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Uganda – A new set of utility consistent poverty lines

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Abstract: Uganda has seen impressive economic growth and substantial poverty reductions over the past few decades. Today, official headcount poverty stands at about 20 per cent. However, recent research relying on non-monetary wealth indicators challenges official poverty statistics and suggests that headcount poverty is about 60 per cent higher. We argue that an outdated poverty line that does not take into consideration the spatial variation of diets in Uganda could explain the divergence. In this paper, we document how we estimate a new set of utility consistent poverty lines for Uganda using the Uganda National Household Survey of 2012-13 and use these updated poverty lines to calculate poverty. We find poverty levels to be higher and much more in line with what other studies suggest.

Keywords: poverty lines, diet, basic needs, spatial patterns, Uganda
JEL classification: I320, O55, O21

Figures and Tables: at the end of the paper.

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1 Introduction

During the past few decades, Uganda has experienced substantial economic growth. Especially during the 1990s, Uganda outperformed other economies in Southern and Eastern Africa. Part of this accelerated growth is likely to be a peace dividend after years of civil war during the Amin and Obote regimes. However, some of this growth is also attributed to the far-reaching economic reforms implemented by the new government, transforming Uganda in one of the most liberal economies in sub-Saharan Africa (World Bank 1993). This growth has been accompanied by equally impressive social progress. Indeed, Uganda used to be considered a show-case when it comes to reducing poverty, fighting HIV/AIDS and promoting social development (Dijkstra and van Donge 2001). According to official figures, poverty fell from about 56 per cent in 1992-93 to around 20 per cent in 2012-13 (UBOS 2006; Ssewanyana and Kasirye 2014). These days, in terms of economic growth, Uganda has been overtaken by some of the neighbouring countries, such as Tanzania and Ethiopia. While GDP growth shows a marked slowdown from 2005-06 onward (Duponchelle et al. 2014), official poverty statistics seem to persist their downward trend.

However, research has cautioned that the positive aggregate trends may hide less positive dynamics at a more disaggregate level (Lawson et al. 2006). For instance, Emwanu et al. (2006) find that poverty reductions in the North were much less pronounced, and today, poverty levels in for example Karamoja remain disturbingly high. More recent research on poverty dynamics using a recently constructed panel data survey also point out stagnation or even a reversal in some areas (Ssewanyana and Kasirye 2014; Duponchelle et al. 2014). More worrying is that as of late, some started to call the actual numbers into question. Levine (2012) points out significant diversions between the level and evolution of poverty figures reported by the government of Uganda and those published by the World Bank. Both qualitative and quantitative research on asset accumulation and non-monetary poverty indicators also suggest much more modest progress (Daniels and Minot 2015; Kakande 2010). Some scholars argue that the use of a single national poverty line may bias estimates in certain areas (Appleton 2003; Jamal 1998).

In this paper, we explore some of the causes of these diverging views by estimating poverty from scratch using a unique toolkit (i.e. an analytical code stream referred to as Poverty Line Estimation Analytical Software–PLEASe) for consumption poverty analysis in developing countries and the most recent available dataset for Uganda. We feel that one of the major problem with the official poverty estimates is that it is based on an outdated basic needs basket that is unlikely to adequately reflect current consumption patterns. In addition, we appreciate the fact that Uganda has an unusual dietary diversity (Benson et al. 2008; Appleton 2003), with for example people in the north consuming relatively more sorghum and cassava and those in the west more matooke[1]. It is well known that in many instances—for example, if relative prices of basic commodities vary by region (or through time) and preferences permit substitution—the use of a single consumption bundle may result in inconsistent poverty comparisons (Tarp et al. 2002). We estimate a new set of utility consistent poverty lines taking into account the spatial variation in the cost of basic needs within Uganda and compare this to results using official Ugandan poverty lines.

The rest of this paper is organized as follows. Section 2 describes official poverty in Uganda and discusses some of the issues that have been raised with respect to these figures. This is followed by a reassessment of poverty in Uganda in Section 3. We first briefly introduce the data we will

[1] Matooke is a variety of starchy banana, commonly referred to as cooking bananas.

use in this reassessment in sub-Section 3.1 and then in sub-Section 3.2, we describe in detail how we construct the welfare indicator. In sub-Section 3.3, we describe how we construct consumption bundles that are corresponding to basic needs in different locations and the sub-Section 3.4 discusses how we make sure all these bundles provide the same basic needs. We then present the poverty estimates in sub-Section 3.5 using the new poverty lines. Finally, Section 4 concludes.

2 Poverty in Uganda

According to official estimates, poverty has decreased substantially since the 1990s in Uganda. Table 1 draws from various reports of large scale household budget surveys that are periodically carried out by the Uganda Bureau of Statistics (UBOS) to monitor poverty. At the national level, we see that poverty has been declining steadily over time, with the exception of 2002-3 when poverty increased slightly. The long-run downward trend in poverty, from 55.5 per cent to 19.7 per cent in just 20 years translates into an average yearly reduction in headcount poverty of more than 3 per cent.

Nevertheless, the aggregate trend hides quite some variation in poverty reduction rates at a more disaggregate level. For example, if we restrict attention to the Central region, headcount poverty reduced from 45.6 per cent to just 5.1 per cent. This is partly because the Central region includes Kampala, and poverty fell much faster in urban areas than in rural areas. The reduction in Central region over the 20-year period amounts to a 4.4 per cent reduction per year. At the other extreme, the drier and more remote northern region started off with poverty that was already about 60 per cent higher than headcount poverty in the central region. Poverty reduces from 72.2 per cent to 43.7 per cent over the course of 20 years, which amounts to an annual rate of poverty reduction of less than 2 per cent.

The contrast becomes more pronounced with increasing disaggregation. If we go down to the sub-regional level, the lowest level at which the data is deemed representative, we find that for example poverty in Kampala is reduced from about 5 per cent at the turn of the century to about 0.7 per cent at the latest survey, corresponding to an impressive annual poverty reduction rate of 8.5 per cent. The north-eastern region, which covers one of the poorest districts in Uganda, Karamoja, started the new century with headcount poverty at a staggering 82.8 per cent. By 2012-13, still around three-quarters of the population in this sub-region live below the national poverty line. The annualized rate of poverty reduction in this region was about a mere 1 per cent per year.

Naturally, the divergence in rates of poverty reduction means that inequality has worsened over time. While the north was only 60 per cent poorer than the Central region in 1992-03, it was already 2.7 times poorer than Central in 2002-2003 and more than eight times poorer in 2012-13. Again, this increasing inequality in wellbeing is amplified at lower levels of disaggregation. While at the beginning of the 20th century the poorest sub-region was about 20 times as poor as Kampala, the north-east is more than 100 times as poor than the capital in 2012-13. This illustrates that Uganda has been much less successful in reducing poverty in poor and remote areas. This fact was already noted in Okidi and McKay (2003) who found that using panel data, the chronic poor did not benefit from market oriented reforms that seem to drive poverty reduction at the aggregate level. Recent work using newly available panel data seem to confirm this (Ssewanyana and Kasirye 2014).

Apart from the above qualifications, researchers have also raised methodological issues with the way poverty is measured in Uganda. In particular, official estimates in Uganda rely on a single

national poverty line that is based on a nationally representative food consumption bundle of the poor.[2] While the continued use of this poverty line is defended as key to the comparability of poverty over time, it also means that today's welfare is compared to the cost of a basket of goods that may not adequately reflect the consumption patterns of the poor today. In addition, Appleton (2003) and Jamal (1998) argue that a single poverty line that does not take into account spatial heterogeneity in the diets of the population cannot adequately identify the poor. When they allow for spatial heterogeneity in the composition of the basic needs basket, they find that the western region is poorer than official statistics suggest, reflecting the relatively high price of matooke as a source of energy.

Official figures have also been challenged recently when compared to alternative methods to estimate poverty. For instance, Levine (2012) compares the official poverty estimates with the poverty estimates using the World Bank's 'one dollar a day' international poverty line.[3] He finds that absolute poverty is higher according to the World Bank, and also that reduction in poverty is substantially slower than official numbers suggest. The author identifies adjustments to account for urban and rural price differences, adjustments to account for household composition and statistical weighting as potential causes for the divergence.

Studies that employ alternative welfare indicators also paint a less optimistic picture. For example Daniels and Minot (2015) use information on asset ownership, access to water and sanitation and other non-monetary indicators of wellbeing to predict poverty using Demographic and Health Surveys (DHS) data. Using methods related to poverty mapping and small area estimation, they find that poverty has reduced much slower than official figures suggest. The similar conclusions are reached in studies that use more qualitative methods to assess poverty and wellbeing (Krishna et al. 2006; Kakande 2010).

3 A reassessment of poverty and its evolution in Uganda

Poverty measurement generally involves three steps. The first two steps are together often referred to as the **identification** stage and the last step involves **aggregation**. The first step in the identification stage consists of the construction of a welfare indicator and in the second step one agrees on a poverty line. The welfare measure from the first step is used to rank units according to wellbeing.[4] Ideally, this should be a measure that reflects the multi-dimensional nature of wellbeing, but in general, one settles for a money metric measure that is correlated with wellbeing. In practice, preference is given to consumption expenditure above income, as the first tends to be less susceptible to fluctuations over time and less prone to measurement error.

The poverty line is then used to delineate the poor from the rest of the population. There are two common ways to fix poverty lines. The cost of basic needs (CBN) method assembles a basket of goods typically consumed by the poor that generates a minimum necessary energy level (e.g. 3,000 kcal per adult) that is deemed sufficient, and a non-food allowance is added. Alternatively, using the food energy intake (FEI) method the poverty line is derived from a

[2] The national poverty line does allow for some spatial heterogeneity in the non-food component of the poverty line. Spatial price heterogeneity is also incorporated in the official poverty estimates through deflation of the welfare indicator, although the exact details (what prices are used to make the adjustments) are lacking.

[3] This is done using PovcalNet, the online tool for poverty measurement developed by the Development Research Group of the World Bank (http://iresearch.worldbank.org/PovcalNet/).

[4] Often, these units are households due to the nature of surveys, but this can also be individuals, countries, regions, etc.

regression of food expenditure on caloric intake at the individual level, which is then used to predict expenditure needed to yield a particular minimum necessary energy level. The advantage of this method is that a non-food allowance is automatically included in the predicted expenditure, but the disadvantage is that one needs detailed data on food energy intake to estimate the regression.

In the aggregation step, the information pertaining to the position of the units in terms of welfare with respect to the poverty line is summarized at a particular level of aggregation. For instance, one can simply count the number of households that fall below the poverty line and express this as a proportion of the total number of households at a national level. This would be the poverty headcount, and this is usually what people refer to when they talk about the level of poverty in a particular country. An often used poverty measure that encompasses the poverty headcount, is the Foster-Greere-Thorbecke (FGT) indicator (Foster et al. 1984). For more information on poverty measurement and analysis in practice, the reader is referred to Ravallion (1994).

3.1 The data

Uganda has been lauded for its efforts to monitor poverty and wellbeing. At the basis of this is a fairly well functioning statistics agency that collects information on socio-economic characteristics at the household and community levels for monitoring development performance. As such, researchers that want to work on poverty measurement and comparisons have a range of data they can work with. The first household budget survey since the end of the civil war was done in 1989-90 and smaller surveys have been done at varying time intervals. From 1999-00 onward, the format of the survey was adapted. The survey was modelled to conform the Living Standard Measurement Survey (LSMS) and was held every three years. This first survey is popularly known as the Uganda National Household Survey 1999-00 or UNHS-I. The latest UNHS that was publicly available at the time of writing was the one from 2012-13 of UNHS-V.

The UNHS consists of some core modules, such as a socioeconomic, a labour, a community, and a price module. In some rounds, some modules are added to collect information on some specific topics. For example, the UNHS 2009-10 had an extra module on the informal sector. In this regard, the UNHS 2005-06 was particularly interesting, as it had an extended module on smallholder agriculture, which is the main occupation of the majority of the population in Uganda, especially the poor. The UNHS generally surveys about 6,000 to 8,000 households.

The UNHS 2005-06 is also noteworthy because it became the basis of the LSMS-ISA project in Uganda, a project managed by the LSMS team at the World Bank with the aim of making high-quality panel data with a strong focus on agriculture available in a selection of African countries. In particular, a random subset of the households interviewed in the UNHS 2005-06 was administered virtually the same questionnaire in 2009-10 and each subsequent year, to form the Uganda National Panel Survey (UNPS). In principle, the analysis that is described in this paper can readily be replicated using one of the UNPS rounds, although the sample size is likely to be too small to estimate poverty lines in many different spatial domains.

While it is difficult to assess the quality of the data without a proper benchmark, internal inconsistencies within the data signal that there are at least some issues with the quality. For example, in the UNPS wave of 2010-11, there is a gigantic unexplained drop in the number of people reporting to consume sweet potatoes (and to a lesser extent cassava). While in all other rounds of the UNPS about 1,500 households report non-zero consumption of sweet potatoes, which is less than 300 households in the 2010-11. Duponchelle et al. (2014) also find suspicious

patterns of attrition in the UNPS, consistent with declining motivation of interviewers, something not unusual in government organizations like UBOS that grapple with funding issues.

In this study, we will present results based on the UNHS 2012-13. This is the latest UNHS available. In addition, it covers about 6,888 households, a sufficient numbers of observations to allow us to estimate poverty lines at a sufficiently disaggregated level.

3.2 Constructing the welfare indicator

The datasets that are disseminated by UBOS often have an extra file that can be used to replicate the official poverty numbers. For instance, the UNHS 2012-13 has a file called *Poverty2012.dta*. In this file, one will find a variable called *welfare*, which is the welfare indicator used for official poverty estimates[5]. One also needs the poverty lines (called *spline*) and the weights called *hmult*. Poverty can then simply be obtained as the weighted mean of a dummy that indicates if welfare is smaller than spline.

The consumption aggregate supplied by UBOS is convenient to replicate official estimates. However, often, one would like to rerun the analysis with slight modifications to check robustness. For instance, one may want to check if scaling household consumption by household size would lead to different conclusions than scaling by the number of adult equivalent units within the household. This is often difficult as there is no detailed information available on how the consumption aggregate has been constructed and the code that is used to generate the welfare variable is not in the public domain. Furthermore, while some datasets have a range of seemingly intermediate variables, such as the Poverty2012.dta referred to above, others have only a few intermediate variables.[6]

PLEASe contains modules to construct a consumption aggregate. Although it would be possible to use the consumption aggregated supplied by UBOS to rank households and compare them to a new set of poverty lines, the construction of the poverty lines itself using PLEASe requires more detailed consumption information than just the welfare indicator. Therefore, we decided to reconstruct our own welfare indicator from the raw consumption data.

One of the first things we do is merge household size from the household roster in section 2 with the identifying information in section 1, which we will use to classify households into different spatial domains. To determine household size, we only incorporate usual or regular members present or absent, which leads to an average household size of about five members. Already, due to undocumented data cleaning and/or a different definition of what constitutes a household, our household size differs slightly from the one reported in the Poverty2012.dta dataset.

To calculate the welfare indicator at the household level, we start in section 6B and we simply sum all quantities consumed out of purchases at home, consumed out or purchases away from home (such as in restaurants), consumed out of home production, and quantities received in

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[5] The data should be requested in writing from the director of the Uganda Bureau of Statistics. However, a reference to the content of the file is available on the website of the international household survey network: http://catalog.ihsn.org/index.php/catalog/4620/datafile/F18. The questionnaires can also be found on that website: http://catalog.ihsn.org/index.php/catalog/4620.

[6] Such as, for instance, the file kwelfare.dta that holds information to calculate poverty in the UNHS2009-10. The reference is http://catalog.ihsn.org/index.php/catalog/2119/data_dictionary#page=F21&tab=data-dictionary.

kind or for free. These amounts are divided by seven to get an average daily consumption for each consumption item at household level.

A typical issue encountered in household budget surveys is that food consumption is often recorded in non-standard units. Some may be relatively straightforward to convert to kilograms, such as a 1 kg kimbo of maize grains, where kimbo is a well-known type of cooking fat that comes in 1 or 2 kg plastic containers, and so standard conversion factors are available for each crop.[7] Others are less precisely defined, such as a bunch of bananas or a bundle of fish. We convert non-standard units using a set of conversion factors that UBOS assembled during the Uganda Census of Agriculture 2008-09 (UCA), and for missing conversion factors in the UCA we use conversion factors provided for the UNHS 2012-13. But even then, about 7 per cent of the household— item level observations cannot be converted into kilograms because of missing conversion factors. In most cases, these are foodstuffs that are not well defined, such as 'other fruits'.

Section 5 of the UNHS 2012-13 provides a section on health, with a single question on the cost of consultation. However, section 6C, on expenditures on Non-durable Goods and Frequently Purchased services also asks about health and medical expenses. This is done in a much more detailed way than in section 5, explicitly probing for traditional doctor's fees and in-kind or received for free services. We therefore include medical expenditures as non-durable goods and frequently purchased services. Other categories under this heading are (imputed) rent and fuel such as charcoal; non-durable and personal goods such as soap; transport and communication such as airtime; and other services such as barber. As this was recorded during the last 30 days we converted to daily averages and aggregated to total household expenditures.

Section 4 records education for household members above the age of five and has a question on expenditures. However, section 6D on expenditures on semi-durable and durable goods and services that were purchased during the last year also includes questions on expenditure for education. To encourage uniformity with health, we therefor decided to use the figures from section 6D rather than those in section 4. Other semi-durable and durable goods include clothing and footwear; furniture; household appliances and equipment; utensils and others. Finally, there is a separate section for non-consumption expenditure, which collects tax payments, interests, funerals, and other functions.

The resulting welfare indicator is quite close to the official consumption aggregate that is in the Poverty2012.dta. The official welfare measure is expressed on a monthly basis and scaled by number of adult equivalents (Appleton et al. 1999). We therefore divided it by 30 and multiplied it by the number of adult equivalents and then divided it again by the number of household members to make it comparable to our daily consumption per capita measure. In addition, the welfare variable is expressed in 2005-06 prices, so we multiply it by 1.85, which is the Consumer Price Index (CPI) that is implied by the poverty lines. We then get that our measure has a median value of about 2,700 Ugandan shillings per day per capita, while the official estimate is slightly lower at about 2,530.

Figure 1 shows in more detail how the distributions of the two welfare indicators compare to each other. The solid line represents a kernel density estimate of the distribution of the official welfare indicator, and the dashed line is the one we computed from the raw data. As you can see, they are very close, although the distribution of our welfare indicator suggests a slightly higher degree of inequality. The reason for the difference is most likely because of the way UBOS

[7] For instance, a 1 kg kimbo of maize would hold 0.8 kg of maize.

adjusts the welfare indicator in various ways. For instance, Appleton et al. (1999) mention that the welfare indicator is adjusted for spatial price differences. However, it is not documented how this actually happens and so impossible to replicate.

3.3 Cost of Basic Needs

The official poverty estimates are based on poverty lines that are rooted in a single national food consumption bundle, derived from 1993-94 Monitoring Survey data. In particular, a single food basket was identified at the national level with 28 of the most frequently consumed food items by households with less than the median income. The items in this food basket were then converted into caloric equivalents and scaled to generate 3,000 calories per adult equivalent per day using the World Health Organization (WHO, 1985) estimates for an 18-30 year-old male as a reference. Next, a non-food allowance was added. Non-food requirements were estimated as the average non-food expenditure of those households whose total expenditure was around the food poverty line. The non-food allowance does allow for spatial heterogeneity, as separate averages were calculated for urban and rural locations interacted with the four regions (central, eastern, northern, and western), using the method described in Ravallion and Bidani (1994). These poverty lines have since been updated by the official inflation figures each time a new household survey came out. More information can be found in Appleton et al. (1999).

We use a slightly different approach in that we first calculate the average per person caloric requirement and use this as the basis of our poverty line. If one uses the average caloric requirement of the population instead of for instance the caloric requirement of an 18-30 year-old male reference, one does not need to adjust the welfare indicator for nutritional requirements anymore. One can just use consumption expenditure per capita, which is then compared to (the cost of) obtaining the energy needed by the average person within the population. Specifically, we find the calories needed for each person given their age, gender, likelihood of being pregnant, and likelihood of breastfeeding.[8] If we calculate average caloric requirement for the entire sample, we find this to be about 2,184 kcal per day.

However, we will allow for spatial heterogeneity in the average caloric requirements. For instance, it may be that fertility rates are lower in urban areas or that rural areas host a disproportionate amount of elderly people. We will use the same spatial domains as we will use for the consumption baskets. The resulting caloric requirements are in Table 2.

In addition to heterogeneity in basic needs caused by demographics, Uganda has a very diverse diet. While in most of Eastern and Southern Africa, diets are heavily skewed towards maize, there are at least four other staples that are widely consumed within Uganda: matooke, cassava, sweet potatoes, and sorghum. In addition to these staples, Ugandans also derive a lot of energy from beans, and in some parts, millet is also considered a staple. Rice is becoming more important, but mostly at the upper end of the welfare distribution.

To illustrate the unusual variation in diets in Uganda, we have selected the five most consumed staple crops in terms of calories in Uganda by the poor. We have then calculated how much calories a typical poor person derives from each of these crops in rural areas of each of the four regions (central, eastern, north, and western). This is illustrated in the dotchart in Figure 2. The chart shows that people in the west rely heavily on matooke to obtain their calories. However, people in the rural areas in the north and the east do not consume matooke. People in the north

[8] The likelihood of being pregnant is estimated using fertility rates in Uganda.

mainly consume sorghum and cassava, as matooke has a hard time growing in these dryer areas. In the east, there is a relatively higher reliance on maize.

Differences in diets would not really be a problem for poverty measurement and analysis if the cost of arriving at a specified level of calories would be the same regardless of the diet. However, different products often widely differ in terms of its cost to generate a given amount of food energy. This is illustrated in the barchart in Figure 3, which shows the average price per kilocalorie for each of the five important staple crops consumed in Uganda. The barchart shows that matooke is rather inefficient as a source of calories, a point also made by Appleton (2003). The same amount of calories can be obtained at less than half of the cost of matooke by choosing to consume sorghum and cassava.

Referring back to Figure 2, we found that people living in western Uganda derive almost all their calories from Matooke. People in the north, on the other hand, have diets that are dominated by sorghum. A basic needs basket that takes into account local diets will therefore differ in cost. In particular, the cost of obtaining a given amount of food energy in the west will be much higher than the cost of obtaining this same amount of energy using the northern diet. Failure to account for this may lead to inconsistent poverty comparisons (Tarp et al. 2002).

While differences in prices in different locations are usually incorporated in poverty measurement by adjusting the welfare indicator to reflect prices used in the construction of the poverty lines (or by adjusting the poverty lines to reflect prices used in the construction of the welfare indicator), it is becoming more and more common to also account for spatial heterogeneity in consumption patterns. Specificity, as defined by Ravallion and Bidani (1994), means that poverty lines should reflect local perceptions of what constitutes poverty. Turning this around, specificity requires that a locally irrelevant basket of goods should not be imposed. In an effort to increase specificity, studies have started using consumption bundles that are disaggregated over spatial domains (e.g., Ravallion and Lokshin 2006; Mukherjee and Benson 2003).

Given the diversity in diets in Uganda, we feel the current official poverty line that is rooted in a single national food basket is inadequate. In this study, we therefore construct a new poverty line that allows consumption bundles to vary by location. In particular, we will define six spatial domains within Uganda that will each have their own basic needs bundle. The domains are: Kampala, Central Rural, Eastern Rural, Northern Rural, Western Rural, and Other Urban. While these spatial domains are obviously not perfect, and higher specificity would be desirable, one also needs to make sure there are sufficient observations in each domain.

3.4 Utility consistency

Allowing for different basic needs bundles in each location improves on specificity. But how can we be sure that two different consumption bundles provide the same basic needs? Or, in the language of Ravallion and Bidani (1994), how do we ensure consistency?[9] Poverty measurement and analysis derives from welfare economics, where utility is maximized given a budget constraint. A poverty line is then defined as the cost of a consumption bundle that yields utility associated with the minimally acceptable standard of living. In other words, two bundles of goods are consistent if they yield the same utility.

[9] A poverty measure is consistent if two individuals at the same welfare level are considered equally poor.

To make sure that all basic needs bundles correspond to the same utility level, we use a revealed preference approach (Ravallion and Lokshin 2006). The underlying assumption is that a rational consumer always prefers consuming more, sometimes referred to as the principle of non-satiation. Therefore, a particular bundle in a spatial domain will only be chosen if it minimizes expenditure. As such, we need to compare the cost of all other bundles to the cost of the bundle in a particular domain. If a bundle of the other domains turns out to be cheaper in that particular domain, it means it must have lower utility, otherwise, the rational consumer would have chosen it. Thus, a particular bundle in a spatial domain is utility consistent if and only if all bundles in the other spatial domains' values at the prices of the particular domain turn out to be equally or more expensive.

As mentioned above, we have six spatial domains. This means that each of the six bundles needs to be compared to five other bundles, making for a total of 30 comparisons. Of these 30 comparisons, only eight fail the revealed preference test. Also, seven comparisons are mutually consistent, meaning that the revealed preference conditions are satisfied both when the two bundles, A and B, are evaluated at region B's prices and when the same bundles are evaluated at region A's prices. As there are 15 such mutual possibilities, this means that almost 50 per cent are mutually consistent. This seems to be remarkable, as other studies suggest failures of revealed preference conditions occur more often than not. For example, Ravallion and Lokshin (2006) find that in Russia, revealed preference conditions are violated almost half of the time and only find 1 per cent of comparisons to involve mutually consistent bundles. Arndt and Simler (2010) find that conditions are less violated in Egypt, but more problematic in Mozambique. In case revealed preference conditions fail, adjustments need to be made to make the bundles involved until they pass the test. We use a minimum cross-entropy framework to adjust consumption shares in such a way that revealed preference conditions are satisfied. The details of this procedure are described in Arndt and Simler (2010).

It can be instructive to have a closer look at the poverty lines. After all, poverty lines are not only useful to separate the rich from the poor, but also serve as deflators for cost-of-living differences, permitting interpersonal welfare comparisons when the cost of acquiring basic needs varies over time and/or space (Ravallion 1998). Table 3 presents the resulting poverty lines after adjustments to render the different bundles utility consistent. We see that the poverty line in Kampala is highest and the poverty line in the Northern Rural region is the lowest. The difference between these two poverty lines is substantial. The poverty line for Kampala is almost 50 per cent higher than the one estimated for the rural areas in the north.[10]

The fact that the poverty line in the rural north is much lower than the poverty line in the Central or Western region is evident from Figures 2 and 3. In the north, the preferred diet contains mainly sorghum and cassava, which are relatively more cost effective in generating the necessary food energy.[11] In the central and western regions, relatively less cost effective staples are preferred, such as matooke and sweet potatoes.

While Table 3 reports the poverty lines at the level of disaggregation that they were estimated, Table 4 compares official and utility consistent poverty lines at the same level of disaggregation. The official updated poverty line, which has also been converted to yield the average minimum

[10] The average bi-lateral exchange rate was about UGX 2,600 per USD in 2012-13. However, the purchasing power parity conversion factor for Uganda at that time was only about UGX 1,000 per international dollar.

[11] Which, as it happens, is also the lowest among the six spatial domains according to Table 2. However, the differences with other spatial domains are small and unlikely to be the main driver of the large differences found in the poverty lines.

caloric requirement of the sample to make it comparable to the utility consistent line, is about 26 per cent lower than the utility consistent poverty line. If we disaggregate by the four administrative regions of Uganda, the official poverty line does not vary a lot, except for central, where it is a little higher due to the presence of Kampala in that region. The utility consistent poverty line is everywhere higher, but it varies a lot by region. Thus, we get that while the official poverty line for the northern region is 20 per cent lower than the utility consistent poverty line, the difference increases to 33 per cent in the western region. This is again consistent with Appleton (2003) who also finds a large difference with the official poverty line in the western region.

3.5 Aggregation

The final step in poverty measurement is aggregation. In this step, information from the relative position of the welfare indicator of the units is compared to the poverty line and summarized at different levels of aggregation. The simplest and most common way of aggregation is to just calculate the proportion of units that fall below the poverty line. This measure is often referred to as headcount poverty (P0). One can also calculate the average shortfall of welfare to the poverty line as a share of the poverty line. This is often referred to as the poverty gap (P1). Alternatively, one can square the gap to give a higher weight to households or individuals that fall further below the poverty line to make the measure sensitive to inequality. This is often referred to as the squared poverty gap index (P2). All three measures belong to the family of poverty measures introduced by Foster et al. (1984). The measures can be calculated at the national level, but also separately for different regions or different mutually exclusive groups within the sample. As such, one can construct a poverty profile, which identifies where the poor tend to live, what education levels they have, what their households look like in terms of number of children, elderly, etc.

Table 5 presents headcount poverty, the poverty gap index, and the squared poverty gap using utility consistent poverty lines next to the official figures. As can be seen, in general, estimated poverty using utility consistent poverty lines is much higher than official reported poverty.[12] If we disaggregate by region, we find that the higher utility consistent poverty lines did not increase the poverty headcount that much in the northern region. A virtually equal increase in the poverty line in the eastern region has a much larger effect on poverty. This seems to suggest that the bulk of the people in the northern region are concentrated at the lower end of the welfare distribution, which is confirmed by the relatively high P2. Central and west both have significantly higher poverty measures when using utility consistent poverty lines. This was to be expected given the higher poverty lines caused by the less cost effective diets people have in these regions.

The regional results are again magnified at the sub-regional level. In the north-east, poverty is extremely high regardless of the poverty line used. In the south-west, mid-west, and central regions, the difference between official poverty and poverty using utility consistent poverty lines is very large. The use of different poverty lines also reduces differences in poverty estimates between the regions. Inequality in the headcounts between sub-regions is also much lower when using utility consistent poverty lines as measured by the gini.

[12] But pretty close to the estimates using the 1.25 dollar a day international poverty line as reported by the World Bank of 37.8 per cent (http://iresearch.worldbank.org/PovcalNet/).

Conclusion

Since the government of Yoweri Museveni took over in 1986, Uganda has seen impressive economic growth. The growth also seemed to be particularly pro-poor, leading to large reductions in P0. However, over time, studies have pointed out substantial heterogeneity in the dynamics of poverty, with some areas such as the north-east lagging in poverty reduction. The government's market-oriented development policy that was credited for most of the poverty reductions in the 1990s did not seem to work for the chronic poor (Okidi and McKay 2003). In addition, while alternative welfare measures and qualitative studies pointed to a stagnation or even regression of wellbeing, official poverty estimates continued their downward trend.

In this study, we have used the UNHS 20012-13 to estimate a new set of utility consistent poverty lines. The lines, which are differentiated by six spatial domains, result in higher poverty estimates, nationally at around 33 per cent, and less extreme poverty differences between (sub-) regions. While the north-east sub-region remains the poorest sub-region, higher poverty lines in Kampala and areas that rely on matooke as their main source of food energy appear have done less well over time in terms of poverty reduction than official figures suggest.

We feel that a poverty line rooted in a basic needs bundle derived from consumption patterns of the poor more than 20 years ago is bound to result in misleading poverty estimates. In addition, the theory of poverty measurement and analysis has progressed since the first poverty estimates, and it is now common to allow for heterogeneity in the underlying consumption bundles to increase specificity. We feel it is high time the Government of Uganda updates its poverty line. The argument of holding on to the original 1993 poverty line to ensure comparability for inter-temporal poverty comparisons, does not make much sense anymore after more than two decades of rapid economic growth in a volatile macroeconomic environment, including two food price crises.

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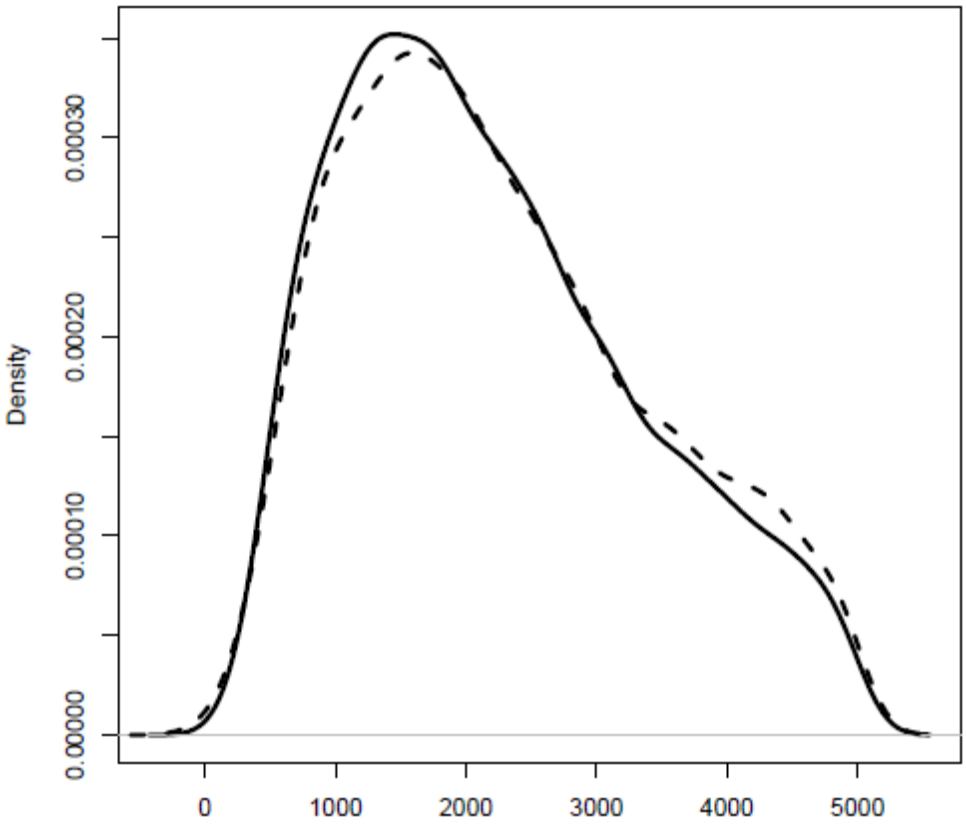
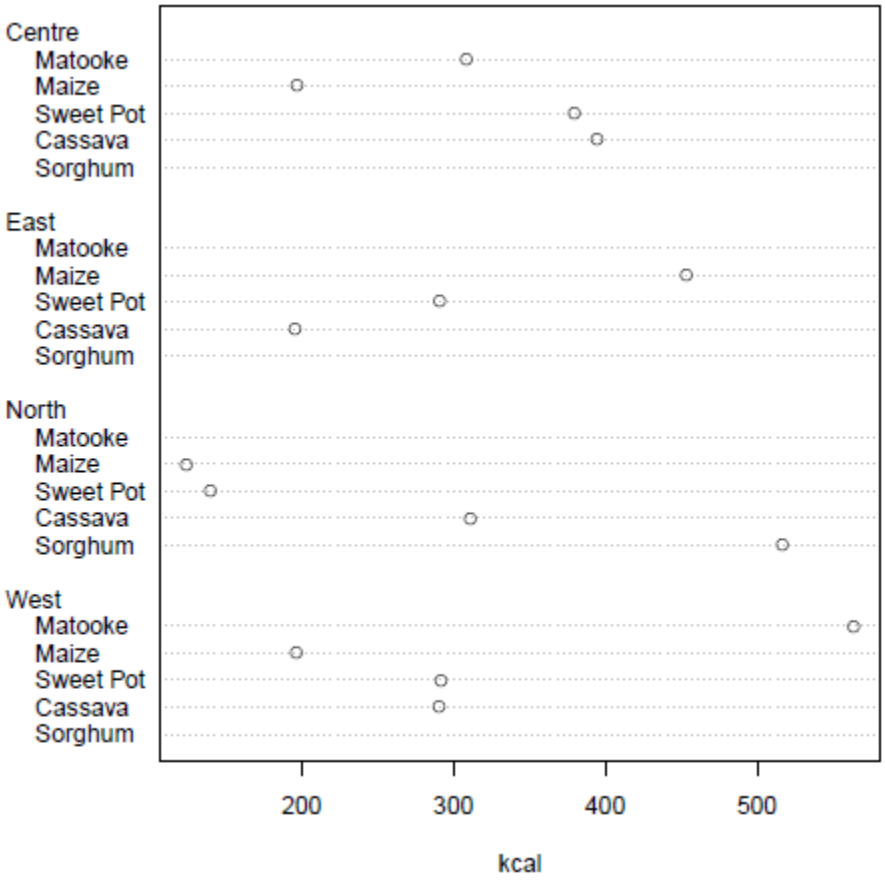
Figures

Figure 1: Density estimates for welfare indicators



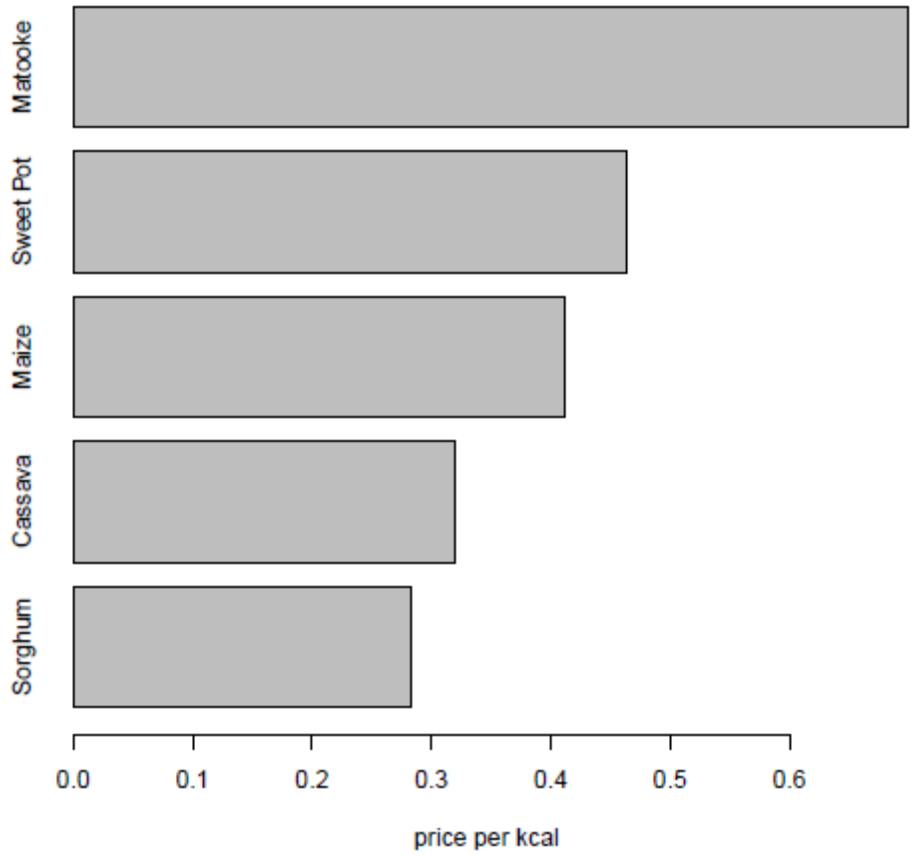
Source: authors' calculations based on the UNHS 2012-13.

Figure 2: Calories derived by the poor from different crops per region



Source: authors' calculations on the basis of UNHS 2012-13.

Figure 3: Average price per kcal for different crops



Source: authors' calculations on the basis of UNHS 2012-13.

Tables

Table 1: Official Poverty in Uganda

	1992-3	1999-0	2002-3	2005-6	2009-10	2012-13
National	55.5	33.8	38.8	31.1	24.5	19.7
Central	45.6	19.7	22.3	16.4	10.7	5.1
East	58.8	35.0	46.0	35.9	24.3	24.1
West	53.1	26.2	32.9	29.5	21.8	7.6
North	72.2	63.7	63.0	60.7	46.2	43.7
Kampala			4.7	4.4	4.0	0.7
Central 1			22.0	18.8	11.2	3.7
Central 2			30.0	19.7	13.6	7.3
East Central			42.6	32.7	21.4	24.3
Eastern			48.4	39.2	26.5	24.7
Mid-Northern			57.4	61.1	40.4	35.4
North-east			82.8	79.3	75.8	74.2
West Nile			62.8	55.3	39.7	42.3
Mid-western			37.9	23.2	25.3	9.8
South-western			29.0	18.7	18.4	7.6

Source: Uganda Bureau of Statistics (2010), Uganda Bureau of Statistics (2014), and Levine (2013). Note: Central 1 comprises of the following districts: Kalangala, Masaka, Mpigi, Rakai, Sembabule, Wakiso, Lyantonde, Bukomasimbi, Butambala, Gomba, Kalungu and Lwengo. Central 2 comprises of the following districts: Kiboga, Luwero, Mubende, Mukono, Nakasongola, Kayunga, Mityana, Nakaseke, Buikwe, Buvuma and Kyankwanzi.

Table 2: Average caloric requirement by spatial domain

Spatial domain	Caloric requirement
Kampala	2222.19
Central Rural	2145.17
East Rural	2114.05
North Rural	2111.02
West Rural	2138.29
Other Urban	2160.56

Source: authors' calculations on the basis of UNHS 2012-13.

Table 3: Estimated poverty lines for each spatial domain

spatial domain	non-food component	food component	poverty line	food share
Kampala	576.41	1759.64	2336.05	0.75
Central Rural	695.51	1418.86	2114.37	0.67
East Rural	477.68	1144.39	1622.07	0.71
North Rural	454.78	1141.45	1596.23	0.72
West Rural	577.66	1425.65	2003.31	0.71
Other Urban	579.04	1354.06	1933.10	0.70

Source: authors' calculations based on the UNHS 2012-13.

Table 4: Estimated versus official poverty lines

	Official poverty line	Utility consistent poverty line
National	1361.59	1851.53
Central	1447.33	2099.43
East	1329.98	1668.08
North	1335.73	1652.78
West	1330.49	1989.51
Kampala	1553.45	2336.05
Central 1	1443.36	2047.72
Central 2	1415.68	2076.53
East Central	1332.40	1674.42
Eastern	1328.32	1663.75
Mid-Northern	1339.08	1664.25
North-east	1331.23	1637.39
West Nile	1331.91	1639.70
Mid-western	1334.74	1987.03
South-western	1326.25	1991.98

Source: authors' calculations based on the UNHS 2012-13. Note: Central 1 comprises of the following districts: Kalangala, Masaka, Mpigi, Rakai, Sembabule, Wakiso, Lyantonde, Bukomasimbi, Butambala, Gomba, Kalungu and Lwengo. Central 2 comprises of the following districts: Kiboga, Luwero, Mubende, Mukono, Nakasongola, Kayunga, Mityana, Nakaseke, Buikwe, Buvuma and Kyankwanzi.

Table 5: Poverty headcount estimates

	Utility consistent poverty lines			Official poverty lines		
	P0	P1	P2	P0	P1	P2
National	33.0	9.3	3.9	19.47	5.2	2.0
Central	17.3	4.0	1.4	4.7	1.0	0.3
Eastern	40.8	10.3	3.8	24.5	5.3	1.7
Northern	51.2	18.7	9.1	43.7	14.1	6.2
Western	24.2	5.7	2.0	8.7	1.7	0.5
Kampala	2.5	1.1	0.7	0.7	0.0	0.1
Central1	14.1	3.4	1.3	3.7	0.2	0.4
Central2	25.5	5.5	1.8	7.3	2.0	0.4
East Central	35.7	8.6	3.0	24.3	2.7	1.4
Eastern	44.2	11.4	4.3	24.7	11.3	2.0
Mid-North	44.3	14.5	6.4	35.4	18.9	3.9
North East	78.5	37.8	21.5	74.2	22.0	17.0
West Nile	49.0	15.8	7.0	42.3	21.2	4.7
Mid-West	27.4	6.6	2.4	9.8	13.9	0.6
South-western	21.2	4.8	1.6	7.6	4.6	0.4

Source: authors' calculations based on the UNHS 2012-13. Note: Central 1 comprises of the following districts: Kalangala, Masaka, Mpigi, Rakai, Sembabule, Wakiso, Lyantonde, Bukomasimbi, Butambala, Gomba, Kalungu and Lwengo. Central 2 comprises of the following districts: Kiboga, Luwero, Mubende, Mukono, Nakasongola, Kayunga, Mityana, Nakaseke, Buikwe, Buvuma and Kyankwanzi.