Progress on the 2017 Housing Comparisons to Link the Regions

Overview

In previous Housing Task Force meetings there was a focus on experimenting with small changes in the way the quality of housing was measured as well as the unadjusted volumes. This note reports on the application of these approaches to the preliminary 2017 housing data. Regional estimates of the total volume of quality adjusted housing for 2017 are discussed in Part A. In Part B the first efforts at estimating PPPs for dwelling rents for 2017 are reported. The survey rents underlying these rental PPPs are often limited to a capital city or several large cities, often only covering a small portion of the housing within as well as between countries. Should these PPPs be assumed to apply owner occupied and rental housing in non-metropolitan areas? These and other issues of rental equivalence are also discussed in Part B. The results in Parts A and B yield estimates of *indirect* and *direct* PPPs and *direct* and *indirect* volumes of housing in each region. Part C compares the two sets of estimates of linking factors for housing volumes across the regions. In considering the results presented below, it must be borne in mind that there has only been one validation of the data and that additional rent and volume responses are still to be received.

Part A: Direct Volume Comparisons across regions

Building on previous notation relating to direct quantities the equation $HV_A = HQ * HV_U$, has underlay much of the work on housing in the ICP; where HV_A is a measure of housing volume adjusted for quality, HQ is the index of housing quality, and HV_U is a measure of housing volume unadjusted for quality, for example, number of rooms. The data used earlier to examine these changes were those used in the linking of the 2011 housing volumes. The proposed changes looked promising enough to examine on the 2017 housing data. Originally it was planned to compare the volumes using the 2011 measures of HV_U and HQ with the 2017 measures of the same variables.   The share of dwellings with electricity, running water and inside toilet, the ingredients for the 2011 HQ measure, and have been calculated for all

countries as of the April 11 data submissions with one departure. The geometric rather than the arithmetic mean has been used in the Tables in Part A because it has a smaller range and the choice makes little difference.

1. The Housing Volume Measure (HV$_U$)

At the HTF in September, 2018, it was agreed that use of number of rooms would be better measure of HV$_U$ than number of dwellings because there is much greater variation in the size of dwellings than the size of rooms across countries of differing incomes. It was also agreed that a still better measure of size would be area in square meters (m^2), but except for the EUO, responses on floor area of dwelling has been scant, only 20 countries. There were 71 countries providing the number of rooms and fortunately there is a defensible way to augment this count. In re-estimating the HV$_U$ measure of rooms for 2011 an estimating equation was used that was based on the rooms per dwelling and per capita consumption for 85 of the 111 countries that had been used to link the regions for 2011. Number of rooms were estimated for the 26 countries that had only provided number of dwelling and actual rooms were used for the remaining countries. As a by-product of these estimates for 2011 calculations of persons per room could also be made for some countries not reporting rooms in 2017.[i]

Table 1 provides the effect of using rooms versus number of dwellings as the measure of HV$_U$ when combined with the quality measure, HQ, using the geometric mean of the indicators used in 2011. The results in Column 6 are not plausible and are also doubtful for Latin America in column 7, which may be due to the small number of observations. The one clear conclusion is that using number of rooms as a measure of raw volume increases the spread across regions in estimates of quality adjusted housing.

2. Estimated Real Quantities of Housing in 2017 using an Alternative Quality Measure

The Joint Monitoring Program of the WHO and UNICEF (JMP) publish detailed information on aspects of sanitation and water supply as Kaushal Joshi has illustrated to the HTF for Asia. These series published under the umbrella WASH are at the national, rural and urban levels, though only the national statistics have been used in this note. The motivation

for using the WASH measures is that they are available for a wider number of countries than countries have provided thus far.   Further the WASH data set is built up from information collected in a standard format. Five of the WASH measures were chosen for use because they had an adequate number of observations. Four of these measures pertain primarily to water supply and their geometric mean has been used as the measure of water supply (for some countries only 3 of the measures were available for the geomean). The square root (WASH water * WASH % not using open defecation) has been taken as 2/3 of the alternative HQ measure. This combined water and sanitation index was available for 157 countries in five ICP regions that are being used for linking in 2017 (CIS direct quantity data will be available at the end of June, 2019 and will likely not be used for linking in any event.)   Unfortunately, the actual number of countries that have the WASH measures, a measure of rooms and electricity is closer to 100.

For electricity we also used the series developed by the World Bank in collaboration with the International Energy Agency and the Energy Sector Management Assistance Program that estimates the share of the population of 130 countries with access to electricity. We had previously used a measure of quality of electric service from the Global Competitive Survey (CGS) that was replaced by another set of questions that focused on the reliability of electric service that was considered for the results below.[ii] The product of access to electricity times its reliability is index that has been calculated for electricity for the 81 countries for which both are available. However, only two countries from West Asia and six from LAC had this measure so in the end we do not report this experiment, but believe it is worth further exploration.

In previous work electricity had been given 1/3 weigh in the overall housing quality index. This practice has been continued here, not to imply it is written in stone, but only that as a first crack at the data it is a starting place. Combining electricity with the WASH index at 2/3 weight, gives us our HQ index, which is available for 109 countries. Combining the HV_U with our estimate of HQ we have HV_A, our estimate of the real volume of housing in each country. Summing these country volumes for each of the five regions yields and the corresponding populations the per capita results in Column 2 of Table 2 are obtained. Column

3 expresses the regional volumes of housing as a percent of the EU-OECD.   These results seem unlikely for both LAC and West Asia.

Part B: Direct Rents and Indirect Volumes of Housing

This section reports the results of pooling rents from all countries by region into a CPD covering responses to the ICP rent form. The GO has previously provided the separate CPDs for the non EUO regions. The EUO have had their own set of 8 housing specifications that had been part of the EU regulations prior to the ICP work sheet of 13 specifications. In this work five of the EU specifications were matched to ICP units involving a bit of imprecise matching (perhaps even less close for Japan and Korea). In total there are 1101 observations with the number of countries per specification ranging from 62 for a studio apartment (35--60 m^2) to 110 (all countries) for a two bedroom apartment(60--120 m^2) . This provides a basis for linking the five regions for housing in a similar manner to core prices.

In estimating a pooled CPD, one can estimate the regional and housing type coefficients, or country and type coefficients as discussed further below. The coefficients of interest for linking the regions, the regional values, have been estimated with and without the EUO observations. Because of the structure of the CPD formulation, the inclusion or exclusion of the EUO makes does not affect the regional coefficients, only the structure type coefficients.   The regression coefficients (in logs) of the CPD (with EUO) are provided in the Appendix. In Table 3, column 1, they are shown as the exponent of the least square (or marginal) means where no region or structure type is the reference. Column 2 shows the corresponding results for the CPD without EUO. The rents were provided in national prices and have been converted to USD at exchange rates so the values in Table 3 can be read as nominal USD per square meter. The means on the housing types are on average higher when the EUO is included, which makes sense since nominal rents are usually higher in those countries.

The first step in obtaining the indirect quantities is to sum the exchange rate converted expenditures on actual and imputed rents (no attempt has been made to estimate separate

PPPs and volumes for these two basic headings). These expenditures have been put on a per capita basis and divided by the price level of each region to obtain real volumes of housing per capita. The results are given in Table 4 with the EUO as the reference region with a price level of 100. The volume of quality adjusted housing in each region in column 3 seems plausible but these results should be treated as a first approach to linking the regions through indirect volumes. Some directions for further validation are suggested below.

One weakness in the Table 4 is that it uses the results of the urban rents surveys as though they apply to all dwellings in a country, whereas the surveys only cover urban areas and often only one city. At a minimum, some adjustment for the degree of urbanization should be explored. The direction of the adjustment would be to raise the real volume of housing in countries with a substantial rural population. It is hoped that enough non-EU countries provide meta-data about their rental surveys over the 2nd and 3rd quarters of 2019 to further investigate this question.

CPDs can also be estimated by country and structure type, the purpose being that the results may be useful in evaluating the expenditure and rent data. That is, for each country an indirect country housing volume estimate can be derived that will provide the GO with another validation tool. Finally, as more direct volume estimates become available, it will be possible to compare housing quantities, direct and indirect, by region and country to better understand how to improve linking of the regions. If useful to the regions, this information could be provided by the GO to the ROs.

Part C: Where do we go from here?

The quantitative results reported here are preliminary and hopefully will be improved as more validation is carried out and more data is submitted. The linking factors based upon direct quality adjusted volumes appear implausibly low for LAC and West Asia and high for Africa and Asia in Table 2. The direct volume comparisons based upon less observations in

column 7 of Table 1 appear more plausible except for Latin America. Clearly further work needs to be done.

Are the indirect volumes any better? The results in Table 4 seem more plausible than the direct volume linking factors, and worth further pursuit, particularly with respect to the application of rental equivalence. In terms of the future it appears very difficult to obtain country responses on amenities that are as comprehensive as those collected by international entities. Perhaps the ICP might devote some of its housing resources in a different direction seeking more direct volume measures for example. Further the direct rent samples held together across regions better than anticipated so the ICP and regions might improve our understanding of the source of these rental observations and their coverage as has been requested in the meta questionnaire.

A next step is for the GO to examine the direct and indirect adjusted volume measures (or PPPs) country by country as a check on all the moving parts: 1) national currency expenditures on rented and owned housing, 2) rent surveys coverage, 3) country estimates of number of rooms and other volume measures unadjusted for quality, and 4) measures of housing quality. This review will also be shared with each region.

Table 1: Comparing 2011 and 2017 unadjusted volumes of Housing

Number	Region	Population	Dwellings	Per Capita	Volume	Volume
				Dwellings	Dwellings	Rooms
	2	3	4	5	6	7
31	AFR			0.207	52.0	14.3
		884,998,642	182,999,899			
11	ASI			0.155	38.8	41.8
		1,760,127,212	271,964,206			
24	EUO			0.398	100.0	100.0
		683,892,958	272,175,426			
6	LAC			0.201	50.4	24.4
		36,043,341	7,230,563			
4	WA			0.186	46.7	38.4
		20,196,783	3,750,772			

Table 2: Linking Factors for Housing for 2017 Based on PC Direct Volumes

Region	Number	Quality Adjusted Rooms	2017 Linking	
	Countries	Per capita	EUO = 100	
Africa	37	.573	36.6	
Asia	18	.630	40.2	
EU-OECD	43	1.566	100.0	
LAC	9	.249	15.9	
WA	2	.391	25.0	

Table 3: Regional and Structure Type Means in US$ per square meters (from CPD coefficients)

Region and Structure Type	With EUO	w/out EUO
Africa	18.6	18.6
Asia	44.4	44.4
EU-OECD	**114.3**	
Latin America and Caribbean	59.7	59.7
Western Asia	81.6	81.6
Single-detached House, 120-180 m2	46.2	38.4
Single-detached House, 180-240 m2	43.0	38.0
Single-detached House, 240-360 m2	45.2	38.5
Single-detached House, 360-460 m2	41.4	35.3
Attached House / Row House, 80-120 m2	40.9	34.9
Attached House / Row House, 120-180 m2	40.9	34.8
Attached House / Row House, 180-240 m2	37.6	32.1
Studio Apartment, 15-35 m2	81.6	69.5
Studio Apartment, 35-60 m2	60.4	51.4
One-bedroom Apartment, 40-60 m2	63.6	54.3
One-bedroom Apartment, 60-80 m2	56.5	48.1
Two-bedroom Apartment, 60-80 m2	64.5	54.5
Two-bedroom Apartment, 80-120 m2	62.2	52.6

Table 4 Per Capita estimates of Housing Volumes across Regions

Region	Per capita	Price Level	Per capita

	Nominal Rents US$	Region	Rent Volume
Africa	88	0.16	541
Asia	309	0.39	795
EUO	**3707**	**1.00**	**3707**
LAC	708	0.52	1355
WA	1011	0.71	1417

Appendix: CPD with Regions and Type of Structure (EUO included)

CPD2 2017 Rents per sqm

The GLM Procedure

Class Level Information

Class	Levels	Values
region	8	AFR ASI CIS EUO LAC PAS SPP WAS
itemdesc	13	101_dh_120 102_dh_180 103_dh_240 104_dh_360 105_rh_080 106_rh_120 107_rh_180 108_a0_15 109_a0_36 110_a1_40 111_a1_60 112_a2_60 113_a2_80

Number of Observations Read	2782
Number of Observations Used	1101

Dependent Variable: l_rent_usd

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	532.032459	31.296027	28.42	<.0001
Error	1083	1192.427400	1.101041		
Corrected Total	1100	1724.459859			

R-Square	Coeff Var	Root MSE	l_rent_usd Mean
0.308521	29.75772	1.049305	3.526160

Source	DF	Type I SS	Mean Square	F Value	Pr > F
region	5	477.5169680	95.5033936	86.74	<.0001
itemdesc	12	54.5154910	4.5429576	4.13	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
region	5	441.5804778	88.3160956	80.21	<.0001
itemdesc	12	54.5154910	4.5429576	4.13	<.0001

Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	4.595192853	0.14553567	31.57	<.0001
region AFR	-1.479289776	0.11666976	-12.68	<.0001
region ASI	-0.607158995	0.13209180	-4.60	<.0001
region EUO	0.337342829	0.16205440	2.08	0.0376
region LAC	-0.311411567	0.13570245	-2.29	0.0219
region SPP	-0.732065665	0.31038350	-2.36	0.0185

Parameter	Estimate	Standard Error	t Value	Pr > |t|
region WAS	0.000000000	.	.	.
itemdesc 101_dh_120	-0.297181620	0.14520965	-2.05	0.0409
itemdesc 102_dh_180	-0.368226097	0.14749015	-2.50	0.0127
itemdesc 103_dh_240	-0.317803296	0.15529813	-2.05	0.0410
itemdesc 104_dh_360	-0.406594731	0.15979900	-2.54	0.0111
itemdesc 105_rh_080	-0.418092550	0.16050674	-2.60	0.0093
itemdesc 106_rh_120	-0.418810914	0.16244390	-2.58	0.0101
itemdesc 107_rh_180	-0.501582343	0.16379885	-3.06	0.0023
itemdesc 108_a0_15	0.271552913	0.16050674	1.69	0.0910
itemdesc 109_a0_36	-0.028766272	0.17277139	-0.17	0.8678
itemdesc 110_a1_40	0.023301023	0.15068967	0.15	0.8771
itemdesc 111_a1_60	-0.096366680	0.14827895	-0.65	0.5159
itemdesc 112_a2_60	0.036956804	0.14518478	0.25	0.7991
itemdesc 113_a2_80	0.000000000			

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[i] In addition to the 45 non-EUO countries that provided estimates of the number of rooms for 2017, publicly available data was available for 44 EUO countries. So the number of countries needing number of rooms to be estimated using persons per room ratios was not that large.

i This ordinal scale of 0 -7 has been put on a scale using the conversion, [√ response / √ 7], which provides a much reduced range.