



**From:**  
**Eurostat-OECD Methodological Manual on  
Purchasing Power Parities**

**Access the complete publication at:**  
<http://dx.doi.org/10.1787/9789264189232-en>

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## Housing

**Please cite this chapter as:**

OECD/Eurostat (2012), "Housing", in *Eurostat-OECD Methodological Manual on Purchasing Power Parities*, OECD Publishing.  
<http://dx.doi.org/10.1787/9789264189232-9-en>

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**Housing**

**6**



## 6.1 Introduction

6.1 Final expenditure on housing is an important component of GDP. Its share of GDP for countries participating in Eurostat and OECD comparisons is usually between 8 and 12 per cent and tends to increase as GDP per capita rises. Although housing is a part of household consumption expenditure, it is not included in the cycle of price surveys for consumer goods and services described in Chapter 5. Instead it is covered by a special rent survey<sup>1</sup> for which participating countries are not expected to collect data specifically but to extract them from existent statistical sources. The survey is organised by Eurostat and is held every year.<sup>2</sup> Data are collected on the rents paid by tenants and on the rents imputed to owner-occupiers for a set of broadly-defined dwellings. Quantity and quality data on the housing stock are also collected.

6.2 The data collected on rents are used to calculate purchasing power parities (PPPs) with which the final expenditures on actual and imputed rents are deflated to derive volume measures for housing indirectly. This is the *price approach*. It is the approach generally applied in Eurostat and OECD comparisons. There is, however, a refinement in the case of rents. Basic heading PPPs are calculated with actual expenditure weights for products and not with the usual quasi-expenditure weights to indicate whether or not a product is representative.

6.3 The data collected on the housing stock are used to compute volume measures for housing directly. This is the *quantity approach*. It is not widely applied in Eurostat and OECD comparisons being employed only for housing and education. The direct volume measures for housing from the quantity approach are used in place of the indirect volume measures for those participating countries that do not have a large and representative rent market and so are unable to supply the data required on actual and imputed rents.

6.4 This chapter describes the rent survey and the derivation of expenditure weights. It explains how PPPs for housing are calculated directly by the price approach with the data collected on rents and indirectly by the quantity approach with the data collected on the housing stock. It also explains how these two sets of PPPs, neither of which has complete country coverage, are combined to obtain a single series of PPPs covering all participating countries.

## 6.2 Actual and imputed rents

6.5 Most participating countries estimate final expenditure on housing in line with the SNA 93<sup>3</sup> or the ESA 95<sup>4</sup>, namely:

- *Household expenditure on actual rents* is obtained by summing the rents paid by households that rent their accommodation. The calculation includes dwellings that are rented but not occupied. It also includes rented secondary residences.

Rents are defined as payments for the use of the land on which the property stands, the dwelling occupied, the fixtures and fittings for heating, plumbing, lighting, etc., the furniture in the case of a dwelling let furnished, and the garage or parking space providing parking for the dwelling<sup>5</sup>.

<sup>1</sup> The term *rent* is used throughout this chapter. From a national accounts perspective, this is incorrect. The term *rental* should be used instead. The SNA 93 and the ESA 95 broadly define rent as property income received by owners of non-produced assets such as land or subsoil assets and rentals as payment for a service made to owners of produced assets such as buildings or machinery.

<sup>2</sup> For OECD comparisons, the survey is organised once every three years by the OECD.

<sup>3</sup> *System of National Accounts 1993*, Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, World Bank, 1993.

<sup>4</sup> *European System of Accounts 1995*, Eurostat, Luxembourg, 1996.

<sup>5</sup> The garage or parking space does not have to be physically contiguous to the dwelling nor does it have to be rented from the same landlord.

Rents do not cover payments for maintenance and repair of the dwelling, water supply, refuse and sewage collection, electricity and gas, and heating and hot water supplied by district heating plants. Nor do rents cover co-proprietor charges for caretaking, gardening, stairwell cleaning, maintenance of lifts and refuse disposal chutes, heating and lighting, etc., in multi-occupied buildings.

- *Household expenditure on imputed rents* is obtained by summing the rents imputed to households that own and occupy their accommodation. Owner-occupied secondary residences are included in the calculation. Dwellings owned by households that are not occupied (nor rented out) are excluded.<sup>6</sup>

Imputed rents are defined as rental equivalents – that is, the estimated rent that a tenant would pay for identical accommodation let unfurnished, taking into consideration factors such as the type of dwelling (single-family or multi-family), its size (useable surface, number of rooms), its facilities (running water, indoor toilet and bathroom, electricity, central heating, etc.), its location (city centre, suburban or rural) and neighbourhood amenities.

The preferred method of determining rental equivalents is the stratification method whereby the housing stock is broken down by type, size, quality and location into strata and combined with information on actual rents paid in each stratum. More precisely, the number of owner-occupied dwellings in the stratum is multiplied by the average rent paid for rented accommodation in the stratum to arrive at the total imputed rent for the stratum. Summing the imputed rents across strata gives the total imputed rent for the country.

Implementation of the stratification method requires the existence of a well-organised market for rented housing. In the absence of such a market, the second best method, the user cost method, has to be employed. This entails estimating imputed rents by summing all the costs that owner-occupiers incur in owning their dwellings: intermediate consumption, compensation of employees, consumption of fixed capital, net operating surplus and other taxes (less subsidies) on production.<sup>7</sup>

6.6 Household expenditure on actual rents and household expenditure on imputed rents constitute two of the four basic headings covering housing in the Eurostat-OECD classification of GDP expenditures. The other two basic headings are the expenditure on housing by non-profit making institutions serving households (NPISHs) and the expenditure on housing by general government. Neither price nor quantity data are collected specifically for either of these two basic headings. Their volume indices are derived with the PPPs calculated for household expenditure on actual rents.

<sup>6</sup> Not occupied means empty, that is, unfurnished. Principle 12 of Commission Regulation (EC) No 1722/2005 of 20 October 2005 on the principles for estimating dwelling services for the purpose of Council Regulation (EC, Euratom) No 1287/2003 on the harmonisation of gross national income at market prices states that “a furnished owner-occupied dwelling in general shall be treated as an occupied dwelling”.

<sup>7</sup> The SNA 93 recommends that the output of owner-occupied dwellings should be estimated by the rental equivalence method and assumes that well-organised markets for rented housing exist in most countries. It makes no recommendation if such a market does not exist in a country. But, when considering the valuation of goods and services produced on own account in general, the SNA 93 recommends that output produced for own final use should be valued by the total production costs incurred if it cannot be valued at average basic prices of the same goods and services sold on the market. In other words, in countries where a well-organised rent market does not exist, housing output produced by owner-occupiers should be valued by the total cost to the producer or user. The European Union is more explicit. It requires EU Member States and EU Candidate Countries to apply the stratification method. If the method cannot be applied, because the rent market is small and unrepresentative, it requires Member States and Candidate Countries to apply the user cost method instead. See Principle 1 of Commission Regulation (EC) No 1722/2005.

**Box 6.1:** Price approach reporting form

<b>Country</b>	
<b>Year</b>	

N°	Item definition				Data collection						Average size m <sup>2</sup>
	Rental	Flat/House	Rooms	Central heating	Monthly rent per m <sup>2</sup>	Total surface m <sup>2</sup>	Annual expenditure	Monthly rent per dwelling	Number of dwellings	Annual expenditure	
1	2	3	4	5	6	7	8=(6*7)*12	9	10	11=(9*10)*12	12=(7/10)
1	Actual	Flat	1-2	No							
2	Actual	Flat	1-2	Yes							
3	Actual	Flat	3	No							
4	Actual	Flat	3	Yes							
5	Actual	Flat	4+	No							
6	Actual	Flat	4+	Yes							
7	Actual	House	All	No							
8	Actual	House	All	Yes							
9	Actual rents for dwellings without facilities										
A	Actual rents: average or total				$(\sum 8/\sum 7)/12$	$\sum 7$	$\sum 8$	$(\sum 11/\sum 10)/12$	$\sum 10$	$\sum 11$	$\sum 7/\sum 10$
10	Imputed	Flat	1-2	No							
11	Imputed	Flat	1-2	Yes							
12	Imputed	Flat	3	No							
13	Imputed	Flat	3	Yes							
14	Imputed	Flat	4+	No							
15	Imputed	Flat	4+	Yes							
16	Imputed	House	All	No							
17	Imputed	House	All	Yes							
18	Imputed rents for dwellings without facilities										
B	Imputed rents: average or total				$(\sum 8/\sum 7)/12$	$\sum 7$	$\sum 8$	$(\sum 11/\sum 10)/12$	$\sum 10$	$\sum 11$	$\sum 7/\sum 10$

GDP (from the expenditure questionnaire)		Difference
Actual rents	AR	$\sum 8A - AR$
Imputed rents	IR	$\sum 8B - IR$

Difference
$\sum 11A - AR$
$\sum 11B - IR$

**Box 6.2: Quantity approach reporting form**

<b>Country</b>	
<b>Year</b>	

**Quantity indicators**

Dwellings with	Flats				Houses				Total				Average size of dwelling m <sup>2</sup>		
	Number of dwellings	%	Total surface m <sup>2</sup>	%	Number of dwellings	%	Total surface m <sup>2</sup>	%	Number of dwellings	%	Total surface m <sup>2</sup>	%	Flats	Houses	Total
1 room															
2 rooms															
3 rooms															
4 rooms															
5 rooms															
6+ rooms															
<b>Total</b>															

**Quality indicators**

Dwellings with	Flats		Houses		Total	
	Number of dwellings	%	Number of dwellings	%	Number of dwellings	%
Electricity						
Running						
Inside toilet						
Central						
<b>Total</b>						



### 6.3 Rent survey

6.7 The rent survey collects data for both the price approach and the quantity approach. The survey questionnaire which is in Excel has two reporting forms: one for the price and other data on actual and imputed rents needed for the price approach; the other for the quantity and quality data on the housing stock needed for the quantity approach. Examples of the reporting forms are given in Box 6.1 and Box 6.2. Participating countries estimating final expenditure on imputed rents by the stratification method are required to complete the reporting form for the price approach in Box 6.1. Participating countries applying the user cost method to estimate final expenditure on imputed rents are required to complete the reporting form for the quantity approach in Box 6.2. A small subset of countries completes both reporting forms. By supplying data for both approaches, these countries provide the means of linking the direct PPPs derived by the price approach with the indirect PPPs obtained by the quantity approach.

6.8 The rent survey covers three years:  $t-2$ ,  $t-1$  and  $t$ . The questionnaire has a reporting form for each approach for each year. Participating countries are only expected to fill in the cells that have been highlighted on the reporting forms in Box 6.1 and Box 6.2. The reporting forms are programmed to complete the cells that are not highlighted. In addition to the reporting forms, the questionnaire has three summary sheets – two for the price approach, one for the quantity approach – whereby countries can check the inter-temporal consistency of the data they have reported for each year over the three years covered. Respondents do not have to fill in the summary sheets as the questionnaire is programmed to complete them automatically as data are entered on the reporting forms. Examples of the summary sheets are available in Boxes 6.3, 6.4 and 6.5. The questionnaire also has a comments page where apparent inconsistencies and anomalies in the data can be explained.

6.9 Both reporting forms refer to rooms, useable surface and central heating. These are defined as:

- *Rooms*: Bedrooms, dining rooms, living rooms, habitable cellars and attics, servants' rooms and other separate spaces used or intended for habitation all count as rooms. Kitchens, corridors, verandas, halls, utility rooms (such as boiler rooms and laundry rooms), lobbies, bathrooms and toilets do not count as rooms.
- *Useable surface*: The floor space measured inside the outer walls minus the thickness of internal walls and door and window recesses. Excluded are stairs, balconies and terraces, non-habitable cellars and attics and, in multi-dwelling houses, all common spaces.
- *Central heating*: A dwelling is considered as centrally heated if heating is provided either from a community heating centre or from an installation built in the building or in the housing unit that is established for heating purposes without regard to the source of energy.

6.10 Both reporting forms also refer to *facilities* but the definitions differ. For the price approach, facilities are specified as a bundle of amenities comprising hot and cold running water, electricity, inside flush toilet and bathroom and kitchen. The bundle may or may not include central heating. For the quantity approach, facilities are specified individually. The amenities identified are electricity, running water, inside toilet and central heating. In other words, with the price approach, a dwelling must have all the facilities listed in the bundle, with the exception of central heating, to be counted as *with facilities*. This is not the case with the quantity approach. For example, a dwelling may have running water but not an inside flush toilet to be counted as *with running water*.

6.11 Eurostat distributes the rent questionnaire in February of  $t+1$ . Participating countries are expected to return the questionnaire to Eurostat via eDAMIS by the end of August of  $t+1$  after having completed and validated the reporting forms. Validation in the context of the rent survey requires countries to check the summary sheets for any inter-temporal inconsistencies in the data they have supplied. It also requires countries to ensure that the data reported are consistent with the data on which the expenditure estimates on rents in the national accounts are based. Consistency with the national accounts is particularly important in the case of the price approach for which respondents are required to make an explicit check as explained below.

### 6.3.1 Price approach reporting form

6.12 Participating countries that use the stratification method to estimate imputed rents are required to fill in a price approach reporting form (Box 6.1) for each of the three years covered by the rent survey. The reporting form in Box 6.1 lists 18 dwellings of which nine are rented and nine are owner-occupied. The definitions for the rented dwellings are the same as the definitions for the owner-occupied dwellings with two exceptions. First, the rented dwellings specified refer to all rented dwellings irrespective of whether they are rented furnished or unfurnished, whereas the owner-occupied dwellings specified refer to dwellings without their furnishings (that is to say, the furnishings of the dwelling are not taken into account when imputing the rent). Second, rented dwellings can be vacant, they do not have to be occupied to be counted. Owner-occupied dwellings, on the other hand, cannot be empty, they have to be occupied - indicated by being furnished - to be included.<sup>8</sup>

6.13 The definitions first distinguish between dwellings with facilities and dwellings without facilities. Facilities are defined as hot and cold running water, electricity, inside flush toilet and bathroom and kitchen. If one of these amenities is missing, the dwelling is classified as without facilities. The data on dwellings without facilities have to be reported for completeness to assist validation, but they are not broken down further nor are they used to calculate PPPs for rents. The second distinction, which applies only to dwellings with facilities, is between dwellings that are flats and dwellings that are houses. Flats are broken down by size, where size is defined by number of rooms. Houses are not broken down by size. A further and final distinction is between whether or not the flat or house is centrally heated.<sup>9</sup>

6.14 The reporting form in Box 6.1 has two parts. In the first part, participating countries are to report for each dwelling specified the average monthly rent paid (or imputed) per square metre of useable surface in column 6 and the total number of square metres of useable surface in column 7. In the second part, countries are to report for each dwelling specified the average monthly rent paid (or imputed) per dwelling in column 9 and the total number of dwellings in column 10. Participating countries are required to fill in both parts of the reporting form, although it is recognised that some countries are unable to supply data by square metre. It is important that countries which can complete both parts do so, as this provides the means whereby countries that have no data by square metres can be linked with those countries that do. Countries that only have rent per dwelling typically impute an average size of dwelling (and then total surface in square metres and rent per square metre) by taking the arithmetic mean of the average size of dwellings in countries that are able to provide both sets of data. The questionnaire is programmed to complete the summary table in Box 6.3 so that countries can check the consistency of both sets of monthly rent data and average dwelling sizes over the three years surveyed.

6.15 The annual expenditure on actual and imputed rents for each of the dwellings specified is obtained either by multiplying the monthly actual/imputed rent per square metre in column 6 by the total surface in column 7 (and by 12 to make the monthly expenditure annual) or by multiplying the monthly actual/imputed rent per dwelling in column 9 by the number of dwellings in column 10 (and by 12). These annual expenditures are calculated and entered automatically into column 8 and column 11 respectively. They provide the weights to calculate the PPPs for the basic heading covering household expenditure on actual rents and for the basic heading covering household expenditure on imputed rents. The questionnaire is programmed to compute the weights and enter them into a summary table (Box 6.4) so that they can be checked by countries for consistency over the three-year period covered. Inconsistencies that reflect actual circumstances should be retained with an explanation on the comments page, otherwise they should be corrected.

6.16 Not only is it important that the annual expenditures and the data from which they are derived are consistent over time, it is also important that they are consistent with the data underlying the expenditure estimates for actual and imputed rents in the national accounts. In other words, whenever possible, the same data sources should be used to complete the price approach reporting

<sup>8</sup> See footnote 6.

<sup>9</sup> The reporting form for the OECD rent survey covers a longer list of dwellings to accommodate the circumstances of non-European participating countries. The definitions of these additional dwellings specify either number of rooms or number of bedrooms.

form as those used by the national accountants in their rent estimation model. Sources other than these should only be used, if the questionnaire cannot be filled in directly from the national accounts sources. At the bottom of the price approach reporting form, under columns 5 to 8, there are boxes in which the estimates of expenditure on actual rents and expenditure on imputed rents that the national accountants report for the computation of PPPs and real expenditures should be recorded. The reporting form is programmed to show the differences between the national accountants' estimates and those in columns 8 and 11 on the reporting form. Differences should be explained on the comments page.

6.17 When reporting expenditure on actual and imputed rents to Eurostat and the OECD, national accountants report household expenditure on actual rents, household expenditure on imputed rents, expenditure on housing by NPISHs and expenditure on housing by general government separately. But the actual rents recorded on the reporting form are, as explained below, total rents that included the amounts paid by households plus any social transfers in kind for housing that households receive from NPISHs and general government. Hence, for consistency, when completing the box labelled *actual rents* under columns 5 to 8 on the reporting form, the expenditure to be recorded is the sum of household expenditure on actual rents, expenditure on housing by NPISHs and expenditure on housing by general government. These expenditures, plus household expenditure in the box labelled *imputed rents*, constitute actual individual consumption of housing.

6.18 The rents that countries report should be national averages and not capital city prices. They should also be monthly averages for the reference year and not month-of-survey prices. And, further, they should be consistent with the internationally agreed definitions of actual and imputed rents given earlier.

6.19 Not all countries have national definitions that comply with those of the SNA 93 and the ESA 95. For example, some national definitions include heating and hot water. Participating countries with such national definitions are still required to report rents that conform to the international definitions – that is, they are expected to adjust their national rent data accordingly. To preserve consistency between prices and final expenditures, they are also required to adjust their expenditures on the basic headings covering actual and imputed rents in their detailed estimates of GDP expenditures that they report for the calculation of PPPs. This calls for close collaboration between price statisticians and national accountants.

6.20 Consistency also requires participating countries to supply prices for imputed rents that correspond to the prices underlying the estimated expenditure on imputed rents. According to the SNA 93 and the ESA 95, expenditure on imputed rents for owner-occupied dwellings should be estimated using actual rents paid for comparable unfurnished dwellings. But, if the renting of furnished dwellings is widespread, actual rents paid for comparable furnished dwellings may also be used providing a deduction is made first for the rent differential between furnished and unfurnished dwellings. When this is the case, consistency requires that price statisticians and national accountants adjust actual rents for furnished dwellings by the same furnished-unfurnished rent differential. Similarly any other adjustments that national accountants may make to the actual rents used to estimate expenditure on imputed rents should be applied by the price statisticians. This too calls for close collaborate between price statisticians and national accountants.

**Box 6.3:** Price approach summary sheet I

N°	Rental	Flat/ House	Rooms	Central heating	Monthly rent per m <sup>2</sup>			Monthly rent per dwelling			Average size m <sup>2</sup>		
					t-2	t-1	t	t-2	t-1	t	t-2	t-1	t
1	Actual	Flat	1-2	No									
2	Actual	Flat	1-2	Yes									
3	Actual	Flat	3	No									
4	Actual	Flat	3	Yes									
5	Actual	Flat	4+	No									
6	Actual	Flat	4+	Yes									
7	Actual	House	All	No									
8	Actual	House	All	Yes									
9	Actual rents - dwellings without facilities												
A	Actual rents: average or total												
10	Imputed	Flat	1-2	No									
11	Imputed	Flat	1-2	Yes									
12	Imputed	Flat	3	No									
13	Imputed	Flat	3	Yes									
14	Imputed	Flat	4+	No									
15	Imputed	Flat	4+	Yes									
16	Imputed	House	All	No									
17	Imputed	House	All	Yes									
18	Imputed rents - dwellings without facilities												
B	Imputed rents: average or total												

**Box 6.4:** Price approach summary sheet II (weights)

N°	Rental	Flat/ House	Rooms	Central heating	Weights based on rent per m <sup>2</sup>			Weights based on rent per dwelling					
					t-2	t-1	t	t-2	t-1	t			
1	Actual	Flat	1-2	No									
2	Actual	Flat	1-2	Yes									
3	Actual	Flat	3	No									
4	Actual	Flat	3	Yes									
5	Actual	Flat	4+	No									
6	Actual	Flat	4+	Yes									
7	Actual	House	All	No									
8	Actual	House	All	Yes									
9	Actual rents - dwellings without facilities												
A	Actual rents: average or total												
10	Imputed	Flat	1-2	No									
11	Imputed	Flat	1-2	Yes									
12	Imputed	Flat	3	No									
13	Imputed	Flat	3	Yes									
14	Imputed	Flat	4+	No									
15	Imputed	Flat	4+	Yes									
16	Imputed	House	All	No									
17	Imputed	House	All	Yes									
18	Imputed rents - dwellings without facilities												
B	Imputed rents: average or total												

**Box 6.5:** Quantity approach summary sheet

Dwellings with	Number of dwellings			Average size of dwelling		
	t-2	t-1	t	t-2	t-1	t
1 room						
2 rooms						
3 rooms						
4 rooms						
5 rooms						
6+ rooms						
<b>Total</b>						

Dwellings with	t-2 %	t-1 %	t %
Electricity			
Running water			
Inside toilet			
Central heating			
<b>Total</b>			

6.21 The actual rents reported by participating countries should be a weighted average of the rents paid by households for dwellings rented from the private sector and dwellings rented from government. Generally, when a dwelling is rented from the private sector, the full market rent is paid by the household. But if a household pays a reduced rent because of the social benefits it receives from government, the full market rent - that is, the part paid by the household plus the part paid by government - should still be used when calculating the average<sup>10</sup>. A household renting a dwelling from government may pay a rent that does not cover total costs – where total costs are defined as including compensation of employees, intermediate consumption, consumption of fixed capital and other taxes (less subsidies) on production. When this is the case, the rent of a dwelling rented from government should be valued at total cost when calculating the average.

### 6.3.2 Quantity approach reporting form

6.22 Participating countries that have small unrepresentative rent markets<sup>11</sup> and are unable to estimate expenditure on imputed rents by the stratification method are required to estimate the expenditure by the user cost method if they are EU Member States or EU Candidate Countries<sup>12</sup>.

6.23 The user cost method consists of estimating each of the costs that the owners of dwellings would need to take into account in fixing the market rent if they decided to rent their dwellings. These costs are intermediate consumption (comprising routine maintenance and repair that does not extend the lifetime of the dwelling and insurance services), consumption of fixed capital, other taxes (less subsidies) on production and net operating surplus (defined as the nominal rate of return on capital invested in the dwellings and the land). The method provides realistic estimates of final expenditure on housing. This is an important consideration because with the quantity approach it is the PPPs that are derived indirectly. Realistic final expenditures give meaningful PPPs. Similarly, realistic final expenditures provide realistic weights when the PPPs for housing are aggregated to obtain PPPs for individual consumption expenditure by households and GDP.

6.24 Participating countries responding to the rent questionnaire that estimate imputed rents by the user cost method are required to fill in a quantity approach reporting form (Box 6.2) for each year covered by the rent survey. The reporting form in Box 6.2 refers to the total housing stock. There are two tables to be completed: one for quantity data, the other for quality data. In both tables data are required for flats and houses separately. In the table for quantity data, flats and houses are ordered by size, where size is defined by number of rooms. For each size category specified, respondents are to report the number of dwellings in the category and the total number of square metres of useable surface for all dwellings in the category. In the table for quality data, respondents are to report the number of flats and the number of houses having electricity, running water, inside toilet

<sup>10</sup> That is, the total or composite price should be used. But the expenditures remain separate. The reduced rents paid by households are recorded under household final consumption expenditure and the social benefits paid by government are recorded under government final consumption expenditure.

<sup>11</sup> Commission Regulation (EC) No 1722/2005 defines a rent market as small when less than 10 per cent of the dwelling stock are privately rented and unrepresentative when the disparity between private rentals and other paid rentals exceeds a factor of three.

<sup>12</sup> If they are not EU Member States or EU Candidate Countries, they are encouraged to apply it.

and central heating. Respondents are only expected to fill in the cells that are highlighted as the reporting form is programmed to complete the cells that are not highlighted. The questionnaire is programmed to complete the summary table in Box 6.5 which allows respondents to check the consistency of the data supplied for the three years the questionnaire covers. Inconsistencies that mirror actual changes should be kept and explained on the comments page; those that do not should be corrected.

## 6.4 Calculating PPPs for housing

6.25 PPPs for housing are obtained either directly with the price approach or indirectly with the quantity approach. With the price approach, PPPs are calculated with the price and expenditure data collected on actual and imputed rents. The PPPs are subsequently used to convert the national expenditures<sup>13</sup> of participating countries on housing to real expenditures from which the volume indices for housing are derived. Conversely, with the quantity approach, first the volume measures are computed using the quantity and quality data collected on the housing stock. The volume measures are then divided into the national expenditures of participating countries on housing to get the PPPs for housing.

### 6.4.1 Directly by the price approach

6.26 As described in Chapter 12 and illustrated in Annex V, the standard way of calculating bilateral PPPs for a basic heading is first to calculate a Laspeyres type PPP between each pair of participating countries, then to calculate a Paasche type PPP between each pair and finally to calculate a Fisher type PPP between each pair. The Fisher type PPP between two countries is the geometric mean of their Laspeyres type PPP and their Paasche type PPP. The Fisher type PPPs are not transitive. They are made transitive by the Ëltetö-Köves-Szulc (EKS) procedure.

6.27 Expenditure weights are not usually employed to calculate the bilateral PPPs for a basic heading. But, when they are, the Laspeyres type PPP between two countries is defined as the arithmetic mean of the price ratios weighted with the weights of the base country.

$$L_{j/h} = \sum_{i=1}^k \left( \frac{P_{ij}}{P_{ih}} \right) * w_{ih} / \sum_{i=1}^k w_{ih} \quad (1)$$

And the Paasche type PPP is defined as the harmonic mean of the price ratios weighted with the weights of partner country.

$$P_{j/h} = \sum_{i=1}^k w_{ij} / \sum_{l=1}^m w_{ij} / \left( \frac{P_{ij}}{P_{ih}} \right) \quad (2)$$

In both equations,  $h$  is the base country and  $j$  the partner country,  $P_{ij}$  and  $P_{ih}$  are the prices of product  $i$  in countries  $j$  and  $h$  (in this case, the average rent per square meter for each dwelling type),  $w_{ih}$  is the weight as a percentage for product  $i$  in the base country  $h$  (that is, the share in total expenditure on the basic heading),  $w_{ij}$  is the weight as a percentage for product  $i$  in partner country  $j$ , and  $k$  is the number of products for which price ratios exist between  $j$  and  $h$ .

6.28 In practice, Paasche type PPPs are not calculated directly. Instead they are derived as the reciprocal of the transpose of the Laspeyres type PPPs when  $j$  is the base country and  $h$  is the partner country. In other words,

$$P_{j/h} = 1/L_{h/j} \quad (3)$$

<sup>13</sup> Final expenditures valued at national price levels and expressed in national currencies.



where  $P$  is the Paasche type PPP between  $j$  and  $h$  when  $h$  is the base country and  $L$  is the Laspeyres type PPP between  $j$  and  $h$  when  $j$  is the base country.

6.29 Direct PPPs are calculated separately for the basic heading household expenditure on actual rents and for the basic heading household expenditure on imputed rents. First, equation (1) is employed to obtain a matrix of Laspeyres type PPPs. These Laspeyres type PPPs are then transposed and their reciprocals taken to derive a matrix of Paasche type PPPs. The geometric means of the two sets of PPPs provide a matrix of Fisher type PPPs which, as explained in Chapter 12 and Annex V, are made transitive by the EKS process.<sup>14</sup> The EKS PPPs are used to convert the national expenditures that participating countries report for actual rents and for imputed rents to real expenditures. The real expenditures are subsequently expressed as volume indices and per capita volume indices. EKS PPPs for rents – that is, actual and imputed rents combined – are obtained by aggregating the EKS PPPs for the two basic headings following the EKS aggregation method described in Chapter 12 and Annex V.

#### 6.4.2 Indirectly by the quantity approach

6.30 The quantity approach as applied to housing involves combining the quantity data collected on the housing stock in a single measure of quantity and combining the quality data collected on the housing stock in a single measure of quality. The quantity and quality measures are used to compute a volume measure. The mechanics of the quantity approach are illustrated by the worked example in Box 6.6. The example shows how the volume measure between two countries, A and B, is calculated. Although there are only two countries in the example, volume measures derived in this way would be transitive in a multilateral comparison. The calculations in the example are based on all dwellings in the housing stock. No distinction is made between flats and houses as this is how the volume measures are calculated in practice.

6.31 From the worked example, it can be seen that:

- the quantity measure is the ratio between the usable surface per capita in country B and the usable surface per capita in country A;
- the quality measure is the ratio between the average percentage share of dwellings having the specified facilities in country B and the average percentage share of dwellings having the specified facilities in country A;<sup>15</sup>
- the volume measure is the product of the quantity measure and the quality measure so that the per capita volume index for B is 33 when the per capita volume index for A is 100.

In other words, the quantity measure between the two countries is adjusted, downwards in the worked example, for the differences in quality between their housing stocks.

6.32 The indirect PPPs for housing are obtained by dividing the per capita indices of national expenditure on housing by the corresponding per capita volume measures for housing. In other words:

<sup>14</sup> The matrix of Fisher type PPPs may not be complete. This could be because there is no overlap between a pair of countries. For example, one country only prices dwellings with central heating, while the other only prices dwellings without central heating. An incomplete matrix could also be because of the requirement that the overlap's share of total expenditure on actual rents (or on imputed rents) should be at least 25 per cent in both countries. So, if there is an overlap between two countries but the overlap's expenditure share is less than 25 per cent of total expenditure in one or both countries, either the Laspeyres type PPP or the Paasche type PPP or both will be discarded and no Fisher type PPP will be calculated. Gaps in the matrix of Fisher type PPPs are filled by PPPs obtained indirectly through third countries as described in Annex V.

<sup>15</sup> In principle, the quality measure should be the weighted average of the percentages of the dwelling stock having each of the facilities that contribute to the total value of rent, with the weights being each facility's share in the total value of rent. In practice, it is calculated as the sum of the percentages of the dwelling stock with electricity, with running water, with an inside toilet and with central heating. The measure is rough because the four facilities represent only a part of the total value of rent and because each facility is given the same weight. Even so, although the four facilities give an incomplete picture of the quality of the dwelling stock, they are important basic facilities for which data are generally available across countries.

$$\text{Indirect PPP}_{B/A} = [PCFEHnc_B / PCFEHnc_A] / PCVIH_{B/A} \quad (4)$$

where  $PCFEHnc_A$  and  $PCFEHnc_B$  are the per capita final expenditure on housing in the national currency of country A and country B respectively, and  $PCVIH_{B/A}$  is the per capita volume index for housing between country A and country B.

6.33 The per capita national expenditures on housing used in the derivation of the PPPs include all final expenditure on housing. They are the sum of the four basic headings for housing in the Eurostat-OECD expenditure classification: household expenditure on actual rents, household expenditure on imputed rents, expenditure on housing by NPISHs and expenditure on housing by general government on housing. This is because the volume measures refer to the housing stock in total with no distinction being made between dwellings that are rented and dwellings that are owner occupied. The indirect PPPs for housing therefore refer to all housing.

### 6.4.3 Linking the direct and indirect PPPs

6.34 In order to make price and volume comparisons of housing across all participating countries, the PPPs of countries that follow the price approach have to be linked with the PPPs of countries that follow the quantity approach. Overlaps between the two groups of countries are established through bridge countries - that is, countries that supply data for both the price approach and the quantity approach. The three participating countries that report data for both approaches and serve as bridge countries are currently France, Austria and Finland. By combining the data of the three countries a link is established between the direct PPPs for actual rents of the price approach and the indirect PPPs for total rents of the quantity approach and between the direct PPPs for imputed rents of the price approach and the indirect PPPs for total rents of the quantity approach.

6.35 The mechanics of the process is as follows. A linking factor is calculated as the ratio of the geometric mean of the direct PPPs of the three bridge countries from the price approach to the geometric mean of the indirect PPPs of the three bridge countries from the quantity approach. The indirect PPPs of countries following the quantity approach are subsequently multiplied by the ratio to obtain a set of PPPs that can be combined with the direct PPPs of those countries following the price approach. In other words, the indirect PPPs are scaled to the level of the direct PPPs. For the three bridge countries, the final PPPs are those of the price approach.

6.36 The PPPs linked in this way are used to provide volume measure across all participating countries for household expenditure on actual rents and for household expenditure on imputed rents. The PPPs for actual rents are also used to derive volume measures for all countries for expenditure on housing by NPISHs and for expenditure on housing by general government.



**Box 6.6:** A worked example of the quantity approach**1. Estimation of the quantity measure (Qt)**

Population (in thousands): country A = 7 718; country B = 23 207

Number of rooms per dwelling	Number of dwellings (thousands)	Total surface (million m <sup>2</sup> )	Number of rooms per dwelling	Number of dwellings (thousands)	Total surface (million m <sup>2</sup> )
	n	m		n	m
<b>Country A</b>			<b>Country B</b>		
1 room	308	10.7	1 room	1008	20.4
2 rooms	698	39.8	2 rooms	3243	120.0
3 rooms	834	66.8	3 rooms	2353	122.3
4 rooms	551	57.2	4 rooms	789	53.7
5 and more	509	68.8	5 and more	240	21.7
Total	2900	243.3	Total	7632	338.1
<b>per capita</b>		<b>31.5</b>	<b>per capita</b>		<b>14.6</b>

Quantity measure country B relative to country A =  $Qt_{b/a} = [\Sigma m_b / \text{pop}_b] / [\Sigma m_a / \text{pop}_a] = 14.6 / 31.5 = 0.462$ **2. Estimation of the quality measure (Ql)**

Facility	Number of dwellings with the specified facility (thousands)		Weight of facility w	Share of dwellings with the specified facility (%)	
	Country A	Country B		Country A f <sub>a</sub>	Country B f <sub>b</sub>
Electricity	2900	7556	0.25	100	99
Running water	2863	4503	0.25	99	59
Toilet inside	2729	3739	0.25	94	49
Central	1775	3205	0.25	61	42
Total	2900	7632	1.00	88.5	62.2

Quality measure country B relative to country A =  $Ql_{b/a} = (\Sigma f_b * w) / (\Sigma f_a * w) = 62.2 / 88.5 = 0.703$ **3. Estimation of the volume measure**Volume measure country B relative to country A =  $Qt_{b/a} * Ql_{b/a} = 0.462 * 0.703 = 0.325$

## 6.5 Validation of housing data

6.37 Before submission of the housing data to Eurostat, participating countries are required to perform an initial validation. Countries import the Excel questionnaire into the Data Entry Tool (DET) which performs a number of basic checks, such as the completeness of the information.<sup>16</sup> In addition, countries should check the data for consistency over time and for revisions compared to previous submissions of the same data. The price data should also be checked for their internal plausibility, for example, that a two room apartment has a lower monthly rent than a three room apartment. The quantity data should be checked for consistency between changes in total surface data and changes in total numbers of dwellings. These plausibility checks are also carried out by Eurostat during the validation process.

6.38 For the inter-country validation of the actual and imputed rents collected by the price approach, the Quaranta editing procedure is used. The procedure as applied to the prices of consumer goods and services is explained in Chapter 5, Section 5.6, and in Annex IV. The structure of the Quaranta tables produced for rents is exactly the same as that described for consumer goods and services in the Annex, but – due to the nature of the survey – some columns are not used or are used differently. For example, because there is only one price observation per product (an average rent per specified dwelling), there is no price observation variation coefficient in column 22 of Box IV.2A. In addition, instead of using asterisks as representativity indicators, weights are used at the product level. The weights are shown in column 20 of Box IV.2A. Otherwise the process of applying the Quaranta tables to the inter-country validation of rents is similar to that for consumer goods and services. Validation takes place between the submission of the data at the end of August and the inclusion of the data in the annual calculations made in the following December.

6.39 The Quaranta editing procedure cannot be used for quantity approach data. Instead the data are validated by direct comparison of the quantity and quality indicators across countries and by evaluating the plausibility of the resulting per capita volume indices.

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<sup>16</sup> The DET also converts the file with the questionnaire into the standard xml format for transmission to Eurostat via eDAMIS.