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Methods matter

The sensitivity of Malawian poverty estimates to definitions, data, and assumptions

Ulrik Beck,[1] Karl Pauw,[2] and Richard Mussa[3]

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Abstract: This paper decomposes differences between the official poverty estimates of Malawi and a set of revised estimates by Pauw et al. (2016, forthcoming) with respect to five methodological differences: (i) the use of a revised set of unit conversion factors; (ii) the specification and use of regional poverty lines as opposed to a single national poverty line; (iii) the use of implicit survey-based prices rather than external price data; (iv) estimation of food separate poverty lines in the two surveys; and (v) permitting a change in the food/non-food composition of the consumption basket over time. Our results suggest that the decline in national poverty varies between 3.4 and 8.4 percentage points, compared to the official estimate of a decline of 1.8 percentage points.

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Figures and Tables: at the end of the paper.

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[1]Development Economics Research Group, Department of Economics, University of Copenhagen; [2]United Nations Food and Agriculture Organization (FAO), Ethiopia; [3]Chancellor College, University of Malawi; corresponding author: ulrik.beck@econ.ku.dk

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UNU-WIDER, Katajanokanlaituri 6 B, 00160 Helsinki, Finland, wider.unu.edu

1 Introduction

In principle, the poverty headcount is a trivial statistic to compute: it requires an estimate of per capita consumption for every person in the country and a poverty line that represents a minimum level of disposable income needed to secure basic necessities. In practice, however, estimating per capita consumption and computing a poverty line—typically using household expenditure survey data—is not trivial at all. The analyst must make many methodological choices and assumptions, for some of which there is no consensus on what constitutes the best approach. In this paper, using Malawi as a case study, we demonstrate how poverty estimates can be highly sensitive to these choices. In doing so, we carefully document the implications of various assumptions underlying the poverty analysis by Pauw et al. (2016, forthcoming)[1] (PBM hereafter), which yielded very different estimates of poverty compared to official ones prepared by Malawi's National Statistical Office (NSO 2012).

Somewhat contrary to expectations, Malawi's official poverty estimates suggested that the national poverty headcount rate declined by only 1.8 percentage points between 2004–05 and 2010–11, whereas rural poverty increased marginally (NSO 2012). The analysis was based on two national surveys of Malawi: the Integrated Household Survey 2 (IHS2), conducted in 2004–05 (NSO 2005a) and the Integrated Household Survey 3 (IHS3), conducted in 2010–11 (NSO 2012). By contrast, using the same datasets and a largely comparable cost-of-basic-needs methodology, PBM estimate a substantial 8.4 percentage point decrease in national poverty, driven by equally sharp declines in rural and urban poverty rates. PBM interpret these findings by comparing to non-monetary poverty indicators as well as placing them in a larger, macroeconomic context of rapid, smallholder-led agricultural growth. This technical analysis delves deeper into the methodological choices made by PBM to show how alternative assumptions influence estimates of poverty lines and, ultimately, poverty rates.

For their analysis, PBM apply the Poverty Line Estimation Analytical Software (hereafter, PLEASe) (Arndt et al. 2016, forthcoming). PLEASe is not overly prescriptive, but rather provides guidelines in the form of a sequence of steps that can be followed to estimate poverty. Within each of these steps, certain assumptions must be made. At least as far as some of the more fundamental decisions are concerned—such as minimum calorie requirements—PBM try to ensure consistency with the approach used by the NSO. However, various other choices remain, and this study explores the impact of some of these in more detail. That being said, the analysis is not exhaustive; instead, we focus on some of the more important choices that poverty analysts are confronted with, and particularly those that have non-trivial implications for results.

2 Comparing methodologies

2.1 Areas of methodological consistency

Several fundamental methodological choices made by PBM are consistent with those of the NSO (for details see NSO 2005a, 2005b, 2012). First, PBM adopt the same monthly price indices as the NSO to ensure temporal consistency of consumption across different months

[1] An earlier version of the forthcoming book chapter has been published as a WIDER Working paper (WP) (Pauw et al. 2014, WP2014-123). The results of the book chapter are not directly comparable to that WP due to the discovery of two coding errors in the time between the publication of the WP and the book chapter. The results of the current WP should therefore be directly compared with the results of the book chapter only.

within the same survey. Although this is a deviation from the PLEASe default guideline, which proposes the use of survey prices to estimate inter-survey temporal deflation rates, the existence of missing price information for major products in some regions/months makes this a sensible choice.

Second, PBM follow the approach of the NSO in using median prices to calculate implicit unit prices used to value consumption of own production. The default behaviour of PLEASe is to use average prices.

Third, PBM adopt the NSO approach of estimating the non-food poverty line as an average of non-food consumption for households whose food consumption is near the food poverty line. The default PLEASe method is to use households whose total consumption is near the poverty line.

Fourth, the calorie requirement used for estimating the poverty line is the same as that of the NSO, that is, 2400 kcal per person per day. Finally, since the estimation of non-food consumption is potentially a source of contention—for example, owing to the multi-year use of durable goods, the need to estimate rental value of owned housing, and so on—PBM opt to use the NSO's published non-food consumption aggregate. The food consumption component, however, is estimated separately by using a revised set of food consumption conversion factors.

2.2 Areas of methodological differences

In order to examine the effect of methodological differences between NSO and PBM, we introduce some of these differences in a sequence of six steps. Table 1 summarizes these steps. In the first step, we estimate a set of baseline estimates (1) that aim to remove some of the most important differences between results of PBM and those of the NSO. Subsequent steps bring the underlying methodology closer to the results of PBM. The second step introduces a modified set of food consumption conversion factors (2); in the third step, we adopt regional poverty lines (3); next, implicit survey prices are used in the estimation of the poverty line inflation rate (4); fifth, we permit changes in the underlying food consumption basket (5); and, finally, a flexible non-food consumption share is introduced (6). Changes in results can thus be directly attributed to the methodological changes introduced at each step of the decomposition exercise. Although the decomposition allows us to isolate the effect of several methodological differences, the comparison of poverty results is still not straightforward as each change may affect the estimated poverty line, the estimated consumption aggregate, or both. The following sub-sections provide further details on the methodological changes introduced at each point in the decomposition exercise.

Baseline estimates

In the first step, we aim to get close to the methodology described by the NSO. This set of results therefore serves as a baseline against which successive steps in the decomposition exercise can be compared. This is not an attempt to replicate official figures as some differences still remain between the method employed to construct the baseline results and the method outlined by the NSO. Perhaps most importantly, PBM use the consumption structure of the poorest 60 per cent of the consumption distribution to construct initial regional poverty lines using an iterative procedure (see Box 1 for details). By contrast, the NSO's poverty line in 2004–05 is derived on the basis of consumption structures of the fifth and sixth consumption deciles only. Therefore, in the results presented in the next section, we also include the official estimates—labelled column (0) in each instance. However, for comparative purposes with the subsequent models the baseline (1) serves as the reference case.

Box 1: Adjustments to the PLEASe methodology

The code used for this study employs the PLEASe toolkit with some modifications. The code stream in the 'do' folders reproduces the results of PBM. The folder do_0tech in the IHS3 folder produces results of this study, including results based on various assumption sets (see Box 2). The file '000_master.do' runs the entire code stream. This box documents five important changes PBM made to obtain results, compared to the default behaviour of the PLEASe code stream.

First, PBM use a temporal price index supplied with the surveys to ensure temporal consistency. This is implemented in the 090_temp_index.do-files.

Second, PBM use median prices instead of mean prices to estimate implicit unit prices. This is done by using the median price already estimated in the 110_price_unit.do and 140_iterate.do files.

Third, the non-food poverty line of PBM is estimated on the basis of the consumption of households whose food consumption is close to the food poverty line. This is in contrast to the default behaviour of PLEASe, where the non-food poverty line is based on those households whose total consumption is close to the food poverty line. This is implemented by changing the estimation of the weighting kernel 'triwt' in three different 'do' files:

```
replace triwt = 11 - round(50*abs(food_pc_tpi/povline_f_flex-1)+0.5) if
abs(food_pc_tpi/povline_f_flex-1)<=0.2
```

Fourth, PBM use a calorie requirement of 2,400 calories for all households. This is implemented in 4_calpp.do-file:

```
gen calpp2=2400
replace calpp=calpp2
```

Fifth, the iterative method of poverty line estimation is modified. The default behaviour of PLEASe is to estimate an initial poverty line based on the consumption structure of those whose consumption is below some percentile of the consumption structure. The poverty line is then re-estimated using the consumption structure of those found to be poor using the initial poverty line. PBM keep using the lowest 60 per cent of the consumption distribution, but the iterative procedure is used to deflate consumption by region, and the resulting poorest 60 per cent of the deflated consumption distribution is used to re-estimate poverty lines in order to achieve convergence. Five iterations are run. This is implemented by keeping the original cut-off across iterations in 140_iterate.do:

```
local cutpt= $bottom
```

Choice of conversion factors

Food consumption conversion factors are used to convert non-standard measurement units often employed in household consumption surveys (e.g. cups, plates, pails, or sachets) into standard metric units (i.e. grams). Conversions are necessary in order to calculate standardized unit prices and to estimate the calorie content of foods consumed. The latter involves two further conversion steps. For those purchased foods that contain non-edible portions (e.g. bananas or maize on the cob), the weight is first converted to an edible portion equivalent. Next, the calorie content is calculated by multiplying the weight by the typical number of kilocalories contained per edible gram. Poverty lines are essentially calculated as the cost of achieving a certain number of calories per day, and hence getting the unit prices, edible portions, and calorie content right is crucial.

Analysis by Verduzco-Gallo et al. (2014) of the International Food Policy Research Institute (IFPRI) complemented by further investigations by PBM revealed various inconsistencies in the sets of conversion factors provided in the IHS2 and IHS3 datasets. The authors subsequently released modified sets of weight conversion factors for both IHS2 and IHS3 in which commodity-specific inconsistencies were identified systematically on the basis of unit price outliers. As a first explicit deviation from the official poverty estimation procedure, PBM adopt the modified IFPRI conversion factors as the main source of conversion factors. PBM also apply the same set of conversion factors across all regions rather than attempting to reconcile some of the regional inconsistencies.

One example of a commodity-specific inconsistency is the IHS2 official conversion factor for sachets of cooking oil. These small plastic containers are typically around 8–10 cm in height and around 3 cm in diameter, and therefore weigh approximately 50 g. However, the IHS2 conversion factor is 456 g. Double-checking the price per gram paid for sachets confirms that the official conversion factor deviates by a factor of approximately ten. Another example is the excessive calorie content for sugar cane (purported to be 400 kcal/100 g serving) in the official sets of conversion factors. Following the food composition tables by Lukmanji et al. (2008), a calorie content of 260 kcal per serving is applied instead.

There are three channels through which conversion factors affect poverty estimation. First, since the food poverty line is the cost of achieving a certain number of calories per day, based on the observed consumption structure of the poor, the conversion of consumption into calories matter for the composition of the food poverty line bundle because the calorie content of food items are usually only available in standard weight units such as grams or litres. Second, unit prices are used to price the food poverty line bundle, and conversion factors affect this valuation since unit prices are expressed in standard units. Third, as products that are not home produced or received as in-kind transfers or gifts are priced using the median unit price of products that are bought, the choice of conversion factors also impact the consumption aggregates of individual households.

Regional poverty lines and utility consistency

Malawi's official poverty statistics for 2004–05 and 2010–11 compare per capita consumption levels against a single national poverty line. This approach may not be adequate to capture differences in consumption structures across different regions and between urban and rural areas (Arndt and Simler 2007; Tarp et al. 2002). Following in the tradition of the Malawian poverty analysis for 1997–98 (see NSO 2001), PBM estimate regional poverty lines for four regions: three rural regions (North, Central, and South) as well as an urban region, consisting of urban areas (cities) across the country.

The introduction of region-specific poverty lines gives rise to the problem that different poverty bundles may not equate to the same level of welfare. Hence, following Arndt and Simler (2007), PBM adjust the regional bundles using a maximum entropy approach that ensures utility consistency. This entropy procedure is also the default procedure in the PLEASe toolkit. The next step in the decomposition exercise therefore introduces the region-specific and utility-consistent poverty bundles.

Using survey prices to update the food poverty line

Up to this point we have used a consumer price index (CPI)-based measure of inflation to adjust the estimated 2004–05 poverty line to comparable 2010–11 prices. The inflation rate used (128.9 per cent) is a national average inflation estimate used by the NSO in their poverty analysis, which was derived from a revised CPI series constructed especially for the poverty analysis (for a more detailed discussion, see Pauw et al. 2016, forthcoming). The alternative method adopted by PBM, and introduced as the next step here, is to use survey unit prices to update poverty lines. Importantly, rather than estimating a national average inflation rate, region-specific rates are estimated from the survey to adjust poverty lines. Unit prices are based on the consumption patterns of poor households and are calculated as expenditure on a given item divided by quantity. Once again, this is also the default option of the PLEASe toolkit. Using implicit survey prices has several advantages: first, it allows the explicit use of prices faced by poor consumers when calculating the poverty line inflation rate (Günther and Grimm 2007); second, the method is transparent in the sense that the underlying data used is available in the survey rather than obtained from an external source that uses a different data collection and aggregation methodology.

Allowing for temporal changes in the consumption of the food basket

The rationale for accounting for regional differences in food baskets can also be applied temporally. Although poverty analyses assume a consistent set of preferences over time, it is reasonable to expect that consumers change their consumption bundles over time in response to relative price changes. If ignored, this could lead to an overestimation of the poverty line in subsequent periods of analysis.

Just as spatial utility consistency between regions can be imposed, it is also possible to impose intertemporal utility consistency (Arndt and Simler 2005). This means that the changes in the food basket of the poverty line is bounded by a utility consistency requirement in order to ensure that poverty lines are consistent, not just between regions but also between surveys. The next step in our decomposition exercise therefore simultaneously allows for intertemporal changes in the food basket of the poverty line (i.e. flexible food poverty lines), subject to a minimum calorie requirement, and imposes intertemporal utility consistency restrictions.

Allowing for changes in non-food consumption shares over time

PBM find that the non-food share of consumption, somewhat counter-intuitively considering general improvements in welfare, declined between 2004–05 and 2010–11 in all three rural regions and over a wide range of the consumption distribution. Figure 1 shows estimated non-food expenditure shares (vertical axis) for urban and rural households for different chosen food poverty lines (e.g. a value of 80 per cent means '80 per cent of the actual food poverty line' as per Table 2). The horizontal dashed line represents the 38 per cent non-food expenditure share estimated by the NSO in its 2004–05 poverty assessment and subsequently maintained in the NSO's estimation of the 2010–11 poverty line.

The figure is interesting in several respects. First, if Engel's law holds, the estimates of non-food expenditure shares would rise as we move to higher poverty lines, simply because given the estimation procedure we would then be evaluating non-food expenditures of slightly wealthier households. It appears this only holds for urban households in 2004–05. In all other instances the non-food share declines or is constant as we move to higher food poverty lines, which suggests extra income earned by the poor is initially spent on more (or better quality) food rather than non-food expenditures (see further analysis by Pauw et al. 2015).

Second, while NSO assumed a constant non-food expenditure share of 38 per cent, PBM find this rate to only be reasonably close to PBM's non-food shares in 2004–05 in the rural South and Central regions. The non-food shares increased between the two surveys across the entire range of poverty lines considered in the rural South and Central regions, and for a wide range of possible poverty lines in the rural North. The official poverty line has a constant non-food share in the two surveys. As discussed earlier, NSO used an inflation factor of 128.9 per cent to update both the food and non-food poverty lines (NSO 2013). PBM estimate a similar non-food poverty line in 2004–05 in rural areas but a substantially lower inflation over time (on average 75.1 per cent).

On the other hand, PBM also find a higher non-food poverty line for urban areas in 2004–05 as well as a higher poverty line inflation rate for non-food (133.4 per cent). The higher level of non-food consumption of the poor in urban areas is consistent with the literature where urban households are often found to consume fewer and more expensive calories (Tarp et al. 2002). This inflationary wedge is consistent with the Malawi CPI information for this period. The choice to inflate both the food and non-food parts of the bundle by the weighted average of food and non-food inflation is problematic since the differential inflation will change the relative shares of food and non-food consumption moving forward. In reality, the differential food and non-food inflation rates will result in a lower share of non-food items in the poverty line, even if the total poverty line does not change. The figure shows that in urban areas and for both surveys, the share is well above 38 per cent for a wide range of poverty lines. This finding should therefore also be reflected in the estimated poverty line for the urban areas.

Box 2: Adjustments to the code to implement different assumption sets

In the following, we describe how each of the assumption sets detailed in Section 2 were implemented. We take the final set of methodological choices (6) as the point of departure since this is the scenario implemented by PBM and is the one closest to the default PLEASe code.

Moving to choice set (5), we fix the non-food share at the IHS2 levels. This is done simply by disregarding the IHS3 non-food estimation and, instead, using the share of non-food consumption from IHS2. The code used to generate these poverty lines is (in 050_gen.do):

```
gen nfsh=povline_nf/(povline_nf+food_povline_ent) if ihs==2
foreach sp of numlist 1 2 3 4 {
            sum nfsh if spdomain==`sp' & ihs==2, meanonly
            replace nfsh=r(mean) if spdomain==`sp' & ihs==3
            }
gen povline_nffix=food_povline_ent/(1-nfsh) if ihs==3
```

In choice set (4), we fix the food bundle of IHS3 to the food bundle estimated using IHS2. This poverty line is built into PLEASe as food_povline_fix, so generating the total poverty line is a simple matter of (in 050_gen.do):

```
gen povline_fix=food_povline_fix/(1-nfsh) if ihs==3
```

For choice set (3), we switch to using the CPI estimate of NSO instead of the survey-based measure to update the poverty line from IHS2 to IHS3. This means that while the IHS2 poverty lines do not change, the IHS3 poverty lines are now simply estimated as (in 050_gen.do)

```
foreach sp of numlist 1 2 3 4 {
            sum povline_ent_m if ihs==2 & spdomain==`sp'
            replace povline_nsoinfl=r(mean)*(1+1.289) if ihs==3 & spdomain==`sp'
            }
```

To implement choice set (2), we switch from regional poverty lines to a single, national poverty line. This is done simply by letting all households belong to a single spatial region (in 1_household_2.do in the do_2nat-subfolder):

```
gen spdomain=1
```

Finally, choice set (1) is implemented by switching conversion factor set. This is implemented by loading a different set of conversion factors (in the 2_food_2.do and 1b_consumption_aggregate_ihs2.do files in the do_1cf-subfolder):

```
use "in\kgfactor04.dta",clear
```

In summation, the regional and time-specific approach to poverty line estimation appears to be important in the present setting: consumption patterns, even the crude non-food shares shown here, differ substantially across regions and shift over time. Therefore, the final change we consider in our decomposition exercise is to allow the non-food consumption share to be independently determined by the actual consumption shares in both surveys, not just in the IHS2.

3 Comparison of results

The poverty headcount rate is the share of people, nationally or in a population sub-group or region, whose per capita expenditure falls below the relevant poverty line. Since in each of our decomposition exercises, we introduce changes to consumption aggregates and/or poverty lines, we start by presenting the different poverty lines and show density plots of the different consumption aggregates. We then proceed to present the poverty results.

3.1 Poverty lines

Table 2 shows the different poverty lines used and/or estimated. The baseline estimation (model 1) gives poverty lines, which are about 6 per cent lower than the official poverty line (model 0). Since the IHS2 poverty line is inflated by 128.9 per cent, this difference carries through to IHS3 poverty lines. Switching to the IFPRI set of conversion factors (model 2) lowers the IHS2 poverty line slightly.

The introduction of regional poverty lines (model 3) raises most of the estimated regional poverty lines for 2004–05. However, the estimated national poverty line, which is a population-weighted average of the regional lines, is remarkably close to the official national poverty line (43.2 vs. 44.3 MWK per day). Differences in regional poverty lines vary between 2 per cent in the rural Central region and 40 per cent in the urban areas. The urban region is where we would expect to see the largest increase due to higher non-food consumption share documented in Figure 1. Differences in the structure of food consumption of the poor or the prices they encounter are strong justifications for the use of regional poverty lines. We return to the structure of the consumption bundles later. The remaining steps involve the method of updating the poverty line from IHS2 to IHS3. Thus, the IHS2 poverty line does not change in these steps.

The next change is to update the poverty line using the survey prices of IHS3 (model 4) instead of exogenously imposing inflation rate of 128.9 per cent. This change increases the poverty lines of IHS3 in all four regions substantially; for example, compared to the original estimate (model 3), the national poverty line for 2010–11 is now 54 per cent higher. This implies that the prices of the IHS2 poverty bundles rose faster than 128.9 per cent. One potential explanation for these large increases is that the IHS2 bundles were no longer representative of the consumption structure of the poor in 2010–11 when IHS3 was collected. When relative prices shift, substitution towards relatively cheaper goods means that a Laspeyres price index tends to overestimate increases in the cost of living. Using the fixed quantities of the IHS2 poverty line and updating with the IHS3 prices essentially corresponds to employing a Laspeyres price index. The implication is that the use of survey prices may be somewhat nonsensical if the consumption bundles are not updated at the same time. In fact, the use of actual (flexible) consumption bundles (model 5) brings the IHS3 poverty lines back to levels that are comparable to those in column (3). In all rural regions, the rural poverty lines are still slightly higher than the official line, while the urban poverty line is substantially higher than both the rural and official poverty lines.

The final change brings us to the set of poverty lines presented by PBM (model 6). Here, the share of non-food consumption is now permitted to vary between the two survey periods. This lowers the poverty lines in all regions except in the urban region. This reflects the finding reported by PBM that the non-food share of consumption fell between the two surveys in the three rural regions (see Pauw et al. 2016, forthcoming).

3.2 Consumption aggregates

We now turn to the consumption aggregates used for calculating the poverty rates. Figure 2 shows the distribution of the different consumption aggregates used for the two surveys.

While the changes in consumption aggregates appear small due to the use of a log-scale on the horizontal axis, the differences between consumption aggregates are in fact substantial, particularly for IHS3. Moreover, even if changes are small, they can have a big effect on estimated poverty rates since the density of observations is high in the region of the poverty line. Using the conversion factors supplied by NSO, we do not replicate the NSO consumption aggregate—the estimate of the current paper has a lower mean. Switching to the IFPRI conversion factors reverses this, however: the distribution of the consumption aggregate using the IFPRI conversion factors is right-shifted, compared to the NSO consumption aggregate.

3.3 Poverty headcount rates

Table 3 shows the poverty headcount rates under different sets of methodological choices. There are two noticeable differences between the official figures (model 0) and the baseline estimates of the current paper (model 1). First, the baseline poverty lines are slightly lower. Since the IHS3 poverty line in the baseline scenario is simply 128.9 per cent higher than the IHS2 poverty line, the differences carry through to IHS3 poverty lines. Second, although the IHS2 consumption aggregates are quite similar, baseline estimation of the IHS3 consumption aggregate gives somewhat lower values for a large proportion of households. In total, this means that in this baseline estimation, poverty is found to increase from IHS2 to IHS3.

The poverty headcount is always a result of combining the consumption aggregates and the poverty lines presented above. The rest of the results in Table 3 are therefore unsurprising given the discussion in the previous section. Using the IFPRI set of conversion factors (model 2) lowers poverty rates substantially since poverty lines are mostly unchanged while the IHS3 consumption distribution shifts to the right. We now have a statistically significant decrease in poverty of 3.5 percentage points at the national level.

Imposing regional poverty lines and utility consistency (model 3) raises the poverty levels of all four regions, which explains the increases in the level of poverty in 2004–05, compared to the previous model. Since the poverty line inflation is still imposed exogenously to be 128.9 per cent, it also raises the level of poverty in 2010–11. At the national level, the decline in poverty is practically unchanged. When allowance is made for a flexible bundle that changes between survey rounds, however, there is a moderate decrease in poverty of 4.1 per cent at the national level (model 5). Finally, allowing the non-food share to change over time (model 6) contributes substantially to the decline in poverty, which relates to the declining non-food shares over the period, as discussed earlier and in detail by PBM. This change gives the final result reported by PBM: a decrease in the poverty rate of 8.4 percentage points.

3.4 Robustness of the underlying food bundles

The underlying food bundle used for constructing poverty lines is crucial for poverty line construction. Yet, this matter is rarely discussed in poverty analyses. One reason for this might be that there is no formula for determining what a reasonable food bundle looks like: typically, it is very country-specific and may also reflect economic conditions particular to the survey year.

As a result poverty analysts often have to make judgement calls as to whether a given bundle seems 'reasonable'. Explicit presentation of the food bundle opens up a discussion of whether the food bundle is reasonable. Of course, the lack of a gold standard to compare food bundles does not mean that this step should be overlooked when constructing poverty lines. As the results above show, changes in how the food bundle is constructed can change poverty rates substantially. And the food bundles contain useful information that can help explain spatial and temporal differences in poverty lines.

Table 4 presents shares of calories in the food bundles of IHS2 before regional bundles are allowed and utility consistency is imposed (i.e. as in model 2 in Table 1) and after (as per models 3–6). Table 5 presents the utility consistent bundles of IHS2 and IHS3 (this corresponds to model 6 in Table 1). The seven most important items in terms of calorific contribution to the poverty lines of model 6 in each region in each year are selected. Only items that show up in three or more region-years are included. The focus on calorific contributions means that a few items such as salt that do not provide calories but are still part of the food bundles do not feature in this table. Alternatively, one could have picked products based on expenditure shares of the food bundle, but by using calorific contributions PBM are able to abstract from prices and still compare food bundles in a meaningful way. This procedure results in a total list of seven food products that make up at least 79 per cent of the calorie content of the food poverty lines an all regions in both years.

Table 4 reveals some differences in the composition of the food consumption of the poor between the four regions. In the urban and rural South regions over 70 per cent of calories come from maize flour, whereas this share is only 54 per cent in the rural North region. Here, cassava and cassava flour provide 17 per cent of calories. The national bundle calorific shares are bounded by the lowest and highest shares in each region but the regional differences are substantial and are missed using this approach. Table 4 therefore provides supporting evidence that estimating regional poverty lines may be important to capture spatial differences in the consumption structure of the poor.

In general, the calorie structure of the regional IHS2 food bundles look reasonable. Verduzco-Gallo et al. (2014) report that different types of maize makes up between 63 and 72 per cent of calorie consumption for the three poorest quintiles. The PBM food bundle has a somewhat lower maize consumption share for the rural North but this is largely made up for by cassava consumption, another cheap source of calories.

The consumption structure derived from IHS2 and IHS3 is shown in Table 5. The structure exhibits a great deal of consistency over time. Also in IHS3, maize flour was by far the most important source of calories and it appears to have increased in importance in all rural areas. This is perhaps not surprising as the Malawi Farm Input Subsidy Programme (FISP) is thought to have increased maize yields significantly. The official statistics report more than a doubling of maize yields in the years between the two surveys. Even though the maize production statistics have been questioned, it is still reasonable to expect maize consumption of the poor to have increased over this period, particularly in the rural North and rural Central where the contribution of maize to the calorie content of the poverty lines was relatively lower in 2004–05. A natural next question is what are the products in 2004–05 that were substituted for the additional calories covered by maize in 2010–11. This substitution cannot be attributed to one single product; instead, there are smaller decreases in many reported products as well as in other products in the poverty lines with calorific shares too low to be featured in the table (this is evident from the increases in the 'Total' row).

The changes over time are consistent with the observations of Verduzco-Gallo et al. (2014) who find that while dietary diversity increases for the rich and middle-income quintiles, dietary diversity decreases from 2004–05 to 2010–11 for the poorest quintiles, partly due to an increase in the consumption of maize.

In conclusion, the food bundles exhibit a great deal of consistency over time and correspond with what can be called stylized facts about the consumption structure of the poor in Malawi, including decreasing dietary diversity over time and a high and increasing degree of dependence on maize to meet calorie needs. Table 5 therefore provides supporting evidence that the changes in food bundles over time seem reasonable.

4 Concluding remarks

This study has considered a set of methodological choices for estimating poverty using the two integrated household surveys of Malawi, collected in IHS2 and IHS3.

Different methodological choices are found to matter for both the level of poverty and the evolution over time. However, the various results based on what we deem reasonable sets of assumptions (models 0, 2, 3, 5, and 6) all agree that poverty declined in this period in Malawi. Of these, the results of models estimated by the current paper (2, 3, 5) and by PBM (6) show a statistically significant decline in poverty at the national level. The magnitude varies between 3.4 and 8.4 percentage points, which are all larger than the officially reported poverty decrease. In this sense, the main result of a decline in poverty is characterized by a high degree of robustness of the main result that poverty decreased significantly in Malawi over the period—even though the actual numbers are quite sensitive to the specific assumptions made.

In what sense is it reasonable to re-estimate the poverty line bundle for IHS3? One might argue that despite entropy adjustments made to ensure utility consistency, welfare equivalence cannot be guaranteed. If the same bundle is used in both periods, at least we are sure that at the poverty line, people can buy a well-defined and unchanging bundle. There are two problems with this argument. First, as shown by Arndt and Simler (2005) and reiterated by PBM, changing prices mean that the IHS2 bundle priced at IHS3 prices is most likely overvaluing the cheapest way to obtain a welfare-equivalent bundle at the time IHS3 was collected. Second, the poverty line was updated by exogenously imposing an inflation rate of 128.9 per cent. It is not clear how this inflation rate is connected to the IHS2 poverty line bundle, so the welfare equivalence of the IHS2 and the IHS3 poverty line, even in the interpretation that the same bundle should be affordable at the poverty line, cannot be taken for granted. The fact that the food and the non-food poverty lines were inflated by the same factor is almost certainly incorrect, considering the large increases in food prices over the period as well as the observed decline of non-food consumption as a share of total consumption. The food bundle analysis of this study lends additional credibility to temporal re-estimation of poverty line food bundles, as the bundles appear quite stable over time except for the increase in maize consumption, which most likely reflects a real change due to the introduction of FISP, and which is corroborated by other evidence (Verduzco-Gallo et al. 2014).

Ultimately, as far as poverty analysis is concerned, there is no single set of methodological choices that can be deemed 'most correct' or appropriate. However, the relatively large changes in results obtained from one method to another underlines the importance of clearly articulating these choices and their implications to ensure that results are transparent. This would ensure that discussions can be fruitfully focused on what poverty estimates imply for past and future policy rather than whether or not the numbers can be trusted.

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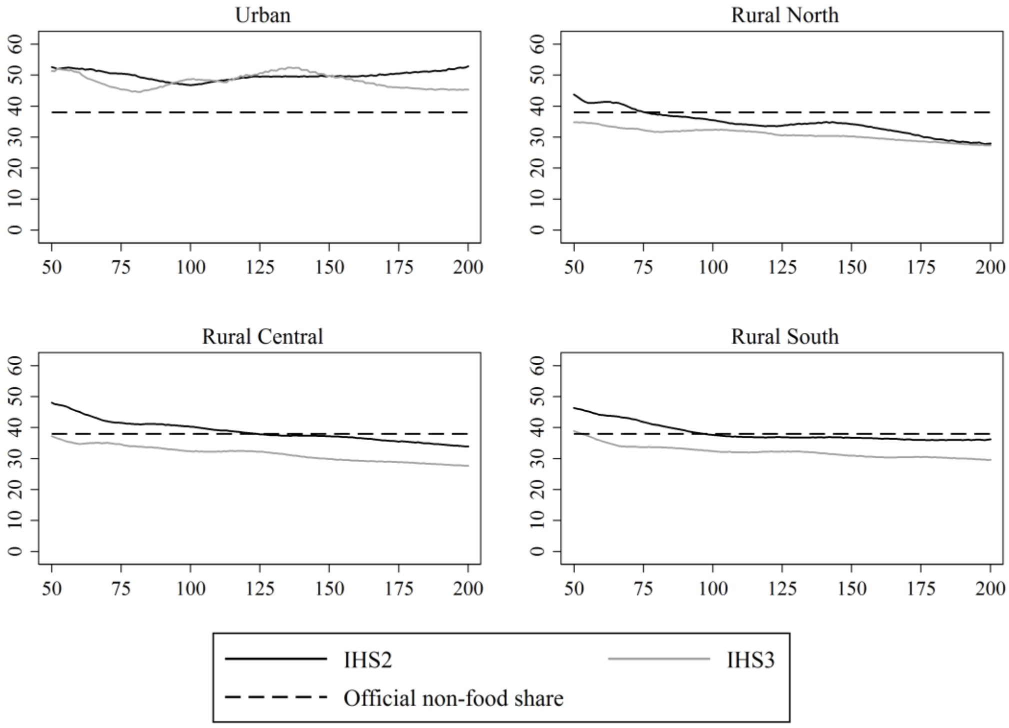
Figures

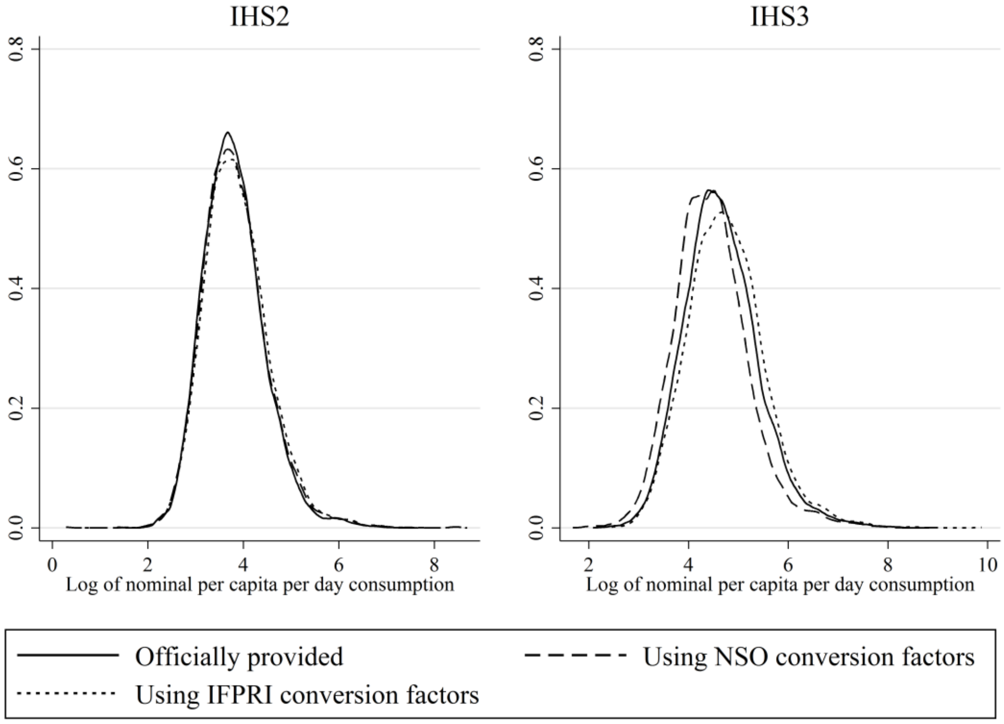
Figure 1: Estimated non-food share of total expenditure for different food poverty lines



Note: The horizontal axis is the food poverty line considered, in per cent of the estimated food poverty lines of the final model (i.e. the ones used by PBM). The vertical axis is the share of expenditures going towards non-food expenditures for households near the food poverty line. The horizontal dashed line (along the x-axis) represents the share of the food poverty lines of the final model.

Source: Authors' calculations based on data from Integrated Household Survey 2 (IHS2) 2004/05, Integrated Household Survey 3 (IHS3) 2010–11, and NSO (2005a, 2005b, 2012).

Figure 2: Kernel density plots of consumption aggregates using different conversion factor sets



Note: IFPRI, International Food Policy Research Institute; NSO, National Statistics Office.

Source: Authors’ calculations based on data from IHS2 and IHS3.

Tables

Table 1: Overview of the sets of methodological choices investigated in this paper

Assumption	Baseline (1)	Modify conversion factors (2)	Use regional poverty lines (3)	Use survey-based prices (4)	Allow change in food basket (5)	Allow change in non-food shares (6)
Conversion factor	NSO	IFPRI	IFPRI	IFPRI	IFPRI	IFPRI
Poverty line	National	National	Regional	Regional	Regional	Regional
Inflation estimate	CPI-based	CPI-based	CPI-based	Survey-based	Survey-based	Survey-based
Fixed food bundle	Yes	Yes	Yes	Yes	No	No
Fixed non-food share	Yes	Yes	Yes	Yes	Yes	No

Note: NSO, National Statistics Office; IFPRI, International Food Policy Research Institute; CPI, consumer price index.

Source: Constructed by the authors using information from NSO (2005a, 2005b, 2012).

Table 2: Poverty lines under different sets of methodological choices

	Official poverty estimates (NSO) (0)	Baseline (1)	Modify conversion factors (2)	Use regional poverty lines (3)	Use survey-based prices (4)	Allow change in food basket (5)	Allow change in non-food shares (6)
IHS2							
Urban	44.3	41.8	40.8	57.0	57.0	57.0	57.0
Rural	44.3	41.8	40.8	41.5	41.5	41.5	41.5
Rural North	44.3	41.8	40.8	46.1	46.1	46.1	46.1
Rural Central	44.3	41.8	40.8	43.8	43.8	43.8	43.8
Rural South	44.3	41.8	40.8	38.2	38.2	38.2	38.2
National	44.3	41.8	40.8	43.2	43.2	43.2	43.2
IHS3							
Urban	101.4	95.7	93.5	130.5	166.6	123.2	127.5
Rural	101.4	95.7	93.5	95.2	152.6	94.8	86.2
Rural North	101.4	95.7	93.5	105.5	122.3	100.2	95.6
Rural Central	101.4	95.7	93.5	100.2	164.5	100.1	88.4
Rural South	101.4	95.7	93.5	87.4	150.3	88.1	81.3
National	101.4	95.7	93.5	100.5	154.7	99.1	92.5
Poverty line inflation							
Urban	128.9	128.9	128.9	128.9	192.4	116.1	123.8
Rural	128.9	128.9	128.9	129.5	268.0	128.7	108.0
Rural North	128.9	128.9	128.9	128.9	165.5	117.5	107.6
Rural Central	128.9	128.9	128.9	128.9	275.8	128.8	102.1
Rural South	128.9	128.9	128.9	128.9	293.7	131.0	113.1
National	128.9	128.9	128.9	132.6	257.9	129.3	114.0

Note: The poverty lines are reported in Malawian Kwacha per day per person. The national poverty line is a population-weighted average of the regional poverty lines. The fact that national poverty line inflation differs from regional poverty line inflation factors in column 3 is due to population shifts between the regions in the timespan between the two surveys.

Source: Authors' calculations based on data from IHS2, IHS3, and NSO (2005a, 2005b, 2012).

Table 3: Poverty headcounts under different sets of methodological choices

	Official poverty estimates (NSO) (0)	Baseline (1)	Modify conversion factors (2)	Use regional poverty lines (3)	Use survey-based prices (4)	Allow change in food basket (5)	Allow change in non-food shares (6)
IHS2							
Urban	25.5	22.6	20.4	37.6	37.6	37.6	37.6
Rural	55.9	51.2	47.0	48.2	48.2	48.2	48.2
Rural North	56.3	56.0	50.8	59.4	59.4	59.4	59.4
Rural Central	46.7	39.1	35.3	40.0	40.0	40.0	40.0
Rural South	64.4	61.3	57.0	53.1	53.1	53.1	53.1
National	52.4	47.9	43.9	47.0	47.0	47.0	47.0
IHS3							
Urban	17.3	28.5	14.6	28.7	38.9	26.0	27.3
Rural	56.6	63.1	45.1	46.2	71.3	45.9	40.6
Rural North	59.9	68.1	47.1	54.9	64.5	50.6	48.0
Rural Central	48.7	55.4	36.8	40.6	67.9	40.6	33.7
Rural South	63.3	69.1	52.4	49.1	76.5	49.6	45.1
National	50.7	57.9	40.4	43.6	66.4	42.9	38.6
Change in poverty headcount (percentage points)							
Urban	–8.2*	6.0	–5.8	–8.9	1.3	–11.6*	–10.3*
Rural	0.8	12.0*	–1.9	–1.9	23.1*	–2.3	–7.5*
Rural North	3.6	12.1*	–3.7	–4.5	5.1	–8.8*	–11.4*
Rural Central	2.0	16.3*	1.5	0.6	27.9*	0.6	–6.3*
Rural South	–1.1	7.8*	–4.5*	–4.0	23.5*	–3.5	–8.0*
National	–1.8	10.0*	–3.5*	–3.4*	19.4*	–4.1*	–8.4*

Note: Asterisks indicate that the poverty change is statistically significant at the five per cent level. The confidence interval is used to determine the statistical significance of the difference in the poverty rate between 2004–05 and 2010–11. Since the distribution of the poverty rate is unknown, we follow Arndt and Simler (2007) in defining the confidence interval as plus or minus twice the standard error.

Source: Authors' calculations based on data from IHS2 and IHS3.

Table 4: Calorific shares of most important food items in national and regional poverty lines in 2004–05

	National bundle	Regional bundles				Differences			
		Urban	Rural North	Rural Central	Rural South	Urban	Rural North	Rural Central	Rural South
Maize flour	68.7	73.6	54.4	65.6	71.3	4.9	–14.3	–3.1	2.6
Normal	43.1	39.0	16.7	31.1	54.4	–4.2	–26.4	–12.1	11.2
Refined	25.5	34.6	37.7	34.6	16.9	9.1	12.1	9.0	–8.6
Cassava tubers	3.1	2.2	4.0	2.6	3.5	–0.8	1.0	–0.4	0.4
Cassava flour	2.5	0.0	12.9	2.3	0.0	–2.5	10.4	–0.2	–2.5
Bean, brown	1.9	2.1	2.4	3.0	1.6	0.2	0.5	1.1	–0.4
Groundnut	3.4	1.4	4.3	6.9	1.2	–2.0	1.0	3.5	–2.2
Sugar	1.8	4.3	3.3	1.4	1.6	2.5	1.5	–0.4	–0.2
Total	81.4	83.6	81.4	81.8	79.1	2.3	0.1	0.5	–2.3

Note: All numbers are in per cent.

Source: Authors' calculations based on data from IHS2.

Table 5: Calorific shares of most important food items in entropy-adjusted poverty line

	IHS2				IHS3				Differences			
	Urban	Rural North	Rural Central	Rural South	Urban	Rural North	Rural Central	Rural South	Urban	Rural North	Rural Central	Rural South
Maize flour	73.6	54.4	65.6	71.3	72.7	70.9	77.6	73.6	−0.9	16.5	12.0	2.3
Normal	39.0	16.7	31.1	54.4	39.4	20.9	34.6	56.4	0.4	4.1	3.6	2.1
Refined	34.6	37.7	34.6	16.9	33.2	50.0	43.0	17.1	−1.4	12.3	8.4	0.2
Cassava tubers	2.2	4.0	2.6	3.5	1.0	2.0	0.9	1.7	−1.2	−2.0	−1.7	−1.8
Cassava flour	0.0	12.9	2.3	0.0	0.0	7.1	1.2	0.0	0.0	−5.8	−1.1	0.0
Bean, brown	2.1	2.4	3.0	1.6	1.6	3.0	1.7	0.9	−0.6	0.6	−1.3	−0.6
Groundnut	1.4	4.3	6.9	1.2	1.7	1.5	3.1	1.8	0.3	−2.8	−3.8	0.6
Sugar	4.3	3.3	1.4	1.6	4.0	2.8	1.5	1.7	−0.3	−0.5	0.2	0.1
Total	83.6	81.4	81.8	79.1	80.9	87.4	86.0	79.6	−2.8	6.0	4.2	0.5

Note: The food bundles shown in this table are the final bundles that were used by PBM. They correspond to assumption set 6 in Table 1.

Source: Authors' calculations based on data from IHS2 and IHS3.