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Does the context-specific cost-of-basic-needs hit the mark?

Theory and evidence from Mozambique

by

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Abstract

We study the common approach in economics to identify poverty patterns from household surveys by applying a threshold on the cost-of-basic-needs, the poverty line. As an alternative to a national poverty line, context-specific thresholds have been proposed that reflect local habits and local prices with the purpose to improve targeting. However, we show that context-specific poverty lines cannot be expected to hit the mark, essentially because of an inevitable upward (urban) bias and a downward (rural) bias. Notwithstanding the intent and appeal of context-specific poverty lines, the corresponding poverty pattern tends to conceal the spatial dimension of poverty and be incongruent with the patterns of malnutrition, education and ownership of assets. Indeed, evidence for Mozambique indicates that adding specificity to the poverty line leads to a picture that is less and less is in line with the actual development pattern in the country. In other words, as the theoretical biases hint, the national poverty line is closer to the mark than the context-specific lines.

1. Introduction

The poverty line is one of the basic elements of national poverty assessments across the world (Ravallion, 2010). In developing countries, an nutrition-based estimate of the cost of basic needs in the country is the commonly used benchmark. The basic needs approach to poverty has a long history. Already in 1948 the UN agreed that "*Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services.*" (Universal Declaration of Human Rights, Article 25). More recently, in 2000, the UN declared poverty reduction as the primary millennium development goal.

From a human right perspective and also from a societal perspective, the use of a national nutrition-based poverty line seems appealing. It reflects the minimum threshold income agreed upon in a society, applicable to all households, irrespective of differences in their circumstances and characteristics. To put it differently, the national poverty line implicitly assumes that every household has similar needs and similar cost to reach the minimum standard of living.

Yet, in view of the differentials of observed consumption and price patterns this would seem a crude assumption. As is well known, the cost of basic foods can differ among households. Likewise, it is unlikely that the cost to cover for a minimum of non-food consumption can be identified univocally, while the cost differentials for the necessary social services adds to the complexities involved in computing a relevant poverty line.

To relax the assumption that a single national poverty line applies to all households, it has been proposed to use a different poverty line for different population groups, in response to the local context as regards the budget that is deemed necessary to reach the minimum living standard in the country. The idea is that a context-specific poverty line could capture locally relevant demand behavior and local relational perspectives (Sen, 1983).

The use of a context-specific poverty line can have important effects on poverty assessments. For example, in a seminal article on the subject, Ravallion and Bidani (1994) discuss the implications of alternative poverty lines in Indonesia. They compare poverty patterns from using a poverty line based on a consumption basket for the rural and the urban poor separately with patterns that correspond to a single poverty line based on a national basket for all the poor. The picture changes dramatically. Notably, under the rural-urban specific baskets, urban poverty exceeds rural poverty, while the reverse is true under the national basket. In other words, whereas poverty seems mainly an rural problem under a national poverty line, the topping up of the line for urban areas and the decrease for rural areas leads to a picture where poverty seems equally prevalent in cities.

For the case of Mozambique, the study by Tarp et al. (2002) addresses the same issue, namely the robustness of poverty patterns for the choice of the poverty line. Analyzing the data from a national budget survey, the authors distinguish 13 population groups by province and by urban-rural locality, each with their own minimum diet, their own minimum non-food budget and their own food prices. Contrary to expectations, it appears that the spatial poverty pattern are less robust than the patterns resulting from a single national basket. In particular, the association between poverty on the one hand and other provincial-level welfare indicators like child malnutrition and asset ownership on the other hand appears weak (Tarp, op. cit., Table 9). What is more, the correlation between the household poverty status and the presence of stunted children in the household comes out as significant when using a single national poverty line, but, surprisingly, it is zero when using a different line for each of the 13 population groups (Tarp, op. cit., Table 10).

A related issue concerns the use of provincial prices and unit values as an indicator of price differences in Mozambique. Here too the argument is that adding specificity to the poverty line might help to determine the poverty status of households more accurately. In particular, when a household in a high-cost economic environment (city) is at the edge of poverty at a certain expenditure level, a similar household at the same expenditure level could be non-poor in a low-cost environment (village). However, empirically, spatial price differentials as they are observed in the budget survey tend to be large and undependable. The differentials might reflect systematic measurement errors as well as a higher quality of the same products on urban markets and this may create a bias in the resulting poverty assessment. In a recent study, Maia and van den Berg (2010) argue that the huge price differentials that are said to exist between Maputo city and the rest of the country is likely to be the source of a gross overestimation of poverty in Maputo.

All this suggests that a certain specificity of the minimum consumption bundle and the associated prices may be preferable from a theoretical angel, but, empirically, it may come at a cost, namely a certain loss of consistency and robustness due to biases. Specifically, it may happen that the available data overestimate the urban-rural gap in the cost of attaining a certain living standard. There is a risk that households in the village are mistakenly classified as non-poor and, contrariwise, households in the city are mistakenly classified as poor. The evidence mentioned above for Indonesia and for Mozambique, inter alia, indicates that this rural-urban bias is far from imaginary and can be of great significance to the spatial dimension of poverty.

There are reasons to believe that, in the case of Mozambique, the use of locally observed consumption patterns and locally imputed prices may lead to an underestimation of rural poverty lines and an overestimation of urban lines (Van den Boom, 2011). Rural poverty lines may be too

low as a result of the fact that the consumed items in the observed bundles are not homogeneous and sometimes consist of several goods, like "other vegetables", "meat" and "fresh, refrigerated or frozen fish". Therefore, relatively low prices in rural areas may reflect not only supply-demand conditions, but also a relatively low quality. Contrariwise, to the extent that the higher prices in urban areas reflect higher quality, the urban food poverty lines might be too high.

The urban food poverty line might also be too high because the urban poor tend to consume more outdoor meals for which underreporting is more likely to happen, and which are not in the food basket. In the case of Mozambique such underreporting is indeed a major data issue and adjusting for this can have a large impact (see MPD-DNEAP, 2010, Section 10.6). For example, as shown in MPD-DNEAP (op. cit. Table 10-4) poverty headcounts change appreciably after a proportional inflation of the expenditures of the population groups with an apparent calorie deficit. Although this adjustment for the underreporting appears to have only a limited impact on the overall national poverty headcount –less than 3 per cent points− it has major consequences for the poverty headcount in Maputo City (in 2009: down from 36 to 22%) and in Maputo Province (in 2009: down from 63 to 31% in the urban part and down from 77 to 66% in the rural parts).

Another factor that comes into play is the non-food component of the poverty line. In the poverty assessment for Mozambique, this component has been estimated as the average non-food budget share of households whose total expenditure is close to the food poverty line. Because the non-food budget shares appear to be much higher in urban areas, this could amplify any initial urban bias in the food poverty lines.

More importantly, the foremost element that tends to create a bias in the empirical computation of a poverty line poverty is the fact that it is practically impossible to built-in various non-market items that are often crucial to the household living standard. Examples are the availability and the use of public water taps, public transport, market infrastructures, schools and health facilities of good quality. Such commodities are consumed much more by the urban poor and clearly increase their living standard. Yet, they are not a significant part of the household expenditure profile. For non-market publicly provided goods, one major problem is the lack of standards to impute a value for the availability of certain physical and social infrastructures. Also the households' actual use of non-market goods is generally difficult to measure and difficult to price properly. For example, in Mozambique this "*consumption of commodities supplied by the public sector free of charge or the subsidized element in such commodities*" is recognized as a major omission from the consumption measure (MPF/IFPRI/PU, 2004, page 4). Clearly, this could create an additional bias and would warrant a mark-up of the consumption measure of the urban households or, equivalently, a lowering of the urban poverty line relative to the rural one.

In that regard, an empirical check of the extent to which the poverty status of a household, measured in terms of expenditure inadequacy, matches other relevant poverty indicators can be helpful.

Against the backdrop of the potential biases briefly discussed above, we proceed with a more in-depth investigation of the poverty patterns in Mozambique. In section 2 we provide a theoretical framework that can describes an upward bias of the urban poverty line and a downward bias of the rural poverty line. The urban bias may stem from an (unobserved) higher quality of the food consumption (section 2.1) and from an underreporting of consumption outside the household (section 2.2). The rural bias is caused by the relatively costly access to essential public goods and services (section 2.3).

In section 3 we discuss the data taken from three rounds of a recurring large-scale household survey (INE, 1998, 2004, 2010a). Based on existing poverty assessments, we reconstruct household expenditure from these data, apply alternative poverty lines, and discuss the striking differences.

Next, in the penultimate section, we confront the poverty status of the household with other dimensions of poverty. On this note, we can exploit a unique feature of the survey data, namely the inclusion of not only housing conditions and levels of education, but also child anthropometrics. This allows for various checks and balances of the standard of living and the extent of poverty in the various population groups. The main checks will consist of bi-variate correlations of poverty rankings in terms of consumption with poverty rankings in terms of child malnutrition and asset ownership. Also, results from a welfare-ratio regression model will be presented to explore the plausibility of the poverty pattern in Mozambique within a multivariate setting.

Section 5 summarizes and discusses the implication for the ongoing efforts to target the poor in Mozambique. We will assert that the impact of the upward (urban) and the downward (rural) bias described in section 2 might explain why the picture that emerges from a single national poverty line tends to outperform the picture obtained from using urban-rural lines, as documented in section 3 and 4. The results from a further adaptation of poverty lines over provinces and over time reinforces the conclusion that poverty patterns from context-specific poverty lines tend to pick up less of the differences in living standards in the population.

2. Upward and downward bias of the poverty line

In this section we follow the conventional definition of the poverty line as the cost-of-basic-needs, i.e. the monetary value of a consumption bundle that corresponds to a certain minimum standard of living. The minimum living standard is common to all households, but the poverty line need not be because the price of basic needs is not the same for all, while the composition of a minimum bundle to reach the standard is in principle household-specific. In that regard it may be noted that, due to theoretically admissible variation of preferences, a household might attain the minimum living standard at a bundle which is quite different from the minimum bundle of another household with similar observed characteristics. On theoretical grounds, one cannot preclude a certain disparity of preferences that remains unobserved and that jeopardizes the guarantee that a bundle that is adequate for one household is automatically adequate for households that seem very similar. Nonetheless, assuming a certain degree of commonality between households, it is possible to empirically approximate the cost-of-basic-needs with some confidence. In doing so one has to take on board certain limitations that are inherent in household surveys and that may cause a sizeable and systematic bias.

2.1 Upward bias of urban poverty: higher quality of the food

Food is by far the main component of the poverty line, comprising more than two thirds of the total expenditure by poor households in Mozambique. A food basket that generates sufficient energy for a healthy and active life is often the basis to set a poverty line. If the energy contents of the food were the only thing that matters to the poor, the poverty line could simply be computed as the cost of the cheapest source of calories to reach, say, 2000 Kcal per capita per day. Clearly, such a single product diet cannot be a diet that provides for a healthy and active life and, hence, a minimum food basket will consist of a variety of food items, mixing cheap sources of calories with more expensive ones.

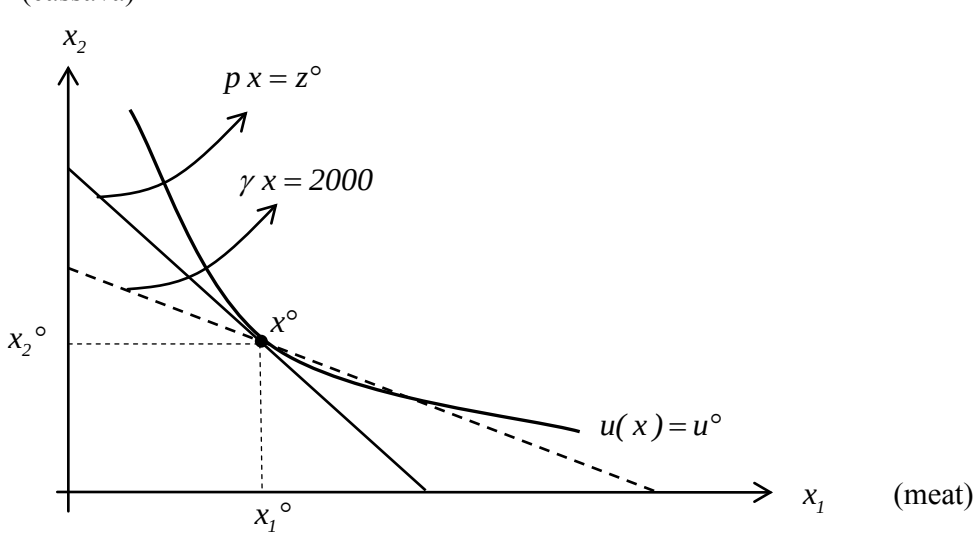
The choice for a balanced diet is depicted in Diagram 1. The first panel of the diagram describes consumption by a poor household that has an income z° corresponding to a given diet $x^\circ = (x_1^\circ, x_2^\circ)$ to reach a certain minimum living standard u°. The household preferences are assumed to possess the standard property that the rate of substitution of one good for another good increases along indifference curves. It is further assumed that the minimum diet satisfies the energy requirement $\gamma x^\circ = 2000$, where $\gamma = (\gamma_1, \gamma_2)$ denotes the energy contents of one unit of each food item and γx° is the in-product of the two vectors. The household can buy at prices

(p_1, p_2), where the food on the x-axis provides relative expensive calories. The latter is reflected in the budget line having a steeper slope than the iso-calorie line: $\frac{p_1}{p_2} > \frac{\gamma_1}{\gamma_2}$.

The optimal consumption is reached in the point where the budget line is tangent to the indifference curve. In Panel A of the diagram, this point is x° with utility $u(x) = u^\circ$ and an exact match to the 2000-norm for energy requirements[2]. By way of a numerical illustration, we use plain figures and let the household spend its income in equal proportion over x_1° (meat) and x_2° (cassava), with quantities $x_1^\circ = x_2^\circ = 1$ at prices per unit $p_1 = p_2 = 1$. Finally, as indicated, the food differs in caloric contents and we let one unit of the expensive source of calories contain $\gamma_1 = 750$ Kcal while $\gamma_2 = 1250$ for the cheap source.

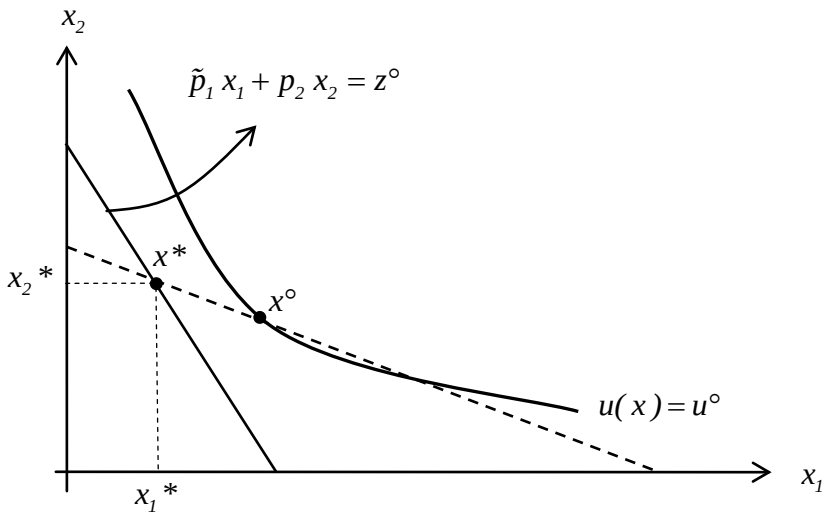
Diagram 1: Biased food poverty line under differential calorie prices and quality of the diet

A. Budget, calorie requirement, basic diet and indifference curves

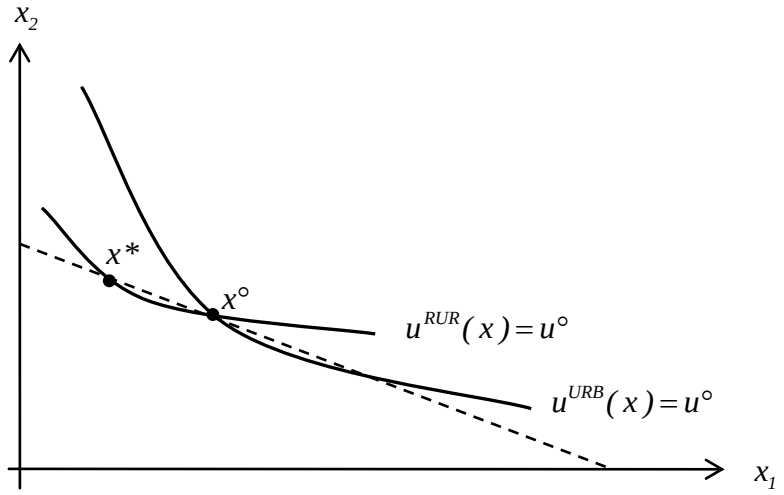


[2] One may note that, under other indifference curves, the optimum can lie to the left or to the right of x°. A household with a particular taste for cassava might choose a point on the budget line to the left with energy contents above requirements 2000. Conversely, a taste for wheat could lead to a point below requirements.

B. Falling in poverty after a price increase ($\tilde{p}_1 >> p_1$) with decreasing quality of the diet



C. Rural taste for relatively cheap food versus urban taste for relatively expensive food?



The (food) poverty line of the household in panel A equals $z° = p\,x° = 2$. In Panel B of the diagram, we describe the effect that a price increase of meat would have on the household. In the example, we take a price increase of 40% ($\tilde{p}_1 = 1.4 * p_1$) and, at an income that stays put, the household has no other option than to adjust its diet and replace meat for cassava. In the new point, $x_1 * = 0.5$ and $x_2 * = 1.3$ which means that the household halved its consumption of meat as compared to the original consumption $x_1 ° = 1$, whereas it increases its cassava consumption

by 30%. Note that this shift to cheaper calories has enabled the household to still satisfy its caloric requirements of 2000 Kcal[3].

In spite of its ability to cope with the price increase of the preferred food, one should keep in mind that the household was assumed to be at the edge of poverty before the price increase with meat and cassava consumed in equal proportions at x° (Panel A). Therefore, the price-induced shift to less nutritious cassava must imply a lower utility level: $u(x^*) < u(x^\circ)$. This is clear from Panel B and, hence, one can conclude that the household has fallen into poverty. Even though the total amount of calories has remained similar, the quality of the new diet x^* has fallen below the minimum quality x° that was considered healthy in the first place. Those who can afford it will tend to move to the right on the calorie-line $\gamma x = 2000$, while the poorer households are forced to move to the left and substitute cheap for expensive calories.

The argument can be extended to describe a potential upward urban bias involved in the use of context-specific diets as the basis for computing the minimum cost of living. Suppose that the point x° is taken as the minimum food bundle for the urban poor, while the point x^* would describe the critical diet of the rural poor who have a subsistence diet of their own, with fewer calories from more expensive foods. As illustrated by the indifference curves $u^{URB}(x) = u^\circ$ $u^{RUR}(x) = u^\circ$ in Panel C of the diagram, in either case, the diet could correspond to the same minimum standard of living u°. Yet, the figure also shows that this can only happen when the indifference curve of the rural poor are very flat, reflecting a high propensity to consume cassava, while those of the urban poor must be steep with a taste for meat (as depicted in the panels A and B).

Although, theoretically, it might indeed be possible to construct preference orderings that have a rural-urban gradient by which rural households would prefer their own 2000 Kcal diet above the urban diet (as is the case in Panel C above), in practice it would seem somewhat synthetic. In that regard the observation in the seminal paper on the topic is worth noting: "*we would be surprised if most Indonesians did not choose the urban bundle*" (Ravallion and Bidani, 1994). The diet in urban areas tends to be more balanced and of a higher quality.

In general, a similar reasoning applies when poverty comparisons are made among population groups in different parts of a country and of different backgrounds. The differences in preferences among population groups are probably less pronounced than the observed differences in their diets. In other words, the observed diets of the poor might well reflect a coping

[3] Again, depending of the curvature of the indifference curves, the optimal consumption after the price increase might be a little left or a little right of x^*, see previous footnote.

mechanism under harsh conditions and low living standards (see panel B above), rather than a particular taste by which a given minimum living standard can be reached with a diet of substandard quality (see panel C).

In the same way, poverty comparison over time requires cautious interpretation. In the graph with the intersecting indifference curves (Panel C), one might interpret the utility function of the two poor households (URB and RUR) at a given point in time as the utility function of a single poor household in two different time periods, with the household developing a taste for relative cheap food as it is forced to move from x° to x^{*} on the iso-calorie line (here in response to a price increase of meat). Given the decrease of the quality that comes with this adjustment, such a change of preferences is highly unlikely. In other words, when dietary changes among the poor are mistakenly attributed to a change of their preferences, poverty might appear rather inelastic to price changes.

In the stylized example, the 40% increase in the price of meat resulted in a halving of the meat consumption by the poor and a simultaneous substitution of meat for less nutritious cassava. Both before and after the price increase, the poor are able to meet their energy requirements (Panel B, points x^{*} and x° respectively). Yet, the new diet has a lower quality and such a worsening of the diet of the poor can be of major concern. In the case of Mozambique, the recent food riots in Maputo in response to the surge of the price of bread provides just one instance.

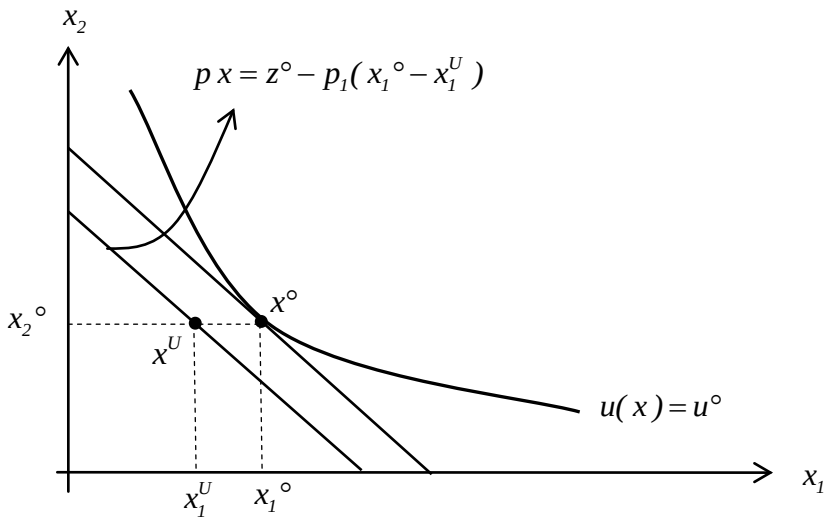
2.2 Upward bias of urban poverty: underreporting of outside consumption

When analyzing household expenditure surveys one should be aware that the data might reflect certain systematic measurement errors in the food consumption. Specifically, looking at the calorie contents of the reported food consumption, underreporting is a common phenomenon, even in surveys with a particular nutritional focus. For example Mchiza et al. (2010) find that 26% in a sample of 200 women from Cape Town reported an energy intake below a threshold of 1.05 of their basic-metabolic-rate. Underreporting is often more elevated in urban areas, where it is more habitual to consume part of the food outside the household. The food consumed by household members while commuting to and from a job is difficult to track. By the same token, the underreporting of consumption from school feeding might be a source of bias, which, for the case of Mozambique concerns around 6% of the children attending primary education (Danhoundo and Tsutsui, 2009).

If such underreporting of consumption is unusual in some and more usual in other parts of the population, the use of a poverty line (like z° in Panel A of Diagram 1 above) tends to overestimate poverty in those population groups with the highest underreporting. This bias is

illustrated in Diagram 2, where for simplicity it is assumed that the bias only applies to the food that is relatively expensive, i.e. to x_1. As before, the point x° denotes the minimum food consumption of the poor. Now suppose that, in urban areas, there is an underreporting in the consumption of the first good, meaning that the *observed* consumption of the urban poor, denoted x_1^U, is less than their *actual* consumption, denoted x_1°. In effect, when $x_1^U < x_1^\circ$, poverty patterns based on observed consumption will tend to show an urban bias. In other words, in the presence of systematic underreporting, the urban poverty line z° would need to be scaled down.

Diagram 2: Biased poverty line under underreporting of expenses on outside (relative costly) food



One may note that the same argument holds for systematic under- or over-reporting of any consumption good in the sense that under-reporting requires downward adjustment of the poverty line and over-reporting requires upward adjustment.

2.3 Downward bias of rural poverty: costly access to basic services

Food and many other goods and services can be bought on markets, but for certain basic services such as the access and provision of a health and education services, electricity and drinking water this is often practically impossible. Such services constitute an essential part of the standard of living of the poor, yet the use is rationed. The quantity of this part of consumption is difficult to measure, while the price is even more difficult to impute. In fact, as mentioned in the introduction, the survey data for Mozambique preclude the full inclusion of this component in the poverty line.

The basic (non-market) services form a major aspect of the multidimensionality of poverty. For example, the Millennium Development Goals (MDGs) includes targets for schooling, for child nutrition and for maternal health. Yet, in the consumption poverty literature the topic seems underrated, possibly because of the empirical problems to incorporate this element in the poverty line[4]. Indeed, as is common in budget surveys, the coverage of non-market consumption in the Mozambican survey is limited. This adds to the inherent problem of imputation and makes it practically impossible to estimate the value of the access and use of, for example, water taps, public transport, markets, schools and health facilities. Moreover, many public goods and services are hardly available and scarcely used in rural areas, while the use in urban areas is only partly observed and against user prices that are often only a fraction of the full cost.

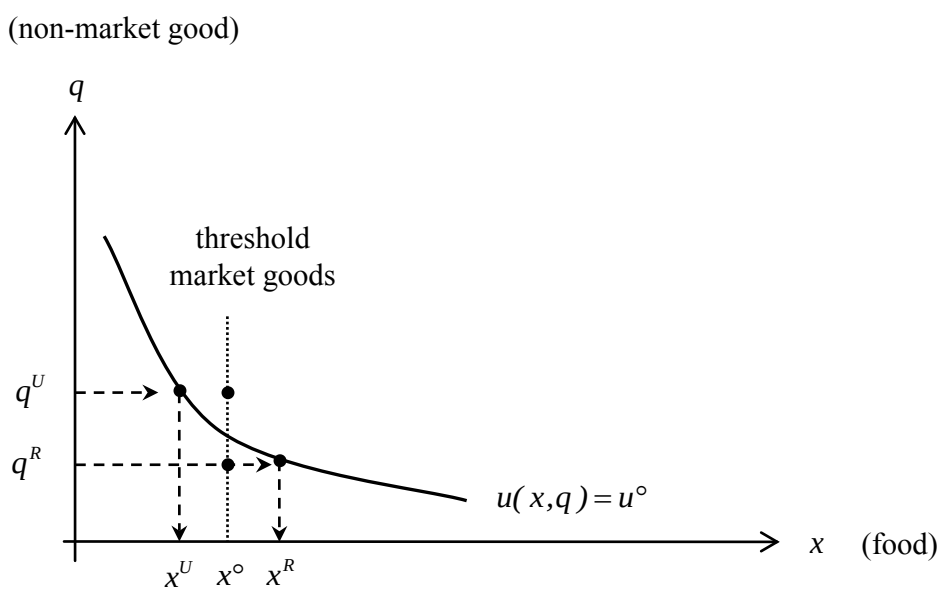
The problems involved in the valuation of non-market goods leave unaffected the importance of this consumption category for the living standard and for poverty comparisons. This is illustrated in Diagram 3, which as before describes a stylized situation with simple numbers. The diagram describes the trade-off between consumption of market goods x (food) and non-market goods q (vaccination) for poor households. A household lives in either of two environments, the city or the village. For the urban household the provision of the non-market good, for example, the level of vaccination, is higher than in the village where household members are vaccinated less $q^U > q^R$. In the diagram, the provision of the non-market good is twice as high in urban areas.

The two poor households, or, for that matter, the same household living in the rural area or moving to the city, have an indifference curve $u(x,q) = u^\circ$ that consists of combinations of market and non-market consumption that give a similar minimum standard of living. The curvature reflects the increasing rate of substitution of market for non-market goods as the provision of non-market goods diminishes.

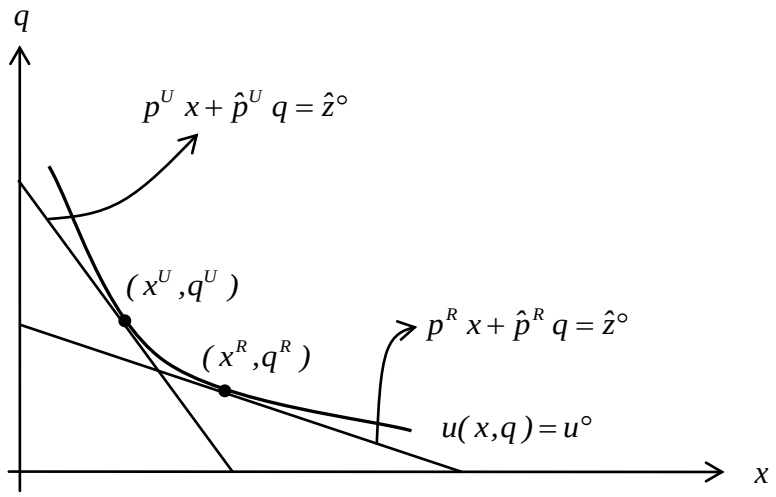
[4] Hentschel and Lanjouw (2000) is one of the few papers that include basic services in household expenditures. Using survey data from Ecuador, they adjust water and electricity expenses using imputed prices and imputed consumption levels and find a large effect on the poverty incidence. The extreme poverty rate drops by almost 20 per cent points (op. cit. Table 3), an effect that is largely due to a lowering of urban poverty.

Diagram 3: Biased poverty line under rationed / non-market consumption

A. Urban-rural bias when the poverty line is based on a threshold for market goods



B. Implicit pricing of rationed / non-market good



The households in the diagram are rationed with respect to their non-market consumption at levels (q^U, q^R). Given these rations, the minimum food consumption of the two households follows from solving $u(x,q^U)=u^\circ$ and $u(x,q^R)=u^\circ$ for the urban and the urban poor, respectively. In the example, this implies that the rural poor require more food than the urban poor to reach the minimum living standard. The extra food is required to compensate for the lower level of vaccination.

To see what consequences this may have, let us suppose that the level of vaccination is twice as high in urban areas, but, at the same time, urban food prices are twice as high: $(q^U, q^R) = (1, \frac{1}{2})$ and $(p^U, p^R) = (2,1)$. If the poverty line is based on a single threshold x° for food consumption then an urban bias emerges. For later reference we normalize at $x^\circ = 1.5$. As illustrated in Panel A, we see that the poverty line $z^U = p^U x^\circ = 3$ for the urban poor enables them to attain minimum living standard u° at (x^U, q^U). What is more, they can even go beyond the minimum at (x°, q^U). Contrariwise, applying the rural poverty line of $z^R = p^R x^\circ = 1.5$, the rural poor are unable to attain the minimum u°. Although they can buy the same food, they can only attain the point (x°, q^R), yielding a utility below the minimum u°. In other words, because the urban-rural poverty line does not account for the rationing of non-market goods, it will underestimate rural poverty and overestimate poverty in urban area: $u(x^\circ, q^R) < u^\circ < u(x^\circ, q^U)$.

Another way to look at the issue of non-market goods and the substitution between market and non-market rationed goods is to look at the implicit pricing of the latter. Such implicit prices are illustrated in Panel B of the diagram above. The important thing to observe is that the tangent to the indifference curve of a household at the edge of poverty reflects the price ratio that the poor attach to the two types of consumption.

The two tangents can be interpreted as the respective budget constraint that corresponds to a "full-expenditure" poverty line with an implicit valuation of non-market goods[5]. For proper valuations and poverty comparisons, this full-expenditure would be a better measure of welfare than the market expenses alone. Therefore, the full-expenditure poverty line for the rural poor may be expected to be similar to the full-expenditure threshold for urban poverty. Even more, for commonly used forms such as the class of homothetic utility functions, the full-expenditure poverty line can be shown to be the same for all points along the indifference curve $u(x,q) = u^\circ$.

This situation is depicted in Panel B, where the full-expenditure poverty line equals $\hat{z}^\circ$. It is composed of a part that covers for the minimum consumption of market goods and an imputed part that represents the valuation of non-market goods, where, as before, urban food is twice as expensive as rural food and vaccination levels of the rural poor is only half of that of the urban poor: $(p^U, p^R) = (2,1)$ and $(q^U, q^R) = (1, \frac{1}{2})$. To illustrate the consequences, consider a Cobb-Douglas utility function $u(x,q) = x^\beta q^{1-\beta}$ with $\beta = \frac{1}{2}$ and take $u^\circ = 4$ as the minimum standard

[5] The "full-expenditure" concept that we use here follows the concept of full income that was introduced by Becker (1965) to incorporate the (implicit) value of non-market activities and goods in the household budget.

of living. Then, the full-expenditure poverty line will equal $\hat{z}^{\circ} = 4$ and the implicit price of vaccination will be $(\hat{p}^U, \hat{p}^R) = (2,4)$ in the city and in the village, respectively[6]. Hence, the village environment is characterized by a low food price and a high price for non-market consumption, while the opposite holds in the city. The corresponding minimum consumption in urban areas is $(x^U, q^U) = (1,1)$, while rural poverty is characterized by consumption levels below the minimum requirements $(x^R, q^R) = (2, \frac{1}{2})$.

Logically, the full-expenditure poverty line will exceed the poverty line based on market goods alone. The size of the gap is though quite different in the city as compared to the village. For example, in a setting with relative expensive food in urban areas and relative costly health services like vaccination in rural areas, the topping up of the poverty line is much higher in rural areas than in urban areas. In the numerical example, the major increase from $z^R = 1.5$ to $\hat{z}^{\circ} = 4$ for a rural household compares to a relatively small increase from $z^U = 3$ to $\hat{z}^{\circ} = 4$ in the urban setting

These numerical results are admittedly stylized. They assume that market goods like food are twice as costly in cities and non-market goods like vaccination are twice as costly in villages. Yet, in the case of Mozambique, this might not be too far from reality. For example, the cost of a calorie ranges between less than 2 MT in rural areas in the northern provinces to more than 5 MT in the southern cities (Maia and Van den Berg, 2010; MPD-DNEAP, 2010). Moreover, where a health facility is generally nearby in the cities, in rural Mozambique, where road infrastructure is underdeveloped and cars are rare, people must walk for miles to reach the nearest facility. Moreover, the absence of electricity raises the cost of critical health services such as sterilizing equipment and refrigeration of medicines and vaccines.

Hence, the outcomes may be illustrative to explore the bias of using a locality-specific poverty line when only market goods are accounted for in the budget equation. In particular, suppose that the targeting of households is based on an urban-rural poverty line that covers only market goods, in this case $z^R = 1.5$ and $z^U = 3$. All households that are given income support up to these levels can consume $x^{\circ} = 1.5$, both in the cities and in the village. Nevertheless, in line with the argument above about the benefits of living an urban environment, many urban dwellers who would be eligible to income support are in fact non-poor, namely those with an income between $2 \leq z < 3$. These households would be able to reach the minimum living standard u° on

[6] The prices of the market good is given, the implicit prices of the non-market goods follow the rate of substitution in the two respective points and the full-expenditure poverty line results ue to homogeneity of the utility function (see Appendix).

their own, without support. Contrariwise, the rural poor are deemed to remain poor at a living standard below u°, even those who are eligible to income support according to the rural poverty line. As long as the rural-urban gap in the provision of non-market goods prevails, the rural poor would require additional income support in order to escape from poverty, namely up to $z = 2$.

It is interesting to note how the use of a single national poverty line may lead to a much more effective targeting of the poor. In terms of the numerical example, one could opt for a poverty line based on average prices. Using a population weight of two-thirds for rural areas would lead to $p^\circ = \frac{2}{3} p^R + \frac{1}{3} p^U = \frac{4}{3}$, with an associated national poverty line $z^\circ = p^\circ x^\circ = 2$ for all. It then happens that the targeting of the poor becomes fully effective in the sense that all eligible households cannot reach the minimum living standard on their own and the support is exactly sufficient. At this level of income support to every household, the urban poor can buy only $x^U = 1$ while the rural poor can buy more at $x^R = 2$, but have to deal with a gross under-provision of non-market goods and services. Of course this 100% effectiveness of the targeting under the national poverty line is an artifact of the numbers that appear in the example. Yet, it illustrates how an averaged-out poverty line can be a helpful targeting device if the use of context-specificity is plagued by systematic biases.

In the example, neither in the village nor in the city households can change the ration of the non-market good. In other words, substitution is impossible. Still, Panel B is also illustrative for the case that markets would exsis for both goods. If the non-market good on the y-axis is interpreted as non-food, the two budget lines can be interpreted as the true budget lines of a poor household in a urban and a rural environment. It then reflects a situation of relatively cheap food and expensive non-food in rural area and relatively expensive food and cheap non-food on urban markets.

3. Poverty line and poverty patterns in Mozambique

The review of the evidence in the introduction and the theoretical underpinning in the previous section have indicated that the construction of a poverty line from a budget survey requires a careful empirical appraisal. The evidence suggests that the poverty pattern will in general be highly responsive to the poverty line methodology, while theory further suggests that expenditure data are predictably limited and unable to fully reflect the true living standard.

This certainly holds true in the case of Mozambique. Official poverty patterns have been criticized for a certain incongruence with economic growth figures and for rankings and re-rankings at provincial level which are difficult to explain (Van den Boom, 2011; Alfani et al, 2012). In addition, it has been observed that the poverty status of the household shows a worryingly low correlation with other indicators of poverty.

3.1 Survey expenditure data and poverty line

We use data from three rounds of the household survey in Mozambique to explore the alternatives and refer to INE (1998, 2004, 2010a) for a detailed description of the survey. In Table 1 we list the mean of the key variables used to compute the household poverty status in the three survey years.

Table 1: Expenditure, food share, calories, calorie requirements in Mozambique 1997, 2003, 2009 (population-weighted averages[7])

	1997	2003	2009
expenditure per caput per day (MZN)	5.41	10.97	23.81
food share in total consumption	0.68	0.61	0.63
total Kcal per caput per day	1,903	1,705	1,704
required Kcal per caput per day *	2,154	2,132	2,113
household size	4.85	4.81	4.69
household adult equivalent scale	0.72	0.71	0.70
sample size (number of households)	8,239	8,678	10,754

Source: INE (1998, 2004, 2010a,b); MPF/UEM/IFPRI (1998); MPF/IFPRI/PU (2004); MPD-DNEAP (2010).
* Based on a requirement of 3,000 Kcal for a 18 to 35 years old male, the adult equivalent scale (James and Schofield, 1990).

[7] The survey employs a stratified sampling, defining a stratum for each province and, within each province, a rural and an urban stratum (Cavero, 1998). The use of population weights from the 1997 and 2007 Census (INE, 2010b) then ensures that the sample averages are passable indications of the true average in the respective population groups. Consequently one may say that, in each survey year, the total sample is representative of Mozambique, the rural sample is representative of rural Mozambique and so on.

In view of the predominance of food, which accounts for over 60 per cent of expenditure for an average Mozambican household and much more for the poor, it is customary to base a poverty line on a food poverty line, i.e. on the level of expenditure that a household needs to meet the food and calorie requirements of its members. Because food consumption baskets in the country are quite different and also the price of a given food item differs at different locations, the cost of a calorie varies widely.

The problem of finding a diet which is considered sufficiently balanced for the poor and corresponding reliable prices is not an easy task, especially because a single-product diet consisting of the cheapest source of calories available is not an option and also because large scale survey data have certain relevant limitations. For example, in the case of Mozambique, using the data of Table 1, one can compute the implicit price that households pay for a calorie[8]. It appears that this price shows an unrealistically high variation and an unrealistic spatial pattern, which has also been documented by Maia and Van den Berg (2010). For instance, grouping the population in accordance with the implicit price paid for a calorie, it appears that those in the cheapest decile pay only 12 per cent of those in the most expensive decile in 1997, a percentage which increases gradually to 18 and 24 percent for the two subsequent survey years. Similarly large price variations reappear in rural and urban population groups and also at the level of provinces. As regards the spatial patterns, the (implicit) price of a calorie is much lower in rural areas, on average some 30 per cent in 1997 and 2007 and, notably, rural calories are almost 50 per cent cheaper in 2003. Surprisingly, however, in some years and in some provinces, calories are more expensive in rural areas. The median calorie price in rural areas of Zambezia, Inhambane and Gaza exceeds the urban price in 1997, while the same happens in 2009 in Tete and Inhambane.

Another limitation of the data concerns the calories themselves. For a considerable part of the sample the calorie estimates are unrealistic from a nutritional point of view. For example, according to the 2003 and the 2009 estimates, 30 per cent of the population of Mozambique consumes less than half of their energy requirements, levels which are insufficient for survival (WHO, 1985). With an additional 10 per cent of the population with less than half of their requirements, the calorie-estimates for 1997 are even less realistic.

As we indicated in the previous section, such data limitations may wreak havoc with the empirical computation of a relevant poverty line. Ideally, the poverty line should take on board the higher quality of urban food, the systematic underreporting of urban consumption and the (prohibitive) cost of access to essential non-market goods in rural areas. To explore the issue and

[8] The results of these computations are available from the authors.

illustrate the sensitivity of rural-urban and provincial poverty patterns to the poverty line, in Table 2 we give the poverty line in accordance to different levels of disaggregation. We compute of a single national line, two separate lines for urban and rural localities and 11 separate lines by province. We also employ the poverty line for each of the 13 spatial domains that have been used in the national poverty assessments and which combine provinces and rural-urban localities (see Panel D of Table 2b below)[9]. The latter allows a direct comparison of our results with the official poverty patterns that emerge from a spatial poverty line that entails time-flexible food bundles with entropy correction (MPD-DNEAP, 2010; Arndt and Simler, 2010).

Table 2a: Characteristics of subsample (population-weighted averages)

	1997	2003	2009
number of households in sub-sample*	2,222	2,563	3,131
sub-sample expenditure per caput per day (MZN)	3.29	5.67	12.88
sub-sample food share	0.76	0.71	0.74
sub-sample Kcal per caput per day	1,308	1,460	1,464
sub-sample required Kcal per caput per day	2,125	2,090	2,072
cost of a Kcal** (MZN per Kcal)	1.89	2.82	6.41

* The sub-samples are constructed by exclusion of those in the highest quintile of per capita (food) expenditure, those in the lowest quintiles with respect to food share and those in the lowest and in the highest calorie-bracket.
** Median of the food expenditure per Kcal in the respective sub-sample[10].

[9] In addition, 21 poverty lines have been computed, one for every province and rural-urban locality. The results will not be reported separately, because of a very high resemblance with the results obtained from the 13 spatial domains. In fact, each spatial domain is an aggregate of rural-urban localities in one or two provinces.

[10] The calorie price is slightly adapted for the purpose of consistency with the official average poverty line of 5.34, 8.47 and 18.41 MZN in the respective survey years (MPD-DNEAP, 2010).

Table 2b: Poverty lines for Mozambique 1997, 2003, 2009, based on a typical sub-sample (population-weighted averages)

A National poverty line	1997	2003	2009
Food poverty line (MZN per caput per day)	4.08	6.02	13.55
Poverty line, including non-food (MZN)	5.34	8.47	18.41
B Rural-urban poverty line			
Rural poverty line	5.01	7.64	16.94
Urban poverty line	6.58	10.23	21.76
C Provincial poverty line			
Niassa	3.09	7.64	20.11
Cabo Delgado	4.72	7.51	18.22
Nampula	3.13	6.04	14.59
Zambezia	5.37	6.33	12.54
Tete	5.38	8.01	22.92
Manica	5.41	10.11	20.99
Sofala	6.04	7.49	18.56
Inhambane	6.06	6.74	16.81
Gaza	6.18	11.07	19.54
Maputo provincial	8.03	15.89	27.22
Cidade de Maputo	8.75	17.72	30.64
D Spatial domain poverty line			
Niassa & Cabo Delgado (rural)	4.02	7.10	15.95
Niassa & Cabo Delgado (urban)	5.43	10.23	18.91
Nampula (rural)	3.36	5.97	14.33
Nampula (urban)	4.95	6.66	16.72
Sofala & Zambezia (rural)	4.85	5.47	14.35
Sofala & Zambezia (urban)	7.60	8.77	19.07
Manica & Tete (rural)	4.71	6.93	19.39
Manica & Tete (urban)	7.41	9.69	21.47
Gaza & Inhambane (rural)	6.43	9.01	18.37
Gaza & Inhambane (urban)	7.83	10.72	20.31
Maputo provincial (rural)	7.32	16.76	24.84
Maputo provincial (urban)	8.71	18.30	30.86
Cidade de Maputo	8.54	19.52	33.14

Source: Panel A, B and C from own computations based on Table 1; Panel D from MPF/IFPRI/PU (2004) and MPD-DNEAP (2010).

The cost of a calorie can be computed as the ratio of food expenditure over calories. For each survey year, we computed this cost for a typical (poor) household, excluding households in the highest population quintile in terms of food expenditure or in terms of total expenditure, and households in the two lowest quintiles in terms of their food share in total consumption[11]. Moreover, in avoidance of the aforementioned volatility of the calorie and implicit price data, we exclude households in the highest and in the lowest population quintiles in terms of calories. From this we compute a national food poverty line as the median price of a calorie in this sub-sample of households and in the respective years, multiplied by the caloric requirements of the

[11] Several cut-off procedures exist to define the cost of a calorie relevant for the poor (Ravallion, 1998; MPD-DNEAP, 2010). The exclusion of data from the lowest and in the highest calorie-bracket is a common procedure (for an application in Mozambique, see Garrett and Ruel, 1999).

household with correction for adult equivalent scales. As regards the basic needs in terms of non-food items we simply use the respective food shares in the same sub-sample.

The resulting figures are given in Table 2a and show that the sub-samples comprises about one third of the entire sample. As expected, the households in the sub-samples are characterized by expenditure and calorie levels far below the average. Notably, their total expenditure is below the food poverty line. For such households one may argue that non-food expenditure reflects the basic non-food needs of the poor in the sense that non-food competes directly with basic food requirements or, at least, non-food is at the expense of the quality of the food consumed (MPF/IFPRI/PU, 2004). Therefore the non-food share in the sub-sample can be considered a suitable choice to top-up the food poverty line.

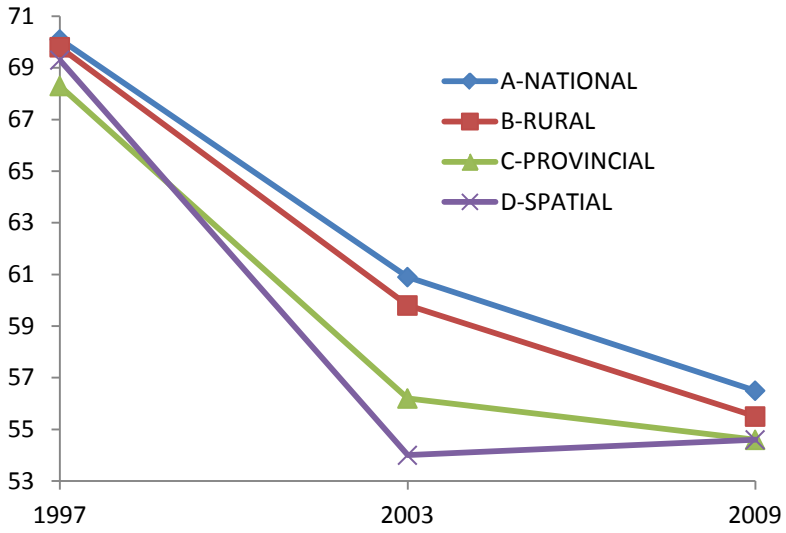
The national poverty line computed in this manner is given in the first part of Table 2b (part A). The line can be made context-specific by simply disaggregating the figures of Table 2a. This is done for rural-urban sub-samples in part B of Table 2b and for provincial sub-samples in part C. Finally, the official poverty line which employs 13 spatial domains is given in part D.

3.2 Implied poverty patterns

A household is considered poor if its per caput expenditure per day is below the respective poverty line of Panel A, B, C and D. Accordingly, four alternative poverty patterns in Mozambique emerge. As will become clear below, the picture is highly responsive to the choice for a particular poverty line. In the remainder of this section, we will probe into this sensitivity and discuss which picture is commendable on empirical grounds, by looking at the dynamics, at the urban-rural dimension and at provincial disparities. In the next section, we will advance this investigation further by looking at child nutritional status and other poverty correlates.

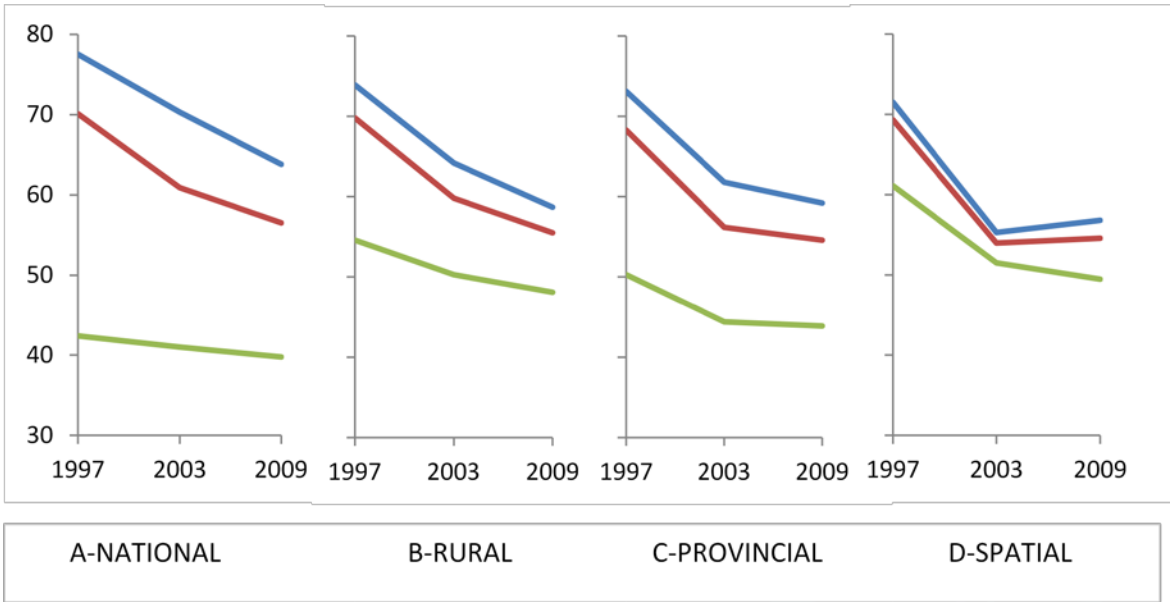
The evolution of poverty during the two six-year periods between the three consecutive surveys provides a first indication of the sensitivity of the poverty patterns to the poverty line.

Diagram 4: Evolution of poverty in Mozambique, 1997, 2003 and 2009, under alternative poverty lines (headcount, % of total population)



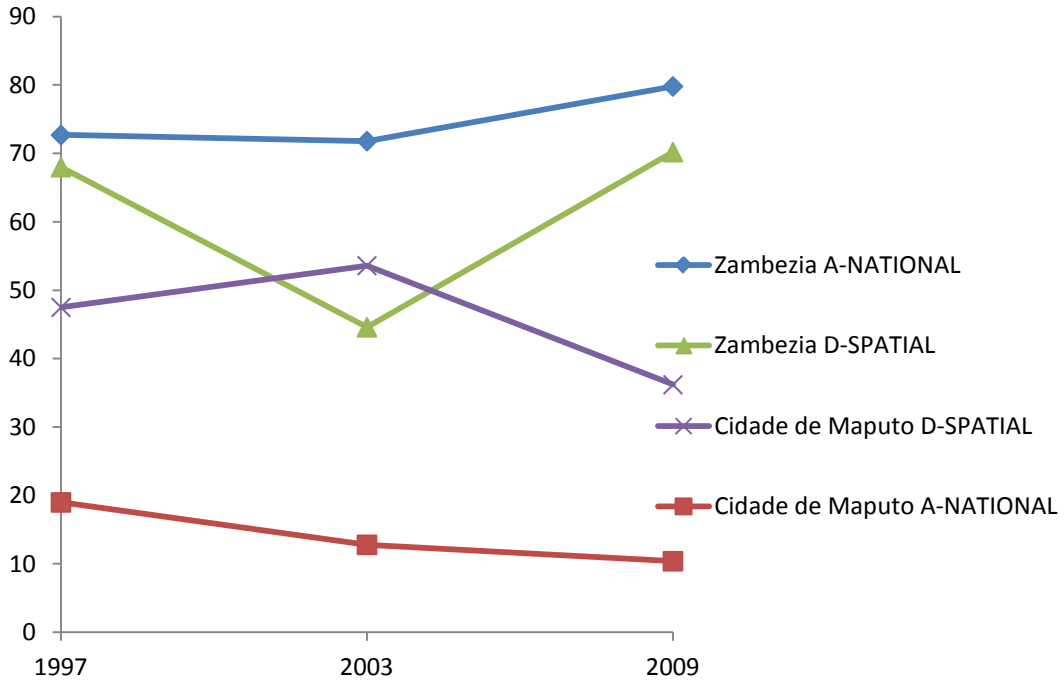
Considering the picture at some more detail, the rural-urban dimension is another poverty dimension of particular interest in the case of Mozambique.

Diagram 5: Evolution of rural and urban poverty, 1997, 2003 and 2009, under alternative poverty lines (top-line = rural poverty; bottom-line = urban poverty; mid-line = national average of Diagram 4)



Finally, another illustration of striking changes of the picture, both in terms of poverty levels and in terms of poverty dynamics, comes out by comparing the populated province of Zambezia (around 20% of the total population) with the capital Maputo (almost 6% of the population).

Diagram 6: Poverty in Zambezia and Maputo City, 1997, 2003 and 2009, under alternative poverty lines



As we will document below, the three Diagrams show a certain loss of consistency as one moves from the national to the context-specific poverty line.

3.3 Loss of consistency of context-specific poverty lines

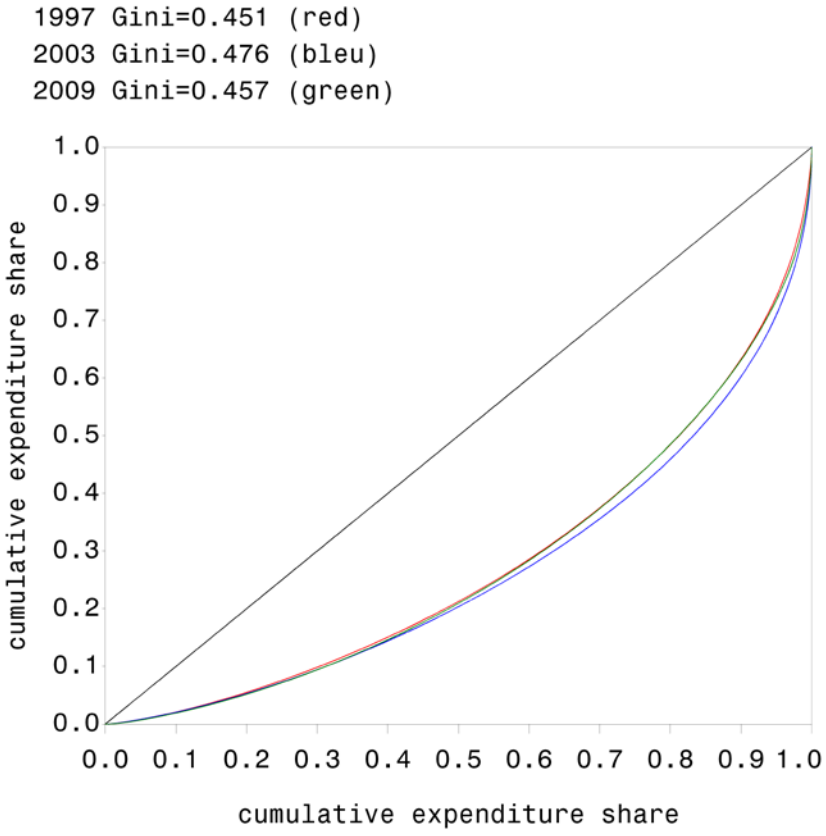
The Diagrams show that, for the case of Mozambique, a change of the poverty line can lead to a striking change in the poverty pattern. This raises the question which poverty line would best represent the actual poverty situation. From the comparison of results of applying the national poverty line (A) with those from the rural-urban line (B), the provincial line (C) and the spatial domain line (D), a certain loss of consistency emerges along the way. The loss appears both in the dynamic picture, in the urban-rural dimension and is also reflected in the provincial disparities.

For example, consider the national trend illustrated in Diagram 4. The dynamics of poverty reduction according to the national poverty line (A-line) is most consistent with sustained economic growth in the country. The poverty reduction of 9 per cent points in the first period from 1997 to 2003 is less sharp than for the other trends (for example, 15 per cent points under the spatial domain poverty line D), while in the recent period from 2003 to 2009 poverty continued to decline with 4 per cent points, although at a slower pace (as compared to a complete standstill for the D-line). In view of a sustained annual economic growth above 5% (World Bank, 2012) and because there is little evidence of a dramatic change of the income distribution (James et al., 2005) a continual poverty reduction seems more plausible.

It is important to note that a further analysis of household expenditure data from Table 1 support the idea that Mozambique enjoyed economic growth under an income distribution that has remained more or less stable. For example, if we deflate the expenditure with the Consumer Price Index, as reported in World Bank (2012), the mean expenditure per caput per day rose from 11.10 in 1997 to 13.24 in 2003 and 17.07 in 2009, all expressed in MZN 2006. This corresponds to a 3.0% annual expenditure growth in the period 1997-2003 and 4.3% between 2003 and 2009.

As regards the income distribution, the Gini-coefficient is the most common indicator. It is defined as the surface between the line reflecting full equality and the line that plots the cumulative expenditure share against the cumulative population share (Lorentz-curve).

Diagram 7: Lorenz curves and Gini-coefficients for Mozambique, 1997, 2003 and 2009



Source: Own computations based on data summarized in Table 1.

Diagram 7 shows that the inequality in the period 1997-2007 did not change much. A slight increase in the years up to 2003 was followed by a return to 1997 levels by the year 2009. Internationally, the inequality levels in Mozambique are in the mid-range, comparable to Côte d'Ivoire, the USA and China, for example.

Returning to the comparison of poverty patterns, in terms of the urban-rural dimension of poverty, the national poverty A-line in Diagram 5 also seems to concur best with disparities that prevail in Mozambique in the sense that the rural-urban gap is highest. Urban poverty falls gradually in contrast to an initial sharp decline followed by a much lower pace of urban poverty reduction for the B- C- and D-lines. By the same token, the A-line shows a picture of rural poverty reduction which took place in a non-dichotomous manner, as opposed to the D-line which suggests that rural poverty has increased in the recent period. Though there are warrantable concerns about rural productivity, especially among small-scale farmers (INE/TIA, 2009), while some authors even claim that poverty is not being reduced at all (Cunguara and Hanlon, 2010), there is evidence that poverty indicators in rural areas are improving, see also section 4 below.

It may be noted that, according to the official poverty patterns (D-line) the incidence of poverty in rural Mozambique is not greatly higher in comparison to urban areas. This is surprising in view of the fact that rural poverty in sub-Saharan Africa is usually about two or three times higher. For example, in Ghana rural poverty is 39% as compared to 11% in urban areas, in Uganda 34% compared to 14% and in Kenya 50% compared to 32%, see World Bank (2012). As can be seen from Diagram 4, for Mozambique, the D-line classifies some 50% of the urban population as poor in 2009 as compared to 57% of the rural population, while in 2003 this difference is even smaller: 52% poverty in urban areas and 55% in rural areas.

The dynamics at the provincial and spatial domain level confirm that there is a certain loss of consistency when going from the A-line to the D-line, or, to put it differently, a certain gain from using a national poverty line instead of a context-specific one. For example, comparing the A-line with the D-line, the amplitude of the excessive poverty swings in the province of Sofala is halved, while, in Zambezia, the swing up and down by more than 20 per cent points turns into a gradual deterioration. Furthermore, the position of Maputo City and Maputo Province as the parts of the country where the incidence of poverty is relatively lowest is most evident and most consistent over the years when the national poverty line is applied. This relatively favorable position of Maputo is confirmed in other studies. Tvedten et al. (2009) find child mortality rates in Maputo City to be less than half of those in rural areas and female literacy rates to be almost quadruple.

The poverty rankings over provinces and spatial domains seem to lose coherence when going from the national A-line to the regional B- C- and D-lines. For example, the D-line finds Sofala to be the poorest province in 1997 (head count 88%) and the least poor province in 2003 (36%). The poverty incidence in 2009 is found to be lowest in Niassa, Maputo City and Cabo Delgado (at 32, 36 and 37%, respectively), followed by Tete (42%) and Nampula (55%). The

position of Maputo is remarkable in the sense that poverty would be almost as high as in various other parts of the country, which seems at odds with the consistent top position of the capital elsewhere in Africa. Another point that is worth noting is the remarkable success of poverty reduction in Niassa. This success is confirmed by in all lines, but seems exaggerated by the D-line which positions Niassa above Maputo in the most recent 2009. Another striking figure concerns the impoverishment of Maputo City between 1997 and 2003 according to the C- and D-lines, during a period in which poverty decreased significantly in all other provinces.

4. Child malnutrition and other poverty correlates

In this section we consider the match between the poverty patterns in the previous section and the patterns that emerge from other poverty indicators. This is relevant for various reasons. Most importantly, the poverty line measures only one of the multiple dimensions of poverty. Other dimensions include malnutrition, education and asset ownership. Multidimensional poverty indices have been proposed that try to combine these aspects of poverty into one single measure (Alkire and Santos, 2010; UNDP, 2012). However, in view of the fact that different dimensions of poverty have causes and effects of their own, a single measure might be inadequate for poverty assessments. As an alternative, poverty assessments can focus on a set of measures, each measure describing one dimension with the ensemble of measures spanning the entire poverty profile (Ravallion, 2011).

In view of this, we proceed investigating the extent to which the poverty line assessment is able to capture the other dimensions. On this note, a unique feature of the survey data is of great significance, namely the inclusion of child anthropometrics, in addition to the more commonly collected information on housing conditions and levels of education. Hence the survey data allow for various checks and balances of the standard of living and the incidence of poverty in the various population groups. Our comparison of poverty patterns under alternative poverty lines will include bivariate correlations of the poverty status of households with indicators of child malnutrition and asset ownership. Furthermore, results from a welfare-ratio regression model will be presented to explore the alternative poverty patterns in a multivariate setting.

4.1 Nutritional status of children under five years of age

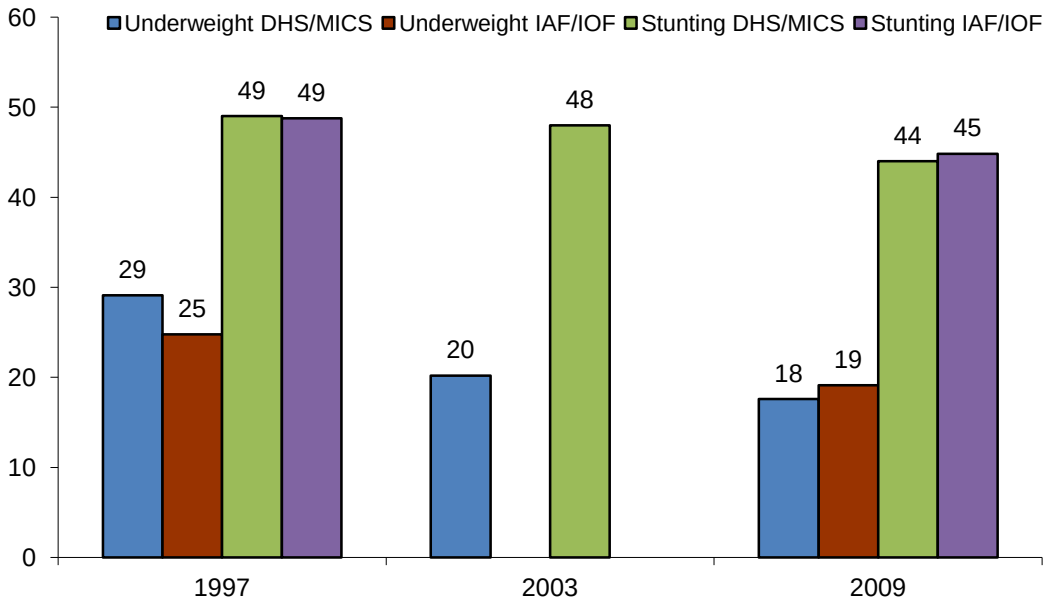
The alternative poverty patterns are remarkable when compared to other (non-monetary) MDG poverty indicators for which data have been collected in the household survey itself as well as in other surveys covering the same period. It will appear that the correlation of the poverty status of households in terms of expenditures decreases as one proceeds from applying the national poverty line to the rural-urban line and further to the provincial and spatial domain line.

In this regard the nutritional status of children under five years of age is a common measure of poverty, included in the MDGs. In the survey years 1997 and 2009, the height and the weight of all under-fives in the households have been measured. From these data and using child growth curves (WHO, 2007), we computed the Z-score indicators for child malnutrition[12]. In Diagram 8

[12] The Z-scores compares the nutritional status of a child with the average in a healthy population. If the score is two standard deviation below the average height-for-age, weight-for-age or weight-for-height, the child suffers from stunting, under-weight or wasting, respectively.

shows the associated prevalence of child malnutrition in terms of stunting and underweight. It also gives the corresponding figures taken from the DHS/MICS survey (INE, 1998b, 2004b; INE/UNICEF, 2009), a survey which was also implemented in 2003 when the IOF did not measure child anthropometrics. The latter survey is especially interesting for an evaluation of the nutritional status of children and poverty patterns in Mozambique, because, for the most part, the time frame overlaps with the household budget survey. In particular, putting side by side the malnutrition figures from the DHS1997 and the MICS2008 with similar figures collected in the IAF1997 and IOF2009, provides an immediate robustness check. Moreover, in the absence of child anthropometrics in the IOF2003, the use of the DHS2003 allows an analysis of child nutritional status between 1997 and 2003.

Diagram 8: Evolution of stunting and underweight in Mozambique, 1997, 2003, 2009 (headcount, % of under-fives having a Z-score below −2)



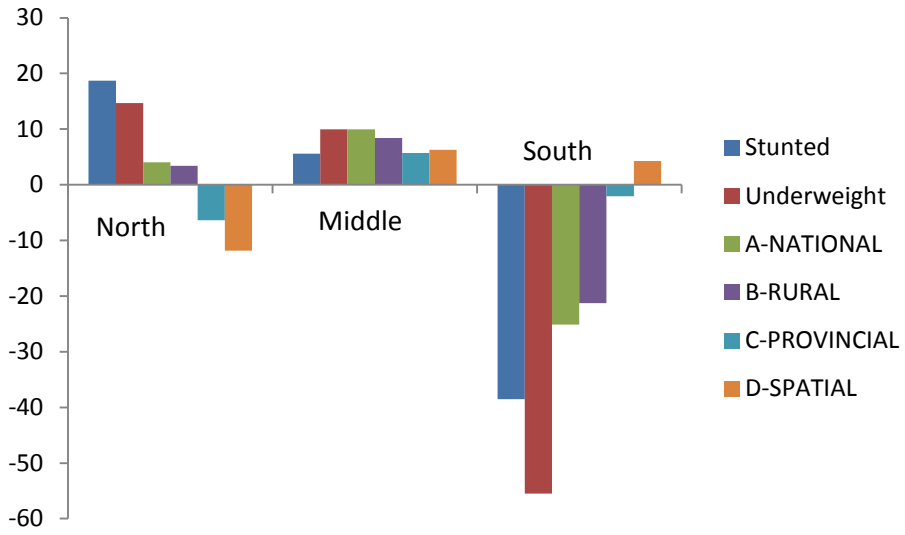
The IOF2009 figures indicate that about 45% of the under-fives in Mozambique were stunted in 2009. Though this is an improvement as compared to 49% in 1997, stunting rates are still among the highest in the world. Underweight is much lower and, moreover, its prevalence showed a notable improvement from 25% in 1997 to 19% in 2009.

The corresponding DHS/MICS figures are fairly close to these IOF-figures and the differences can be attributed to the differences in the time frame of the surveys (see also Figure 3-12 in MPD-DNEAP, 2010). One captivating feature that comes out of the Diagram concerns the evolution of malnutrition in between the survey years 1997 and 2009. Regarding the prevalence of stunting, the progress is particularly low in the first period 1997 to 2003, but the situation in

the recent period 2003 to 2009 shows a bit more progress. Furthermore, looking at underweight, the situation improved appreciably during the first part of the period with a continued improvement during the recent period at a slower pace. It is noteworthy to compare these trends with the poverty trends in Diagram 4. On this score too, the trend that corresponds to a context-specific poverty line shows a sort of incongruence with malnutrition trends. For example, following the D-line, poverty reduction came to a standstill in the recent period, a period in which child malnutrition continued to show improvements. Contrariwise, following A-line, the headcounts of poverty and underweight have gone hand in hand, with a nod in 2003 that reflects a slowing down of the fast track in the previous period.

To investigate this issue further, consider the spatial poverty patterns in terms of inadequacy of expenditure and in terms of child malnutrition as they appear from the most recent survey. Taking together the provinces in the north (Niassa, Cabo Delgado and Nampula), in the middle (Zambezia, Tete, Manica and Sofala) and in the south (Inhambane, Gaza and Maputo), we computed the prevalence of malnutrition for these regions and the poverty headcounts corresponding to the alternative poverty lines. The results are presented in Diagram 9, where it should be noted that the figures refer to the sub-sample of households with young children, about half of all households. It appears that these households are relatively poor, as one might expect. The poverty incidence is however not very far from the incidence in households without young children, some 10 to 20%, depending on the poverty line[13].

Diagram 9: Poverty and malnutrition relative to the national average in Mozambique, 2009 (percent points above or below the national average, N = 5,210)



[13] To be precise, the poverty incidence among households with young children equals 59.3, 58.3, 57.9 and 60.8 per cent for the respective A-B-C-D poverty line.

A couple of salient features come to the fore. First, the Figure illustrates that the co-variation of poverty and malnutrition shows a certain inaptness over space. Especially, there is a clear and steep North-South gradient in terms of malnutrition (first two vertical bars), but this gradient is only partly mirrored in the poverty gradients (third to sixth bar). For example, whereas stunted children are most prevalent in the northern provinces, the households in the middle belt of the country are consistently ranked poorer, i.e. about 5% poorer according to the A- and B-line and up to 20% poorer according to the D-line.

What is more, the situation in the southern provinces is markedly better than in all other parts of the country. Stunting rates are about 50% and 40% lower than those in the north and in the middle, respectively. For the underweight measure the relative favorable position of the south is even more apparent with rates that are 60% lower than in the rest of the country. This relative favorable living standard in the south is reflected by the poverty pattern of the national poverty A-line, indicating that poverty incidence is about 30% lower, and to a lesser extent also by the B-line. Yet, startlingly, following the context-specific C- and D- poverty lines, the south comes out as equally poor or even poorer than the north.

It should be noted that, in general, the relationship between low expenditure and the presence of malnourished children in a household can never be established at a very high level of confidence. One reason for this is that the measurement of food consumption is often imprecise, both quantitatively (calories) and qualitatively (diet). As we discussed in section 3.1, and as documented at length in Alfani et al. (2012), this is surely the case for the surveys in Mozambique. Another reason is that the nutritional outcomes, though related to food consumption and expenditure levels, have additional causes of their own related to, for example, the frequency of meals, the dietary diversity, the feeding and childcare practices, the intra-household food allocation food, the availability of household amenities and the access to healthcare. For a recent account of malnutrition and its correlates for Mozambique, see UNICEF (2011).

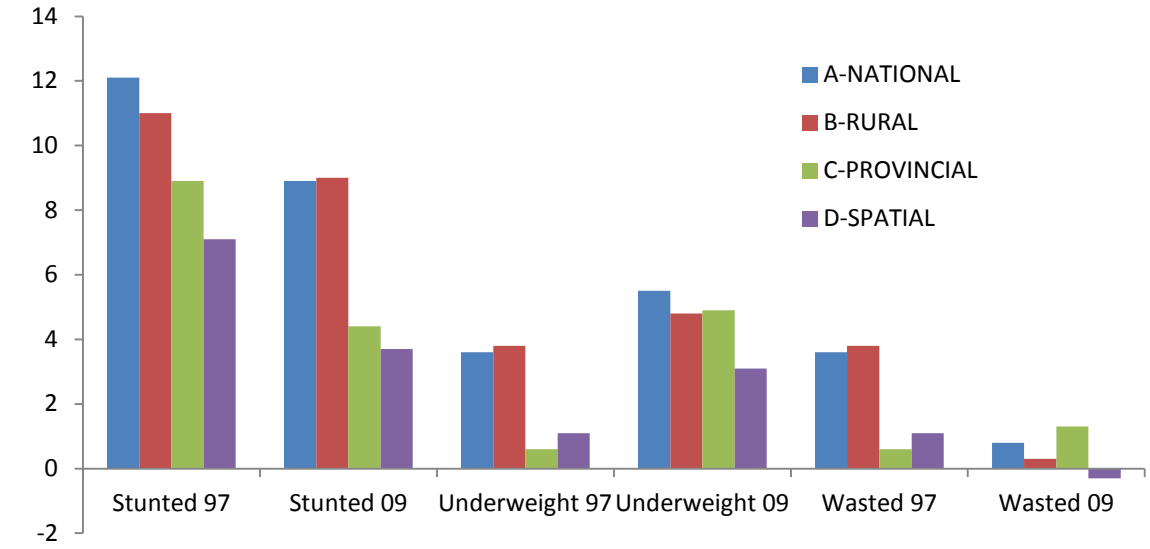
Though the relationship between food consumption and malnutrition is undependable at the level of an individual household, at aggregate levels, the correlation is strong. Across countries, the variation in food consumption accounts for about half of the variability in malnutrition, while the education of the mother comes out as another important determinant of child malnutrition (Smith and Haddad, 1999; World Bank, 2012). By the same token, within a country, one may expect to see a certain co-movement of average expenditure and average nutritional outcomes at the level of population groups. For example, for Ethiopia, Girma and Genebo (2002) found a high elasticity of the prevalence of stunting in a household with respect to its economic status.

Stunting rates were 54% in the poorest households as opposed to 26% in the richest. By the same token, in a study on Bangladesh, Rahman et al. (2009) found that, other things being equal, mothers earning a wage appeared to have healthy weighted children two-and-a-half times more frequently than mothers without cash income.

As Diagram 10 illustrate, the degree of co-variation between poverty status and the presence of malnourished children is quite responsive to the poverty line.

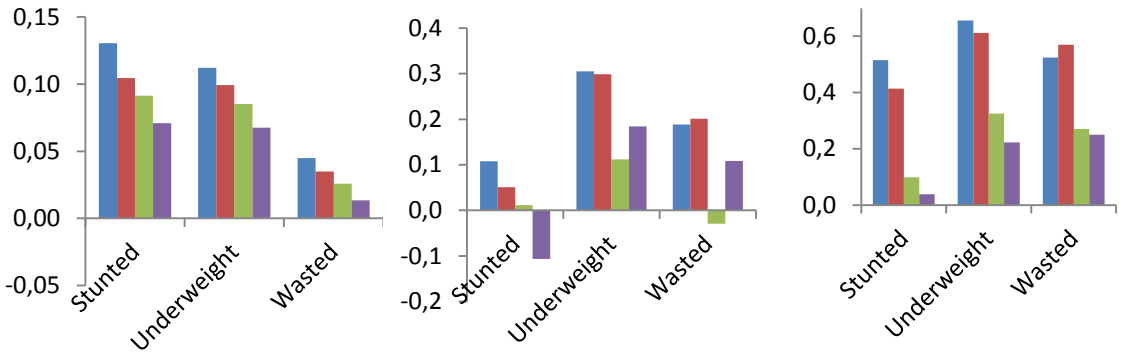
Diagram 10: Co-variation of poverty status and presence of malnourished children in Mozambique, 1997, 2009

A. Difference in malnutrition headcount between poor and non-poor according to alternative poverty lines



B. Correlation with malnutrition, according to alternative poverty lines (pooled sample 1997, 2009)

household level N = 8,511 | district level N = 273 | provincial level N = 22



Once more, as is evident from Panel A, the poverty ranking of households is less and less in line with their ranking in terms of child malnutrition as one moves to more context-specificity. The highest co-variation occurs from applying the national poverty line, the lowest from the provincial and spatial domain line.

Applying the A-line, malnutrition rates in 1997 are 30, 52 and 60% higher for the poor in 1997, for stunting, underweight and wasting, respectively. In 2009, the relatively high malnutrition among the poor was less pronounced at 20, 36 and 12%. For the D-line, the prevalence of stunting was 17% higher in poor households in 1997 and only less than 6% in 2009. Wasting under the D-line was some 14% percent higher in poor households in 1997, while in 2009, counter to intuition, wasted children resided more frequently in non-poor households, a result that also came out in the official poverty assessment (MPD-DNEAP, 2010, Figure 3-10).

This pattern of changing co-variation can be further illustrated by computing the correlation coefficient between household poverty status on the one hand and having malnourished children on the other. The results are shown in Panel B of the above Diagram[14]. At the household level, the correlation between poverty status and the presence of stunting is 0.13 for the A-line and gradually decreases to only 0.07 for the D-line. Nevertheless, statistically, even the latter is still highly significant. However, when we consider the ensemble of households at the district and at the province level, the co-variation of poverty rates and malnutrition rates is only significant for the national poverty line. It gradually disappears as one moves to a more context-specific line. For example, the correlation coefficient between the provincial poverty rate and the incidence of stunting is 0.52 for the A-line and only 0.04 for the D-line. This level of connectivity between poverty and malnutrition is statistically significant in the former case, but completely disappears in the latter case. A similar pattern appears for all malnutrition indicators.

4.2 Other poverty correlates

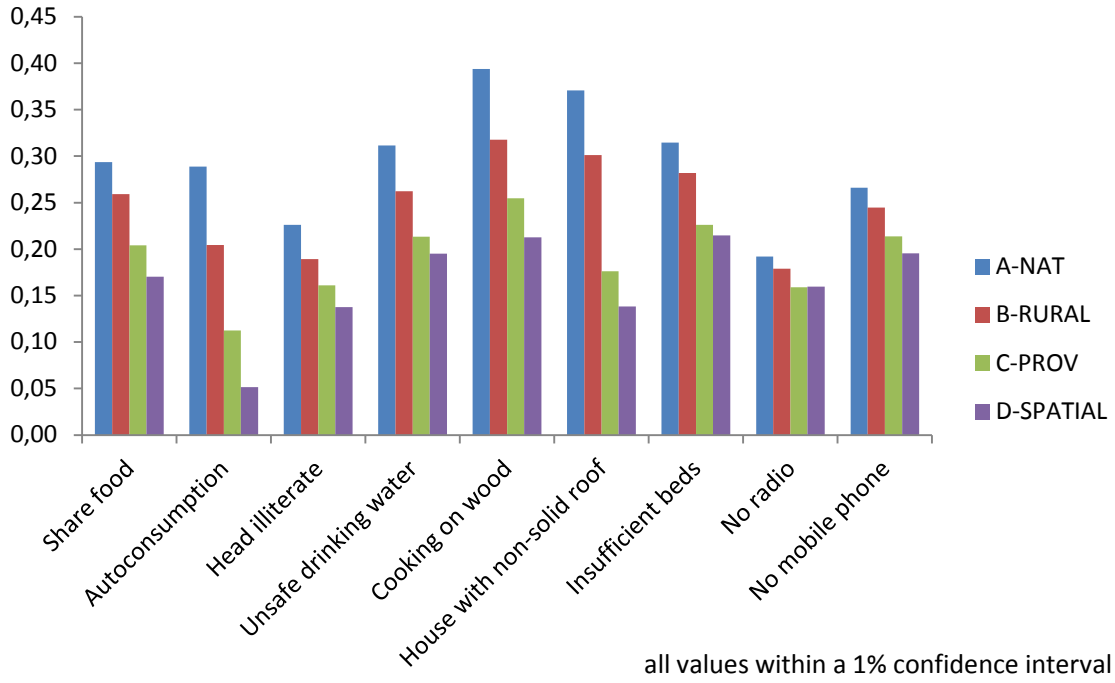
The food share in total consumption gives an indication of the household's preoccupation with its basic needs, while the own-consumption share in total calories shows the extent to which households are dependent on low productive subsistence farming. These two characteristics are often reflective of impoverished communities and can therefore be useful as an indicator of poverty (Schmidt, 2009).

The first panel of Diagram 11 illustrates the relationship of these shares with the poverty status of the household, according to the four poverty lines A, B, C and D. On this score too, the national poverty A-line seems to outperform the context-specific ones. For example, the

[14] In Annex 1 we provide the significance of the correlations at the various levels

correlation with the food share is twice as high for A-line than for the D-line, while for the own-consumption share it is even more than 5 times higher.

Diagram 11: Poverty correlates, by household poverty status according to alternative poverty lines (correlation coefficients, N = 27,6510)



Given the analysis hitherto it comes as no surprise that the co-variation of poverty on the one hand and other remaining measures that are indicative of the household living standard shows the same gradient with highest correlations for the national poverty A-line and gradual less correlation as the poverty line becomes more and more context-specific.

As a final piece of evidence, we consider poverty patterns in a multivariate setting and perform a regression of the welfare ranking of the households in the three surveys on the correlates in Diagram 11 and on selected demographic characteristics of the household. Following Ravallion (2010) and Alfani et al. (2012), the welfare ranking is defined as the ratio of per capita expenditure (see Table 1) over the respective poverty line (see Table 2). The results of the four regression models, one for each poverty line, are listed in the Annex. In brief, with a few exceptions, the coefficients have the expected sign and are statistically significant in every regression. However, the fit changes remarkably. The regression with A-line welfare ranking has an R-squared of 0.51 which implies 13% more explanatory than the B-line welfare ranking. This additional explanatory power increases to 22 and 30 percent for the C- and D-line rankings. This

corroborates the evidence that the relationship between poverty and its correlates is strongest when the national poverty line is applied.

4.3 Loss of consistency of context-specific poverty lines

From the outset of the paper, our concern has been that the addition of specificities to a poverty line can have important repercussions on poverty patterns. The empirical application to Mozambique has suggested that this is an important issue. In the previous section we illustrated a certain loss of consistency in dynamics, in the urban-rural dimension and in provincial disparities. Here we have advanced this argument further by considering the correlation of the household poverty status with malnutrition and other poverty correlates.

Following the national poverty A-line, it appear that the north-middle-south ranking in terms of consumption poverty is more in line with the corresponding ranking in terms of child malnutrition. Furthermore, as compared to the poverty B- C- and D-line, poverty incidence is correlated more with child malnutrition. The correlation coefficient of the A-line household poverty status are more than two times higher than those of the D-line poverty status. The differences are even more pronounced at the level of population groups, aggregated to the district and the provincial level. A further investigation of results derived from the national poverty A-line with those of the context-specific B- C and D-lines confirm the picture of a weakening of the co-movements of the household poverty status with other poverty indicators, like the food share in total consumption and the own-consumption share in total calories. By the same token, the co-variation between household poverty status and household assets appears to be more robust when the national poverty line is used. Finally, the regression of alternative welfare rankings on a set of commonly employed welfare generating household characteristics confirms that, also in a multivariate setting, poverty patterns as they arise from the national poverty line make the best match with poverty correlates.

5. Conclusion

Poverty patterns are usually described through a ranking of household expenditure around a poverty line, defined as the monetary value of a basic needs consumption bundle that corresponds to a minimum standard of living. This minimum is common to all households, but the cost to reach it need not be. The computation of that cost can be an intricate matter because basic needs are in principle household-specific as are the prices paid for them. Poverty lines have therefore been proposed that reflect local habits and local prices. In this manner, urban food poverty lines may exceed rural ones by a factor two and more, in response to relatively high food prices and relatively rich diets of the urban poor.

When analyzing poverty with household surveys, the estimated quantity of each good and each service actually consumed and the corresponding prices can be biased for various reasons. For example, the items consumed not only carry different prices but might also be of different quality at different locations, e.g. higher food prices for the urban poor may partly reflect a higher quality of urban food as compared to similar rural home produced food items. Moreover, one should be aware of possible systematic errors in the reported quantities, e.g. the underreporting of consumption outside of the house which is likely to be larger for urban dwellers. Finally, and probably most importantly, the consumption of non-food, non-market goods is often difficult to measure and impossible to monetize, e.g. the implicit price of public goods and services may be prohibitively costly for villagers.

In this paper we investigated these potential biases against the backdrop of the poverty patterns in Mozambique, using data from a recurring large-scale household survey, 1997, 2003, 2009. The data comprise details on expenditures as well as on child nutritional status, education and asset ownership. The unique features of the data set allowed for various checks and balances of the poverty status of a household.

The checks and balances helped to evaluate the choice for a particular poverty line. We compared poverty patterns under a single national poverty line, based on the same minimum consumption bundle for all households valued against the same prices, with those under various context-specific thresholds, based on prices and consumption bundles adapted to rural-urban and/or provincial conditions, possibly time variant. The comparison showed that the poverty pattern in Mozambique is highly responsive to the poverty line. Moreover, it was found that the national poverty line tends to work better than the urban-rural lines in the sense that the poverty pattern shows a more consistent picture over time and space, and also in the sense that the poverty status of a household is much more in line with what may be expected considering the

nutritional status of children in the household, the schooling of the household head and the assets that the household possesses. By the same token, a welfare-ratio regression model appeared more accurate under a national poverty line than under the urban-rural line.

A further adaptation of poverty lines over provinces and over time reinforced the finding that poverty patterns from context-specific expenditure thresholds tend to pick up less of the actual differences in household living standards. The relative good conduct of the national poverty line is probably attributable to the facing out of two opposing biases, namely an upward bias of the (high) urban poverty line due to a higher quality diet and an underreporting of outside consumption and a downward bias of the (low) rural poverty line due to the costly access to essential public goods and services.

These results suggests that ongoing efforts to improve poverty targeting by adding local specificities to the basic-needs expenditure level might not hit the mark. Even worse, from an empirical perspective, it may trigger a backfire. For example, in the case of Mozambique, the use of context-specific lines showed a surprising standstill of poverty reduction between 2003 and 2009 and an equally surprising position of Maputo, with poverty in Maputo City comparable to various other parts of the country and Maputo Province ranking among the poorest provinces. Contrariwise, the use of a national line produces results that are in line with other information, namely that poverty in Mozambique continues to reduce, though at a slower pace, and that poverty is least prevalent in Maputo. In the same way, the rural and North-South dimension of poverty and malnutrition was reflected most consistently by applying a national poverty line.

Be this as it may, it is unrealistic to expect that a single household characteristic, like an empirically biased threshold on expenditure, will suffice to assess poverty patterns. As the evidence from Mozambique shows, even the best poverty line is incapable of picking up poverty in all its dimensions, essentially because of the inevitable bias and also because each dimension can have causes and effects of its own.

Appendix 1: Correlation of poverty and malnutrition

(Pearson correlation coefficients and P-values)

Household level	A-National	B-Rural	C-Provincial	D-Spatial
Stunted	0.13061	0.10458	0.09144	0.07087
	<.001	<.001	<.001	<.001
Underweight	0.11217	0.09924	0.08524	0.06759
	<.001	<.001	<.001	<.001
Wasted	0.04487	0.03491	0.02568	0.01334
	<.001	.001	.017	.219
District level				
Stunted	0.10763	0.05085	0.01150	-0.10612
	.076	.403	.850	.080
Underweight	0.30484	0.29883	0.1128	0.18395
	<.001	<0.001	.064	.002
Wasted	0.18813	0.20095	-0.02939	0.10855
	.002	<.001	.629	.073
Provincial level				
Stunted	0.51549	0.41415	0.09872	0.03860
	.014	.055	.662	.865
Underweight	0.65640	0.61232	0.32563	0.22264
	<.001	.003	.139	.319
Wasted	0.52451	0.56980	0.27056	0.24989
	.012	.006	.223	.262

Appendix 2: Poverty correlates and regression results

Table: Population weighted means of poverty correlates

Description	1997	2003	2009
Sample size	8,239	8,678	10,754
welfare ratio A-NATIONAL	1.001	1.267	1.271
welfare ratio B-RURAL	0.974	1.227	1.244
welfare ratio C-PROVINCIAL	1.000	1.252	1.248
welfare ratio D-SPATIAL	0.971	1.263	1.236
household size	6.217	6.218	5.965
dependents 14-	3.053	3.095	3.118
dependents 65+	0.132	0.150	0.136
household adult equivalent scale	0.718	0.711	0.704
female headed household	0.168	0.205	0.241
age of household head	43.258	43.310	42.579
household head illiterate	0.474	0.455	0.442
food share in total consumption	0.675	0.608	0.633
house has solid roof	0.218	0.291	0.327
house has toilet or latrine	0.407	0.491	0.534
drinking water from tap	0.069	0.169	0.136
cooking on electr/gas/petr/coal	0.121	0.171	0.178
beds	1.013	0.822	0.923
radio	0.393	0.608	0.573
car	0.012	0.017	0.047
bicycle	0.148	0.388	0.509
mobile phone	0.000	0.071	0.514
computer	0.000	0.004	0.020

Table: Regression results of welfare-ratio regressions
(dependent variable: logarithm of welfare ratio under alternative poverty line A, B, C and D)

Description	A-National		B-Rural		C-Provincial		D-Spatial	
N=27,671	coefficient	t-score*	coefficient	t-score	coefficient	t-score	coefficient	t-score
1997	1.479	24.44	1.538	25.16	1.797	29.93	1.821	29.87
2003	1.540	25.42	1.606	26.23	1.852	30.80	1.894	31.02
2009	1.407	23.36	1.468	24.12	1.760	29.44	1.800	29.65
February	-0.070	4.10	-0.082	4.70	-0.024	1.41	-0.058	3.33
March	0.030	1.82	0.020	1.17	0.046	2.81	0.031	1.88
April	0.013	0.79	0.016	0.94	0.009	0.54	0.016	0.96
May	0.056	3.38	0.037	2.21	0.095	5.76	0.069	4.12
June	0.060	3.40	0.047	2.66	0.071	4.07	0.050	2.78
July	0.051	3.08	0.051	3.07	0.049	3.03	0.058	3.48
August	0.061	3.28	0.063	3.35	0.050	2.74	0.058	3.10
September	0.053	3.05	0.073	4.20	0.056	3.32	0.085	4.90
October	0.032	1.91	0.037	2.16	0.006	0.38	0.024	1.44
November	-0.041	2.36	-0.040	2.29	-0.043	2.52	-0.029	1.65
December	0.101	5.84	0.103	5.91	0.105	6.13	0.118	6.77
household size	-0.621	83.71	-0.627	83.61	-0.638	86.74	-0.631	84.51
adult equivalent scale	-1.069	18.01	-1.133	18.89	-1.011	17.18	-1.084	18.12
dependency-ratio	-0.204	10.09	-0.210	10.30	-0.144	7.21	-0.169	8.31
age of household head	-0.012	1.08	-0.004	0.35	-0.067	6.14	-0.060	5.49
female headed	-0.016	1.72	-0.030	3.16	-0.055	5.89	-0.066	6.98
household head illiterate	-0.136	15.81	-0.113	13.03	-0.128	14.96	-0.107	12.34
food share	-0.163	17.77	-0.153	16.54	-0.118	12.95	-0.100	10.77
house has solid roof	0.211	20.92	0.160	15.70	-0.024	2.39	-0.042	4.13
house has toilet / latrine	0.130	15.34	0.093	10.80	0.062	7.33	0.025	2.88
drinking water from tap	0.209	17.80	0.168	14.10	0.186	15.96	0.166	14.03
electr/gas/petr/coal	0.342	29.73	0.239	20.53	0.238	20.86	0.201	17.37
beds	0.103	31.33	0.101	30.45	0.108	33.19	0.111	33.59
radio	0.133	22.40	0.128	21.46	0.121	20.53	0.129	21.58
car	0.246	11.15	0.254	11.42	0.381	17.41	0.377	16.96
bicycle	0.113	16.27	0.125	17.90	0.151	21.95	0.164	23.47
computer	0.566	21.67	0.584	22.13	0.541	20.88	0.561	21.32
mobile phone	0.081	13.49	0.088	14.62	0.077	12.89	0.079	13.11
Adjusted R^2	0.5144		0.4561		0.4224		0.3938	

* The t-scores is reported in absolute value. For the given sample size, a value at or above 1.94 indicates that the effect is statistically significant at the 5% level, while effects with t-scores above 2.46 are significant at the 1% level.

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The Centre for World Food Studies (Dutch acronym SOW-VU) is a research institute related to the Department of Economics and Econometrics of the Vrije Universiteit Amsterdam. It was established in 1977 and engages in quantitative analyses to support national and international policy formulation in the areas of food, agriculture and development cooperation.

SOW-VU's research is directed towards the theoretical and empirical assessment of the mechanisms which determine food production, food consumption and nutritional status. Its main activities concern the design and application of regional and national models which put special emphasis on the food and agricultural sector. An analysis of the behaviour and options of socio-economic groups, including their response to price and investment policies and to externally induced changes, can contribute to the evaluation of alternative development strategies.

SOW-VU emphasizes the need to collaborate with local researchers and policy makers and to increase their planning capacity.

SOW-VU's research record consists of a series of staff working papers (for mainly internal use), research memoranda (refereed) and research reports (refereed, prepared through team work).

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