Household Expenditure Shares for Africa in ICP 2005: Lessons for ICP 2011

Derek Blades, OECD (Retired)

Paper Prepared for the Special IARIW-SSA Conference on

Measuring National Income, Wealth, Poverty, and Inequality in African Countries

Cape Town, South Africa, September 28-October 1, 2011

Session 2A: International Comparison Program in Africa (Parallel)

Time: 2:00 PM-5:30 PM

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Abstract

A data base of household expenditure statistics for 45 African countries that took part in the 2005 round of the International Comparison Program is analyzed to determine the quality of their estimates of household expenditure.

There is first an examination of the variance of the data to determine which expenditure categories may have been poorly estimated and which countries appear to have had particular problems in estimating detailed expenditures. The second part of the paper looks at the relationship between expenditure shares and per capita GDP for a number of expenditure categories. The relationships for the 45 African countries are compared with those for a control group of 44 OECD-European countries.

The paper concludes with suggestions for ways to improve the expenditure statistics that will be required for the current round of the International Comparison Program.

Introduction

Countries taking part in the ICP are required to submit estimates of final expenditures on the GDP for the reference year of each ICP round broken down into a number of standard commodity groups known as Basic Headings (BH). These expenditure estimates are converted to shares of GDP and are used as weights in combining average price relatives for the various goods or services included in each BH to obtain Purchasing Power Parities (PPPs) for higher levels of aggregation. To take an example, each country collects prices for several kinds of rice included in the BH "Rice". Price relatives (or PPPs) are then calculated by dividing the price in one country of a particular kind of rice by the prices for the same kind of rice in other countries. Simple averages of these price relatives are then calculated to obtain a PPP for "Rice". This PPP is then combined with the PPPs for other kinds of food to obtain a PPP for "Food" but, instead of taking a simple average, the "Food" PPP is a weighted average using the expenditure share of rice and the expenditure shares of other food product BHs as weights. The expenditure shares therefore play in important part in calculating PPPs for all levels of aggregation higher than the BH and including, most especially, each country's PPP for gross domestic product (GDP). Even if great care is taken to ensure that the prices of identical products are correctly recorded in each country, the PPPs will be falsified if the expenditure weights are incorrect.

This paper examines the expenditure weights submitted by the African countries taking part in the 2005 round of the International Comparison Programme (ICP2005)in order to determine how reliable those expenditure weights may have been and to suggest what measures might be taken to improve the reliability of weights for the current 2011 round of the ICP (ICP2011).

Data base

The data base used here contains expenditure weights for the 120 BHs included under Household Final Consumption Expenditure (HFCE). The BHs cover everything that enters into HFCE as defined in

the 1993 SNA. They cover goods like *Beef and veal*, *Garments*, and *Motor cars* and services like *Catering*, *Air passenger transport*, and *Insurance*. They mostly consist of purchased goods and services but they also include "imputed" expenditures such as crops and livestock products consumed by farm households from their own production and imputed rents of owner-occupiers.

Breaking down HFCE into 120 expenditure categories was a major task for most countries. In their own statistics many developing countries only break down HFCE into a few broad categories such as *food and beverages, clothing and footwear, transport and communications*, and so on. Even if they give a more detailed breakdown it will rarely coincide with the standard breakdown required for ICP. The ICP Global Office (the coordinating body attached to the World Bank) suggested that in the absence of a large scale consumer expenditure survey or other reliable information on household consumption expenditures countries might use expenditure weights from a consumer price index even if they do not exactly reflect national expenditure patterns , update weights from an old input-output or social accounting matrix, derive household expenditures as a residual by deducting other final uses from the total of domestic production and imports, or even borrow weights from neighboring or similar countries. No doubt these and even less reliable methods were used by many countries so that the matrix of expenditures on 120 Basic Headings by 45 African countries certainly contains many errors and omissions.

The 45 African countries include three Indian Ocean islands – Mauritius, Madagascar and Comores Islands – and all of continental Africa except Algeria, Burundi, Equatorial Guinea, Gabon, Libya, and Somalia[1]. The full list is shown in Appendix A.

Variation in expenditure shares

In this section we look at the variance in expenditure shares between countries. We make the assumption that all countries in Africa have fairly similar patterns of expenditure so that BH expenditure shares which are particularly variable between countries may have been badly estimated by some of the participating countries. On the same assumption that all countries in Africa have similar expenditure patterns, countries that had more or fewer than average high or low expenditure shares could be countries that had particular difficulties in estimating expenditure shares.

Table 1 shows the forty BHs that had the highest standard deviations(SD) across the 45 participating countries. BHs are ordered according to the size of their standard deviations so that BHs in the bottom half of the right-hand column are those whose expenditure estimates were the most variable. Given our assumption that households in all 45 countries actually have similar expenditure patterns, high standard deviations identify BHs whose expenditure shares may have been poorly estimated.

Table 1. The Forty Basic Headings with the Highest Standard Deviations. Africa ICP 2005			
Basic Heading	*SD*	*Basic Heading*	*SD*
110736 Other purchased transport services	0,007	1101113 Bread	0,012

1103211 Footwear	0,007	1101132 Preserved fish and seafood	0,012
110430 Maintenance of the dwelling	0,008	110220 Tobacco	0,014
111261 FISIM	0,008	1101181 Sugar	0,014
1101151 Butter and margarine	0,008	111110 Catering services	0,015
110121 Coffee, tea and cocoa	0,008	1101131 Fresh or frozen fish and seafood	0,016
110722 Fuel for transport equipment	0,009	1101121 Beef and veal	0,016
110830 Telephone and telefax services	0,009	110119 Food products n.e.c.	0,016
1103111 Clothing materials and accessories	0,009	110453 Other fuels	0,016
1101123 Lamb, mutton and goat	0,009	1103121 Garments	0,017
110630 Hospital services	0,010	1102131 Beer	0,017
110711 Motor cars	0,010	1101171 Fresh or chilled vegetables	0,018
1101142 Preserved milk and milk products	0,010	1101141 Fresh milk	0,018
1101124 Poultry	0,010	110732 Passenger transport by road	0,018
1101161 Fresh or chilled fruit	0,010	111300 Net purchases abroad	0,019
110451 Electricity	0,011	111000 Education	0,026
1101125 Other meats and preparations	0,011	110410 Actual and imputed dwelling rents	0,030
1101153 Other edible oils and fats	0,011	1101172 Fresh or chilled potatoes	0,030
110611 Pharmaceutical products	0,011	1101111 Rice	0,040
1101173 Frozen or preserved vegetables	0,011	1101112 Other cereals and flour	0,045

Some of the BHs that have high standard deviations (SDs) may do so because our assumption that all 45 countries have similar consumption patterns is wrong. For example rice is popular in West Africa but is rarely grown or consumed in Central and East Africa; expenditure on beer is low in Moslem countries of West, Central and North Africa but is high in most other parts of the continent; and potatoes are a popular vegetable in Northern and Southern Africa but are a rare commodity in other countries. BHs that contain zero or negligible expenditure shares for some countries will usually have high SDs but this does not necessarily indicate that the expenditures have been badly estimated.

Nevertheless, it is reasonable to expect similar expenditure shares for many of the BHs in Table 1 and several of the high SDs do indeed suggest errors in estimation rather than real differences between countries. These include the BHs for poultry, fruit, vegetables, edible oils and fats, tobacco, sugar, garments, and actual and imputed rents for dwellings. Table 1 can serve as a guide to the BHs where countries should pay special attention in estimating expenditure shares for the current ICP2011.

Chart 1 shows the distribution of the 45 countries according to the number of outliers in their reported expenditure shares for ICP2005. An outlier is here defined as a share that was more than ±1.0 SD from the average expenditure share for all 45 countries.

Chart 1. Distribution of countries by number of outliers

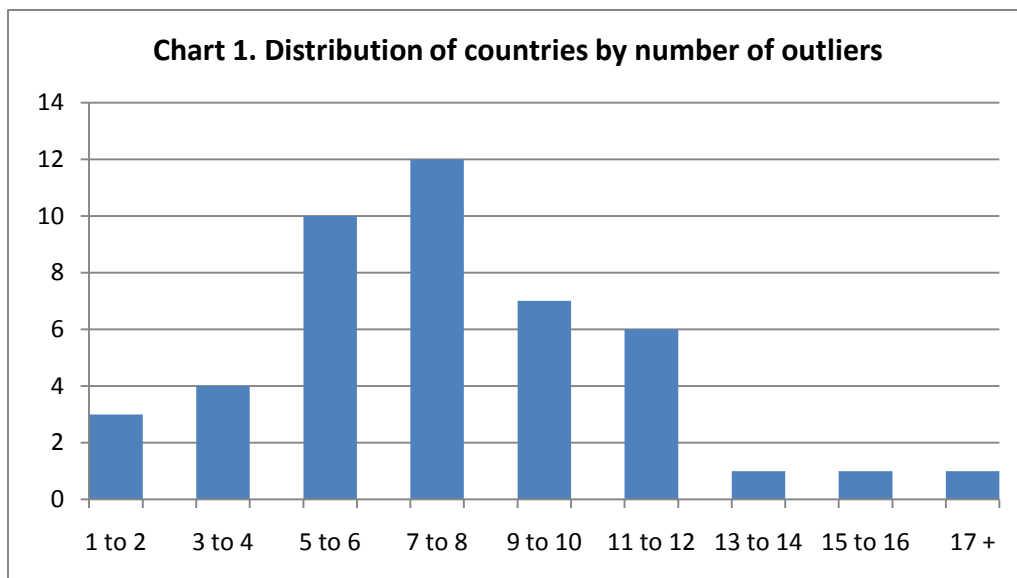| Number of outliers	Count
1 to 2	3
3 to 4	4
5 to 6	10
7 to 8	12
9 to 10	7
11 to 12	6
13 to 14	1
15 to 16	1
17 +	1

Table 2 lists the 45 countries by the number of expenditure outliers. The shaded area covers countries with between 5 and 9 outliers and this range is here taken – arbitrarily – as the norm. Countries with fewer or lesser are those whose expenditure estimates seem particularly dubious and are therefore candidates for special technical assistance in estimating expenditure weights for ICP2011.

At the high end, Sudan, Sao Tome and Principe, and the Central African Republic had 13 or more outliers and the ICP regional coordinator for Africa – the African Development Bank (AfDB) - may need to review their 2011 weights with particular care. At the other extreme the very low number of outliers for Angola, Botswana and Congo Republic may also be a cause for concern. As noted above borrowing weights from a neighboring or similar country was a strategy suggested by the Global Office for filling gaps in expenditure shares. A similar but less defensible approach would have been to borrow the average of the weights for a large group of countries and this would, of course, drastically reduce the number of outliers.   Is that what these three countries did – and also perhaps Benin, Swaziland, and Liberia?

Table 2. Countries by number of outliers in expenditure weights					
1	Angola	Botswana	Congo, Rep.		
2					
3	Benin	Swaziland			
4	Liberia	Morocco			
5	Ghana	Guinea	Mali	Mozambique	Namibia	Rwanda
6	Cameroon	Congo, D.R.	Gambia, The	Tunisia		
7	Côte d'Ivoire	Djibouti	Madagascar	Mauritius	Uganda	Zambia
8	Burkina Faso	Cape Verde	Chad	Ethiopia	Niger	Sierra Leone
9	Mauritania	Nigeria	South Africa	Tanzania		

10	Comoros	Lesotho	Senegal	
11	Egypt	Kenya		
12	Guinea-Bissau	Malawi	Togo	Zimbabwe
13	Sudan			
14				
15				
16	São Tomé and Principe			
17				
18				
19	Central African Republic			

Comparing Africa with the OECD-Europe group

In this section we compare the relationships between expenditure shares and per capita GDP for the 45 African countries and 44 countries that were included in the OECD-Europe group. Annex A lists the countries concerned.

For many consumer goods and services there are well established relationships between per capita GDP and shares of expenditure. At the individual country level it is well known that the share of expenditure on food and other basic necessities declines as people get richer while the shares of expenditures on motor vehicles, recreation, and luxury goods in general tend to rise. These tendencies can be translated to inter-country differences – in countries with high per capita GDP shares of expenditure on food, for example, will be lower than in poorer countries and shares of expenditures on motor cars, for example, will usually be higher.

Here we make the assumption that the 44 OECD-European countries have accurately measured their expenditure shares and that the relationships we observe between shares and income for these countries should be replicated in other regions including Africa. With these two assumptions differences between Africa and OECD-Europe in the relationships between per capita GDP and expenditure shares must indicate errors in the expenditure shares reported by the African group.

Clearly objections can be raised to both assumptions. The assumption that data for the OECD-Europe countries is accurate is supported by the long experience that most of this group have had in compiling expenditure shares for the calculation of PPPs. Most are now doing this on an annual basis and most generate their GDP expenditure from a supply/use table which is generally regarded as the most reliable procedure. It is true that the OECD-Europe group includes several countries – mainly EU-candidate countries - which have only recently joined the PPP programme and which use less reliable methods of estimating final expenditures on the GDP. Nevertheless the expenditure data submitted by the large majority of the 44 OECD-Europe countries can be taken as reliable.

The second assumption we make is that the income/expenditure relationships observed in the OECD-Europe group apply equally to Africa.   There are certainly cultural, religious and socio-economic differences between countries in the two groups but the author's view, admittedly based on anecdotal evidence, is that regardless of where they live most people have rather similar objectives and priorities. With a given income and a given set of goods and services to choose from people everywhere will make rather similar choices.
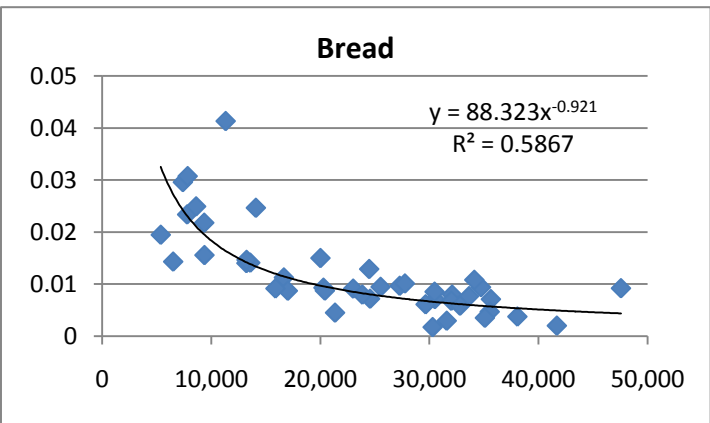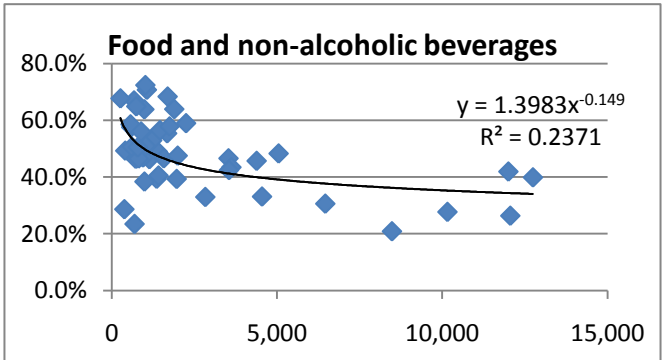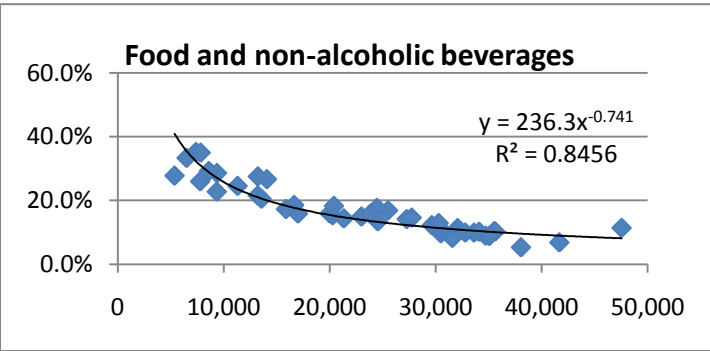
Before looking at the evidence, three technical matters. First, GDP per capita is calculated by converting GDP in local currency to US dollars using PPP conversion rates: per capita GDP is therefore comparable across countries as price level differences have been eliminated. Second, expenditure shares are calculated with household consumption expenditure equal to 1.0: the alternative would have been to set GDP equal to 1.0. Finally, Luxembourg has been dropped from the OECD-Europe group because it is very much an outlier. It has unusually high per capita GDP because it is home to many financial and international organizations and its expenditure shares are affected by extensive cross-border shopping as households in neighboring countries take advantage of Luxembourg's low product taxes.

Charts 2a and 2b show the relationships between per capita GDP and expenditure shares for four food items and four non-food items respectively. The lines fitted are of the form $y = ax^b$, where y is the expenditure share and x is per capita GDP in US dollars. Logarithmic, exponential and linear lines were also fitted but generally gave no better fit as measured by the R^2. The advantage of the functional form used here is that the b coefficient has a useful interpretation – negative values indicate a "basic necessity" whose shares decline with rising per capita GDP, and positive values identify "luxury items" whose shares rise with increasing per capita GDP.

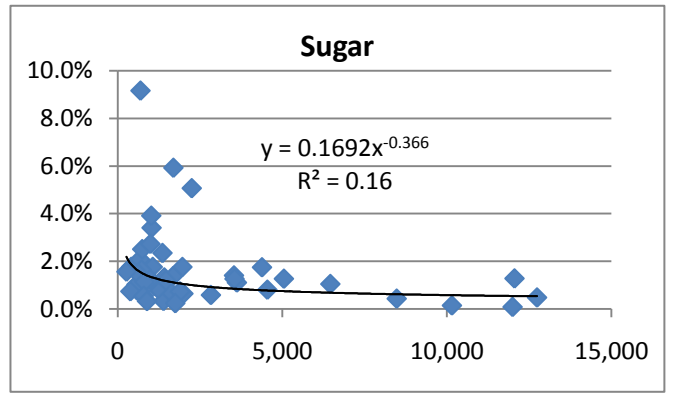## Chart 2a. Expenditure shares and per capita GDP

OECD Europe

Food and non-alcoholic beverages

$y = 236.3x^{-0.741}$
$R^2 = 0.8456$

Africa

Food and non-alcoholic beverages

$y = 1.3983x^{-0.149}$
$R^2 = 0.2371$

Bread

$y = 88.323x^{-0.921}$
$R^2 = 0.5867$

Bread

$y = 0.0028x^{0.2196}$
$R^2 = 0.069$

Edible oils and fats

$y = 112.51x^{-1.034}$
$R^2 = 0.6034$

2.0%
1.5%
1.0%
0.5%
0.0%

0   10,000   20,000   30,000   40,000   50,000

Edible oils and fats

$y = 0.0788x^{-0.179}$
$R^2 = 0.065$

8.0%
6.0%
4.0%
2.0%
0.0%

0   5,000   10,000   15,000

Sugar

$y = 8771x^{-1.59}$
$R^2 = 0.7025$

1.2%
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%

0   10,000   20,000   30,000   40,000   50,000

Sugar

$y = 0.1692x^{-0.366}$
$R^2 = 0.16$

10.0%
8.0%
6.0%
4.0%
2.0%
0.0%

0   5,000   10,000   15,000

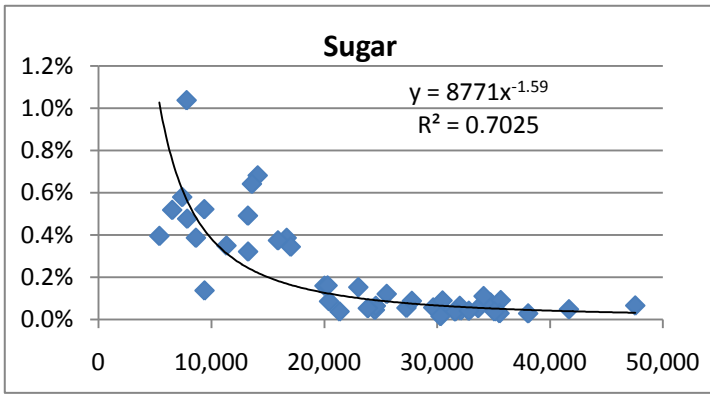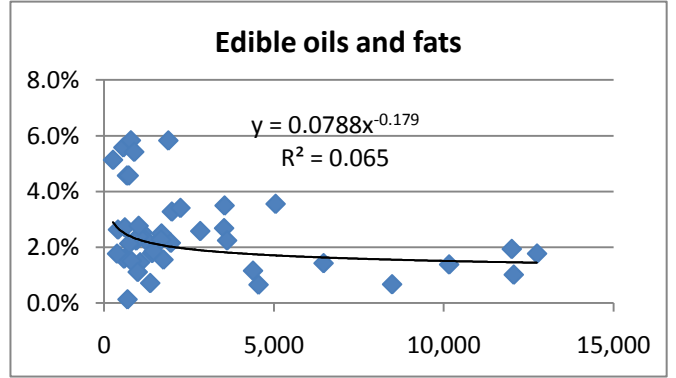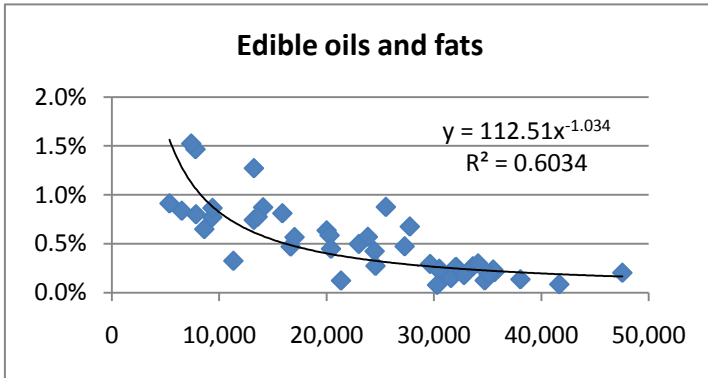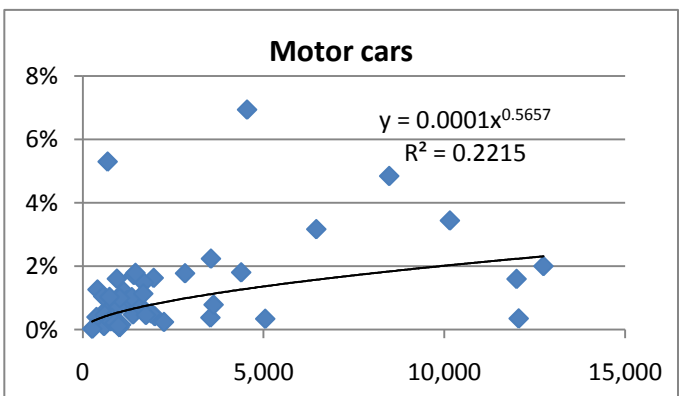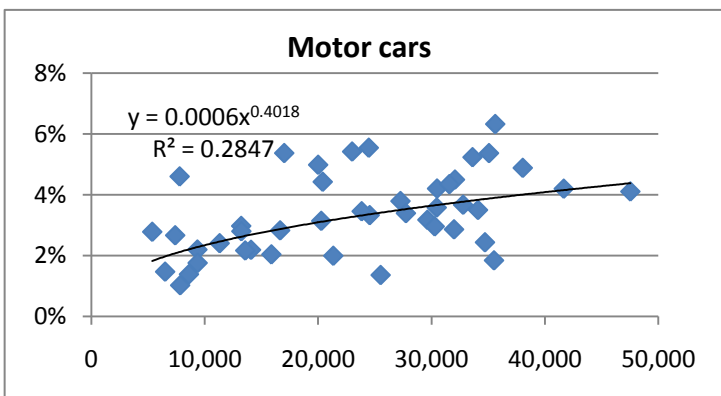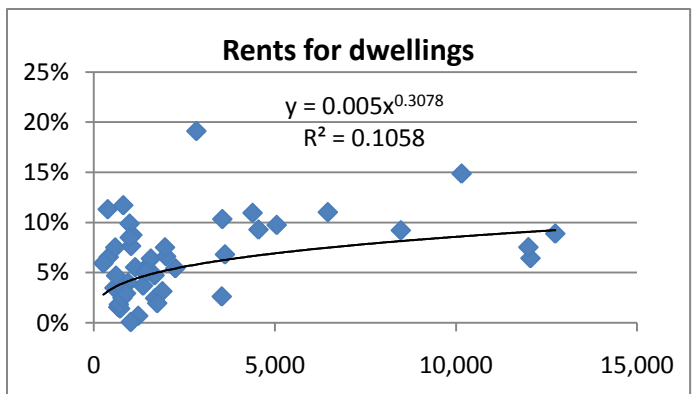## Chart 2b. Expenditure shares and per capita GDP

OECD - Europe

Africa

Rents for dwellings

$y = 0.0265x^{0.1589}$
$R^2 = 0.1394$

20%
15%
10%
5%
0%

0   10,000   20,000   30,000   40,000   50,000

Rents for dwellings

$y = 0.005x^{0.3078}$
$R^2 = 0.1058$

25%
20%
15%
10%
5%
0%

0   5,000   10,000   15,000

Motor cars

$y = 0.0006x^{0.4018}$
$R^2 = 0.2847$

8%
6%
4%
2%
0%

0   10,000   20,000   30,000   40,000   50,000

Motor cars

$y = 0.0001x^{0.5657}$
$R^2 = 0.2215$

8%
6%
4%
2%
0%

0   5,000   10,000   15,000
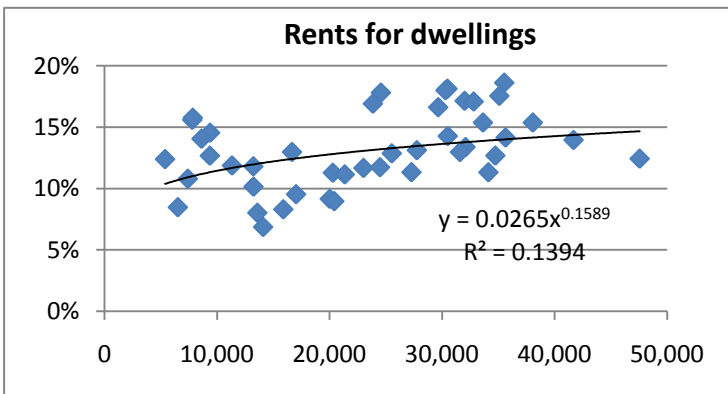
Table 3. Results for 24 commodities: $y = ax^b$

Recreation and culture

$y = 1E\text{-}05x^{0.7941}$
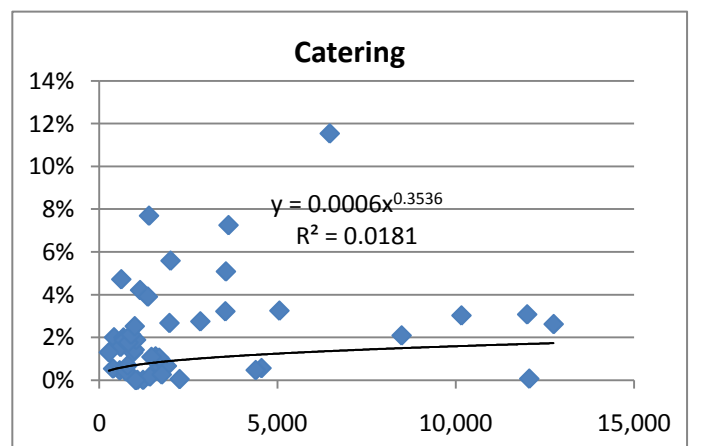$R^2 = 0.5975$

Recreation and culture

$y = 0.001x^{0.2704}$
$R^2 = 0.0663$

Catering

$y = 0.0006x^{0.4451}$
$R^2 = 0.214$

Catering

$y = 0.0006x^{0.3536}$
$R^2 = 0.0181$
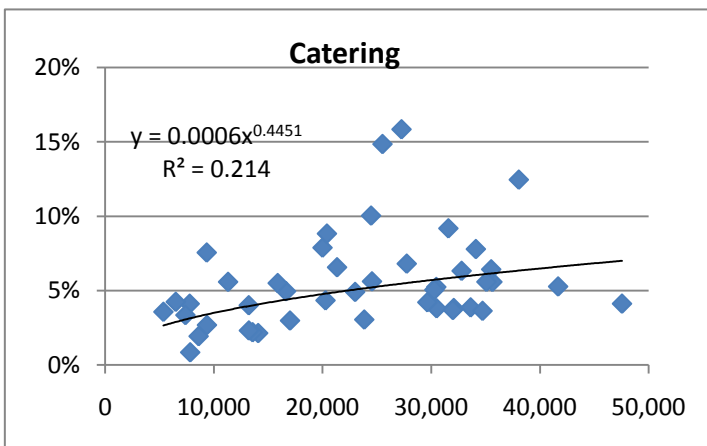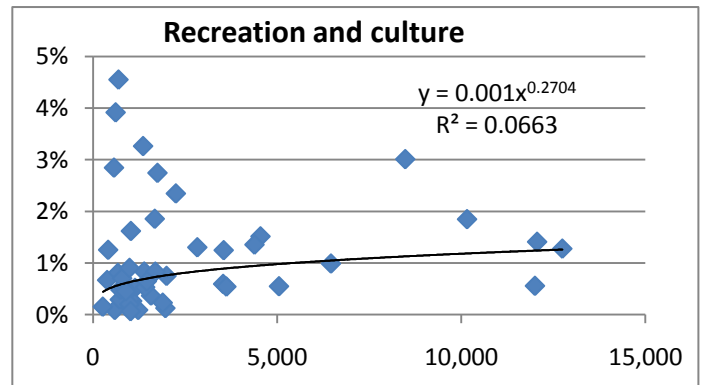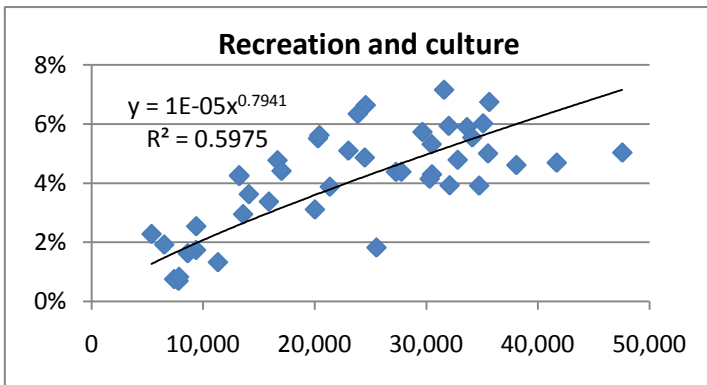
	OECD - Europe			Africa		
	a	*b*	R²	*a*	*b*	R²
Basic headings						
1101111 Rice	74,032	-1,167	0,35	0,762	-0,481	0,10
1101113 Bread	88,323	-0,921	0,59	0,003	**0,220**	0,07
1101115 Pasta products	0,350	-0,553	0,18	0,000	**0,372**	0,05
1101121 Beef and veal	11,989	-0,781	0,24	0,024	-0,035	0,00
1101131 Fish and seafood	0,245	-0,433	0,10	0,019	-0,052	0,00
1101181 Sugar	8771,000	-1,590	0,70	0,160	-0,361	0,15
1103121 Garments	0,016	0,074	0,02	0,153	0,086	0,02
1103211 Footwear	1,420	-0,503	0,36	0,006	**0,080**	0,01
110410 Rents for dwellings	0,027	0,159	0,14	0,005	0,308	0,11
110561 Non-durable household goods	0,200	-0,316	0,15	0,000	**0,482**	0,03
110711 Motor cars	0,001	0,402	0,28	0,000	0,566	0,22
110911 Audio-visual,camera, computers	0,001	0,209	0,09	0,000	0,676	0,03
111000 Education	0,004	0,170	0,06	0,031	**-0,024**	0,00
111110 Catering services	0,001	0,445	0,21	0,001	0,354	0,02
111211 Hairdressing and grooming	0,001	0,263	0,09	0,000	0,723	0,04
Commodity groups						
Alcoholic beverages	0,125	-0,198	0,03	0,008	-0,303	0,00
Communications and IT	0,181	-0,141	0,10	0,002	**0,309**	0,14
Edible oil and fats	112,510	-1,034	0,60	0,073	-0,172	0,06
Food and non-alcoholic beverages	236,300	-0,741	0,85	1,259	-0,138	0,15
Household equipment	0,090	-0,159	0,10	0,011	**0,027**	0,00
Personal care services and goods	0,023	0,021	0,00	0,000	0,461	0,02
Personal transport	0,033	0,104	0,06	0,002	0,374	0,20
Public transport	0,757	-0,355	0,16	0,013	**0,118**	0,03
Recreation and culture	0,000	0,794	0,60	0,001	0,270	0,07

Table 3 gives results of fitting $y = ax^b$ for 24 Basic Headings and commodity groups. A first observation is that the R² values are mostly substantially higher for OECD-Europe than for Africa. For example, the tendency for total food expenditure shares to decline with rising incomes is a well known phenomenon and is born out by the results for both groups of countries. However, in the OECD-Europe group variation in per capita GDP accounts for 85% of the variation in expenditure shares on *food and non-alcoholic beverages*, but only 15% in the case of Africa. There are three

cases where the Africa R² is higher – *personal transport, communications and IT,* and *personal care services and goods* – but most of the African R² values are far smaller than for the OECD-Europe group. The explanation is almost certainly the lower reliability of the African data.

There are eight cases where the *b* coefficients have different signs in OECD-Europe and Africa. These are shown in bold in the Africa part of Table 3. There may be an explanation for some of these differences – bread and pasta products, for example, may indeed be luxury items (positive *b* values) in African countries with very low per capita GDP while they are basic necessities (negative *b*) in the rich countries of OECD-Europe - but in most these eight cases the African *R²* values are so low that the safest conclusion is that the sign difference for the *b* coefficient are due to errors.

A final observation – from Chart 2 rather than Table 3 – is the extreme variance among the shares for the poorest countries in Africa. For *food and non-alcoholic beverages,* countries with per capita GDP below US$5,000 report shares ranging from 20% to nearly 80%. It is quite possible that those reporting very low shares are underestimating or simply omitting consumption of food products from own production. For *recreation and culture* shares for the poorest countries go from zero to nearly 5% and for *bread* from around zero to 7. This suggests that any technical assistance that can be provided for ICP2011 should focus on the poorer countries of the region – those with per capita GDP under US$5,000.

Conclusion

This paper raises a number of questions about the reliability of the expenditure statistics supplied by the African countries for ICP2005. This will, of course, come as no surprise to those in the AfDB and the ICP Global Office who worked with the African countries for ICP2005. They made valiant efforts to bring as many African countries as possible into the 2005 round and in consequence they had to accept dubious expenditure statistics from countries with weak statistical systems. We have used these data to identify some of the BHs that seem to have been particularly unreliable and some of the countries which may have experienced most difficulties.

The adoption of Supply/Use tables for compiling GDP ensures consistency between GDP from the production and expenditure sides and is now being advocated by the UN Economic Commission for Africa. This initiative may be too late for most countries participating in ICP2011 but will eventually provide more reliable statistics for subsequent rounds. Other short-term solutions are also available including workshops focused on areas of the national accounts that are known to be particularly weak. These include the measurement of consumption of crops and livestock products from own production, the imputation of rents for owner occupiers, and better valuation of dwellings and farm buildings constructed by farm households for their own use.

Appendix A. African and OECD-Europe countries included in the data base.

Africa		OECD-Europe	
Angola	Malawi	Albania	Korea, Rep.
Benin	Mali	Australia	Latvia
Botswana	Mauritania	Austria	Lithuania
Burkina Faso	Mauritius	Belgium	Macedonia, FYR
Cameroon	Morocco	Bosnia & Herzegovina	Malta
Cape Verde	Mozambique	Bulgaria	Mexico
Central African Republic	Namibia	Canada	Montenegro
Chad	Niger	Croatia	Netherlands
Comoros	Nigeria	Cyprus	New Zealand
Congo, Dem. Rep.	Rwanda	Czech Republic	Norway
Congo, Rep.	São Tomé & Principe	Denmark	Poland
Côte d'Ivoire	Senegal	Estonia	Portugal
Djibouti	Sierra Leone	Finland	Romania
Egypt, Arab Rep.	South Africa	France	Serbia
Ethiopia	Sudan	Germany	Slovak Republic
Gambia, The	Swaziland	Greece	Slovenia
Ghana	Tanzania	Hungary	Spain
Guinea	Togo	Iceland	Sweden
Guinea-Bissau	Tunisia	Ireland	Switzerland
Kenya	Uganda	Israel	Turkey
Lesotho	Zambia	Italy	United Kingdom
Liberia	Zimbabwe	Japan	United States
Madagascar			