

## **Annex 4**

### **Description of Methodology to Derive Poverty Indicators**

The World Bank defines poverty as whether households or individuals have enough resources or abilities today to meet their needs. Poverty is usually measured based on consumption levels rather than other measures such as income. Actual consumption is more closely related to a person's well-being in the sense of having enough to meet current basic needs. Also, in poor agrarian economies and in urban economies with large informal sectors, income may be difficult to estimate. It may be seasonal and erratic, and it may be difficult to estimate particularly for agricultural households whose income may not be monetized.

The prevalence of household poverty was measured using information on household expenditures to compute a household consumption aggregate. The consumption aggregates was constructed following guidelines from Deaton & Zaidi (2002)<sup>1</sup> and Grosh & Muñoz (1996)<sup>2</sup> by adding together the various goods and services consumed by each household during a period of 12 months. The various components of consumption were grouped together into 6 main categories, including food, usual expenses (expenses in the last 7 days), occasional expenses (expenses in the last 30 days), unusual expenses (expenses in the last 12 months), housing, and durable assets.

In general consumption was calculated by adding the value in local currency units (LCU) of the items consumed by the household, as reported by household informants. These items were collected according to different time horizons, but were then transformed into daily per capita consumption.

Whenever a household missed data on the value consumed for a given item, that value was imputed using the closest local median value for that item. That is, if a household missed consumption information on a given item, it was assigned the median value reported by other households in the vicinity. Whenever the item is reported frequently enough, this imputation was done at the cluster level. However some items were consumed by few households. In those cases the level of imputation was at a higher level, depending on how rare the item was. These imputed amounts were subject to checks that the imputed prices are plausible to avoid undue influence from outliers.

The reported values for each item and each consumption component were checked for outliers to detect possible coding errors or extreme values. Values that were 5 standard deviations (SD)

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<sup>1</sup> Deaton, A. and S. Zaidi (2002), A Guide to Aggregating Consumption Expenditures, Living Standards Measurement Study, Working Paper 135. Available at: <http://siteresources.worldbank.org/INTPA/Resources/429966-1092778639630/deatonZaidi.pdf>

<sup>2</sup> Margaret Grosh and Juan Muñoz (1996). A Manual for Planning and Implementing the Living Standards Measurement Study Surveys. LSMS Working Paper #126, The World Bank. Available at: <http://documents.worldbank.org/curated/en/1996/05/438573/manual-planning-implementing-living-standards-measurement-study-survey>

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over the average were flagged and checked for plausibility. Values deemed implausible were imputed using the methodology described above.

Besides this general methodology, some components required specific computations.

- **Food Consumption**

Computation of food consumption is complex because it involves products that are purchased in the market, where price information is available, and products that are home-produced or received as a gift, where price information is not available. Even when products are purchased, it is often difficult for household informants to report the precise market value of the amounts consumed by the household over the reference period, which often results in missing data.

The value of non-purchased food (and of any food missing value information), was imputed by first transforming the amounts consumed by the household to a common metric unit (kilograms or liters). In Uganda, food consumption was measured using a set of non-standard units (heap, bunch, tin etc.), commonly used in the Karamoja region. Conversion factors for these non-standard units were obtained from several sources, including the market survey from the 2006 Uganda National Household Survey, as provided by the Uganda Bureau of Statistics, the Food and Agriculture Organization, the World Food Programme and the Famine Early Warning Systems Network.

Once amounts consumed were transformed into a common metric unit, they were multiplied by the local median value of that unit for imputation of home production and gifts. If a product was reportedly consumed, but amount information was missing or implausible, the median per capita value consumed by local households was imputed.

- **Assets**

Purchases of durable goods represent large and relatively infrequent expenses. While almost all households incur relatively large expenditures on these at some point, only a small proportion of all households are expected to make such expenditures during the reference period covered by the survey. As indicated by Deaton & Zaidi (2002) “From the point of view of household welfare, rather than using expenditure on purchase of durable goods during the recall period, the appropriate measure of consumption of durable goods is the value of services that the household receives from all the durable goods in its possession over the relevant time period” (p. 33).

Consumption of durable goods was calculated as the annual rental equivalent of owning the asset. As the value of the item when new was not available in the data sets, consumption of durable goods was calculated based on the estimated remaining life of the asset, as recommended

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by Deaton & Zaidi (2002): First, the average age for each durable good,  $\bar{T}$ , was calculated from the data on the current age of the particular respondent's asset recorded in the survey ( $T$ ). The average lifetime of each durable good was estimated as  $2\bar{T}$  under the assumption that purchases are uniformly distributed through time. This uniform distribution is defined over the continuum 0 to  $2\bar{T}$  and has a mean of  $\bar{T}$ . The remaining life of each good was calculated as  $2\bar{T} - T$ . A rental equivalent estimating the daily per capita flow of services from the durable goods is then derived by dividing the current replacement value of the good by its expected remaining life.

- **Housing**

The case of housing is similar to other durable goods, in that it is better measured as an annual consumption of housing services, either annual rent expenditures for renters, or an annual rental equivalent for non-renters.

The baseline survey collected information on rent paid among renters, and an estimated rental equivalent for non-renters. It is likely that the housing rental market is small and a significant amount of non-renters were unable to provide an estimated rental equivalent. Missing responses were imputed using two approaches. First, the age of the house and its current replacement value was used to estimate a housing rental equivalent, using the methodology described above for durable goods.

For those cases where an estimated current value or age of the house were not available, an hedonic OLS regression model was used, as suggested by Grosh & Muñoz (1996). The model was built on the sample of households reporting non-zero rent or rental equivalents, with the log of rent paid by renters as a dependent variable, and several sets of independent variables, that included:

- Housing characteristics: number of members, type of water access, type of sanitation services.
- Socio-economic status: consumption sub-aggregates (in log form), asset ownership, Household Dietary Diversity Score.
- Location: District and community, all expressed as a set of dummy variables taking the value of 1 when the code was applicable to a given case, and a value of 0 when it was not.

The final model was estimated based on the following regression equation,

$$\log(R_i) = \beta_0 + \beta X_i + \varepsilon_i$$

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where  $R_i$  represents the reported non-zero rent paid by household  $i$ ,  $\beta_0$  is the constant term,  $X_i$  is the final vector of independent variables and  $\varepsilon_i$  is the error term accounting for unexplained variance. The unstandardized beta weights resulting from this regression equation were applied to the vector of independent variables among non-renting households to estimate their annual rent equivalent.

Total daily consumption per capita was computed as the sum of daily per capita values for all the components of the expenditure module, except those categories that Deaton and Zaidi (2002) recommend excluding:

- Factors that are considered productive assets (e.g. farm equipment, trucks)
- Large and unusual expenditures (ceremonies, marriages, funerals, parties, etc.)
- Gifts, charitable contributions, and remittances to other households
- Taxes and levies

Poverty indicators were computed based on this total consumption aggregate, including the prevalence of poverty, average daily per capita expenditures, and mean depth of poverty. Each of these three indicators is defined below.

#### • **Prevalence of Poverty**

The prevalence of poverty, or poverty headcount ratio, is the proportion of the population in the survey area living in extreme poverty, defined as having average daily consumption of less than US\$1.25 per capita, converted into LCU at 2005 Purchasing Power Parity (PPP) exchange rates. This poverty line was calculated using the following two steps:

- First, the \$1.25 line was converted into LCU, using the 2005 PPP exchange rate for Uganda<sup>3</sup>, of 744.62.
- Second, the resulting figure was adjusted for cumulative price inflation since 2005. The adjustment was done using the average monthly inflation in 2005 as the base factor<sup>4</sup>, and the monthly inflation for each of the survey months as the numerator. Poverty lines were computed using these CPI values, one for each month of data collection (CPI<sub>Jan.2013</sub> = 205.87, CPI<sub>Feb.2013</sub> = 206.79, CPI<sub>Mar.2013</sub> = 208.58, CPI<sub>Apr.2013</sub> = 211.51).

The final poverty lines were:

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<sup>3</sup> Global Purchasing Power Parities and Real Expenditures, 2005 International Comparison Program. Available at: <http://data.worldbank.org/indicator/PA.NUS.PRVT.PP?page=1>

<sup>4</sup> CPI data for Uganda obtained from: <http://elibrary-data.imf.org>

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- January 2013 Poverty Line =  $1.25 * 744.62 * 2.0587 = 1,916.14$  UGX
- February 2013 Poverty Line =  $1.25 * 744.62 * 2.0679 = 1,924.71$  UGX
- March 2013 Poverty Line =  $1.25 * 744.62 * 2.0858 = 1,941.44$  UGX
- March 2013 Poverty Line =  $1.25 * 744.62 * 2.1151 = 1,968.65$  UGX

Note that the poverty line is converted to LCUs to enable a computation of prevalence of poverty using per capita expenditures figures in LCUs, given that the currency units must be standardized in the computation. It is also possible to compute the prevalence of poverty by using the \$1.25 poverty line and converting the per capita expenditure figures from 2013 UGX to 2005 US dollars instead. This is because the prevalence of poverty figures that are reported do not explicitly state which currency underpinned the calculation.

- **Average daily per capita expenditures**

This indicator was computed as the average of daily per capita expenditures, expressed in constant 2010 US dollars at 2005 PPP adjusted to 2010 US prices. The steps to convert daily per capita expenditure in 2013 UGX to constant 2010 US\$ (2005 PPP adjusted to 2010 US prices) were:

- Convert LCU at the time of the survey to LCU at 2005 prices, by dividing by the CPI for the survey month ( $CPI_{Jan.2013} = 205.87$ ,  $CPI_{Feb.2013} = 206.79$ ,  $CPI_{Mar.2013} = 208.58$ ,  $CPI_{Apr.2013} = 211.51$ ).
- Convert 2005 LCU to 2005 US\$ by dividing by the 2005 PPP conversion rate (744.62).
- Convert US\$ in 2005 prices to US\$ in 2010 prices by multiplying by 111.65, which is the US CPI for 2010.

Note that average daily per capita expenditure is expressed in US\$ in 2010 prices in order to enable comparisons with other countries.

- **Mean depth of poverty**

This indicator is useful to understand the average, over all people, of the gaps between poor people's living standards and the poverty line. It indicates the extent to which individuals fall below the poverty line (if they do).

Mean depth of poverty is computed based on the poverty gap index (PGI). This index is defined as the ratio of the Poverty Gap (PG) to the poverty line. The PG is computed as the average of the differences between an individual's total daily per capita consumption and the poverty line,

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divided by the poverty line, with individuals over the poverty line having a PG = 0. The PGI is given by the formula:

$$PGI = \left( \frac{1}{N} \sum_{i=1}^q \left( \frac{z - y_i}{z} \right) \right) \times 100$$

Where N is the total number of individuals in the population, z is the poverty line and  $y_i$  is the daily per capita consumption of individual i.