Inter-country Comparisons of Poverty Based on a Capability Approach: An Empirical Exercise*

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7th July 2006

Abstract

In previous work Reddy and Pogge have argued that inter-country comparisons of income poverty based on poverty lines uniformly reflecting the costs of the basic requirements of human beings are superior to the existing money-metric approaches. In this exercise, we implement a uniform approach to poverty assessment based on basic human capabilities for three countries: Nicaragua, Tanzania and Vietnam. We compute standard errors of the resulting poverty estimates and compare the incidence of poverty across these three countries. The choice of approach affects both cardinal estimates and ordinal rankings of poverty across countries and over time. Meaningful and coherent inter-country poverty comparisons can be advanced through international co-ordination in survey design and in the construction of income poverty lines that uniformly reflect the costs of the basic requirements of human beings.

1 Introduction

How should poverty be estimated? As pointed out by Sen (1981), all poverty assessment involves two component exercises: the identification of the poor (i.e. the determination of who is poor and to what extent) and the aggregation of this information to compose a judgment concerning the extent of poverty in the society. A uniform identification criterion must be applied to all individuals if this exercise is to

*We are grateful to Carlos Sobrado of the World Bank, Emilian Karugendo of the National Bureau of Statistics of Tanzania, Patrick Ward of Oxford Policy Management, and the General Statistics Office of Vietnam for their help with household surveys for Nicaragua, Tanzania and Vietnam respectively. We thank Shaohua Chen for answering several questions about the World Bank's international poverty lines in these three countries. Howard Nye played a role in conceptualizing and implementing this project at an early stage. The Bureau of Development Policy and the International Poverty Center of the United Nations Development Programme provided essential support. We thank Terry McKinley for facilitating this support. We are grateful to Camelia Minoiu, participants of the international conference on the ""many dimensions of poverty"" held by the UNDP International Poverty Center, and participants in a workshop on capabilities and well-being evaluation held at the University of California at Riverside for helpful comments.

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be meaningful. For example, we might choose to define as poor all those whose money income is below a certain level, or instead we might define as poor all those whose money income is below the level required to achieve some end. In either of these approaches, it is a minimal and inescapable requirement that a single identification criterion is applied to all individuals.

Efforts to assess poverty at the regional and global levels are no less subject to this demand. Meaningful inter-country comparison and aggregation requires that a common identification criterion be applied in all countries. The predominant method in use at present for such comparison and aggregation is the "money-metric" approach. In this approach, the identification criterion used depends on an "international poverty line" (IPL) expressed in PPP dollars of a specific year and converted into poverty lines expressed in local currency units (and deemed equivalent to the IPL). Although it may appear that this approach establishes a uniform identification criterion, it may do so only in a hollow sense. As argued by Reddy & Pogge (Forthcoming), the PPP conversion factors used for this purpose do not reflect an invariant level of purchasing power over essential commodities. Therefore, existing $1 and $2 per day IPLs do not provide the uniform identification criterion that is required for the exercise of poverty assessment to be meaningful.

The IPL is inappropriate in another respect as well. A fully meaningful poverty line should reflect the cost of achieving basic human requirements. Although there can be reasonable disagreement about how to understand such requirements, there cannot plausibly be disagreement that a poverty line should reflect them. A poverty line is meaningful only if we can make the case that persons with incomes falling below the poverty line can be thought of as poor. Unfortunately, the IPL often fails to reflect the cost of achieving basic human requirements, and hence this case cannot be made for it (Reddy and Pogge). A fully meaningful approach to inter-country poverty comparison and aggregation would establish a poverty line for each country (or perhaps sub-national jurisdiction) corresponding to the minimum cost (in that country) of achieving a certain set of basic human requirements (or as we prefer to understand them, income-dependent elementary human capabilities) uniformly conceived across countries. The same elementary human capabilities would be used to define the poverty line in each country. The resulting poverty lines would embody a uniform identification criterion, which had the advantage of having the same meaningful interpretation in all countries. This approach would avoid using PPPs altogether, thus curing both problems with the IPL in one stroke. Conceptually, the capability-based alternative involves nothing more than the generalization of an approach that is already widely used and thought of as appropriate at the national level.

In this study we implement such a capability-based approach to poverty assessment. We show that it is possible to use existing household survey data from three different countries (Nicaragua, Tanzania and Vietnam) to define a uniform capability-based criterion for identifying the poor. We focus, for reasons of operationalizability, on the capability to be adequately nourished. We use this criterion to establish poverty lines that possess a common capability-based interpretation in all three countries and then estimate poverty in these countries. By definition, these estimates are comparable in the sense that they refer to the same (capability-based) concept of

poverty in all three countries. We thus demonstrate that even with existing data sources (which have not been specifically designed with the purpose of supporting such comparisons) it is possible to implement a limited capability-based approach to global poverty estimation.

We use our capability-based poverty lines to estimate levels of poverty in these three countries. We contrast these poverty estimates with those based on the money-metric international poverty lines that are commonly used and show that our approach yields notably different results. We also examine how the use of capability-based poverty lines instead of money-metric IPLs affects cardinal and ordinal comparisons of poverty across countries and over time. Based on this exercise, we argue that there is no "quick-fix" with which to align the existing money-metric poverty lines with a capability-based concept of poverty. A more comprehensive program of capability-based poverty line construction (and complementary survey design) offers the best way forward for inter-country poverty comparison and aggregation.

The poverty estimates produced here are not authoritative estimates of poverty in each country, since the data sources and the methods of poverty line construction applied here are insufficiently refined to support the claim that the estimates are definitive. Our method of arriving at the poverty line is but one of several possible methods. Our primary aim is to construct a set of poverty lines that correspond to a uniform and meaningful criterion for identifying the poor in all the countries we study.

We have taken as our starting point the methodology for poverty line construction used in the Vietnam 1993 LSMS survey. We may infer from its adoption that the method was considered acceptable for measuring national poverty in Vietnam. It may also be judged plausible (although far from uniquely plausible) on independent grounds. We apply this methodology of poverty-line construction to Tanzania and Nicaragua. Finally, we compare the resulting estimates with existing national poverty estimates for Tanzania and Nicaragua, and also with those from the money-metric IPL approach.

We find that the choice of approach matters a great deal. In comparing poverty estimates across countries and over time, the capability-based approach that we employ does, in some instances, give significantly different results than the money-metric approach. Both cardinal comparisons and (perhaps more surprisingly) ordinal rankings of poverty across countries are influenced by the approach used.

It is obvious that various enhancements can and should be undertaken to generate more fully adequate poverty assessments for each country (for example, through using household adult-equivalence scales). However, the desirability of undertaking such enhancements is common to all existing approaches to regional and global income poverty estimation.[1] The aim of this study is to point the way to one kind of improvement that can be made when producing regional and global poverty estimates, without thereby implying that other improvements are not also desirable.

The rest of the paper is organized as follows. In the next section, we describe conceptually the method that we apply and provide a diagrammatic exposition of our approach and methodology. In section 4, we describe the methodology used in each

[1]For example, existing global poverty estimates based on money-metric IPLs produced by the World Bank and others have not employed household equivalent scales.

country and the resulting poverty estimates. Section 5 discusses the implications of our analysis for inter-country poverty comparison and aggregation and presents our conclusions.

2 Inter-Country Comparison and Aggregation of Poverty: A Method

The first step in this exercise is to identify a relevant set of elementary capabilities. The cost of achieving these elementary capabilities can be described in a familiar manner. It is assumed that for each individual there exists some set of commodity bundles ("adequacy set"), which suffices to achieve the elementary capabilities. Given the prices faced by an individual and appropriate technical assumptions, we can identify the minimum cost of achieving the elementary capabilities.

In a particularly simple approach, the adequacy set is assumed to be common for all persons. We follow the Vietnam 1993 Living Standards Measurement Survey (LSMS) in adopting this approach. It must be recognized that this approach is insufficiently attentive to the diverse features of persons (e.g. age, gender or occupation) which may influence the way in which they can transform commodities into capabilities. In principle, these diversities should be taken into account.[2]

In our empirical exercise, we take the ability to be adequately nourished as the centrally relevant elementary capability. This capability anchors the identification exercise. If it is assumed that a certain fixed level of calories is sufficient for all persons to achieve adequate nourishment, then the minimum cost of achieving this capability may be identified for all persons. In this paper, we operationalize this idea in a particular way. We follow the Vietnam LSMS in our empirical approach. We choose as a reference group that quintile of the population which comes closest to achieving the nutritional standard (in our case, a food-energy standard, 2100 kilo calories). The consumption pattern of this reference group is taken to indicate the composition of the minimum cost bundle. The food poverty line is the cost of the bundle containing exactly 2100 kilo calories and reflecting this consumption pattern.[3] This method takes into account the preferred patterns of food consumption of the group in the population whose consumption is closest to the nutritional standard.

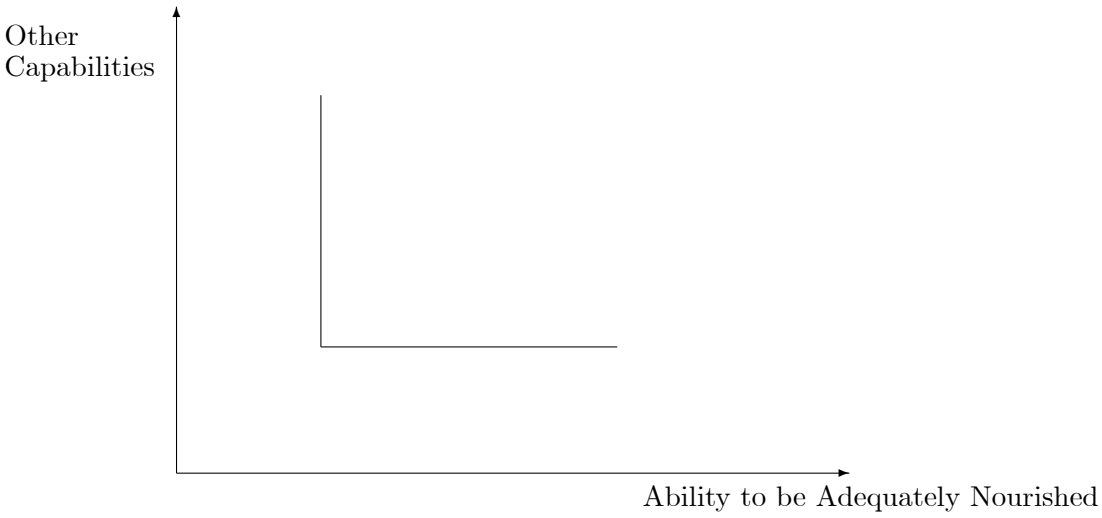
Next, we make an allowance for non-food requirements. Once again, we follow the methodology used in the 1993 Vietnam LSMS. We determine the ratio of non-food to food expenditure for the reference population and then maintain this ratio at the poverty line.

Suppose that the average commodity bundle of the reference population has a calorie content that falls below 2100 KCal by x percent. Our approach assumes that the uneven expenditure of the reference population contains a shortfall in the

[2] In many national poverty estimation exercises, this problem is addressed with the use of adult-equivalents: children are assumed to need smaller commodity bundles to achieve the same capabilities.

[3] Strictly speaking, the minimum cost bundle would contain only one commodity, viz. the one which delivered the most calories per dollar. However, this bundle would not reflect prevailing cultural norms and preferences to any degree. It would also not take into account any non-food-energy nutritional needs.

Figure 1: Capability Space



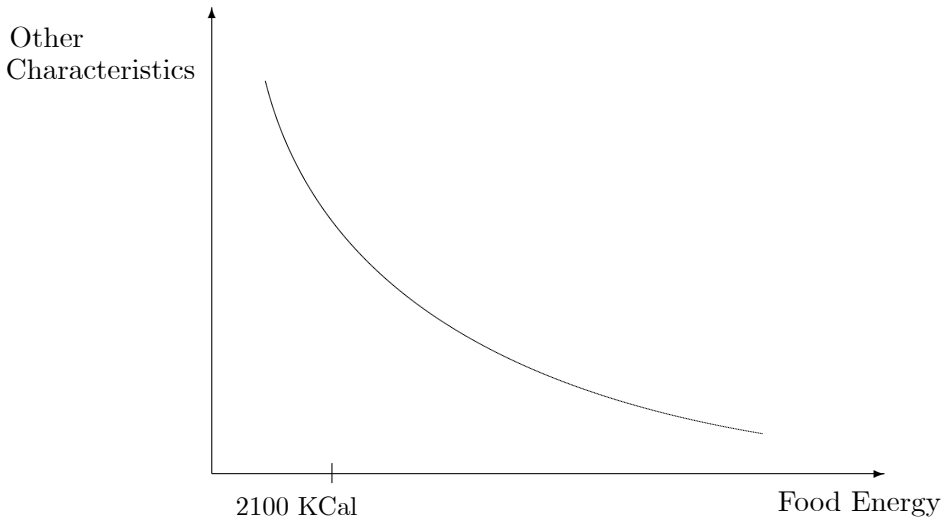
expenditure necessary to achieve the non-food expenditure requirement that is also x percent. The implied food and non-food poverty lines are added to constitute a general poverty line which is assumed to reflect the minimum cost of achieving non-poverty both in food energy and other requirements.

Figures (1)-(4) illustrate our approach and the assumptions behind it. We begin by defining poverty as the failure to achieve elementary capabilities for reason of insufficient income. The decision concerning which capabilities are relevant and what levels are minimally adequate involves evaluative judgements. However, we take as our premise that there would be broad agreement: (a) that the ability to be adequately nourished is a relevant income-dependent elementary capability and (b) that there are other relevant income-dependent elementary capabilities (for example, the ability to be adequately sheltered from the elements). A minimally adequate level of each of these capabilities may be deemed essential to be non-poor, thus giving rise to an achievement set with an L-shaped lower contour in the capability space (see Figure 1).

We next translate this concept of poverty into terms which are more amenable to measurement. An adequately nourished individual needs to receive adequate amounts of various food characteristics[4]: food energy, protein, fats, fiber, macronutrients and so on. It may be thought appropriate to make allowance for adequate amounts

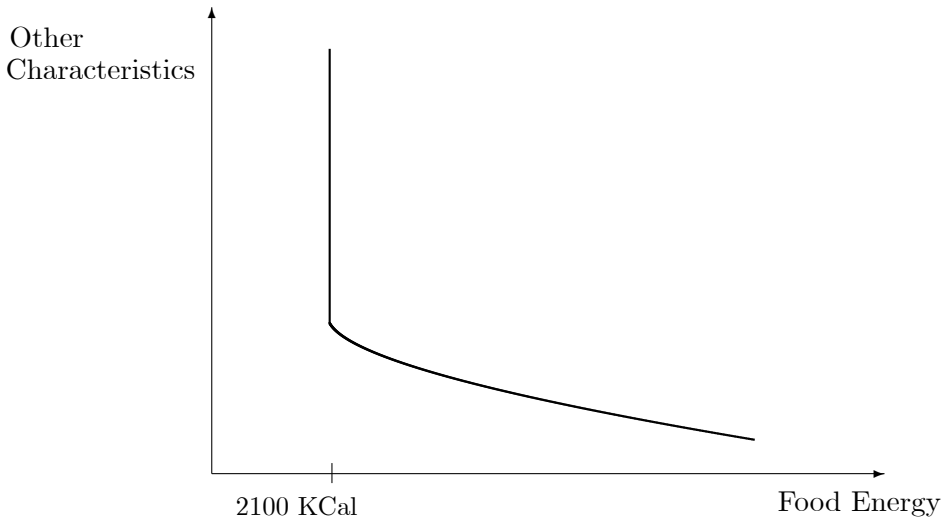
[4] On the concept of charcateristics of commodities, see Lancaster (1971).

Figure 2: Characteristics Space



of other commodity characteristics as well (e.g. taste). Since different commodity bundles contain these characteristics in different proportions, substitution between them may be possible, giving rise to a smooth lower contour of the adequacy set (see Figure 2). For example, it is conceivable that a lower level of food energy intake may suffice for nutritional adequacy if fat, protein, fiber, or other nutrients are contained in the diet to a greater extent, or for that matter if a person is healthier, or is better protected from the elements (such as cold weather). Tradeoffs of this type may exist in relation to the characteristics of goods that promote each of the relevant elementary capabilities. For simplicity, researchers have tended to focus on the food energy intake of individuals and to anchor the poverty line to a calorie adequacy threshold. In our study, this threshold is defined as 2100 kilo calories per day. Figure 3 depicts the lower contour of the adequacy set in an instance in which such substitutability exists, and in which the adequacy set is otherwise consistent with our approach. In the method we implement here, a person who consumes less than 2100 kilo calories per day for reasons of income inadequacy is to be deemed poor, regardless of his level of consumption of non-food-energy characteristics. Thus the adequacy set does not contain points with less than 2100 kilo calories of food energy and no substitution is permitted beneath this level. Since no such threshold is imposed on other characteristics of commodities, the lower contour of the adequacy set is permitted to be flexible (in terms of its content of other characteristics) at levels

Figure 3: Characteristics Space



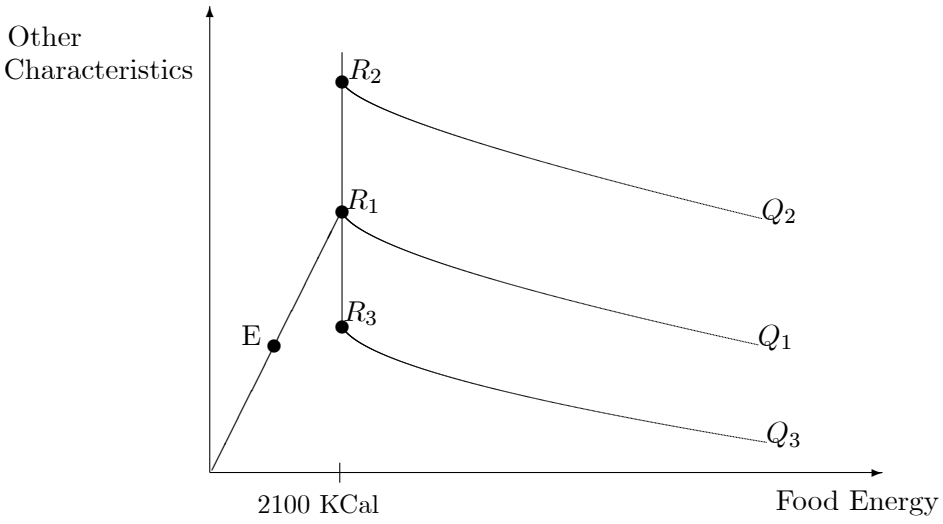
of food-energy intake above 2100 kilo calories.

We are concerned with determining the minimum cost of achieving a set of elementary capabilities. In the approach that we implement, we determine this minimum cost by first identifying the quintile in the sample the food energy consumption of which comes closest to 2100 kilo calories per day. Suppose (see Figure 4) that this reference quintile consumes on average a bundle of commodities which delivers a bundle of characteristics such as E. Thus, the reference quintile consumes less than 2100 kilo calories per capita. We assess the extent to which its expenditure must be scaled up so as to enable a bundle of characteristics that is minimally adequate to be just affordable.

As noted earlier, we make the operational assumption that if the food energy intake of the reference quintile falls below 2100 kilo calories by x percent, then other required characteristics are consumed to an extent which falls below this hypothetical threshold by x percent as well. Let us call this the equiproportionality assumption. Therefore the average expenditure of the reference quintile is scaled up linearly to make a bundle of characteristics in the assumed lower contour of the adequacy set, such as R_1, just affordable. This scaled-up expenditure level is defined as the poverty line.

If the equiproportionality assumption is correct and the true lower contour of the adequacy set is that which was assumed (i.e. Q_1), then R_1 is indeed on the lower con-

Figure 4: Characteristics Space



tour of the adequacy set, and our poverty line correctly identifies the cost of achieving a bundle which just suffices to achieve the relevant elementary capabilities.[5] If, however, the equiproportionality assumption is wrong and the true lower contour set is Q_2, then higher levels of other characteristics are needed to be non-poor than allowed for by our approach, and our poverty line is likely to be below the true minimum cost of achieving elementary capabilities.[6] If the equiproportionality assumption is wrong and the true lower contour set is Q_3 then our poverty line is too high.

Note that this approach is necessary because we do not have sufficient information to establish directly the cost of achieving the non-food capabilities considered essential for an individual to be non-poor. In the case of nutritional requirements, there is widespread consensus that a calorie anchor has a plausible role to play in the construction of a food poverty line. In the absence of such information, the allowance for non-calorie requirements must necessarily be "second-best." The approach used here is empirical; relying on the observed pattern of consumption in the reference group, the calorie anchor, and the equiproportionality assumption to dictate the choice of poverty line.

In principle, it should be possible to relax the equiproportionality assumption. However, in the absence of any consensus on what non-food capabilities are of concern, on the characteristics of the commodities which promote them, on the transformation function that relates these characteristics to capabilities, and on the levels of each capability that ought to be deemed minimally adequate, any adjustment will lack adequate justification. This speaks strongly to the need for an explicit specification of non-calorie requirements. It also calls for adequate survey data to estimate the cost of meeting these requirements. Such an exercise may not be readily feasible without the design of surveys specifically with this end in mind, and complementary exercises in evaluative judgement.

3 Data and Empirical Work

The methodology described in the previous section is applied to three countries: Nicaragua, Tanzania, and Vietnam. The important feature of our exercise is that we use a *common* capability-based approach in all three countries. We use these poverty lines to compute poverty estimates, and then compare them to those from money-metric "$1 per day" and "$2 per day" international poverty lines. We then explore the robustness of inter-country poverty comparison and aggregation to the choice of identification concept.

[5] The bundle R_1 which just suffices to attain the elementary capabilities may still not be the least cost bundle which suffices to do so. It is evident from the diagram that at prices at which food energy is very inexpensive relative to other characteristics of commodities, the least cost bundle in the adequacy set may contain greater than 2100 kCal of food energy. We do not examine this possibility at length, although it is a point to be held in mind.

[6] We speak of the poverty line being "likely "to be too low since if the prices that prevail are such that food energy is very inexpensive relative to other characteristics then the scaled up expenditure may in principle suffice to achieve capability adequacy. This would not of course be true if the lower contour of the adequacy set was L-shaped or of the 'Leontieff ' type, in which case the poverty line would certainly be too low.

We follow to the extent possible an identical methodology of poverty line construction and survey analysis in all three countries. Although we apply a common nutritional (and specifically calorific) standard in all three countries, we attempt to account for differences in dietary norms and local prices. Since the surveys used were not designed with this end in mind, we were forced to make certain decisions to estimate comparable concepts in the diverse surveys used. Despite the necessarily "second-best" nature of the exercise, we believe that it represents a more coherent and meaningful approach for inter-country comparisons of poverty than does the prevalent "money-metric" approach.[7]

The countries selected for this exercise are attractive choices for a few distinct reasons. First, each country lies in a different continent, thus allowing us to demonstrate that capability-based inter-country comparison and aggregation of poverty estimates can be undertaken despite different food habits and non-food expenditure patterns. Second, two of the countries (Nicaragua and Tanzania) had very similar headcount ratios in the 1990s according to World Bank's estimates based on its $1 and $2 per day IPLs, but the third country (Vietnam) had a very different headcount ratio from the other two. This is summarized in Table 1.

Table 1: World Bank's Poverty Headcount Ratio Estimates

Year	1991		1993		1998	
($ a day, PPP)	$1	$2	$1	$2	$1	$2
Nicaragua	...	...	47.94	77.78	44.71	79.03
Tanzania	48.54	72.53	...	...	...	...
Vietnam	...	...	14.63	58.16	3.8	39.68

Source: World Bank's World Development Indicators (accessed on-line on March 13th 2005).

We also compute bootstrapped standard errors of all poverty measures. Thus we can make both ordinal and cardinal comparisons across countries and over years, and check if the differences are statistically significant.

Third, in each of these countries there are well-designed household surveys which we could get access to. For Vietnam and Nicaragua, the data are from the Living Standard Measurement Surveys conducted in these countries by the World Bank in collaboration with national statistical agencies. The data on Tanzania come from the Household Budget Survey conducted by Tanzanian National Bureau of Statistics.

The LSMS for Vietnam adopted a specific methodology of poverty line construction and survey analysis using a capability-based standard of a limited kind (a 2100 calorie nutritional "anchor"). We adopt the same methodology and use the household data sets for Nicaragua and Tanzania to compute comparable poverty lines for these two countries. We make every attempt to adhere to the methodology employed in Vietnam, recognizing throughout that there are many plausible alternative approaches to constructing a nutritionally anchored poverty line.[8] Although we have

[7] The poverty estimates produced by the Economic Commission for Latin America and the Caribbean (ECLAC) are an important exception to the dominant use of the money-metric approach (Altimir 1982).

[8] For a detailed description, see Ravallion (1994).

already alluded to the methodology employed for Vietnam, we describe it in detail below.

In order to facilitate comparison of statistics across countries and across poverty line concepts, we also calculated bootstrapped standard errors (using 1000 iterations) for every poverty estimate. The large number of iterations guaranteed in most, if not all, cases a very high confidence level in the calculation of the standard errors: a 5 percent significance level and a deviation in magnitude of approximately 4.5 percent from the limiting standard deviation.[9]

3.1 Methodology used for Vietnam

The head count ratio for Vietnam was calculated by the Vietnam Living Standards Survey (VLSS) as follows.

The calorie anchor used was 2100 calories per day. Using the data on household per capita expenditure from the VLSS 1993, survey households were divided into quintiles according to their total expenditures per capita. No distinction was made between rural and urban sectors. The average calorie intake per person per day was calculated for each quintile based on the quantities of food consumed by these households, with some calorie numbers imputed when exact quantities consumed were not clear.[10]

The quintile the calorie intake of which was closest to 2100 was identified as the 'reference quintile'. This was quintile 3, with a per-capita calorie intake of 2052 calories per day. Its average food basket was used to construct a 'synthetic' food basket containing 2100 kilocalories and possessing the same consumption pattern as the reference quintile. The average quantities of the food items consumed by the reference quintile were scaled up linearly (by $2100 \div 1969$) to create a "synthetic" food basket containing the required total calorie content.[11] This food basket consists of the quantities of 40 food items that if consumed by a person in a year, can generate a food energy intake of 2100 calories per day. To convert from daily calorie intake to yearly, 2100 was multiplied by 365. Median national prices calculated from the VLSS 93 commune-level price data were used to price the food basket. The prices recorded in the VLSS were observed in January 1993. Evaluation of the cost of the synthetic food basket at the median national prices gives an estimate of the national

[9] We used the method proposed in Andrews & Buchinsky (2000) to choose the optimal number of bootstrap iterations, and to evaluate the performance and precision of the resulting bootstrapped standard errors. In fact, following the procedures proposed by Deaton (1997) and Howes & Lanjouw (1998), we calculate standard errors both using bootstrapping and using the `sepov` command in STATA. The latter implements a standard error calculation based on theoretical premises. In both instances, a simple two-stage sampling design is assumed, whereas in fact all of the surveys we have examined involve a more complicated survey design. As a result, the standard errors we calculate cannot be viewed as more than indicative. This is, of course, not a problem unique to this case but is common to all of the existing literature on the calculation of standard errors for poverty measures. We report and refer only to the bootstrapped standard errors since the standard errors calculated through the two approaches were generally very close.

[10] In some cases where caloric values could not be computed directly, either because of lacking calorie conversion information or when the goods were consumed too inrregularly to be reported, they were imputed. See World Bank (1999) for more details.

[11] The number 1969 is used instead of 2052 because 2052 is the post-imputation number.

'food poverty line' of 749,723 Dong per person per year. For the third quintile, non-food expenditures were 401,291 Dong per person per year. This number was scaled up by 1.023 (= 2100 ÷ 2052) to arrive at a non-food expenditure allowance at the poverty line of 410,640 Dong. The national overall poverty line was set accordingly at 1,160,363 Dong (= 410,640 + 749,723): the sum of the food poverty line and the non-food expenditure allowance. To arrive at more specific regional poverty lines, regional price deflators were constructed from the price questionnaire of VLSS 93, in which the weights were the expenditure shares of all (food and non-food) items.[12]

We were able to reproduce the poverty estimates produced by the LSMS and include them in Table 7 below along with associated standard errors (the methodology of constructing those is discussed further below). We provide resulting estimates for Vietnamese poverty in two different LSMS survey years, 1993 and 1998. We also constructed $1 a day and $2 a day poverty estimates for Vietnam in each year. We used the official general CPI for Vietnam to translate these poverty lines (Actually $1.08 PPP and $2.16 PPP a day) from their base year (1993) to the 1998 assessment year. Since no food-CPI is available for Vietnam for the year 1993, we did not also use a food-CPI for this purpose, as we did for the other countries in the study.

The methodology applied in Vietnam amounts to undertaking five steps:

1. Exogenously identify a threshold of nutritional capability adequacy and characterize it in terms of characteristics of commodities consumed (the 2100 KCal calorie norm)

2. Identify the quintile whose average calorie intake is closest to the calorie threshold

3. Determine the cost of achieving this threshold (the food poverty line) while maintaining the pattern of consumption of a reference quintile

4. Establish an allowance for non-food expenditures such that the ratio of this allowance to the food poverty line is the same as the ratio of non-food to food expenditures for the reference quintile

5. Set an overall poverty line, equal to the sum of the food poverty line and the non-food expenditure allowance, and determining the number of persons living in households with per capita consumption beneath this level.

3.2 Applying the Methodology to Nicaraguan data

The data for Nicaragua are from the Nicaraguan LSMS for 1997-98 (known as the EMNV 1998 Survey). We have followed the methodology used in Vietnam to calculate the capability-based poverty line for Nicaragua. Note that the EMNV Survey itself also produced a poverty line for Nicaragua, also anchored in a calorie standard. However, it used a different methodology to arrive at the poverty line. So as to achieve comparability between our cases to the extent possible we do not further

[12] Since the survey was carried out in different months in different communes even within 1992-93, all household nominal expenditures were deflated so as to express them in the currency units of January 1993. For this, monthly price deflators for 3 categories: rice, other food, and non-food items, provided by the Vietnamese General Statistical Office (GSO) were used.

consider that methodology in our calculations. More specific details regarding the procedure we applied are below.

3.2.1 Construction of Nicaraguan Poverty Line

1. The Nicaragua LSMS asked each survey household to report the quantities of foods purchased and foods received as gifts over the past 15 days. Households were asked questions about 62 different foods. Our first step was to assess the calories consumed per day per person in each household. This required converting each food quantity consumed into the calories it contained.[13] We then multiplied each quantity-unit by the appropriate conversion factor to arrive at the implied calorie consumption from each food quantity. The aggregate of these resulting calories consumed over all foods gave the total calorie consumption per day by the household. This total was divided by the number of household members to arrive at the calorie expenditure per capita for each household.

2. Next, we used data on the total per capita expenditure by each household and divided the sample into quintiles of per capita total expenditure.[14] For each of the five quintiles we computed the mean per capita calorie consumption. These means are presented in Table 2. As can be seen, at 2091.39 calories per day, the mean per capita calorie consumption of quintile 2 was closest in absolute difference to 2100. Therefore, the food poverty line was anchored to the average food basket of persons in the reference quintile. A synthetic food basket was constructed by scaling up this average food basket (by multiplying by $2100 \div 2091.39 = 1.004$) so that the synthetic food basket contained a total calorie content of 2100 calories per day. The next task was to price the synthetic food basket. For each food whose quantity was reported by the household, the price at which the food was purchased was also reported in the survey. Moreover, households reported the monetary value of foods that they received as gifts. For each household, we identified the resulting unit-value information corresponding both to the purchased and received items. We then computed the median price of each food-unit combination over all survey households, the unit-value of the purchased and the gifted items being treated alike. These median prices were used to price the food basket consumed by each household. This total household expenditure was then divided by the total number of household members to arrive at the food expenditure per person per day in each household and was multiplied by 365 to arrive at the annual food expenditure per person in each household in the reference quintile. The mean of these per-person annual expenditures is taken to be the purchasing power a person living in Nicaragua needed to have during 1998 to consume 2100 calories per day. The use of the average food basket of the reference quintile helps to ensure that this

[13] Carlos Sobrado of the World Bank provided us with the calorie conversion factors used to prepare the Nicaragua LSMS report.

[14] To account for the non-random sampling design of the survey, we compute weighted statistics in all steps. The individual weights (or inflation factors) are provided in the LSMS data.

Table 2: Calories consumed per capita per day, by quintile. Nicaragua 1998

Quintile	Mean	Std. Dev.
1	1419.76	1118.61
2	2091.39	1297.82
3	2458.32	1617.71
4	2940.60	3007.98
5	3672.91	3897.25

Table 3: Expenditures by Quintile 2. Nicaragua 1998.

Variable	Observations	Mean	Std. Dev.
Annual food expenditure (food poverty line)	766	2036.53	909.01
Annual non-food expenditure	766	981.90	884.10

food poverty line reflects local dietary norms. This is the food poverty line for Nicaragua: 2036.526 Nicaraguan cordobas per capita/per year.

3. To go from the food poverty line to the overall poverty line, we needed to add to the food poverty line an allowance for non-food expenditures. The mean non-food expenditure of the 2nd quintile was 981.90 cordobas. This is added to the food poverty line to arrive at an overall poverty line per year of 3018.42 cordobas (in the survey year). See Table 3.

3.2.2 Nicaraguan Poverty Estimates

Once we had computed the poverty line for Nicaragua, the next step involved calculating poverty estimates. From the household-level data set we created an expanded individual-level data set in which each member of each household was assigned the annual per capita expenditure of that household. We then calculated the headcount ratio: the proportion of persons in the population whose per capita expenditure was below the poverty line. Similarly we computed the aggregate poverty gap, income gap ratio, Sen Index and the Foster-Greer-Thorbecke indices with values of α equal to 1.5, 2, 2.5, 3, 3.5, and 4. We also calculated standard errors (the methodology is discussed further below) so as to judge the precision with which the poverty measures were estimated.

Our capability-based estimate of the headcount ratio is 30.61 percent. Note that the head count estimated in the LSMS Report is 47.9 percent. Our capability-based estimate is a lower 30.61 percent. That our method provides a lower estimate is not altogether surprising: the LSMS (or EMNV) used a poverty line anchored in a higher calorie standard, 2226 calories per person per day. Also, the EMNV survey used a different method to compute the poverty line: it estimated the relationship between calorie intake and total expenditures with a linear regression on the entire sample, and used the estimated parameters to compute the expenditure needed to consume 2226 calories. Implicitly, our methodology is based on this relationship only

Table 4: Poverty Lines, annual Nicaraguan Cordobas, 1998

$ 1/day general CPI	4017.20
$ 2/day general CPI	8034.40
$ 1/day food CPI	4119.44
$ 2/day food CPI	8238.87
Capability-based	3018.42

for households which are close to consuming 2100 calories per day.[15]

Next, we compared our capability-based estimates of poverty in Nicaragua with the estimates that the $1 per day PPP methodology would have produced. The comparison was done with the poverty estimates corresponding to different poverty lines: the $1 PPP per day and $2 PPP per day poverty lines adjusted by the consumer price index or a food price index for the country.[16] The poverty lines are presented in Table 4.

The table indicates that our capability-estimates are lower than the $1 per day estimates. That this is so can be confirmed to the 99 percent confidence level using the standard errors presented in Table 8.

3.3 Applying the Methodology to Tanzanian Data

The data for Tanzania are from the 2000/01 Tanzanian Household Budget Survey (HBS), conducted by the National Bureau of Statistics between May 2000 and June 2001. Once again, we followed the method used in Vietnam to establish a poverty line.

3.4 Construction of Tanzania Poverty Line

1. The Tanzanian Household Budget Survey (HBS) asked households about their item-wise food consumption from a wide spectrum of sources. This included food consumed from purchases, own production, received gifts, and other sources. Also, the quantities of individual food items were reported, each with associated total monetary value. Since no direct price data were available, we used these to establish the median unit values for each food item and treated these as the median prices The total calorie consumption per capita within each household was established by using the calorie conversion tables found in the final report of the Household Budget Survey, National Bureau of Statistics (2002). We calculated the total calories consumed by each household from its consumption of each food item and arrived at per capita calorie consumption for each household.

[15] See World Bank (2001) for a detailed description of the methodology used in the Nicaragua LSMS.

[16] Shaohua Chen of the World Bank kindly provided us with the consumer price indices. These originate in the World Bank's Development Data Group, and are the same ones used in the Bank's global poverty assessments. The food price indices used are produced by the ILO and available via the World Bank's World Development Indicators on-line database.

Table 5: Calories consumed per capita per day, by quintile. Tanzania 2000/01

Quintile	Mean	Std. Dev.
1	1539.32	751.85
2	2161.44	885.36
3	2617.46	1093.92
4	2995.38	1274.01
5	3733.57	1925.68

2. Next, we used total expenditure per capita for each household to divide the sample into quintiles. With an average daily per capita consumption of 2161.44, the second quintile was picked to be the reference group (see Table 5).

3. We calculated the average per-capita consumption of each food item in the second quintile, measured in units of consumption (e.g., grams, ml, or "pieces"), assuming zero consumption of food items for which the households did not report any value. We then scaled the resulting average bundle down (by multiplying by $2100 \div 2161.44$) to create a synthetic bundle with calorie content of 2100 calories per day. Multiplying the median prices calculated above by this vector of standardized average consumption yielded the *food poverty line* of 170.7 Tanzanian Shillings (TSH) a day, or 62,306.5 TSH's a year (in 2000/01 TSH's).

4. In the same way as we did for the food poverty line, we rescaled the average per-capita non-food expenditure of quintile 2 households (by multiplying by $2100 \div 2161.44$). This gave us the non-food expenditure allowance of 49.48 TSH a day, or 18058.5 TSH's a year (in 2000/01 TSH's).

5. The *general poverty line* is the sum of the food poverty line (from 3) and the non-food expenditure allowance (from 4): 80,365.1 Tanzanian Shillings a year.

3.5 Tanzanian Poverty Estimates

Having defined a capability-based poverty line, we were able to produce resulting poverty estimates. We provide a summary of the results based on our capability-based poverty line and on the \$1 and \$2 PPP per day poverty lines. Once again, we used both the general CPI and a food CPI to convert the IPL from local currency units in the base year to the local currency units of the survey year. Since the Household Budget Survey was administered over the period of a whole year from mid-2000 to mid-2001, we used the geometric means of the price indices pertaining to the relevant years.

As mentioned above, we calculate the poverty estimates pertaining to the capability-based poverty line and compare those to other poverty estimates. The comparison was done with the poverty estimates corresponding to different poverty lines: the \$1 PPP per day and \$2 PPP per day poverty lines adjusted by the consumer price indexes or the food price indexes. The poverty lines are presented in Table 6.

Table 6: General Annual Poverty Lines, Tanzanian Shillings 2000/01

$1/day General CPI	147,613.5
$2/day General CPI	295,227
$1/day Food CPI	158,410.83
$2/day Food CPI	316,821.66
Capability Based	80,365.1

Our capability-based estimate of the headcount ratio is 40.13 percent. This is higher than the head count estimated in the 2000/01 HBS Final Report (35.7 percent). However that estimation used a poverty line anchored in a different calorie standard, 2200 calories per person per day. Also, their methodology was based on the consumption pattern of the poorest fifty percent of the population rather than that of the second quintile. Further, it used adult-equivalents rather than the population of the household to calculate the per capita expenditures.

4 Inter-Country Poverty Comparison and Aggregation: Results

Tables 7–9 below present the three types of poverty estimates for the different country-years. These are Vietnam in 1993 and 1998, Nicaragua in 1998 and Tanzania in 2000/01. The results are based on three different poverty lines: the $1 a day, $2 a day and the capability-based poverty lines. Both the $1 a day and $2 a day money-metric poverty lines are defined by the World Bank for a particular base year: 1993. We use two different price indices to adjust these poverty lines to their assessment year equivalents. The general CPI, which is used by the World Bank for this purpose, may be inappropriate for updating the poverty line because it may adjust for changes in the prices of commodities that are irrelevant to poverty avoidance. On the other hand, the food CPI fails to account for the price changes in non-food commodities that may be needed to avoid poverty. It is therefore not obvious ex ante which of these two indices to prefer for poverty assessment. We present results using both the food CPI and the general CPI.

In the tables, the magnitude of the poverty line can be read in the first row. We provide estimates for the head count ratio, income gap ratio and poverty gap ratio, along with the aggregate poverty gap, Sen Index and the Foster-Greer-Thorbeck indices for different αs. For each poverty estimate, the associated bootstrapped standard error is in parentheses.

We ask three kinds of questions.

1. Does the extent of estimated poverty depend on the poverty identification concept used?

2. Do the ordinal and cardinal comparisons among country-years depend on the poverty identification concept used?

Table 7: Poverty Statistics, Vietnam 1993–1998

	1993			1998		
Poverty Line	$1	$2	Capability B.	$1	$2	Capability B.
HCR	13.37	63.72	58.15	5.20	41.98	35.62
	(1.270)	(1.750)	(1.785)	(.710)	(1.626)	(1.672)
IGR	21.12	34.22	31.78	17.15	27.13	25.43
	(1.729)	(.846)	(.853)	(1.546)	(.915)	(.923)
APG(m)	.42	6.54	5.11	644.80	16470	12070
	(.065)	(.297)	(.258)	(121)	(1150)	(950)
PGR	2.82	21.81	18.48	0.89	11.39	9.06
	(.433)	(.953)	(.905)	(.166)	(.734)	(.669)
Sen	4.04	28.67	24.64	1.30	15.56	12.50
	(.625)	(1.201)	(1.169)	(.237)	(.951)	(.880)
FGT(1.5)	1.59	14.25	11.79	.46	6.87	5.34
	(.305)	(.751)	(.698)	(.099)	(.521)	(.458)
FGT(2)	.98	9.72	7.88	.26	4.38	3.34
	(.228)	(.606)	(.554)	(.062)	(.378)	(.323)
FGT(2.5)	.64	6.85	5.45	.16	2.91	2.19
	(.177)	(.498)	(.450)	(.041)	(.280)	(.234)
FGT(3)	.44	4.95	3.89	.10	2.00	1.48
	(.141)	(.416)	(.373)	(.028)	(.212)	(.174)
FGT(3.5)	.32	3.66	2.84	.07	1.41	1.03
	(.115)	(.352)	(.314)	(.019)	(.163)	(.132)
FGT(4)	.24	2.76	2.12	.04	1.02	.74
	(.095)	(.302)	(.268)	(.013)	(.127)	(.102)

NOTE.— Bootstrapped standard errors in parentheses. See text for details. The $1 a day poverty line for 1993 is 629,341.1 Dongs. The Capability-based poverty line for 1993 is 1,160,363 Dongs. The $1 a day poverty line for 1998 is 953,794 Dongs. The Capability-based poverty line for 1998 is 1,758,581 Dongs.

Table 8: Poverty Statistics, Nicaragua 1998

Poverty Line	$1 food-CPI	$2 food-CPI	$1 general-CPI	$2 general-CPI	Capability-Based
HCR	45.78	79.90	44.62	79.03	30.61
	(1.310)	(1.229)	(1.310)	(1.265)	(1.464)
IGR	37.80	52.43	37.19	51.80	31.66
	(.934)	(.665)	(.976)	(.678)	(.836)
APG(m)	3432	16620	3209	15830	1409
	(154)	(607)	(146)	(581)	(79.800)
PGR	17.30	41.89	16.59	40.93	9.69
	(.720)	(.840)	(.712)	(.837)	(.558)
Sen	22.98	52.21	22.12	51.17	13.25
	(.875)	(.951)	(.862)	(.959)	(.741)
FGT(1.5)	11.99	32.60	11.44	31.73	6.31
	(.573)	(.757)	(.562)	(.753)	(.401)
FGT(2)	8.67	26.06	8.24	25.27	4.33
	(.461)	(.691)	(.448)	(.686)	(.301)
FGT(2.5)	6.46	21.25	6.12	20.54	3.09
	(.374)	(.634)	(.362)	(.627)	(.232)
FGT(3)	4.93	17.59	4.66	16.96	2.26
	(.307)	(.581)	(.296)	(.574)	(.183)
FGT(3.5)	3.84	14.74	3.61	14.18	1.70
	(.256)	(.533)	(.245)	(.524)	(.147)
FGT(4)	3.04	12.49	2.85	11.98	1.30
	(.214)	(.488)	(.205)	(.479)	(.119)

NOTE.— Bootstrapped standard errors in parentheses. See text for details. The $1 a day food-CPI poverty line is 4119.437 Cordobas. The $1 a day general-CPI poverty line is 4017.20 Cordobas. The Capability-based poverty line is 3018.42 Cordobas.

Table 9: Poverty Statistics, Tanzania 2000/01

Poverty Line	$1 food-CPI	$2 food-CPI	$1 general-CPI	$2 general-CPI	Capability-Based
HCR	78.51	95.66	75.39	94.75	40.13
	(1.218)	(.390)	(1.321)	(.518)	(1.756)
IGR	47.84	66.60	45.99	64.80	31.45
	(.850)	(.678)	(.858)	(.698)	(1.092)
APG(m)	1898000	6438000	1632000	5782000	323500
	(110000)	(313000)	(97400)	(285000)	(27800)
PGR	37.56	63.70	34.67	61.40	12.62
	(1.076)	(.803)	(1.077)	(.838)	(.835)
Sen	47.21	73.64	43.91	71.55	17.25
	(1.204)	(.713)	(1.233)	(.781)	(1.069)
FGT(1.5)	28.07	53.78	25.53	51.30	8.19
	(.970)	(.872)	(.953)	(.897)	(.624)
FGT(2)	21.59	45.99	19.39	43.47	5.60
	(.866)	(.899)	(.838)	(.913)	(.474)
FGT(2.5)	16.98	39.72	15.07	37.24	3.98
	(.770)	(.900)	(.736)	(.904)	(.365)
FGT(3)	13.58	34.59	11.94	32.18	2.91
	(.684)	(.885)	(.646)	(.881)	(.285)
FGT(3.5)	11.02	30.32	9.60	28.02	2.17
	(.607)	(.860)	(.567)	(.849)	(.224)
FGT(4)	9.04	26.73	7.82	24.55	1.65
	(.539)	(.829)	(.499)	(.813)	(.179)

NOTE.— Bootstrapped standard errors in parentheses. See text for details. The $1 a day food-CPI poverty line is 158,410.83 Tanzanian Shillings (TSH). The $1 a day general-CPI poverty line is 147,613.5 TSH. The Capability-based poverty line is 80,365.10 TSH.

3. Does the poverty identification concept used influence the estimated extent of aggregate poverty and the share of that aggregate in different countries?

Consider first the case of Tanzania in 2000-01 (Table 9). Columns (1) and (3) report estimates based on a $1 a day poverty line, using the food CPI and the general CPI respectively. Columns (2) and (4) report estimates for the $2 a day poverty line. Column (5) reports the poverty estimates for the capability-based poverty line. Each row corresponds to a different poverty measure. We can see that the capability-based poverty line consistently gives lower estimates than the $1 a day based estimates, regardless of the poverty measure used.

The reduction is substantial; whereas according to the $1 a day poverty line, 75 percent of the Tanzanian population is poor, according to the capability-based poverty line only 40 percent is poor. A similar pattern can be seen in the results for Nicaragua as well (Table 8), although the reductions are less drastic. Whereas the use of the $1 a day poverty line generates a 44.6 percent headcount ratio, the headcount ratio associated with the capability-based poverty line is 30.61 percent. Once again, we consistently find this across poverty measures.

On the other hand, for Vietnam in 1993, the use of the capability-based poverty line gives rise to much higher poverty estimates than the $1 a day poverty line, although they are below the $2 a day estimates. This is true for Vietnam in 1998 as well. The presence of data for two different years for Vietnam also allows to see if the choice of poverty line affects the rate of poverty reduction. According to the $1 a day poverty line, poverty fell from 13.4 percent in 1993 to 5.2 percent in 1998, a

reduction of 61 percent. According to the $2 a day poverty line the reduction was 34 percent. Once again, the use of the capability-based poverty line gives rise to a rate of reduction that is between the two, at 38 percent (see Table 10).

Table 10: Vietnam Head Count Ratio (HCR) Improvement

	1993 HCR	1998 HCR	1998 HCR/1993 HCR
$1/Day	13%	5%	0.38462
$2/Day	64%	42%	0.65625
Capability-Based	58%	36%	0.62069

It is sometimes proposed that the use of the $1 a day and $2 a day money-metric poverty lines is warranted because they realistically reflect the cost of achieving basic human requirements in developing countries. It is also sometimes suggested that these poverty lines are appropriate because they reflect closely the poverty lines that would be chosen by developing countries on the basis of norms and conceptions of poverty prevailing in these countries. These two rationales can in principle, of course, coexist and coincide. Do our results shed light on these justifications for existing money-metric poverty lines? Our methodology is absolutist in the sense that it focuses on the resources required by humans to achieve a set of elementary capabilities that are deemed to be essential. In this way our approach leads to meaningful poverty lines that have an interpretation in terms of the cost of meeting basic human requirements. At the same time, our approach takes account of prevailing norms because it uses the food consumption pattern of a relevant segment of the population, as well as their actual non-food expenditures. However imperfect our approach might be, it was constructed with the explicit aim of capturing the minimum cost of achieving basic capabilities in *each* of these three countries. In the light of this, the fact that our estimates differ drastically from the money-metric estimates is informative. It raises the concern that the money-metric poverty lines fail to represent the cost of achieving basic capabilities in these countries, whether or not they reflect prevailing norms and conceptions of poverty (for which there is little evidence).

In answer to the second question, we find that the ordinal rankings of country-years according to the extent of poverty are often robust to the choice of identification concept. In Table 11, dominance relations are represented in a Hasse diagram. A dominance relation is identified as existing only if one measure can be deemed greater than another at the 95 percent level of confidence. The dominance relations are represented by a vertical hierarchy: country-years with greater poverty are placed in a tier vertically above country-years with less poverty. Countries which do not stand in any dominance relation to one another are placed in the same tier. For example, consider the capability-based estimates of the HCR. The diagram shows that Vietnam in 1993 had a higher HCR than Vietnam in 1998, at a 95% significant level. It was also higher than Tanzania 2000-01, which in turn, together with Vietnam 1998, was higher than Nicaragua 1998. However the HCRs of Tanzania 2000-01 and Vietnam 1998 are not significantly different from each other. It can also be seen that Tanzania (2000/01) “almost always" is estimated to have had greater poverty than Nicaragua is estimated to have had in 1998. This relationship breaks down only for the most

distribution sensitive FGT indices, and for specific methods of calculating standard errors. Similarly, it is "almost always" the case that Vietnam in 1993 is estimated to have had greater poverty than Vietnam is estimated to have had in 1998. Thus some dominance relations remain stable irrespective of the concept underpinning the poverty line or the poverty measure used.

However, some dominance relations are altered drastically. The money-metric IPL based poverty estimates "almost always" suggest that poverty was greatest in Tanzania (2000/01), second greatest in Nicaragua (1998), third greatest in Vietnam (1993) and fourth greatest in Vietnam (1998). In sharp contrast, the capability-based estimates suggest that poverty was "almost always" highest in Vietnam in 1993. However, it is ambiguous whether it was lowest in Vietnam in 1998 or in Nicaragua in 1998.

An important observation emerges from this table. Poverty appears to have decreased in Vietnam from 1993 to 1998, regardless of the method used. There exists a broad-based perception that there was a large decrease in poverty in Vietnam in the 1990s. It is hence reassuring that the capability-based results confirm this. This reduction is apparent in the money metric estimates as well. However, when we compare countries (for example, Tanzania 2000-01 with Vietnam 1993) the direction of ordinal comparisons depends on the choice of poverty identification concept. It may be checked that the ordinal comparisons between country-years are almost uniformly invariant to the choice between money-metric ($1 or $2 per day) IPLs. On the other hand, ordinal comparisons between country-years are greatly influenced by the choice between a capability-based poverty line and a money-metric poverty line. There is a straightforward way to understand this phenomenon. Poverty estimates are determined by the level of the poverty line and the income profile (or distribution of absolute incomes) in each country. A shift from the $1 per day IPL to the $2 per day IPL entails a doubling of the poverty line in each country (since the PPP used to convert the IPL into local currency and the CPI used to convert the poverty line from the base year to the assessment year do not change as a result of this shift). Although such a shift need not preserve ordinal rankings of poverty across countries (since income profiles can vary in shape across countries, so that the impact of the doubling of the poverty line on the headcount may vary from country to country) it has done so in this case. In contrast, a shift from a money-metric ($1 or $2 per day) IPL to a capability-based poverty line entails a proportionate change in the magnitude of the poverty line which varies from country to country. For example, a shift from the $1 per day poverty line to the capability based poverty line leads to an increase in the poverty line by 84 percent in Vietnam in 1993 whereas it leads to a decrease of 45 percent in Tanzania in 2000/01. The shift from money-metric to capability based poverty lines leads to changes that vary both in direction and magnitude from country to country. It is not surprising that the result are changes to the ordinal rankings of poverty estimates of countries. A single "correction factor" applied to the money-metric poverty line in all countries will not work to bring the money metric poverty line in line with a capability-based concept of poverty.

The third question we asked was whether the estimated extent of aggregate poverty and the contribution of a specific country to aggregate poverty is influenced by the criterion used to identify the poor. Since the poverty estimates vary so much,

Table 11: Hasse Diagram for Vietnam, Nicaragua, and Tanzania Poverty Statistics

Poverty Line	$1 General CPI	$1 Food CPI	$2 General CPI	$2 Food CPI	Capability
HCR	T	T	T	T	V93
	N	N	N	N	T,V98
	V93	V93	V93	V93	N
	V98	V98	V98	V98	
IGR	T	T	T	T	V93,T,N
	N	N	N	N	V98
	V93 V98	V93 V98	V93	V93	
			V98	V98	
PGR	T	T	T	T	V93
	N	N	N	N	T
	V93	V93	V93	V93	V98,N
	V98	V98	V98	V98	
Sen	T	T	T	T	V93
	N	N	N	N	T
	V93	V93	V93	V93	V98,N
	V98	V98	V98	V98	
FGT(1.5)	T	T	T	T	V93
	N	N	N	N	T
	V93	V93	V93	V93	V98,N
	V98	V98	V98	V98	
FGT(2, 2.5, 3)	T	T	T	T	V93
	N	N	N	N	T
	V93	V93	V93	V93	N
	V98	V98	V98	V98	V98
FGT(3.5)	T	T	T	T	V93, T
	N	N	N	N	N
	V93	V93	V93	V93	V98
	V98	V98	V98	V98	
FGT(4)	T	T	T	T	V93, T
	N	N	N	N	N
	V93	V93	V93	V93	V98
	V98	V98	V98	V98	

NOTE.— T stands for Tanzania 2000-01, N for Nicaragua 1998, $V93$ for Vietnam-1993, and $V98$ for Vietnam-1998.

For FGT(3), under the capability-based poverty line, T is not significantly different from N.

Under the capability-based poverty line, FGT(3.5) and FGT(4) of Tanzania can be deemed to be larger than corresponding measures of Nicaragua only at the 10% significance level.

Table 12: Synthetic World A (Vietnam 1998, Tanzania 2000, Nicaragua 1998). World Population=115027080

Poverty Line	$1/Day	$2/Day	Capability-based
World Head Count (HC)	31529871.55	67851421.34	42252195.8
World HC Ratio	27%	59%	37%
Nicaragua's Share of World HC	7%	6%	3%
Tanzania's Share of World HC	81%	47%	32%
Vietnam's Share of World HC	13%	47%	65%

Table 13: Synthetic World B (Vietnam 1993, Tanzania 2000, Nicaragua 1998). World Population=108855380

Poverty Line	$1/Day	$2/Day	Capability-based
World Head Count (HC)	36955134.83	80554709.27	55901134.61
World HC Ratio	34%	74%	51%
Nicaragua's Share of World HC	6%	5%	3%
Tanzania's Share of World HC	69%	40%	24%
Vietnam's Share of World HC	25%	56%	73%

it is not surprising that both aggregate poverty and the share of that aggregate represented by poverty in each country are affected. In Tables 12 and 13, we generate "synthetic" worlds consisting of just three countries. Synthetic World A consists of Vietnam in 1998, Tanzania in 2000 and Nicaragua in 1998. In Synthetic World B we have Vietnam in 1993, Tanzania in 2000 and Nicaragua in 1998. The synthetic worlds are based on actual populations of these countries in these years. Both the extent of aggregate poverty and the contributions of each country to aggregate poverty do indeed vary significantly according to the criterion used to identify the poor. In both worlds, a capability based analysis leads to a worldwide headcount ratio which is substantially at variance with those generated by the $1/day and the $2/day identification criteria, and which lies between them. The contribution of individual countries to global poverty varies dramatically depending on the identification criterion used. For example, in the first artificial aggregate considered, Vietnam's 'share' of world poverty rises from 13 percent (using the $1/day identification criterion) to 65 percent (using the capability-based identification criterion).

Our rankings of countries must not be taken as authoritative. Our results suffer from many obvious flaws, among which are the following. First, the survey designs are different in different countries, forcing us to make certain judgements in order to carry out this exercise, and these judgments may be questioned. Second, the non-food poverty line we construct (based on the equiproportionality assumption) may be inappropriate, and indeed its appropriateness may vary from country to country. Third, we do not use equivalence scales to adjust for differences in the calorie and other requirements of different groups of people (as defined by sex, age, etc.). Fourth, while it is useful to employ the consumption pattern of a reference quintile in order to define the composition of the food basket assumed necessary to command at the poverty line (in order to make appropriate allowance for prevailing food habits

and preferences) this procedure may also lead to problems arising from systematic differences in real income across countries. If the reference quintile in one country possesses a higher real income than that in another, it may also possess a richer diet (e.g. one that is more varied and contains foods that are nutritionally or otherwise superior). This reference quintile may consume more "expensive calories" than does that in another country, and hence the food poverty line imputed by our procedure in this country would be (arguably inappropriately) higher. The result would be a substantive non-equivalence of the poverty line across countries, which may be thought to undermine the claim that we have established comparable poverty lines. Concerns of this type are legitimate. However, such problems can be diminished or overcome in a more comprehensive and detailed future programme of poverty line construction and survey design aimed at supporting capability-based poverty comparisons.

5 Conclusions

A requirement for meaningful comparison and aggregation of poverty across countries is that the same criterion must be used to identify the poor regardless of where they live. We have argued that the use of an identification criterion based on the possession of elementary capabilities provides an approach to international poverty comparison and aggregation that is both coherent and meaningful, unlike existing "money-metric" approaches. In our empirical exercise involving three countries from three continents (Nicaragua, Tanzania and Vietnam), we have demonstrated that it is possible to produce internationally comparable capability-based poverty estimates of a limited kind using existing data sources. Standard errors were constructed and intersection partial ordering techniques were employed to establish which pair-wise inter-country poverty comparisons are robust to the choice of identification criterion and which are not. In our case study, both cardinal and ordinal comparisons were affected.

This finding suggests that the choice of identification criterion may be an important determinant of our judgments concerning which countries are poorer than others and by how much. We do not make the claim that our poverty estimates are authoritative, because they were produced using data sources that were not specifically designed to support the exercise we have undertaken. However, our poverty lines possess a meaningful and uniform interpretation. The fact that they lead to substantially different estimates of absolute and relative poverty levels than money-metric poverty lines suggests that existing methods of poverty estimation need to be re-examined.

The exercise presented here points to the desirability of undertaking international coordination of survey design and poverty line construction methods. Such coordination will facilitate larger scale application of capability-based international poverty comparison and aggregation. An effort of this kind must identify relevant elementary capabilities and the characteristics of the commodities that promote them. There may be almost universal agreement on some elementary capabilities (such as the ability to be adequately nourished) and on the characteristics of commodities that promote them (such as calorie content), whereas agreement about other relevant elementary

capabilities (and the characteristics of commodities that promote them) may be more readily achieved. The possibility of controversy is not a reason in itself for dismissing a capability-based approach to inter-country poverty comparison and aggregation as infeasible. Rather it is a reason to seek consensus to the extent possible, to be restrained in the definition of the relevant elementary capabilities, and if necessary to operationalize multiple specifications, so as to take account of reasonable pluralism in value and interpretation.

The proposed program of international coordination in survey design and poverty line construction has the virtue that it can be used to strengthen the quality of national poverty statistics while simultaneously facilitating the comparability of poverty estimates across countries. Although our aim has been to show the feasibility and desirability of undertaking capability-based poverty comparisons using available data, we have not meant to suggest that available data is adequate for this purpose. The development of common international survey design and poverty line construction protocols is an ultimately inescapable requirement for increasing the coherence and meaningfulness of international poverty comparison and aggregation.

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