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Rural and Urban Poverty Estimates for Developing Countries: Methodologies*

Katsushi S. IMAI
Bilal MALEB

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Research Institute for Economics and Business Administration
Kobe University
2-1 Rokkodai, Nada, Kobe 657-8501 JAPAN

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Katsushi S. Imai *
Economics, School of Social Sciences, University of Manchester, Arthur Lewis Building, Oxford Road, Manchester M13 9PL, UK & RIEB, Kobe University, Japan
Email: Katsushi.Imai@manchester.ac.uk

Bilal Maleb
Economics, School of Social Sciences, University of Manchester, Arthur Lewis Building, Oxford Road, Manchester M13 9PL, UK
Email: bilal.malaeb@postgrad.manchester.ac.uk

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Abstract

This paper is to set out the backgrounds for the construction of new rural and urban poverty and inequality estimates using the World Bank Living Standard Measurement Survey (LSMS) data of developing countries with focus on methodological details as well as on their advantages or disadvantages. First, we have reviewed recent regional estimates based on the US$1.25 per day poverty line as well as those based on Multidimensional Poverty Index (MPI) for both rural and urban areas. It has been found that the level of poverty is much higher in rural areas than in urban areas across different regions regardless of the definitions of poverty. Second, we have summarised estimates of poverty and inequality for Tanzania and Uganda based on recent panel data constructed by LSMS.

***Corresponding Author:**
Dr. Katsushi Imai
Economics, School of Social Sciences, University of Manchester, Arthur Lewis Building, Oxford Road, Manchester M13 9PL, UK, Email: Katsushi.Imai@manchster.ac.uk

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Rural and Urban Poverty Estimates for Developing Countries: Methodologies

1. Backgrounds

This paper is to set out methodological backgrounds for the construction of new rural and urban poverty estimates for over 40 countries[1] mainly drawing upon the methodology used by the World Bank. The Global Monitoring Report 2013 (World Bank, 2013) disaggregates poverty estimates based on the international poverty line (US$1.25 a day) into rural and urban poverty as in Table 1. It is not clear exactly which countries World Bank (2013) used to derive regional estimates of rural and urban poverty rates. World Bank (2013, p.18) noted "Data and insights have been drawn from countries in Asia, Sub-Saharan Africa, and Latin America, including Bangladesh, China, India, Indonesia, Kyrgyzstan, Thailand, Ghana, Kenya, South Africa, Tanzania, Uganda, Zambia, Brazil, and Ecuador", implying that only 14 countries were used to derive these estimates. However, as World Bank (2013) does not provide details of how regional aggregates are calculated, or report country-level estimates of rural and urban poverty, it is difficult to assess the extent to which these estimates are reliable or accurate. It should be noted that regional estimates in Table 1 are not likely to represent all the countries in each region. Our research project aims to derive rural and urban poverty estimates for 40 or more countries using LSMS data.[2]

[1] The exact number of countries for which decomposition of poverty is possible will be confirmed shortly by the research team. Our earlier study (Imai et al., 2014) presented recent estimates of rural and urban poverty based on the secondary study for 31 countries (see Appendix 1). The data are available for most of these countries, though for a few countries LSMS data are unavailable. For instance, in the case of India, National Sample Survey Data were used, but this is much more time consuming to process than LSMS data.

[2] The research team is now in the middle of processing LSMS data for the period 2000-2010 for a number of countries for which rural and urban poverty rates can be calculated. This is a highly labour-intensive work as it involves a large amount of data generation and management based on raw household data.

Table 1. Poverty rates in urban and rural areas: Share of the population below $1.25 a day.

	1990		1996		2002		2008		2015 (prediction)		2015 (MDG1)	
	Rural	Urban	Rural	urban	Rural	urban	Rural	urban	Rural	urban	rural	Urban
East Asia and Pacific	67.5	24.4	45.9	13	39.2	6.9	20.4	4.3	*2.1*	*0.0*	33.8	12.2
Europe and Central Asia	2.2	0.9	6.3	2.8	4.4	1.1	1.2	0.2	*0.8*	*0.0*	1.1	0.5
Latin America and the Caribbean	21	7.4	20.3	6.3	20.3	8.3	13.2	3.1	*10.2*	*1.4*	10.5	3.7
Middle East and North Africa	9.1	1.9	5.6	0.9	7.5	1.2	4.1	0.8	*2.2*	*0.4*	4.6	1.0
South Asia	50.5	40.1	46.1	35.2	45.1	35.2	38	29.7	**33.1**	**25.7**	25.3	20.1
Sub-Saharan Africa (SSA)	55	41.5	56.8	40.6	52.3	41.4	47.1	33.6	**44.0**	**30.5**	27.5	20.8
Total	52.5	20.5	43	17	39.5	15.1	29.4	11.6	*20.4*	*8.1*	26.3	10.3

Source: The figures for 1990-2008 are based on World Bank (2013, p.87). '2015 (prediction)' is based on the simple linear prediction using the estimates in 1990 and 2015, while '2015 (MDG1)' shows the target, 50% of poverty headcount ratios in 1990. In the column titled as '2015 (prediction)', the bold numbers show the cases where MDG1 will not be achieved while those in Italics the cases where MDG1 is expected to be met.

Given the limitations, a few points are noted about the aggregate and regional estimates of rural and urban poverty in Table 1. With regard to the aggregate estimates (in the last row of Table 1), a steady reduction in poverty has been achieved in both rural and urban areas. In 18 years between 1990 and 2008, rural poverty rate reduced from 52.5% to 29.4%, while urban poverty rate changed from 20.5% to 11.6%. In both cases, MDG1 is expected to be met.

Table 1 also indicates that MGD1 of halving poverty is unlikely to be met for both rural and urban areas in South Asia and Sub-Saharan Africa. In other areas (*i.e.* East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, and Middle East and North Africa), MDG1 will be achieved by 2015 for both rural and urban areas. As pointed out by World Bank (2013), the pace of poverty reduction is faster in urban areas than in rural areas. However, it should also be noted that the pace of poverty reduction in rural areas was accelerated in the period between 2002-2008 than in earlier periods in East Asia and Pacific and South Asia. It can be, however, safe to argue that reduction of poverty in rural areas in South Asia and Sub-Saharan Africa is likely to key to overall poverty reduction given the large population in these regions.

Imai et al. (2014) used the secondary estimates of rural, urban and aggregate poverty rates for 31 developing countries and statistically examined the extent to which the rural sector contributes to aggregate poverty reduction (see Appendix 1). After adjusting for the effect of rural-urban migration, they have shown that the rural sector makes a substantial contribution to aggregate poverty reduction across all five regions. Recent studies giving greater priority to urbanisation, especially small and secondary towns (e.g. including World Bank, 2013, Collier and Dercon, 2014, Christiaensen and Todo, 2014) are likely to be misleading as discussed in details in Gaiha (2014).

As a supplementary analysis, we report summary statistics of "Multidimensional Poverty Indices (MPI)" separately for rural and urban areas. Because LSMS data do not have information necessary for constructing MPI, it is necessary to use Demographic and Health Surveys (DHS) data (http://dhsprogram.com/Data/) which are available for over 100 developing countries. There has been in the recent empirical literature a search for new poverty measures as the current MDGs do not fully reflect the multidimensional aspect of human development. The UNDP has proposed a MPI to capture micro-level deprivation. Alkire and Foster (2011) also develop an MPI aggregated from individuals to communities.

Oxford Poverty & Human Development Initiative (OPHI) has recently provided estimates of MPI separately for rural and urban areas at country levels. Table 2 summarises rural and urban MPI based on country estimates for 105 countries.[3] It should be noted that Table 1 and Table 2 cannot be compared as Table 1 is based on estimates for much fewer countries. MPI (national, rural and urban) is an index ranging from 0 to 1 based on the share of people who are considered to be poor in multidimensional aspects (H), covering education (years of schooling and child school attendance, with the weight of 1/3), health (child mortality and nutrition, 1/3) and living standard (access to electricity, sanitation, drinking water, flooring,

[3] The data are available from http://www.ophi.org.uk/multidimensional-poverty-index/mpi-2014/mpi-data/. Country-level estimates are reported in Appendix 2.

cooking fuel, TV, telephone etc. 1/3) and the intensity (A).[4] The MPI reflects both the incidence, or headcount ratio (H) of poverty (or the proportion of the population that is multidimensionally poor)[5] and the average intensity (A) of their poverty (or the average proportion of indicators in which poor people are deprived) (Alkire et al., 2014).

Table 2 reports regional averages of MPI for rural and urban areas. The last row shows that the share of households which are multidimensionally poor is much higher in rural areas (38.0%) than in urban areas (16.1%), which is broadly consistent with the estimates in 2008 based on the US$1.25 poverty line in Table 1 (29.4% for rural areas and 11.6% for urban areas). Intensity of deprivation among the poor (A) is also higher in rural areas than in urban areas, leading to the much higher MPI estimate in rural areas (0.205) than in urban areas (0.075). The pattern - in which MPI, headcount ratio (H) and intensity (A) are higher in rural than in urban areas - is consistently found across different regions.[6]

[4] See Alkire et al. (2014) for technical details.

[5] A person is identified as poor if he or she is deprived in at least one third of the weighted indicators. Those identified as 'Vulnerable to Poverty' are deprived in 20% – 33.33% of weighted indicators and those identified as in 'Severe Poverty' are deprived in 50% or more of the dimensions (Alkire et al., 2014, p.4).

[6] While the national estimates for MPI are more or less plausible (i.e., the highest MPI for SSA (0.329), to be followed by 0.187 (South Asia), East Asia and the Pacific (0.115), Latin America and Caribbean (0.055) and Europe and Central Asia (0.011)), the estimates for rural and urban MPI will have to be interpreted with caution because they are not consistent with the national estimates. For instance, it is counter-intuitive to find the highest value of rural MPI for East Asia and the Pacific, but this reflects the high MPI estimates for the Pacific countries (e.g. Vanuatu. See Appendix 2). The estimates for Sub-Saharan African (SSA) countries will also have to be scrutinised as there are a few countries with counter-intuitively low estimates for MPI (e.g. Benin, Burkina Faso, Central African Republic, Cote d'Ivoire. See Appendix 2). This will raise the issues of comparability of MPI estimates across different countries in particular for their rural and urban estimates. It is also counter-intuitive to find that rural MPI estimates for South Asia (0.126) than that for Europe and Central Asia (0.299) or for Latin America and Caribbean (0.169). Finding these inconsistencies is to some extent inevitable as MPI is derived by a number of qualitative questions and the data can be influenced by e.g. social or cultural norms.

Table 2. Multidimensional Poverty Index (MPI) for Rural and Urban Areas

World region (average)	Multidimensional Poverty Index (MPI) National	Multidimensional poverty - Rural			Multidimensional poverty - Urban			Population shares (%)	
		MPI	Headcount Ratio: Population in multidimensional poverty (H)	Intensity of deprivation among the poor (A)	MPI	Headcount ratio: Population in multidimensional poverty (H)	Intensity of deprivation among the poor (A)	Rural	Urban
		Range 0 to 1	% Population	% of weighted deprivations	Range 0 to 1	% Population	% of weighted deprivations		
East Asia and the Pacific	0.115	0.299	53.3	50.9	0.113	23.5	44.3	58.8	41.2
Europe and Central Asia	0.011	0.188	34.9	45.7	0.070	15.1	40.4	50.5	49.5
Latin America and Caribbean	0.055	0.169	31.5	45.0	0.061	13.5	40.2	55.9	44.1
South Asia	0.187	0.126	26.1	39.5	0.032	7.6	34.7	50.4	49.6
Sub-Saharan Africa (SSA)	0.329	0.223	41.3	46.8	0.084	17.7	41.9	56.4	43.6
Total	0.168	0.205	38.0	46.0	0.075	16.1	40.9	54.6	45.4

Data source: Calculated based on OPHI data (2014). Regional averages are derived as simple averages of country estimates for the countries for which the data area available (see Appendix 2 for the list of countries and estimates).

2. Methodological Issues

2.1. Backgrounds for the international poverty lines

This study will apply the international poverty lines based on $1.25 and $2 per capita per day (2005 PPP) separately for rural and urban areas using LSMS data. Before presenting the methodological details, we will provide a few background issues focusing on advantages and disadvantages using these poverty lines.

Obvious advantages include the comparability across different geographical areas/categories (e.g. across different countries as well as between rural and urban areas) as well as over different time periods on the grounds that the consumption or income is adjusted by using PPP (purchasing power parity) in 2005 (Chen and Ravallion, 2008; 2010).

In 2008 the World Bank revised the international poverty line for the extreme poverty and revised it from the US$1.08 per day (1993 PPP) poverty line to US$1.25 (2005 PPP) to increase the coverage of countries as detailed in Chen and Ravallion (2008), which provides revised poverty trends since 1981. The US$1.25 line was adopted as the average of the

national poverty line of the poorest 15 countries in the new dataset in such a way that the new methodology is consistent with earlier ones (World Bank, 2014). The new method has an advantage as the new sample of national lines is representative of low income countries. That is, by using the US$1.25 a day line, we can assess poverty situations broadly in terms of average nutritional requirement in low income countries or the equivalent levels in income or consumption. Using the revised poverty line, Chen and Ravallion (2010, p.1621) concluded that "25% of the population of the developing world, 1.4 billion people, were poor in 2005, which is 400 million more for that year 2005 than implied by our old international poverty line based on national lines for the 1980s and the 1993 ICP". The overall pattern of the results is unchanged if other alternative poverty lines are used (*ibid.*, 2010). Building on this, we propose to disaggregate the poverty estimates into rural and urban poverty.

Disadvantages of using the international poverty lines in the context of the present study include: (i) the lower poverty lines, such as the US$ 1.25 line, may be inappropriate for some middle income countries – in particular for urban areas, (ii) the income or consumption poverty may not capture the actual nutritional situations of the countries, and (iii) nutritional requirements are likely to be different for rural and urban areas. To partially overcome these limitations, we proposed to use both the US$ 1.25 and US$2.00 lines. We also propose to convert detailed food expenditure data into nutrients' intakes for Malawi and for Indonesia.[7]

2.2. FGT Poverty Measure

The methodological framework to derive urban and rural poverty rate is founded in the well-known Foster-Greer-Thorbecke (FGT) measure (Foster et al., 1984) denoted as P_α. The formula is given by:

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{H}\left(\frac{z-y_i}{z}\right)^\alpha \qquad (1)$$

[7] The team is still in the middle of acquiring the datasets.

where z is US$1.25 or US$2.00 poverty line, N is the number of households in either rural or urban areas in the country, H is the number of poor households whose per capita income or consumption is below z, α is the sensitivity parameter which reflects the weight given to poorer households farther below z. We examine the cases where α is 0, 1 and 2.

Headcount ratio $(\alpha = 0)$ is defined as:

$$P_0 = \frac{H}{N} \qquad (2)$$

which indicates the fraction of households which are poor in either rural or urban area.

Poverty gap $(\alpha = 1)$ is defined as:

$$P_1 = \frac{1}{N}\sum_{i=1}^{H}\left(\frac{z-y_i}{z}\right) \qquad (3)$$

which indicates the amount of income necessary to bring everyone in poverty right up to the poverty line, divided by total population in either rural or urban area.

P_2 measure $(\alpha = 2)$ is defined as:

$$P_2 = \frac{1}{N}\sum_{i=1}^{H}\left(\frac{z-y_i}{z}\right)^2 \qquad (4)$$

which reflects the degree of poverty as well as the inequality among the poor households in either rural or urban areas.

2.3. World Bank Estimates versus Our Estimates for International Poverty

As detailed in Ravallion et al. (2008), the World Bank has made the historical update of the international "$1 a day" poverty line, which was first proposed by the World Bank in 1990 for measuring absolute poverty by the standards of the world's poorest countries (Ravallion et al. (1991). Since then poverty researchers have used two major thresholds, "$1.25 a day" and "$2 a day". As discussed in Ravallion et al. (1991, 2008) and World Bank (2015), the World has used only the distributional information of household/individual data or national census aggregated at sub-regional categories, such as, the proportion of population of each

category as well as that of income – which could be defined as cumulative ranked by income, or not cumulative (or alternatively, percentage of the population in a given class interval of incomes as well as the mean income of that class interval).[8] On the other hand, we use directly micro-level household data, such as LSMS data, to derive the estimates of poverty indices. Hence, at national levels, the World Bank estimates of poverty may be different from ours.

2.4. Inequality measures

We also derive estimates for inequality separately rural and urban areas for each country. Among many inequality measures, we will use the Gini coefficient and the Generalised Entropy (GE) measure.

The Gini coefficient derives from the Lorenz curve, a cumulative frequency curve that compares the distribution of a resource (here, per capita consumption expenditure) with the uniform distribution representing equality. It ranges from 0 to 1, representing perfect inequality with 1 (i.e. one member in a society holds all of the resource) and no inequality with 0 (all members shares same level of the resource).

The Gini coefficient can be formally defined as follows:

$$Gini = \frac{1}{2N^2\bar{y}} \sum_{i=1}^{N} \sum_{j=1}^{N} \left| y_i - y_j \right| \qquad (5)$$

[8] More specifically, the World Bank used one of the following types of data of distributional information to derive poverty measures (see http://iresearch.worldbank.org/PovcalNet/index.htm?0,5).
•Type 1: p=cumulative proportion of population (ranked by the poverty indicator, which we will call "income"), L=cumulative proportion of income held by that proportion of the population.
•Type 2: q=proportion of population (as in p, but not cumulative), r=proportion of income (as in L, but not cumulative).
•Type 3: p (as in 1), r (as in 2).
•Type 4: q (as in 2), L (as in 1).
•Type 5: f(x)=percentage of the population in a given class interval of incomes, X=the mean income of that class interval.
•Type 6: upper bound of a class interval, f(x) (as in 5), X (as in 5).
•Type 7: upper bound of a class interval, p (as in 5), X (as in 5).
•Type 8: upper bound of a class interval, f(x) (as in 5).

where $\bar{y}$ is mean income (or consumption expenditure) and $|y_i - y_j|$ is all the pair-wise absolute differences in income. N denotes the number of population. The Gini coefficient is a full information measure drawing up all parts of distribution and the most widely used inequality measure in literature. It allows comparison in the distribution of a variable of interest across different populations. Besides, it also can be used for comparison of distribution over time regardless of whether inequality increases or decreases. However, it has a shortcoming that it often fails to meet decomposability (i.e. the sum of the Gini coefficients of population sub-groups is not equal to the total Gini coefficient of the population).

To supplement Gini coefficient, we also compute the GE measure, which is defined as:

$$GE(\theta) = \frac{1}{\theta(\theta-1)}\left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{\bar{y}}\right)^{\theta} - 1\right] \tag{6}$$

where θ is a discretionary parameter that represents the weight given to distances between incomes at different parts of the income distribution, and can take any real value.

The value of GE measure ranges from zero to infinity, representing higher inequality with higher value. It is more sensitive to changes at the lower (upper) tail of the distribution (i.e. the poorest) for lower (higher) values of θ, and is equally sensitive to changes across the distribution for θ equal to 1.

For example, with θ=0, we obtain Theil's L index, often referred to as the Mean Log Deviation:

$$GE(0) = \frac{1}{N}\sum_{i=1}^{N}\log\frac{\bar{y}}{y_i} \tag{7}$$

With θ=1, we obtain Theil's T index:

$$GE(1) = \frac{1}{N}\sum_{i=1}^{N}\frac{y_i}{\bar{y}}\log\frac{y_i}{\bar{y}} \quad (8)$$

Further supplement Gini coefficient and GE measures, the percentile ratios p90/p10 (or p75/p25) (the ratio of income at 90% (75%) to that at 10%(25%)).

2.5. Derivation of Rural and Urban Poverty Estimates using LSMS data

Deriving aggregate consumption

Using the World Bank Living Standard Measurement Survey (LSMS) data, we propose to use the consumption data to measure rural and urban poverty. If consumption data are not available, income data will be used. In the case where consumption data are used, consumption from own production will be included for each household. The total household consumption or income is then divided by the number of persons living in the household to derive a per capita measure.

More specifically, Deaton and Grosh (2000) and Deaton and Zaidi (2002) detail how the expenditure data are derived by LSMS data. First, it is necessary to add up all reported expenditures on individual goods and services or on groups of goods and services. Then a value for consumption out of home production or in kind received from employers will be added up. Then the estimates must be converted to real terms by adjusting them by a price index to account for differences in prices among different regions or interview dates.[9]

Deaton and Grosh (2000) have also noted limitations when we use consumption or expenditure data from LSMS. These include (i) recall errors associated with the fading of people's memories; (ii) the "telescoping" of reported events by incorrect dating; (iii) reporting errors associated with respondents being overwhelmed either by the length of the survey or by the number of items covered; (iv) "prestige" errors, in other words, misreporting due to various social pressures; (v) conditioning effects from being in the survey; (vi)

[9] Examples of Stata codes aggregating expenditure are provided in the appendix of Deaton and Zaidi (2002).

respondent effects where the identity of the respondent affects the answers that they give; (vii) interviewer effects; and (viii) effects associated with the design of the instrument. Similar errors are expected for income data. These may result in errors in classifying households as poor or non-poor and thus the final results should be interpreted with caution.

Price adjustments

As discussed in Deaton and Grosh (2000), unlike other similar surveys, LSMS is supposed to provide an estimate of annual expenditures at the household level, implying that consumer price index can be constructed either at the household level, or at the community level. While there are both advantages and disadvantages in these two, in light of the main purpose of the project (i.e. classifying households as poor or non-poor), it is appropriate to use price index at the community or PSU (primary sampling unit) averages because measurement errors for quantity and price for each item can be correlated at the household level.

It is necessary for the researchers to impute values of all the items if they are not purchased at the market (e.g. gifts, own farm production, home-made clothes or wood and water fetched by children or women) (Deaton and Grosh, 2000). Ideally, we need to derive the imputed values for all these items, but as this is a time consuming work, we will focus only on the home-produced food as well as food received as gifts or payment in kind, which are likely to be the largest and non-negligible in LSMS data. The respondent is asked to report the value of any home-produced food consumed by the household during the reference period, and then the sum of these items is added in to the consumption total (*ibid.*, 2000).

While the community-level price index should ideally be used to derive the real values of household consumption over different time periods, as these variables are not necessarily available in LSMS data, we will use consumption price index (CPI, available from World Development Indicators (WDI) in 2014) to convert the final private household consumption expenditure per capita per day in local currency unit (LCU) in the survey year (e.g. 2011) to

2005, the base year for international poverty indices. Then they will be converted to US$ in 2005 using the Purchasing Power Parity (PPP) conversion factor which is available in WDI in 2014. The household is defined as poor if per capita per day annual household consumption is below US$1.25, or US$2, in terms of PPP in 2005 and as non-poor otherwise. The same procedure is used to derive poverty rate for the US$2 line.

3. Country Case Studies[10]

Tanzania

First we will report poverty and inequality estimates for Tanzania based on LSMS data in 2008 and 2010. The results on inequality and poverty are summarised in Tables 3 and 4 and the regression results about determinants of poverty and vulnerability are reported in Table 5.

In the first panel of Table 3, percentile ratios for distribution are shown. The figures imply that the magnitude of inequality is large in Tanzania. This is reflected in Gini coefficient which remained relatively large – 0.4557 in 2008 and 0.4467 in 2010. If we decompose the Gini coefficient in rural and urban areas, we will find that Gini remained higher in rural area than urban area, with the gap having narrowed from 2008 to 2010. GE measures have been decomposed into within-inequality (the inequality within rural or urban area) and between-inequality (the inequality between rural and urban areas). The results show that the former contributes more to the overall inequality.

Table 4 summarises poverty in rural and urban areas in Tanzania. The first panel shows the results for the $1.25 poverty line in 2008 and 2010. Poverty headcount ratio – as well as poverty gap and squared poverty gap- is much higher in rural area than urban area. The pattern of the results is similar for $2.00, which are shown in the second panel.

[10] More countries will be covered by Part II to be prepared by Dr Gordon Abekah-Nkrumah and Dr Purnima Purohit.

Table 3 Inequality in Tanzania

2008

Percentile ratios for distribution of expm_pc_2005: all valid obs.

p90/p10	p90/p50	p10/p50	p75/p25	p75/p50	p25/p50
7.375	3.201	0.434	2.841	1.766	0.622

Generalized Entropy indices GE(a), where a = income difference sensitivity parameter, and Gini coefficient

All	Obs	GE(-1)	GE(0)	GE(1)	GE(2)	**Gini**
		0.42886	0.34561	0.37495	0.56056	**0.45567**

Subgroup summary statistics, for each subgroup k = 1,...,K:

rural/urban	Pop. share	Mean	Rel.mean	Income share	log(mean)
Rural	0.63185	1.84619	0.64055	0.40474	0.61312
Urban	0.36815	4.66024	1.61692	0.59526	1.53907

Subgroup indices: GE_k(a) And Gini_k

rural/urban	GE(-1)	GE(0)	GE(1)	GE(2)	**Gini**
Rural	0.23192	0.20374	0.22299	0.31594	**0.35195**
Urban	0.40864	0.30515	0.30061	0.38193	**0.42229**

Within-group inequality, GE_W(a)

All	Obs	GE(-1)	GE(0)	GE(1)	GE(2)
		0.32181	0.24107	0.26919	0.44951

Between-group inequality, GE_B(a):

All	Obs	GE(-1)	GE(0)	GE(1)	GE(2)
		0.10705	0.10454	0.10576	0.11087

2010

Percentile ratios for distribution of expm_pc_2005: all valid obs.

p90/p10	p90/p50	p10/p50	p75/p25	p75/p50	p25/p50
7.443	3.17	0.426	2.812	1.774	0.631

Generalized Entropy indices GE(a), where a = income difference sensitivity parameter, and Gini coefficient

All	obs	GE(-1)	GE(0)	GE(1)	GE(2)	**Gini**
		0.41763	0.33344	0.35881	0.53681	**0.44671**

Subgroup summary statistics, for each subgroup k = 1,...,K:

rural/urban	Pop. share	Mean	Rel.mean	Income share	log(mean)
Rural	0.67196	1.99567	0.70763	0.4755	0.69098
Urban	0.32804	4.50916	1.59888	0.5245	1.50611

Subgroup indices: GE_k(a) and Gini_k

rural/urban	GE(-1)	GE(0)	GE(1)	GE(2)	**Gini**
Rural	0.28011	0.24293	0.27364	0.43419	**0.38314**
Urban	0.36196	0.27975	0.28024	0.36134	**0.40688**

Within-group inequality, GE_W(a)

All	obs	GE(-1)	GE(0)	GE(1)	GE(2)
		0.34026	0.25501	0.2771	0.44912

Between-group inequality, GE_B(a):

All	obs	GE(-1)	GE(0)	GE(1)	GE(2)
		0.07738	0.07843	0.08171	0.08755

Table 4 Poverty in Tanzania

2008					2010				
Based on $1.25 Poverty Line					**Based on $1.25 Poverty Line**				
Foster-Greer-Thorbecke poverty indices, FGT(a)					Foster-Greer-Thorbecke poverty indices, FGT(a)				
All	obs	a=0	a=1	a=2	All	obs	a=0	a=1	a=2
national		**0.28484**	0.08217	0.03333	national		**0.282**	0.08325	0.03496
FGT(0): headcount ratio (proportion poor)					FGT(0): headcount ratio (proportion poor)				
FGT(1): average normalised poverty gap					FGT(1): average normalised poverty gap				
FGT(2): average squared normalised poverty gap					FGT(2): average squared normalised poverty gap				
Summary statistics for subgroup k = 1,...,K					Summary statistics for subgroup k = 1,...,K				
rural/urban	Pop. share	Mean	Meanpoor	Mean gap poor	rural/urban	Pop. share	Mean	Meanpoor	Mean gap poor
rural	0.63185	1.84619	0.88176	0.36824	0	0.67196	1.99567	0.87256	0.37744
urban	0.36815	4.66024	0.94008	0.30992	1	0.32804	4.50916	0.96035	0.28965
Subgroup FGT index estimates, FGT(a)					Subgroup FGT index estimates, FGT(a)				
rural		a=0	a=1	a=2	rural		a=0	a=1	a=2
rural		**0.39166**	0.11538	0.04735	0		**0.3794**	0.11456	0.04861
urban		**0.1015**	0.02516	0.00927	1		**0.08247**	0.01911	0.00698
2008					**2010**				
Based on $2 Poverty Line					**Based on $2 Poverty Line**				
Foster-Greer-Thorbecke poverty indices, FGT(a)					Foster-Greer-Thorbecke poverty indices, FGT(a)				
All	obs	a=0	a=1	a=2	All	obs	a=0	a=1	a=2
		0.53752	0.21024	0.10532			**0.5398**	0.21012	0.10594
FGT(0): headcount ratio (proportion poor)					FGT(0): headcount ratio (proportion poor)				
FGT(1): average normalised poverty gap					FGT(1): average normalised poverty gap				
FGT(2): average squared normalised poverty gap					FGT(2): average squared normalised poverty gap				
Summary statistics for subgroup k = 1,...,K					Summary statistics for subgroup k = 1,...,K				
rural/urban	Pop. share	Mean	Meanpoor	Mean gap poor	rural/urban	Pop. share	Mean	Meanpoor	Mean Gap Poor
Rural	**0.63185**	1.84619	0.88176	0.36824	rural	**0.67196**	1.99567	1.18778	0.81222
Urban	**0.36815**	4.66024	0.94008	0.30992	urban	**0.32804**	4.50916	1.41198	0.58802
Subgroup FGT index estimates, FGT(a)					Subgroup FGT index estimates, FGT(a)				
rural a=0		a=0	a=1	a=2	rural a=0		a=0	a=1	a=2
Rural		**0.70868**	0.28622	0.1455	rural		0.68254	**0.27719**	0.14274
Urban		**0.24376**	0.07984	0.0363	urban		0.24742	**0.07275**	0.03056

In Table 5 the determinants of poverty and vulnerability in Tanzania are presented. Regardless of whether poverty or vulnerability is adopted, the pattern of the results is similar. For instance, better education of head is associated with lower poverty or vulnerability. Household headed by older person tends to be poorer and more vulnerable. Female headed households are more likely to be poorer and more

vulnerable. Larger household size and higher dependency burden are associated with poverty and vulnerability.

Table 5 Determinants of Poverty and Vulnerability in Tanzania

	Case (1) Random-Effects Probit	Case (2) Random-Effects Probit	Case (3) Fixed-Effects Model	Case (4) Random-Effects Model	Case (5) Fixed-Effects Model	Case (6) Random-Effects Model
Dep. Var	Poverty	Poverty	Vulnerability	Vulnerability	Vulnerability	Vulnerability
	$1.25	$2.00	$1.25	$1.25	$2.00	$2.00
VARIABLES						
educ_hhh	-0.0806***	-0.104***	-0.00582***	-0.00468***	-0.00640***	-0.00530***
	(0.00969)	(0.00928)	(0.000308)	(0.000190)	(0.000359)	(0.000196)
age_hhh	-0.00752***	-0.00653***	0.000600**	0.000361***	0.000608*	0.000566***
	(0.00239)	(0.00244)	(0.000272)	(8.61e-05)	(0.000317)	(8.51e-05)
male_hhh	-0.207***	-0.0511	-0.0348***	-0.0264***	-0.0417***	-0.0328***
	(0.0788)	(0.0798)	(0.00547)	(0.00260)	(0.00637)	(0.00262)
Hhsize	0.122***	0.177***	0.0212***	0.0222***	0.0291***	0.0285***
	(0.0129)	(0.0145)	(0.000582)	(0.000374)	(0.000678)	(0.000390)
dep_ratio	0.268***	0.395***	0.0193***	0.0192***	0.0199***	0.0201***
	(0.0322)	(0.0390)	(0.00124)	(0.000946)	(0.00145)	(0.00101)
Mainland	-0.601**	0.0198		0.483***		0.456***
	(0.259)	(0.279)		(0.0107)		(0.0105)
D2008	0.0265	0.0199	-0.00497***	-0.00702***	-0.00643***	-0.00920***
	(0.0501)	(0.0498)	(0.00100)	(0.000845)	(0.00117)	(0.000975)
Rural	-0.722***	-0.764***	0.0133***	0.0173***	0.0156***	0.0188***
	(0.0779)	(0.0698)	(0.00243)	(0.00190)	(0.00283)	(0.00205)
2.region	-0.986***	-0.913***	-0.0462	0.0521***	-0.0688*	0.0580***
	(0.254)	(0.264)	(0.0316)	(0.00979)	(0.0368)	(0.00968)
3.region	-0.791***	-0.793***	0.00634	0.134***	-0.00113	0.150***
	(0.240)	(0.255)	(0.0354)	(0.00970)	(0.0413)	(0.00956)
4.region	-0.582**	-0.231	0.244***	0.519***	-0.0856	0.498***
	(0.226)	(0.256)	(0.0462)	(0.00971)	(0.0538)	(0.00955)
5.region	-0.502**	-0.336	-0.104***	-0.0542***	-0.179***	-0.102***
	(0.225)	(0.249)	(0.0265)	(0.00914)	(0.0309)	(0.00910)
6.region	-1.306***	-1.075***	-0.00510	-0.0425***	-0.0604*	-0.101***
	(0.303)	(0.286)	(0.0299)	(0.0105)	(0.0349)	(0.0104)
7.region	-1.985***	-2.082***	-0.0690***	-0.0369***	-0.151***	-0.0987***
	(0.250)	(0.240)	(0.0243)	(0.00789)	(0.0284)	(0.00786)
8.region	-0.0740	0.0826	0.517***	0.466***	0.432***	0.448***
	(0.216)	(0.246)	(0.0511)	(0.00931)	(0.0595)	(0.00917)
9.region	-0.369*	-0.277	0.601***	0.510***	0.648***	0.596***
	(0.212)	(0.237)	(0.0335)	(0.00885)	(0.0390)	(0.00875)
10.region	0.141	0.425*	0.199***	0.169***	0.189***	0.182***
	(0.210)	(0.248)	(0.0380)	(0.00911)	(0.0443)	(0.00898)
11.region	-0.661***	-0.498**	0.168***	0.333***	0.328***	0.488***
	(0.228)	(0.249)	(0.0312)	(0.00939)	(0.0363)	(0.00929)
12.region	-0.502**	-0.141	0.234***	0.318***	0.272***	0.346***
	(0.214)	(0.242)	(0.0408)	(0.00910)	(0.0476)	(0.00897)
13.region	-0.0231	-0.163	0.233***	0.233***	0.296***	0.297***
	(0.251)	(0.291)	(0.0340)	(0.0108)	(0.0396)	(0.0107)
14.region	-0.195	-0.152	-0.0389	-0.0327***	-0.0689**	-0.0590***
	(0.224)	(0.260)	(0.0284)	(0.00936)	(0.0331)	(0.00929)
15.region	-0.125	0.314	0.0975**	0.0824***	0.132***	0.0881***
	(0.233)	(0.275)	(0.0382)	(0.00989)	(0.0445)	(0.00976)
16.region	0.361	0.653**	0.191***	0.217***	0.210***	0.217***

	(0.223)	(0.281)	(0.0419)	(0.00955)	(0.0488)	(0.00942)
17.region	-0.462**	-0.563**	-0.0954***	-0.0577***	-0.145***	-0.102***
	(0.215)	(0.246)	(0.0339)	(0.00906)	(0.0395)	(0.00896)
18.region	-0.735***	-0.680***	-0.00117	-0.0204**	0.0266	-0.0374***
	(0.221)	(0.247)	(0.0335)	(0.00930)	(0.0390)	(0.00919)
19.region	-0.264	-0.615**	-0.0455	-0.0876***	-0.0775**	-0.155***
	(0.217)	(0.248)	(0.0304)	(0.00896)	(0.0355)	(0.00888)
20.region	-0.0773	-0.348	0.0476	0.0499***	0.0478	0.0317***
	(0.263)	(0.306)	(0.0397)	(0.0110)	(0.0463)	(0.0109)
21.region	-0.285	-0.357	-0.116***	-0.0502***	-0.195***	-0.0973***
	(0.248)	(0.284)	(0.0247)	(0.0103)	(0.0288)	(0.0103)
51.region	0.250	0.258	0.223***	-0.00337	0.255***	-0.000438
	(0.263)	(0.290)	(0.0538)	(0.0113)	(0.0627)	(0.0110)
52.region	-0.427	-0.291	0.366***	-0.0316***	0.385***	0.0168
	(0.344)	(0.307)	(0.0422)	(0.0120)	(0.0492)	(0.0119)
53.region	-0.274	-0.921***	0.311***	-0.0483***	0.382***	0.0420***
	(0.228)	(0.221)	(0.0376)	(0.00876)	(0.0438)	(0.00848)
54.region	0.495*	0.183		-0.00359		-0.00753
	(0.272)	(0.292)		(0.0117)		(0.0113)
Constant	1.297***	1.556***	0.104***	-0.431***	0.168***	-0.336***
	(0.434)	(0.479)	(0.0253)	(0.0172)	(0.0294)	(0.0170)
Observations	5,294	5,294	5,294	5,294	5,294	5,294
Number of hhid2	3,116	3,116	3,116	3,116	3,116	3,116
R-squared			0.657		0.709	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Uganda

As is observed in Table 6, the magnitude of inequality was high in Uganda as well and it gradually increased from 2009 to 2011. In particular, urban inequality in terms of Gini coefficient expanded by 4% from 2010 to 2011.

In Table 7, statistics of poverty in Uganda are summarised. Overall, poverty increased from 2009 to 2011 in both rural and urban areas. In particular, urban poverty increased from 2010 to 2011 (19.2% to 25.1% for headcount ratio based on $1.25; 39.2% to 48.1% for headcount ratio based on $2).

Table 8 shows the econometric results of determinants of poverty and vulnerability. Age of household head is positively associated with vulnerability in a few cases. Surprisingly, educational level of household head is positive and significant for poverty and vulnerability, while its square is negative and significant in all the cases. A larger household tends to be poorer and more vulnerable, while the household headed by a female member tends to be

poorer and more vulnerable. While increase of female share in the household reduces poverty and vulnerability, the increase in female members below 15 years or above 60 years tends to increase poverty and vulnerability significantly.

Table 6: Inequality in Uganda

		Gini Coefficient	Percentile ratios for distribution of expm_pc_2005: all valid obs.					
			p90/p10	p90/p50	p10/p50	p75/p25	p75/p50	p25/p50
2009	Rural	0.392792						
	Urban	0.449661	7.274	2.955	0.406	2.763	1.705	0.617
	Population	0.463589	7.274	2.955	0.406	2.763	1.705	0.617
2010		Gini Coefficient	p90/p10	p90/p50	p10/p50	p75/p25	p75/p50	p25/p50
	Rural	0.416263						
	Urban	0.435774	7.317	2.917	0.399	2.768	1.694	0.612
	Population	0.462197						
2011		Gini Coefficient	p90/p10	p90/p50	p10/p50	p75/p25	p75/p50	p25/p50
	Rural	0.426867						
	Urban	0.476041	7.021	2.963	0.422	2.691	1.715	0.637
	Population	0.466359						

Table 7: Poverty and vulnerability incidence in Uganda

			Poverty			Vulnerability
			FGT(0):	FGT(1):	FGT(2):	Mean
2009	US$1.25	Urban	20.8	7.1	3.4	2.3
		Rural	52.8	19.2	9.4	39.2
		Population	44.6	16.1	7.9	29.7
	US$2.00	Urban	36.5	15.0	8.3	17.0
		Rural	79.0	37.4	21.6	69.9
		Population	68.0	31.6	18.1	56.3
2010	US$1.25	Urban	19.2	6.6	3.2	3.3
		Rural	55.1	21.5	11.0	41.3
		Population	47.2	18.2	9.3	32.9
	US$2.00	Urban	39.2	15.2	8.0	19.2
		Rural	79.6	39.5	23.6	72.0
		Population	70.7	34.1	20.2	60.3
2011	US$1.25	Urban	25.1	8.5	4.1	2.9

		Rural	55.5	20.9	10.3	38.8
		Population	49.2	18.4	9.1	31.5
	US$2.00	Urban	48.1	18.7	10.1	20.3
		Rural	78.4	38.8	23.0	68.6
		Population	72.2	34.7	20.3	58.6

FGT (0): headcount ratio (proportion poor)

FGT (1): average normalised poverty gap

FGT (2): average squared normalised poverty gap

Table 8 Determinants of Poverty and Vulnerability

Dep. Var	Case (1) Random-Effects Probit Poverty $1.25	Case (2) Random-Effects Probit Poverty $2.00	Case (3) Fixed-Effects Model Vulnerability $1.25	Case (4) Random-Effects Model Vulnerability $1.25	Case (5) Fixed-Effects Model Vulnerability $2.00	Case (6) Random-Effects Model Vulnerability $2.00
head_age	-0.00231	0.0122	0.00427	0.00335*	0.00449	0.00532***
	(0.00921)	(0.00976)	(0.00398)	(0.00172)	(0.00369)	(0.00155)
head_age2	-1.60e-05	-0.000138	-2.86e-05	-3.95e-05**	-3.01e-05	-5.16e-05***
	(8.97e-05)	(9.54e-05)	(3.75e-05)	(1.68e-05)	(3.49e-05)	(1.52e-05)
head_edu	0.0206	0.0444**	0.0264***	0.0166***	0.0513***	0.0368***
	(0.0167)	(0.0176)	(0.00385)	(0.00277)	(0.00357)	(0.00253)
head_edu2	-0.00910***	-0.0103***	-0.00359***	-0.00285***	-0.00641***	-0.00543***
	(0.00139)	(0.00138)	(0.000313)	(0.000217)	(0.000290)	(0.000198)
Hsize	0.123***	0.145***	0.0435***	0.0398***	0.0413***	0.0386***
	(0.00807)	(0.00934)	(0.00244)	(0.00137)	(0.00226)	(0.00124)
head_sex (whether male head)	-0.151***	-0.0881	-0.0687***	-0.0279***	-0.0353*	-0.0340***
	(0.0574)	(0.0633)	(0.0210)	(0.0105)	(0.0195)	(0.00956)
1.region	0.243	0.549***	-0.000307	-0.126***	0.0236	-0.0588***
	(0.149)	(0.126)	(0.0210)	(0.0174)	(0.0195)	(0.0159)
2.region	1.266***	1.511***	0.335**	0.168***	0.353**	0.359***
	(0.154)	(0.138)	(0.161)	(0.0203)	(0.149)	(0.0185)
3.region	1.434***	1.693***		0.268***		0.439***
	(0.153)	(0.137)		(0.0200)		(0.0182)
4.region	1.090***	1.365***		0.160***		0.374***
	(0.154)	(0.137)		(0.0205)		(0.0186)
rural	0.729***	0.860***	0.129***	0.184***	0.228***	0.250***
	(0.0647)	(0.0646)	(0.0229)	(0.0113)	(0.0213)	(0.0103)
burden_share_female	1.151***	1.595***	0.901***	0.907***	0.872***	0.819***
	(0.160)	(0.170)	(0.0406)	(0.0270)	(0.0377)	(0.0246)
female_share	-0.539***	-0.420***	-0.219***	-0.179***	-0.285***	-0.208***
	(0.154)	(0.155)	(0.0411)	(0.0254)	(0.0382)	(0.0231)
2010.year	0.0296	-0.000796	0.00837	0.00970	0.0131**	0.0154***
	(0.0423)	(0.0469)	(0.00618)	(0.00603)	(0.00574)	(0.00557)
2011.year	0.121***	0.0931*	-0.0165**	-0.00637	-0.0143**	-0.00963*
	(0.0424)	(0.0479)	(0.00656)	(0.00612)	(0.00609)	(0.00565)
Constant	-2.013***	-2.114***	-0.306***	-0.323***	-0.106	-0.261***
	(0.266)	(0.267)	(0.108)	(0.0447)	(0.101)	(0.0405)

Observations	8,478	8,478	8,372	8,372	8,372	8,372
Number of HHID	3,220	3,220	3,196	3,196	3,196	3,196
R-squared			0.201		0.270	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5. Concluding Observations

This paper has set out the backgrounds for the construction of new rural and urban poverty and inequality estimates using LSMS data with focus on methodological details as well as on their advantages or disadvantages. First, we have reviewed the recent regional estimates based on the US$1.25 per day poverty line as well as those based on Multidimensional Poverty Index (MPI) for both rural and urban areas. It has been found that the level of poverty is much higher in rural areas than in urban areas across different regions regardless of the definitions of poverty. Second, we have summarised estimates of poverty and inequality for Tanzania and Uganda based on recent panel data constructed by LSMS.

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Appendix 1: Contribution of Rural Sector to Aggregate Poverty Reduction

Country	Period (t)		Rural Poverty Rate (RPR)		Urban Poverty Rate (UPR)		Aggregate Poverty Rate (APR)		Change APR	Share of Rural in Population (SRP)		Contribution of Rural Sector to Aggregate Poverty Reduction (%)		
	t-1	t	RPR (t-1)	RPR (t)	UPR (t-1)	UPR (t)	APR (t-1)	APR (t)		SRP (t-1)	SRP (t)	Migration of Non Poor	Neutral Migration	Poor Migration
Eastern Europe and Central Asia														
Albania	2002	2008	0.296	0.146	0.195	0.101	0.2518	0.1234	-0.128	0.5623	0.4989	72.94	58.30	23.48
Azerbaijan	2001	2008	0.425	0.185	0.557	0.148	0.4931	0.1654	-0.328	0.4841	0.4700	36.25	34.42	31.95
Moldova	2009	2010	0.363	0.303	0.126	0.104	0.2536	0.2096	-0.044	0.5382	0.5306	78.67	72.44	61.50
Montenegro	2006	2008	0.176	0.089	0.074	0.024	0.1124	0.0482	-0.064	0.3762	0.3726	51.52	50.53	45.93
Serbia	2004	2007	0.202	0.098	0.104	0.043	0.1489	0.0677	-0.081	0.4586	0.4493	59.83	57.52	48.38
Tajikistan	2003	2007	0.738	0.55	0.688	0.494	0.7248	0.5352	-0.190	0.7355	0.7354	72.95	72.93	72.92
Ukraine	2002	2008	0.351	0.047	0.247	0.02	0.2809	0.0286	-0.252	0.3260	0.3167	39.44	38.16	35.78
South Asia														
Bangladesh	1992	2010	0.587	0.3516	0.427	0.2128	0.5541	0.3129	-0.241	0.7944	0.7211	88.21	70.37	57.82
India	1993	2009	0.5246	0.3428	0.4077	0.2893	0.4940	0.3264	-0.168	0.7077	0.6907	80.25	74.94	70.13
Pakistan	2002	2006	0.393	0.27	0.227	0.131	0.3371	0.2217	-0.115	0.6632	0.6524	73.22	69.52	63.81
East Asia and the Pacific														
China	1996	2009	0.4948	0.2057	0.0887	0.0064	0.3651	0.1103	-0.255	0.6806	0.5748	85.75	65.21	44.24
Indonesia	1996	2011	0.4675	0.1497	0.376	0.174	0.4338	0.1620	-0.272	0.5327	0.4931	64.46	57.67	49.92
Lao PDR	1992	2008	0.487	0.317	0.331	0.174	0.4617	0.2729	-0.189	0.8379	0.6917	99.99	62.29	22.58
Middle East and North Africa														
Morocco	2001	2007	0.251	0.145	0.076	0.048	0.1571	0.0910	-0.066	0.4634	0.4435	78.71	71.14	48.58
Yemen, Rep.	1998	2005	0.425	0.401	0.323	0.207	0.3992	0.3449	-0.054	0.7474	0.7106	60.07	31.37	-7.46
Latin America and the Caribbean														
Costa Rica	2004	2007	0.388	0.212	0.256	0.175	0.3073	0.1888	-0.118	0.3883	0.3730	60.42	55.43	47.54
Ecuador	1999	2008	0.751	0.597	0.364	0.226	0.5196	0.3538	-0.166	0.4021	0.3444	58.10	31.98	23.32
Guatemala *	2000	2006	0.745	0.705	0.271*	0.3 *	0.531	0.5122	-0.019	0.5487	0.5240	208.60 *	110.95 *	77.52
Honduras	2003	2004	0.776	0.757	0.627	0.614	0.7054	0.6883	-0.017	0.5263	0.5199	86.88	57.87	49.49
Mexico	1996	2004	0.807	0.574	0.615	0.411	0.6656	0.4501	-0.215	0.2636	0.2401	34.77	25.96	23.85
Paraguay	2001	2004	0.627	0.442	0.397	0.344	0.4983	0.3853	-0.113	0.4404	0.4216	79.47	69.04	62.83
Sub-Saharan Africa														

Cameroon	1996	2007	0.596	0.55	0.414	0.122	0.5174	0.3372	-0.180	0.5683	0.5027	34.52	12.83	-1.88
Ghana	1992	2006	0.636	0.392	0.277	0.108	0.4999	0.2545	-0.245	0.6208	0.5160	78.49	51.32	35.78
Malawi	1998	2004	0.665	0.559	0.549	0.254	0.6487	0.5134	-0.135	0.8593	0.8503	71.00	66.61	64.40
Mali	2001	2010	0.648	0.506	0.241	0.189	0.5313	0.3973	-0.134	0.7132	0.6572	96.76	69.69	54.98
Mozambique	1996	2003	0.713	0.553	0.62	0.515	0.6881	0.5417	-0.146	0.7320	0.7036	90.78	76.93	71.35
Nigeria *	2004	2010	0.734	0.69	0.522*	0.512 *	0.6385	0.6028	-0.036	0.5493	0.5100	143.78 *	62.90	33.59
Rwanda *	2006	2011	0.642	0.487	0.232*	0.221*	0.5699	0.4361	-0.134	0.8221	0.8088	100.09 *	93.72	90.17
Senegal	2001	2011	0.651	0.571	0.412	0.331	0.5542	0.4689	-0.085	0.5950	0.5744	69.55	53.84	45.42
Togo	2006	2011	0.751	0.734	0.372	0.346	0.6159	0.5865	-0.029	0.6435	0.6198	96.30	35.86	15.81
Uganda	2002	2009	0.427	0.272	0.144	0.091	0.3915	0.2453	-0.146	0.8745	0.8522	96.84	90.33	81.60

Notes: 1. Based on Data from PovCal.Net (Downloaded from http://povcal.net. Note) and WDI Database in 2011.

2. In case of Guatemala, Nigeria and Rwanda (denoted as *), contribution of rural sector to aggregate poverty reduction exceeds 100%. This is due to the fact that urban poverty increased in Guatemala and only marginally decreased in Nigeria and Rwanda.

Source: Imai et at. (2014).

Appendix 2: Multidimensional Poverty Index (MPI) for Rural and Urban Areas at Country Levels

ISO country code	Country	World region	MPI data source		Multidimensional Poverty Index (MPI) National	Population shares (%)		Multidimensional poverty - Urban			Multidimensional poverty - Rural		
			Survey	Year		Urban	Rural	Multidimensional Poverty Index (MPI = H*A)	Headcount ratio: Population in multidimensional poverty (H)	Intensity of deprivation among the poor (A)	Multidimensional Poverty Index (MPI = H*A)	Headcount Ratio: Population in multidimensional poverty (H)	Intensity of deprivation among the poor (A)
					Range 0 to 1			Range 0 to 1	% Population	Average % of weighted deprivations	Range 0 to 1	% Population	Average % of weighted deprivations
CHN	China	East Asia and the Pacific	WHS	2002	0.056	88.4	11.6	0.004	1.2	37.5	0.010	2.8	36.8
IDN	Indonesia	East Asia and the Pacific	DHS	2012	0.066	34.0	66.0	0.015	3.9	38.9	0.063	14.9	42.3
KHM	Cambodia	East Asia and the Pacific	DHS	2010	0.212	60.4	39.6	0.020	5.4	37.6	0.096	20.2	47.6
LAO	Lao People's Democratic Republic	East Asia and the Pacific	MICS/DHS	2011/12	0.174	55.5	44.5	0.021	4.6	45.4	0.104	24.6	42.2
MNG	Mongolia	East Asia and the Pacific	MICS	2005	0.065	30.3	69.7	0.045	11.4	40.0	0.223	43.3	51.4
PHL	Philippines	East Asia and the Pacific	DHS	2008	0.064	40.5	59.5	0.112	25.2	44.6	0.341	65.9	51.7
THA	Thailand	East Asia and the Pacific	MICS	2005/06	0.006	17.7	82.3	0.183	39.0	47.0	0.440	83.2	52.9
TLS	Timor-Leste	East Asia and the Pacific	DHS	2009/10	0.360	30.6	69.4	0.194	41.0	47.4	0.479	88.5	54.2
VNM	Viet Nam	East Asia and the Pacific	MICS	2011	0.017	37.9	62.1	0.262	49.0	53.5	0.610	94.7	64.4
VUT	Vanuatu	East Asia and the Pacific	MICS	2007	0.129	16.4	83.6	0.276	53.9	51.2	0.621	94.7	65.6
ALB	Albania	Europe and Central Asia	DHS	2008/09	0.005	66.1	33.9	0.000	0.0	36.1	0.000	0.0	33.3
ARM	Armenia	Europe and Central Asia	DHS	2010	0.001	53.6	46.4	0.000	0.1	36.9	0.001	0.3	35.8
AZE	Azerbaijan	Europe and Central Asia	DHS	2006	0.021	65.8	34.2	0.000	0.1	35.6	0.001	0.4	36.9
BIH	Bosnia and Herzegovina	Europe and Central Asia	MICS	2011/12	0.002	38.3	61.7	0.001	0.4	35.5	0.006	1.3	44.6
BLR	Belarus	Europe and Central Asia	MICS	2005	0.000	30.0	70.0	0.002	0.5	37.2	0.006	1.7	36.2
CZE	Czech Republic	Europe and Central Asia	WHS	2002/03	0.010	68.1	31.9	0.006	1.8	35.2	0.017	5.0	33.3
EST	Estonia	Europe and Central Asia	WHS	2003	0.026	71.0	29.0	0.008	2.5	33.3	0.022	5.4	41.2
GEO	Georgia	Europe and Central Asia	MICS	2005	0.003	74.6	25.4	0.009	2.3	37.2	0.025	6.7	37.2
HRV	Croatia	Europe and Central Asia	WHS	2003	0.016	25.8	74.2	0.014	3.6	39.5	0.049	13.1	37.3
HUN	Hungary	Europe and Central Asia	WHS	2003	0.016	62.8	37.2	0.015	4.3	34.9	0.061	14.4	42.6
KAZ	Kazakhstan	Europe and Central Asia	MICS	2010/11	0.001	28.3	71.7	0.019	4.7	39.5	0.083	20.5	40.6
KGZ	Kyrgyzstan	Europe and Central Asia	MICS	2005/06	0.019	24.0	76.0	0.020	5.5	36.3	0.093	20.7	45.0
LVA	Latvia	Europe and Central Asia	WHS	2003	0.006	69.4	30.6	0.028	7.7	36.0	0.120	28.9	41.7
MDA	Moldova, Republic of	Europe and Central	DHS	2005	0.007	56.8	43.2	0.034	8.3	40.9	0.159	36.0	44.2

		Asia											
MKD	Macedonia, The former Yugoslav Republic of	Europe and Central Asia	MICS	2011	0.002	44.8	55.2	0.040	9.2	43.4	0.198	39.4	50.2
MNE	Montenegro	Europe and Central Asia	MICS	2005/06	0.006	84.3	15.7	0.044	10.9	40.7	0.216	45.9	47.1
RUS	Russian Federation	Europe and Central Asia	WHS	2003	0.005	53.5	46.5	0.120	26.7	45.1	0.357	66.6	53.6
SRB	Serbia	Europe and Central Asia	MICS	2010	0.000	35.6	64.4	0.150	34.4	43.7	0.393	70.2	56.0
SVK	Slovakia	Europe and Central Asia	WHS	2003	0.000	44.8	55.2	0.164	35.0	46.8	0.412	75.0	54.9
TJK	Tajikistan	Europe and Central Asia	DHS	2012	0.054	31.3	68.7	0.189	38.2	49.6	0.445	81.9	54.3
TUR	Turkey	Europe and Central Asia	DHS	2003	0.028	34.3	65.7	0.226	47.0	48.1	0.504	85.7	58.8
UKR	Ukraine	Europe and Central Asia	DHS	2007	0.008	44.4	55.6	0.247	53.1	46.4	0.573	93.2	61.5
UZB	Uzbekistan	Europe and Central Asia	MICS	2006	0.008	31.4	68.6	0.262	52.0	50.4	0.592	91.4	64.7
BLZ	Belize	Latin America and Caribbean	MICS	2011	0.018	34.2	65.8	0.002	0.6	36.5	0.006	1.7	37.4
BOL	Bolivia, Plurinational State of	Latin America and Caribbean	DHS	2008	0.089	45.1	54.9	0.003	0.8	37.7	0.007	1.9	37.7
BRA	Brazil	Latin America and Caribbean	PNDS	2006	0.011	31.2	68.8	0.004	1.1	33.9	0.008	2.1	38.6
COL	Colombia	Latin America and Caribbean	DHS	2010	0.022	43.8	56.2	0.006	1.6	37.9	0.016	4.7	33.4
DOM	Dominican Republic	Latin America and Caribbean	DHS	2007	0.018	62.2	37.8	0.007	1.7	40.2	0.020	5.7	35.4
ECU	Ecuador	Latin America and Caribbean	WHS	2003	0.009	82.4	17.6	0.007	2.1	34.3	0.021	5.3	38.8
GTM	Guatemala	Latin America and Caribbean	WHS	2003	0.127	68.6	31.4	0.011	2.9	38.6	0.035	8.8	40.2
GUY	Guyana	Latin America and Caribbean	DHS	2009	0.030	27.4	72.6	0.014	3.9	35.7	0.036	9.1	39.7
HND	Honduras	Latin America and Caribbean	DHS	2011/12	0.072	53.6	46.4	0.014	3.9	35.8	0.038	9.6	40.0
HTI	Haiti	Latin America and Caribbean	DHS	2012	0.248	58.6	41.4	0.014	3.9	37.0	0.051	11.4	44.3
MEX	Mexico	Latin America and Caribbean	ENSANUT	2012	0.011	49.8	50.2	0.039	10.2	38.7	0.193	43.3	44.5
NIC	Nicaragua	Latin America and Caribbean	DHS	2011/12	0.128	34.2	65.8	0.077	16.1	48.0	0.292	58.7	49.8
PER	Peru	Latin America and Caribbean	DHS-Cont	2012	0.043	63.7	36.3	0.105	24.5	42.8	0.324	57.5	56.4
PRY	Paraguay	Latin America and Caribbean	WHS	2002/03	0.064	14.0	86.0	0.113	24.9	45.3	0.348	61.8	56.3
SUR	Suriname	Latin America and Caribbean	MICS	2010	0.024	38.9	61.1	0.161	36.2	44.4	0.408	77.1	52.9
TTO	Trinidad and Tobago	Latin America and Caribbean	MICS	2006	0.020	13.5	86.5	0.201	41.7	48.2	0.480	83.9	57.2
URY	Uruguay	Latin America and Caribbean	WHS	2002/03	0.006	29.1	70.9	0.252	52.6	47.9	0.586	93.5	62.7
AFG	Afghanistan	South Asia	MICS	2010/11	0.353	53.2	46.8	0.000	0.0	0.0	0.000	0.0	0.0
BGD	Bangladesh	South Asia	DHS	2011	0.253	55.7	44.3	0.001	0.3	36.3	0.005	1.5	35.2
BTN	Bhutan	South Asia	MICS	2010	0.119	60.6	39.4	0.004	1.1	39.1	0.009	2.1	44.5
IND	India	South Asia	DHS	2005/06	0.283	67.2	32.8	0.015	4.3	35.4	0.065	15.6	41.3
LKA	Sri Lanka	South Asia	WHS	2003	0.021	56.7	43.3	0.022	5.7	38.3	0.118	24.1	49.2
MDV	Maldives	South Asia	DHS	2009	0.018	22.8	77.2	0.039	9.8	39.3	0.193	43.4	44.4
NPL	Nepal	South Asia	DHS	2011	0.217	32.3	67.7	0.087	20.0	43.3	0.299	55.7	53.6
PAK	Pakistan	South Asia	DHS	2012/13	0.230	48.0	52.0	0.091	19.9	45.6	0.316	66.4	47.5
BDI	Burundi	Sub-Saharan Africa	DHS	2010	0.454	55.0	45.0	0.001	0.1	39.8	0.002	0.4	38.0
BEN	Benin	Sub-Saharan Africa	DHS	2006	0.412	61.7	38.3	0.001	0.2	33.3	0.002	0.5	39.1

BFA	Burkina Faso	Sub-Saharan Africa	DHS	2010	0.535	78.2	21.8	0.001	0.3	33.8	0.004	1.2	35.5
CAF	Central African Republic	Sub-Saharan Africa	MICS	2010	0.430	77.7	22.3	0.004	1.1	37.4	0.010	2.8	34.5
CIV	Cote d'Ivoire	Sub-Saharan Africa	DHS	2011/12	0.310	55.4	44.6	0.004	1.2	37.2	0.010	2.9	36.6
CMR	Cameroon	Sub-Saharan Africa	DHS	2011	0.248	29.6	70.4	0.005	1.3	37.2	0.011	3.0	35.9
COD	Congo, Democratic Republic of the	Sub-Saharan Africa	MICS	2010	0.392	31.1	68.9	0.005	1.6	33.3	0.012	3.2	38.7
COG	Congo, Republic of	Sub-Saharan Africa	DHS	2011/12	0.181	92.4	7.6	0.006	1.6	34.7	0.013	3.8	34.7
ETH	Ethiopia	Sub-Saharan Africa	DHS	2011	0.564	64.6	35.4	0.008	2.2	37.7	0.024	6.8	35.8
GAB	Gabon	Sub-Saharan Africa	DHS	2012	0.070	84.9	15.1	0.008	2.2	38.5	0.025	6.3	38.8
GHA	Ghana	Sub-Saharan Africa	MICS	2011	0.139	69.1	30.9	0.009	2.4	38.3	0.028	7.0	39.9
GIN	Guinea	Sub-Saharan Africa	DHS	2005	0.506	55.0	45.0	0.009	2.5	37.1	0.029	7.4	38.6
GMB	Gambia	Sub-Saharan Africa	MICS	2005/06	0.324	42.6	57.4	0.010	2.5	37.6	0.034	8.5	39.5
GNB	Guinea-Bissau	Sub-Saharan Africa	MICS	2006	0.462	64.5	35.5	0.011	3.1	35.3	0.035	8.5	41.4
KEN	Kenya	Sub-Saharan Africa	DHS	2008/09	0.229	59.1	40.9	0.019	4.9	39.4	0.087	17.3	50.1
LBR	Liberia	Sub-Saharan Africa	DHS	2007	0.485	48.1	51.9	0.022	5.2	41.6	0.113	27.1	41.6
LSO	Lesotho	Sub-Saharan Africa	DHS	2009	0.156	22.9	77.1	0.025	6.5	38.0	0.119	25.7	46.5
MDG	Madagascar	Sub-Saharan Africa	DHS	2008/09	0.357	24.0	76.0	0.038	9.7	38.8	0.191	43.0	44.4
MLI	Mali	Sub-Saharan Africa	DHS	2006	0.558	50.4	49.6	0.041	9.6	42.5	0.209	46.6	44.8
MOZ	Mozambique	Sub-Saharan Africa	DHS	2011	0.389	18.1	81.9	0.051	12.0	42.6	0.227	51.1	44.4
MRT	Mauritania	Sub-Saharan Africa	MICS	2007	0.352	48.2	51.8	0.057	13.8	41.4	0.238	48.4	49.2
MWI	Malawi	Sub-Saharan Africa	DHS	2010	0.334	19.4	80.6	0.066	15.6	42.1	0.247	53.4	46.3
NAM	Namibia	Sub-Saharan Africa	DHS	2006/07	0.187	40.4	59.6	0.066	15.3	43.3	0.252	53.9	46.7
NER	Niger	Sub-Saharan Africa	DHS	2012	0.605	12.8	87.2	0.069	15.4	44.8	0.268	56.0	47.9
NGA	Nigeria	Sub-Saharan Africa	MICS	2011	0.240	37.4	62.6	0.074	17.6	41.9	0.269	55.6	48.4
RWA	Rwanda	Sub-Saharan Africa	DHS	2010	0.350	96.3	3.7	0.127	27.2	46.6	0.366	72.0	50.8
SEN	Senegal	Sub-Saharan Africa	DHS	2010/11	0.439	23.9	76.1	0.129	27.7	46.5	0.374	73.2	51.0
SLE	Sierra Leone	Sub-Saharan Africa	MICS	2010	0.388	14.9	85.1	0.133	29.2	45.5	0.385	74.7	51.5
STP	Sao Tome and Principe	Sub-Saharan Africa	DHS	2008/09	0.154	22.8	77.2	0.154	34.6	44.7	0.396	73.7	53.8
SWZ	Swaziland	Sub-Saharan Africa	MICS	2010	0.086	27.8	72.2	0.168	31.5	53.4	0.414	77.0	53.7
TCD	Chad	Sub-Saharan Africa	WHS	2003	0.344	16.6	83.4	0.175	39.7	44.2	0.427	75.8	56.4
TGO	Togo	Sub-Saharan Africa	MICS	2010	0.250	22.5	77.5	0.176	37.3	47.3	0.429	78.0	55.0
TZA	Tanzania, United Republic of	Sub-Saharan Africa	DHS	2010	0.332	21.8	78.2	0.226	45.8	49.4	0.506	84.4	60.0
UGA	Uganda	Sub-Saharan Africa	DHS	2011	0.367	17.9	82.1	0.230	46.4	49.5	0.519	89.8	57.8
ZAF	South Africa	Sub-Saharan Africa	NIDS	2012	0.044	38.4	61.6	0.293	55.9	52.4	0.645	96.2	67.0
ZMB	Zambia	Sub-Saharan Africa	DHS	2007	0.328	37.5	62.5	0.337	68.5	49.2	0.651	96.9	67.2
ZWE	Zimbabwe	Sub-Saharan Africa	DHS	2010/11	0.172	30.4	69.6	0.360	64.8	55.5	0.669	96.2	69.5

Source: Alkire et al. (2014). http://www.ophi.org.uk/multidimensional-poverty-index/mpi-2014/mpi-data/

Appendix 3: Deriving Vulnerability Measure

Vulnerability measure as an expected poverty is specified as:

$$VEP_{it} \equiv V_{it} = \Pr(c_{i,t+1} \leq z) \quad \text{(A1)}$$

where vulnerability of household *i* at time *t*, V_{it}, is the probability that the *i-th* household's level of consumption at time *t+1*, $c_{i,t+1}$, will be below the poverty line, z.

Three limitations, amongst others, should be noted in our measure of vulnerability. First, the present analysis is confined to a consumption (used synonymously with income) threshold of poverty. Second, our measure of vulnerability in terms of the probability of a household's consumption falling below the poverty threshold in the future is subject to the choice of a threshold. Third, while income/consumption volatility underlies vulnerability, the resilience in mitigating welfare losses depends on assets defined broadly-including human, physical and social capital. A household with inadequate physical or financial asset or savings, for example, may find it hard to overcome loss of income. This may translate into lower nutritional intake and rationing out of its members from the labor market (Dasgupta, 1997; Foster, 1995). Lack of physical assets may also impede accumulation of profitable portfolios under risk and generate poverty traps.

The consumption function is estimated by the equation (A2).[11]

$$\ln c_i = X_i \lambda + e_i \quad \text{(A2)}$$

where c_i is mean per capita consumption (i.e. food and non-food consumption expenditure) for the household and X is a vector of observable household characteristics and other determinants of consumption. It is further assumed that the structure of the economy is relatively stable over time and, hence, future consumption stems solely from the uncertainty about the idiosyncratic shocks, e_i. It is also assumed that the variance of the disturbance term depends on:

$$\sigma^2_{e,i} = X_i \theta \quad \text{(A3)}$$

The estimates of β and θ are obtained using a three-step feasible generalized least squares (FGLS)[12]. Using the estimates $\hat{\beta}$ and $\hat{\theta}$, we can compute the expected log consumption and the variance of log consumption for each household as follows.

$$E[\ln C_i | X_i] = X_i \hat{\beta} \quad \text{(A4)}$$

$$V[\ln C_i | X_i] = X_i \hat{\theta} \quad \text{(A5)}$$

[11] We have used White-Huber sandwich estimator to overcome heteroscedasticity in the sample.

[12] See Chaudhuri (2003), Chaudhuri et al. (2002), and Hoddinott and Quisumbing (2003) for technical details. This is summarised in Appendix 3.

By assuming $ln\,c_i$ as normally distributed and letting $\Phi(\cdot)$ denote the cumulative density function of the standard normal distribution, the estimated probability that a household will be poor in the future (say, at time *t+1*) is given by:

$$\hat{VEP}_i \equiv \hat{v}_i = \hat{Pr}(\ln c_i < \ln z | X_i) = \Phi\left(\frac{\ln z - X_i\hat{\beta}}{\sqrt{X_i\hat{\theta}}}\right) \qquad \text{(A6)}$$

This is an *ex ante* vulnerability measure that can be estimated with cross-sectional data. Note that this expression also yields the probability of a household at time *t* becoming poor at *t+1* given the distribution of consumption at *t*.

A merit of this vulnerability measure is that it can be estimated with cross-sectional data (e.g. Imai et al., 2011). However, it correctly reflects a household's vulnerability only if the distribution of consumption across households, given the household characteristics at time t, represents time-series variation of household consumption. Hence this measure requires a large sample in which some households experience positive shocks while others suffer from negative shocks. Also, the measure is unlikely to reflect unexpected large negative shocks (e.g., Asian financial crisis), if we use the cross-section data for a normal year.