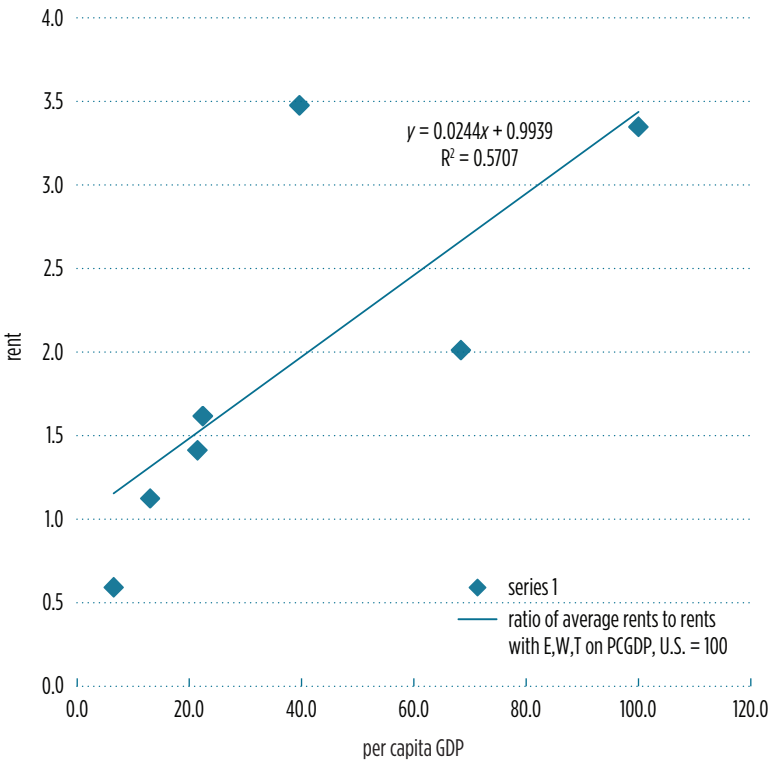
Source: Estimated from table 12.10.

Why do the two plots of points have such different slopes yielding much higher rent differentials at higher levels of GDP per capita? The reason is that many quality features of dwellings are associated with number of bathrooms and other features of dwellings in higher-income countries that are not captured in direct quantity comparisons. For example, in the hedonic rent studies with which the author is familiar, the coefficient on additional half or full bathrooms appears to add much more to estimated rents than one might expect given the extra capital cost involved. The interpretation is that as one moves from the availability of an inside flush toilet to more than one bathroom, there will also be many other less measurable quality features of the dwelling yielding higher rents.

The consequence is that the PPPs for rental dwellings estimated indirectly via direct quantity comparisons are likely too low and the volumes too high compared with estimation from market rents. The effect will be systematic across income levels because rental surveys are available in higher-income countries. In the past, this may have been offset in practice by a systematic understatement of dwelling expenditures in lower-income countries. If rent expenditures are improved in the 2011 ICP, then the problem will become even more apparent.

Figure 12.2 plots the ratio of average rent to rent with just electricity, water, and toilet against per capita GDP. Because the intercept in figure 12.2 is essentially 1.0, the relationship says that moving from a country with 5 percent to a country with 80 percent of the per capita GDP of the

FIGURE 12.2 Ratio of Average Rent to Electricity, Water, Toilet (E, W, T) Rent on Per Capita GDP (United States = 100)



Source: Estimated from table 12.10.

United States would lead to a difference of 83 percent in the estimated price level of rents, the direct volume method being lower—that is, [0.0244 * (80 – 5)] –1 as a percent. This implies a large effect on total rents and could make a difference in consumption of 3 or 4 percent, even for countries reporting rents of only 5 percent of individual consumption.

There is no reason to believe that the 1975 relationship is not present today, but that does not make the earlier quantitative illustration necessarily a guide to exactly what should be done in the 2011 ICP round. 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.

ANNEX

Worksheet for Quantity of Housing and Amenities

Reference year for benchmark

Country

Provide these breakdowns or others available for your country:

	1. Total of all dwellings	2. Type of construction of dwellings			3. Location of dwellings		
		a. Modern construction		b. Traditional	a. Size of urban area		b. Rural
		(1) Houses	(2) Flats		(1) Large	(2) Other	
Number of dwelling units							
Number of rooms							
Total area in m^2 of the unit							
Percentage of dwelling units with							
1–2 rooms							
3–4 rooms							
5+ rooms							
Percentage of dwelling units with							
Electricity							
Inside water							
Private toilet							
Central heating							
Air-conditioning							
Percentage of dwelling units							
Rented							
Owner-occupied							
Assumed growth rate from benchmark period to 2005							

Source: Described on p. 147 of World Bank 2008.

NOTES

1. These papers are posted on the World Bank's ICP website under Technical Advisory Group: http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/ICPEXT/0,,contentMDK:22388553~pagePK:60002244~piPK:62002388~theSitePK:270065,00.html.
2. Some countries use the increase in the 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 such as maintenance, insurance, and depreciation in arriving at rental income on the income side of the accounts.
3. Both the direct rent and direct volume methods are described more fully in the *Eurostat-OECD Methodological Manual on Purchasing Power Parities,* including the 48 strata of rental housing (Eurostat and OECD 2006, 80–84). 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 therefore the approach underestimates the dwelling services of higher-value, owner-occupied units. In particular, the substantial decline in the ratio of rent to the price of houses, from low- to high-priced dwellings, is not adequately taken into account.
4. This discussion is based on Kravis, Heston, and Summers (1982, 54–59). The rent samples varied in size from a few hundred to over 10,000. It is important to note that even a nonrandom sample may produce unbiased regression coefficients on the most important rent-determining features such as floor area and baths, though not necessarily an 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 rental sample from a capital city to approximate all cities.
5. Here it is assumed that the structure required no maintenance and that, contrary to fact, the land value is not to be included in the illustration. Diewert (2009, sec. 8.4) provides a detailed discussion of how maintenance versus renovation should be treated. Typically, recurring maintenance is a current consumption item, and so it is not part of the user cost of a structure, whereas 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, it should be included in the calculation of user cost, even if the service life of the land is infinite because the owner could have received the opportunity cost of the land value.
6. An important illustration is China, which publishes an average floor area per person for the population that appears very high by international standards.
7. Deaton (2010, 14–15) shows that the problem arose because several of the poorest countries were used, appropriately enough, to establish a world poverty line for 2005. But several of these countries, such as Ghana, Chad, and Tajikistan, had estimates of expenditures on housing services that were unrealistically low. The per capita volume of housing of these countries under CEM would be much higher than justified by the expenditures on housing. Therefore, the indirect rent indexes were too low. Because this lowered the PPPs of consumption for these countries, it converted their poverty lines to a higher international value than appropriate. As a consequence, for large countries such as China and India that had reasonable estimates of dwelling expenditures, the poverty line was raised, thereby placing over 100 million more people in poverty in these two countries alone.
8. I would like to thank Sergey Sergeev for the calculations underlying table 12.5 and especially for the suggestion that they would be as interesting for the EU as for South America.

9. See Heston and Hamadeh (2010) for more details. Domestic absorption is referred to as in the *System of National Accounts.* It is the sum of domestic expenditures, excluding the net foreign balance, and therefore differs from GDP.
10. As noted, national sources were used for Mexico and the United States in order to overlap number of bedrooms with the South American countries. Further supplementary household survey data were used for Bangladesh, Benin, Bhutan, Bolivia, Niger, and Peru to fill the 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 information on number of bedrooms was available from the regional comparison.
11. The calculation of the second quality measure is $Q2 = \frac{(1 + 2 \cdot Q1)}{3}$. For example, Benin is $\frac{(1 + 2 \cdot 0.086)}{3} = \frac{1.172}{3}$ or 0.391.
12. Because data for additional countries became available after the linking was completed, the equation reported in table 12.8 contains more observations than were actually used for the report.
13. These coefficient estimates are based on experimental work being done jointly by the BLS and Bureau of Economic Analysis to estimate regional PPPs to convert personal incomes.

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