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ARGUMENTS
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WORLD

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CHAPTER 1

INTER-COUNTRY COMPARISONS OF INCOME POVERTY BASED ON A CAPABILITY APPROACH

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I. INTRODUCTION

How should poverty be estimated? Amartya Sen has argued persuasively that poverty must be seen as the deprivation of basic capabilities, where capabilities are the “substantive freedoms [a person] enjoys to lead the kind of life he or she has

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reason to value”, rather than merely as low income (Sen 1999: 87). Income is one instrument for attaining such substantive freedoms, but only one. Moreover, “the instrumental relation between low income and low capability is *variable* between different communities and even between different families and different individuals (the impact of income on capabilities is contingent and conditional)” (Sen 1999: 88). Sen has also pointed out that, more generally, 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 form a judgement concerning the extent of poverty in a society. An identification criterion that is uniform at *some* level of abstraction must be applied to all individuals if this exercise is to provide a meaningful basis for comparisons. For example, we may define as income-poor all those whose money income falls below a certain level, or instead we might define as income-poor all those whose money income is below the level required to achieve some end (such as the attainment of basic capabilities, as Sen recommends). For an exercise of poverty assessment to be meaningful, it is necessary (although not sufficient) that it be possible to view it as consistently applying a uniform identification criterion to all individuals.

Efforts to assess poverty at the regional and global levels are as subject to this demand as are poverty assessments within the national context. Meaningful inter-country income 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 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 an ultimately futile sense. As argued by Reddy and Pogge (forthcoming), the PPP conversion factors used for this purpose do not reflect an invariant level of purchasing power over essential commodities. Therefore, the substantive interpretation of existing \$1 and \$2 per day IPLs is widely discrepant across countries. If it is demanded that the identification criterion have a common substantive interpretation in order to be deemed uniform in the relevant sense,

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 Centre of the United Nations Development Programme provided essential support. We thank Terry McKinley for facilitating this support. We are also grateful to Ravi Kanbur, Camelia Minoiu, Nanak Kakwani, Terry McKinley, participants in the international conference on the “many dimensions of poverty” held by the UNDP International Poverty Centre, and participants in a workshop on capabilities and well-being evaluation held at the University of California at Riverside for helpful comments. Our greatest thanks are to Amartya Sen for the abiding inspiration that he has provided.

then the existing money-metric approach does not provide the uniform identification criterion that is required (and that would be achieved if it reliably referred to an invariant level of purchasing power over essential commodities).

There is another problem with the money-metric approach. A meaningful poverty line should, at a minimum, 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 persuasive poverty line should reflect them. A poverty line is meaningful only if persons with incomes falling below the poverty line can reasonably be thought of as poor. Unfortunately, the local currency "equivalents" of the IPL not only have discrepant interpretations across countries but often fail to reflect the cost of achieving basic human requirements in each individual country. It is difficult to make the case that the "\$1/day" and "\$2/day" international poverty lines reflect the cost of achieving the real requirements of human beings (see e.g. Reddy and Pogge forthcoming). The poverty lines employed in an income poverty assessment must be evaluatively meaningful if the exercise of income poverty assessment as a whole is to be meaningful, but this test is failed by the money-metric approach.

A fully meaningful approach to inter-country income 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 possessing the advantage of having the same meaningful interpretation in all countries. Such an approach would avoid using PPPs altogether, and eliminate both problems of the current money-metric approach in a single stroke. Conceptually, the capability-based alternative approach to income poverty assessment involves nothing more than the generalization to the context of inter-country comparisons of an approach that is already widely used and thought of as appropriate at the national level. Of course, a capability-based approach to income poverty assessment is not the same as an approach to poverty assessment that assesses capability deprivations as such. There is room and necessity for both approaches to poverty assessment. It may surprise advocates of the capability approach to hear methods which they have viewed as inadequate in the national context described here as "capability-based" but they do merit this description in contrast to the "money-metric" approach.

We report here the results of a capability-based approach to income poverty assessment. We show that it is possible to use existing household survey data from three different countries (Nicaragua, Tanzania and Vietnam) on three continents to define a uniform capability-based criterion for identifying the poor. We focus

centrally on the capability to be adequately nourished, as it is both universally agreed to be a relevant basic capability and is easy to employ. We use this criterion to establish poverty lines that possess a common capability-based interpretation (in terms of nutritional non-deprivation) in all three countries and then estimate income poverty in these countries. By definition, the resulting 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 capability-based approach to global income poverty estimation. The sense in which the approach to poverty assessment adopted here is capability-based is admittedly a very limited one. It focuses on explicitly specifying a single capability (the ability to be adequately nourished) while making indirect allowance for other relevant capabilities. It also takes a rather restricted approach (based on food energy requirements) to the empirical identification of that capability. Finally, no allowance is made for variations in the commodities required for achieving basic capabilities, as is ultimately required in a comprehensive capability-based perspective. The approach pursued therefore falls far short of the best possible. Nevertheless, it presents a superior alternative to the money-metric approach, in that it is in contrast grounded in a conception of basic human requirements, and employs this conception uniformly across countries. For this reason, although we are aware of the limitations of this characterization, we will refer to the approach as "capability-based". It is obvious that various enhancements can and could be undertaken to generate more fully adequate income poverty assessments for each country (for example, through using household adult-equivalence scales). However, the desirability of undertaking such enhancements applies in common to all approaches to regional and global income poverty estimation.¹

We contrast the poverty estimates that we obtain on the basis of capability-based poverty lines 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. On the basis of this exercise, we argue that there is no "quick fix" that can align the existing money-metric poverty lines with a capability-based concept of poverty. A simple increase or decrease in the money-metric IPL without a change in the PPPs used to convert the IPL into local currency units cannot bring about such alignment, because the adjustment that is required varies from country to country. A more comprehensive program of capability-based poverty

¹ Notably, existing global poverty estimates based on money-metric IPLs produced by the World Bank and others have not employed household equivalence scales.

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 non-money-metric methods for constructing a set of poverty lines that possesses a more uniform and meaningful interpretation across countries.

We have taken the methodology for poverty line construction used in the 1993 Vietnam Living Standards Measurement Survey (LSMS) as our starting point. We may infer from its adoption that the method was considered acceptable for measuring national poverty in Vietnam. This starting point is, to a degree, arbitrary. It represents one among many plausible ways of constructing a nutritionally anchored poverty line (see e.g. Ravallion 1994). We also 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 income poverty estimates across countries and over time, the capability-based approach that we employ does, in some instances, give results significantly different to those of the money-metric approach. Both cardinal comparisons and (perhaps more surprisingly) ordinal rankings of income poverty across countries are influenced by the approach used. The rest of the chapter is organized as follows. In the next section, we describe the conceptual content of the method we apply. In section III, we describe the methodology used in each country and in section IV we describe the resulting poverty estimates. Section V discusses the implications of our analysis for inter-country poverty comparison and aggregation and presents our conclusions.

II. INTER-COUNTRY INCOME POVERTY COMPARISON AND AGGREGATION USING EXISTING DATA: A ROUGH METHOD

The first step in the 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 which suffices to achieve the elementary capabilities. Given the prices faced

by an individual, 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 1993 Vietnam LSMS in adopting this approach. As noted, this approach is a mere starting point, and insufficiently attentive to the diverse features of persons (e.g. age, gender, occupation) which influence the way in which they can transform commodities into capabilities. These diversities should be taken into account in a fully adequate approach to poverty assessment.²

In our empirical exercise, we take the ability to be adequately nourished as the centrally relevant elementary capability which anchors the identification exercise, at the risk of considerable over-simplification. 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, following the Vietnam LSMS. 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—2,100 kilocalories (kcal)). For simplicity, 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 2,100 kcal and reflecting this consumption pattern. 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, and is a rough and ready way of making allowance for prevailing consumption norms. Although there is the danger of using a consumption pattern that is “richer” in one country than in another as if they were equivalent, there seems no straightforward way to avoid this problem without bringing in auxiliary judgements. These could (and indeed should) be integrated into more comprehensive exercises.

Next, we make an allowance for non-food requirements. We determine the ratio of non-food to food expenditure for the reference population and then maintain this ratio at the poverty line. This is a highly inadequate approach to a complex problem; we follow it here because of a lack of independent information on non-food requirements and costs.

Suppose that the average commodity bundle of the reference population has a calorie content that falls below 2,100 kcal by x per cent. Our approach assumes that the reference population's shortfall in the expenditure necessary to achieve both the food and the non-food expenditure requirements (for capability adequacy) is also x per cent. Let us call this the equiproportionality assumption. 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.

² In many national poverty estimation exercises, this problem is imperfectly addressed with the use of equivalence scales.

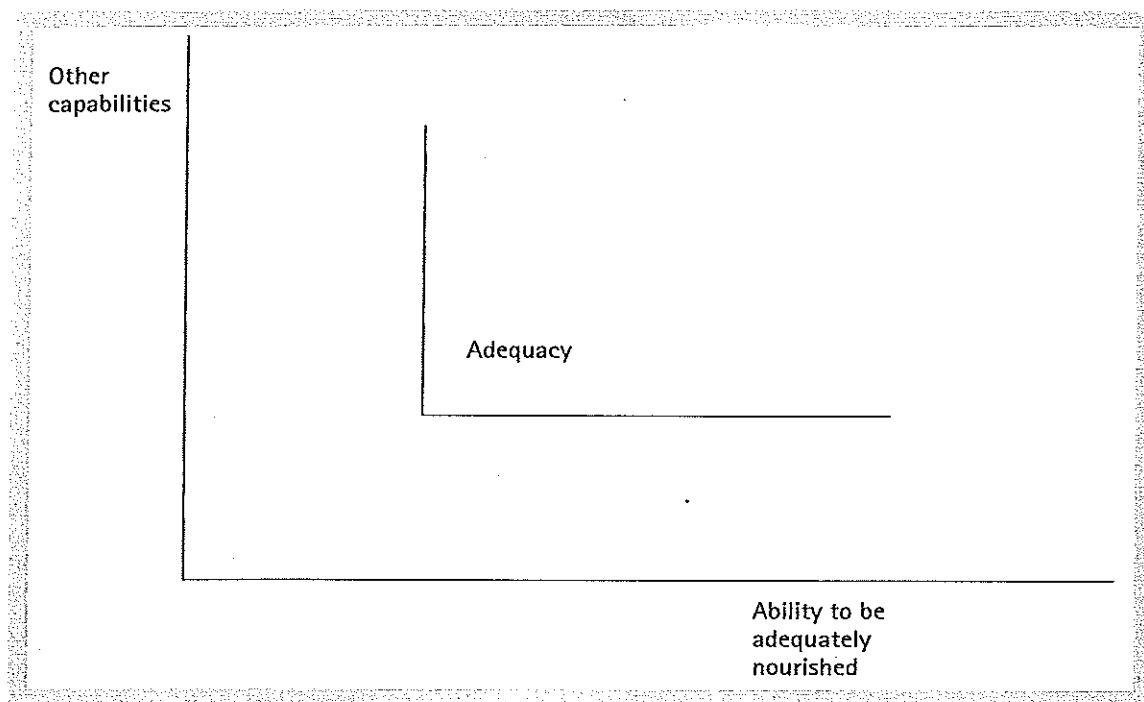


Fig. 1.1. Capability space

We may informally illustrate our general approach as follows, assuming indexable capabilities. If a minimally adequate level of each of the relevant income-dependent capabilities is deemed essential to avoid income poverty, this gives rise to an “adequacy set” with an L-shaped lower contour in the capability space (see Fig. 1.1).

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: food energy, protein, fats, fiber, micronutrients and so on.³ It may be thought appropriate to make allowance for adequate amounts of other commodity characteristics as well (e.g. taste). Since different commodities contain these characteristics in different proportions, substitution between them may be possible, giving rise to a differently shaped (even smooth) lower contour of the adequacy set as represented in characteristics space (see Fig. 1.2). 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. Tradeoffs of this type may be pervasive. However, our approach will not take explicit note of this possibility. For simplicity, researchers have focused historically on the food energy intake of individuals and have anchored the poverty line in a calorie adequacy threshold. We will not depart from this classical approach, despite its very severe limitations,

³ On the concept of characteristics of commodities, see Lancaster (1971).

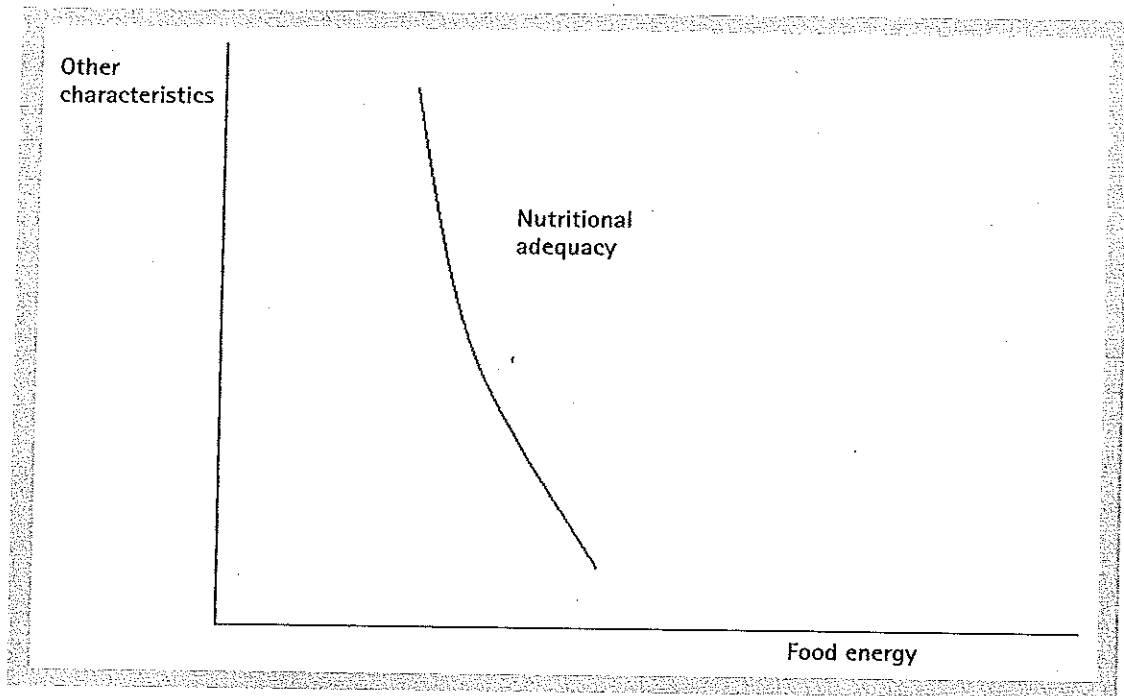


Fig. 1.2. Characteristics space

as employing it will suffice for us to make our broader methodological point which is concerned with bringing to light the limitations of the money-metric approach. In our study, the calorie adequacy threshold is defined as 2,100 kcals per day.

In principle, it should be possible to relax the equiproportionality assumption. However, in the absence of 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 requires justification. There is a need for more explicit specification of the non-food requirements and the collection of information required to determine the cost of meeting these requirements. Such an exercise will not be feasible without the design of surveys specifically with this end in mind, and complementary exercises in evaluative judgement.

III. DATA AND EMPIRICAL WORK

The methodology described in the previous section is applied to three countries: Nicaragua, Tanzania and Vietnam. The most important feature of the exercise is

Table 1.1. World Bank poverty headcount ratio estimates

	1991		1993		1998	
	\$1/day	\$2/day	\$1/day	\$2/day	\$1/day	\$2/day
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 online 13 March 2005).

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 comparisons and aggregates with respect to the choice of identification concept. 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.⁴

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 a limited type of 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 the World Bank's estimates based on its \$1 and \$2 per day IPLs, but the third country (Vietnam) had a very different headcount ratio, summarized in Table 1.1.

We also compute standard errors of all poverty measures by using bootstrapping. 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 to which we could gain access. 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 the Tanzanian National Bureau of Statistics.

In order to facilitate comparison of statistics across countries and across poverty line concepts, we also calculated bootstrapped standard errors (using 1,000 iterations) for every poverty estimate. The large number of iterations guaranteed a very

⁴ 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).

high confidence level in most, if not all, cases in the calculation of the standard errors: a 5 per cent significance level and a deviation in magnitude of approximately 4.5 per cent from the limiting standard deviation.⁵

III.1 Methodology used for Vietnam

The methodology applied in Vietnam amounts to five steps:

1. Exogenously identify a threshold of nutritional capability adequacy and characterize it in terms of characteristics of commodities consumed (the 2,100-kcal 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 determine the number of persons living in households with per capita consumption beneath this level.

The estimates of poverty for Vietnam according to various poverty indicators are reported in Table 1.4.

III.2 Applying the Methodology to Nicaraguan Data

The data for Nicaragua are from the Nicaraguan LSMS for 1997/8 (known as the EMNV 1998 Survey). We have followed the methodology used in Vietnam to calculate the capability-based poverty line for Nicaragua, employing both general and food-based CPIs to calculate equivalents over time.

Once we had computed the poverty line for Nicaragua, the next step involved calculating income poverty estimates. From the household-level data set, we created an expanded individual-level data set in which each member of each household

⁵ We used the method proposed in Andrews and 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 and Lanjouw (1998), we calculate standard errors both using bootstrapping and using the `sepo` 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. We report and refer only to the bootstrapped standard errors, since the standard errors calculated through the two approaches were generally very close.

Table 1.2. Annual poverty lines, Nicaraguan cordobas, 1998

\$1/day general CPI	4,017.20
\$2/day general CPI	8,034.40
\$1/day food CPI	4,119.44
\$2/day food CPI	8,238.87
Capability-based	3,018.42

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, and calculated standard errors (the methodology is discussed further below) so as to judge the precision with which the poverty measures were estimated.

Next, we compared our capability-based estimates of income poverty in Nicaragua with the estimates that the money-metric 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.⁶ The poverty lines are presented in Table 1.2.

The table implies that the capability-based estimates are lower than the \$1 per day estimates. This can be confirmed by referring to Table 1.5, which reports Nicaragua income poverty estimates for varying poverty lines and measures of poverty.

III.3 Applying the Methodology to Tanzanian Data

The data for Tanzania are from the 2000/1 Tanzanian Household Budget Survey (HBS), conducted by the National Bureau of Statistics between May 2000 and June 2001. Once again, we applied our chosen methodology to establish a poverty line for Tanzania.

We produced income poverty estimates based on our capability-based poverty line for Tanzania. We provide a summary of the results based on our capability-based income poverty line and on the \$1 and \$2 PPP per day income poverty lines. Once again, we used both the general CPI and a food CPI to convert the

⁶ 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 we used are produced by the ILO and available in the World Bank's World Development Indicators.

Table 1.3. Annual poverty lines, Tanzanian shillings, 2000/2001

\$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

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. We report the different poverty lines that we employed in Table 1.3.

Our detailed poverty estimates for different poverty lines and measures of poverty for Tanzania are presented in Table 1.6.

IV. INTER-COUNTRY INCOME POVERTY COMPARISON AND AGGREGATION ACCORDING TO ALTERNATIVE APPROACHES: RESULTS

Tables 1.4–1.6 present the three types of poverty estimates for the different country-years: Vietnam in 1993 and 1998, Nicaragua in 1998 and Tanzania in 2000/1. 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 employed are those defined by the World Bank for a particular base year, 1993. As noted, we use both general and food price indices to adjust these poverty lines to their assessment year equivalents.

In the tables, the type of poverty line used is described in the first row. We provide estimates for the headcount ratio, income gap ratio, and poverty gap ratio, along with the aggregate poverty gap, Sen Index and the Foster–Greer–Thorbeck Indices for different values of its distribution sensitivity parameter. 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 in each country depend on the poverty identification concept?
2. Do the ordinal and cardinal comparisons among country-years depend on the poverty identification concept?
3. Does the poverty identification concept influence the estimated extent of aggregate poverty and the share of that aggregate in different countries?

To examine the first question, consider initially the case of Tanzania in 2000/1 (Table 1.6). 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 estimates based on \$1 a day, regardless of the poverty measure used.

The reduction is substantial. Whereas according to the \$1 a day poverty line, 75 per cent of the Tanzanian population is poor, according to the capability-based poverty line, only 40 per cent is poor. A similar pattern can be seen in the results for Nicaragua as well (Table 1.5), although the reductions are less drastic. Whereas the use of the \$1 a day poverty line generates a 44.6 per cent headcount ratio, the headcount ratio associated with the capability-based poverty line is 30.61 per cent.

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 one to see if the choice of poverty line affects the rate of poverty reduction. According to the \$1 a day poverty line, the headcount ratio fell from 13.4 per cent in 1993 to 5.2 per cent in 1998, a reduction of 61 per cent. According to the \$2 a day poverty line, the reduction was 34 per cent. Once again, the use of the capability-based poverty line gives rise to a rate of reduction that is between the two, at 38 per cent (see Table 1.7).

However imperfect our capability-based approach might be, it was constructed with the explicit aim of capturing the minimum cost of achieving the same basic capabilities in *each* of these three countries. In 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.

In answer to the second question, we find that the ordinal rankings of country-years according to the extent of poverty are often robust with regard to the choice of identification concept. In Table 1.8, dominance relations are represented in a Hasse diagram (following the suggestion made by Amartya Sen in diverse writings that

Table 1.4. Income poverty statistics, Vietnam, 1993-1998

	Poverty line					
	1993			1998		
	\$1/day	\$2/day	Capability-based	\$1/day	\$2/day	Capability-based
HCR	13.37 (1.270)	63.72 (1.750)	58.15 (1.785)	5.20 (.710)	41.98 (1.626)	35.62 (1.672)
IGR	21.12 (1.729)	34.22 (.846)	31.78 (.853)	17.15 (1.546)	27.13 (.915)	25.43 (.923)
APG (m)	0.42 (.065)	6.54 (.297)	5.11 (.258)	644.80 (121)	16,470 (1,150)	12,070 (950)
PGR	2.82 (.433)	21.81 (.953)	18.48 (.905)	0.89 (.166)	11.39 (.734)	9.06 (.669)
Sen	4.04 (.625)	28.67 (1.201)	24.64 (1.169)	1.30 (.237)	15.56 (.951)	12.50 (.880)
FGT (1.5)	1.59 (.305)	14.25 (.751)	11.79 (.698)	0.46 (.099)	6.87 (.521)	5.34 (.458)
FGT (2)	0.98 (.228)	9.72 (.606)	7.88 (.554)	0.26 (.062)	4.38 (.378)	3.34 (.323)
FGT (2.5)	0.64 (.177)	6.85 (.498)	5.45 (.450)	0.16 (.041)	2.91 (.280)	2.19 (.234)
FGT (3)	0.44 (.141)	4.95 (.416)	3.89 (.373)	0.10 (.028)	2.00 (.212)	1.48 (.174)
FGT (3.5)	0.32 (.115)	3.66 (.352)	2.84 (.314)	0.07 (.019)	1.41 (.163)	1.03 (.132)
FGT (4)	0.24 (.095)	2.76 (.302)	2.12 (.268)	0.04 (.013)	1.02 (.127)	0.74 (.102)

Notes: Bootstrapped standard errors are in parentheses; see text for details. The \$1 a day poverty line for 1993 is 629,341.1 dong; the capability-based poverty line for 1993 is 1,160,363 dong. The \$1 a day poverty line for 1998 is 953,794 dong; the capability-based poverty line for 1998 is 1,758,581 dong.

Table 1.5. Income poverty statistics, Nicaragua, 1998

	Poverty line				
	\$1 food-CPI	\$2 food-CPI	\$1 general-CPI	\$2 general-CPI	Capability-based
HCR	45.78 (1.310)	79.90 (1.229)	44.62 (1.310)	79.03 (1.265)	30.61 (1.464)
IGR	37.80 (.934)	52.43 (.665)	37.19 (.976)	51.80 (.678)	31.66 (.836)
APG (m)	3432 (154)	16620 (607)	3209 (146)	15830 (581)	1409 (79800)
PGR	17.30 (.720)	41.89 (.840)	16.59 (.712)	40.93 (.837)	9.69 (.558)
Sen	22.98 (.875)	52.21 (.951)	22.12 (.862)	51.17 (.959)	13.25 (.741)
FGT (1.5)	11.99 (.573)	32.60 (.757)	11.44 (.562)	31.73 (.753)	6.31 (.401)
FGT (2)	8.67 (.461)	26.06 (.691)	8.24 (.448)	25.27 (.686)	4.33 (.301)
FGT (2.5)	6.46 (.374)	21.25 (.634)	6.12 (.362)	20.54 (.627)	3.09 (.232)
FGT (3)	4.93 (.307)	17.59 (.581)	4.66 (.296)	16.96 (.574)	2.26 (.183)
FGT (3.5)	3.84 (2.56)	14.74 (.533)	3.61 (.245)	14.18 (.524)	1.70 (.147)
FGT (4)	3.04 (.214)	12.49 (.488)	2.85 (.205)	11.98 (.479)	1.30 (.119)

Notes: Bootstrapped standard errors in parentheses; see text for details. The \$1 a day food-CPI poverty line is 4,119.437 cordobas; the \$1 a day general-CPI poverty line is 4,017.20 cordobas; the capability-based poverty line is 3,018.42 cordobas.

Table 1.6. Income poverty statistics, Tanzania, 2000/2001

	Poverty line				
	\$1 food-CPI (1)	\$2 food-CPI (2)	\$1 general-CPI (3)	\$2 general-CPI (4)	Capability-based (5)
HCR	78.51 (1.218)	95.66 (.390)	75.39 (1.321)	94.75 (.518)	40.13 (1.756)
IGR	47.84 (.850)	66.60 (.678)	45.99 (.858)	64.80 (.698)	31.45 (1.092)
APG (m)	1,898,000 (110,000)	6,438,000 (313,000)	1,632,000 (97,400)	5,782,000 (285,000)	323,500 (27,800)
PGR	37.56 (1.076)	63.70 (.803)	34.67 (1.077)	61.40 (.838)	12.62 (.835)
Sen	47.21 (1.204)	73.64 (.713)	43.91 (1.233)	71.55 (.781)	17.25 (1.069)
FGT (1.5)	28.07 (.970)	53.78 (.872)	25.53 (.953)	51.30 (.897)	8.19 (.624)
FGT (2)	21.59 (.866)	45.99 (.899)	19.39 (.838)	43.47 (.913)	5.60 (.474)
FGT (2.5)	16.98 (.770)	39.72 (.900)	15.07 (.736)	37.24 (.904)	3.98 (.365)
FGT (3)	13.58 (.684)	34.59 (.885)	11.94 (.646)	32.18 (.881)	2.91 (.285)
FGT (3.5)	11.02 (.607)	30.32 (.860)	9.60 (.567)	28.02 (.849)	2.17 (.224)
FGT (4)	9.04 (.539)	26.73 (.829)	7.82 (.499)	24.55 (.813)	1.65 (.179)

Notes: 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.

Table 1.7. Vietnam headcount ratio (HCR) reduction, 1993–1998

	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

intersection partial orderings can be a valuable device in empirical investigations). A dominance relation is identified to exist only if one measure can be deemed greater than another at the 95 per cent 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 headcount ratio (HCR). The diagram shows that Vietnam in 1993 had a higher HCR than Vietnam in 1998, at a 95 per cent significance level. It was also higher than Tanzania 2000/1, which in turn, together with Vietnam 1998, was higher than Nicaragua 1998. The HCRs of Tanzania 2000/1 and Vietnam 1998 are not significantly different from each other. It can also be seen that Tanzania 2000/1 is estimated to have had greater poverty than Nicaragua is estimated to have had in 1998 for almost all the measures. Similarly, Vietnam in 1993 is estimated to have had greater poverty than Vietnam in 1998 for almost all the measures. Thus, some dominance relations are 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 2000/1, second greatest in Nicaragua 1998, third greatest in Vietnam in 1993 and lowest 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 1998 or in Nicaragua 1998.

An important observation emerges from this table. Income poverty appears to have decreased in Vietnam from 1993 to 1998, regardless of the method used. There is 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 2000/1 with Vietnam 1993), the direction of ordinal comparisons depends on the choice of the poverty identification concept. It may be confirmed that the ordinal comparisons between country-years are almost uniformly invariant with regard 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 and

Table 1.8. Hasse diagram for Vietnam, Nicaragua and Tanzania income poverty statistics

	Poverty line				
	\$1 general-CPI	\$1 food-CPI	\$2 general-CPI	\$2 food-CPI	Capability-based
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	

Notes: N stands for Nicaragua 1998, T stands for Tanzania 2000/1, 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 1.9. Synthetic world A (Nicaragua 1998, Tanzania 2000, Vietnam 1998; population 115,027,080)

	Poverty line		
	\$1/day	\$2/day	Capability-based
World A head count (HC)	31,529,871.55	67,851,421.34	42,252,195.8
World A HC ratio	27%	59%	37%
Nicaragua's share of world A HC	7%	6%	3%
Tanzania's share of world A HC	81%	47%	32%
Vietnam's share of world A HC	13%	47%	65%

a money-metric poverty line. There is a straightforward way to understand this phenomenon. Income 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 in proportion 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 per cent in Vietnam in 1993 whereas it leads to a decrease of 45 per cent in Tanzania in 2000/1. The shift from money-metric to capability-based income poverty lines leads to changes that vary both in direction and magnitude from country to country. It is not surprising that the ordinal rankings of income poverty estimates of countries change as a result. A single correction factor applied to the money-metric poverty line in all countries will not cause the money-metric poverty line to generate similar result as a capability-based concept of income poverty.

The third question we asked was whether the estimated extent of aggregate income poverty and the contribution of a specific country to aggregate income poverty are influenced by the criterion used to identify the poor. Since the poverty estimates vary so much, it is not surprising that both aggregate income poverty and the share of that aggregate represented by income poverty in each country are affected. In Tables 1.9 and 1.10, we generate "synthetic" worlds consisting of just three countries. Synthetic world A consists of Nicaragua in 1998, Tanzania in 2000, and Vietnam in 1998. In Synthetic world B, we have Nicaragua in 1998,

Table 1.10. Synthetic world B (Nicaragua 1998, Tanzania 2000, Vietnam 1993; population 108,855,380)

	Poverty line		
	\$1/day	\$2/day	Capability-based
World B head count (HC)	36,955,134.83	80,554,709.27	55,901,134.61
World B HC ratio	34%	74%	51%
Nicaragua's share of world B HC	6%	5%	3%
Tanzania's share of world B HC	69%	40%	24%
Vietnam's share of world B HC	25%	56%	73%

Tanzania in 2000, and Vietnam in 1993. The synthetic worlds are based on the actual populations of these countries in these years. Both the extent of aggregate income poverty and the contributions of each country to aggregate income poverty do indeed vary significantly according to the criterion used to identify the poor. In both synthetic worlds, a capability-based analysis leads to a worldwide headcount ratio which is substantially different from those generated by the \$1/day and the \$2/day identification criteria, and is between them. The contribution of individual countries to global income poverty varies dramatically depending on the identification criterion used. For example, in the first artificial aggregate considered, Vietnam's share of world income poverty rises from 13 per cent (using the \$1/day identification criterion) to 65 per cent (using the capability-based identification criterion).

Our rankings of countries must not in any way 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 judgements 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 the existence of 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 program of poverty line construction and survey design aimed at more adequately supporting capability-based income poverty comparisons. We have referred to the procedure used as "capability-based" in only the most limited sense, with the goal of highlighting the conclusion that even such a limited approach can have results which are very different from those of the money-metric approach.

V. 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 income 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 income 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 with regard to the choice of identification criterion and which are not. In our case study, both cardinal and ordinal comparisons were affected by the choice of approach.

This finding suggests that the choice of an identification criterion may be an important determinant of our judgements 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 and they are based on strong simplifying assumptions. However, unlike existing money-metric international poverty lines, our poverty lines possess a more meaningful and uniform substantive interpretation. The fact that they lead to estimates of absolute and relative poverty levels different from those tied to money-metric poverty lines suggests that existing methods of global poverty estimation ought to be critically re-evaluated.

The exercise presented here points to the desirability of undertaking international coordination of survey design and poverty line construction methods. Such coordination will facilitate wide application of a more comprehensive form of capability-based international income poverty comparison and aggregation than that attempted here. 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 income-dependent 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 income-dependent capabilities (and the characteristics of commodities that promote them) may not be so readily achieved. The possibility of controversy over what the relevant elementary income-dependent capabilities are and how they are furthered is not in itself reason to dismiss the approach as infeasible. Rather, it is reason to seek an operationally adequate consensus over such questions.

Although our aim has been to show the feasibility and desirability of undertaking capability-based income poverty comparisons using available data, we have not meant to suggest that available data are adequate for this purpose. The development of common protocols for international survey design and poverty line construction is a requirement for increasing the coherence and meaningfulness of international poverty comparison and aggregation. Finally, income poverty assessment, although an essential dimension of poverty assessment generally, remains only one aspect of such assessment, as rightly noted by the advocates of the capability perspective. Income poverty assessment must be informed by that perspective but is a limited domain of application which cannot begin to exhaust the relevance and reach of that transformative approach.

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