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NEW GLOBAL POVERTY COUNTS

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ABSTRACT

The main objective of this study is to compute an international poverty threshold based on the food requirement to ensure an adequate calorie intake for the world's poorest. The study proposes a new methodology based on consumer theory to provide a caloric based international poverty threshold. Using this methodology, the international poverty line is estimated to be equal to $1.22 in 1993 PPP exchange rates. According to this new yardstick, almost 1.37 billion people were poor around the world in 2001. The study also provides global estimates of hunger, according to which 13.28 percent of the world population – equivalent to 687 million people – suffered from hunger in 2001.

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1 INTRODUCTION

Global estimates of poverty can play an important role in monitoring the level and change in poverty at the global level. It is true that an in-depth analysis of country- specific poverty profiles is more useful for understanding the nature of poverty and for devising poverty reduction strategies, but global counts can be used as a powerful device to create political awareness in giving priority to poverty reduction, as well as providing benchmarks for individual countries. The World Bank is the main institution that produces global estimates of poverty. It presented global poverty estimates for the first time in its 1990 World Development Report. The Report chose a $1 a day poverty line, measured in 1985 purchasing power parity (PPP). The PPP exchange rates are used because they take into account the local prices of goods and services that are not traded internationally.

The $1 a day poverty line was chosen because it was the most typical poverty line among the low-income countries for which poverty lines were available. This poverty line has come to be regarded as providing the absolute minimum standard of living, below which meeting basic needs is not fully possible. Based on this poverty line, Ravallion and Chen (1997) estimated that 1.30 billion people in the world are poor.

Recently, Chen and Ravallion (2001) have produced much improved global estimates of poverty based on an expanded database consisting of 297 household surveys spanning 88 countries. They have also provided estimates of the change in global poverty over time. The most important feature of the new estimates is that they are based on vastly improved 1993 PPP exchange rates for consumption. These rates are superior to the earlier ones in terms of coverage of countries and are based on price and consumption baskets prevailing in 1993.

The World Bank determined a new poverty line of $1.08 per person per day at 1993 prices, which is the median of the national poverty lines in 10 countries: Bangladesh, China, India, Indonesia, Nepal, Pakistan, Thailand, Tanzania, Tunisia and Zambia. In its calculations of global poverty, the World Bank has now recalculated the number of poor based on this new poverty threshold, which is still referred to as the $1 a day poverty line (Chen and Ravallion, 2001).

The root idea of the poverty line is that it should reflect the cost of achieving basic human needs. However, the $1 a day (or $2 a day) poverty line does not reflect the cost of achieving any kind of basic human needs. It was chosen mainly because it was a typical poverty line prevailing in the 1980s in a sample of 33 countries, which included only 10 low income countries. Thus, there is a clear-cut need to revise the global poverty estimates so that they take some basic capabilities into account (Sen, 1999).

One of the basic human needs is the capability to be adequately nourished. According to Lipton (1988), "access to [an] adequate source of nutrition" is a good indicator of quality of life; health, shelter, education, even mobility, which are all reflected in nutritional status, although not in a linear or otherwise simple way. The main objective of this study is to compute an international poverty threshold based on the food requirement to ensure adequate calorie intake for the world's poorest. The study proposes a new methodology based on consumer theory to provide caloric based international poverty thresholds. In the construction poverty thresholds, the study utilizes unit record data for 19 low income countries (4 in Asia and 15 in Africa). Since the surveys in different countries were conducted in different years, we chose the latest available survey in each country.

The international poverty threshold developed on the basis of 19 countries is used to produce global poverty counts utilizing the World Bank data base consisting of over 450 surveys for about 100 counties covering 93 percent of the population of low and middle-income countries in the world.

2 PURCHASING POWER PARITY

The purchasing power parity (PPP) exchange rates are the essential ingredients of determining internationally comparable poverty lines. The PPP exchange rates are essentially the cost of living indices among the countries. They allow us to make international comparisons of costs of living in different countries. For instance, the World Bank has determined that $1.08 in 1993 PPP (in 1993 prices) dollars is an appropriate international poverty line, then utilizing the 1993 PPP conversion rates, we can estimate the equivalent value of this poverty line in the country's local currency in 1993 prices.

Suppose that we want to estimate the poverty rate of the *i*th country for which the household survey is available for 2000, then we need to know the *i*th country's poverty line in 2000. This can easily be estimated using the inflation rate that occurred between 1993 and 2000. Thus, the estimation of global poverty rates requires both PPP exchange rates and national consumer price indices. The accurate estimation of global poverty rates depends on the accuracy of both PPP exchange rates and consumer price indices.

It must be emphasized that PPP exchange rates were not designed for making international poverty comparisons; they were mainly designed for comparing aggregates from national accounts.[1] PPP exchange rates are based on prices of commodities that are not representative of the consumption baskets of the poor (Rao, 2003). More importantly, weights in the PPP baskets of goods and services do not adequately represent the consumption basket of the poor.

The World Bank's $1 a day poverty line was based on 1985 PPP exchange rates. Recently, the Bank has changed the base to 1993. The changing of the PPP base can make a lot of difference to the poverty lines as well to the poverty rates. In the present study we used the 1993 PPP exchange rates. Table 1 presents the consumer price indices for the 19 countries in 1993 and the survey periods, which are utilized for constructing the poverty thresholds. This table also presents the 1993 PPP exchange rates.

3 HOW DID THE WORLD BANK ARRIVE AT THE $1 A DAY POVERTY LINE?

The 1990 World Development Report presented global estimates of poverty on the basis of the $1 a day poverty line measured using a 1985 PPP exchange rate for the first time. The World Bank arrived at the $1 a day poverty line based on the country specific national poverty lines for a sample of 33 countries. These poverty lines were obtained from a wide range of sources within and outside the Bank. It is stated that these should not be considered as 'official' poverty lines, either of the governments or of the Bank. Many were estimates from independent researchers. Thus, these poverty lines were evolved using widely different methodologies.

TABLE 1

Consumer price indices, 1993 PPP exchange rates and national poverty lines

Countries	Survey Year	Consumer price index		1993 PPP exchange rate	National Poverty line in 1993 PPP dollars
		1993	**Survey year**		
Burundi	1998	73.0	186.5	56.3	1.21
Burkina Faso	1998	74.4	107.1	103.4	0.99
Ivory Coast	1998	70.2	111.1	159.1	1.77
Cameroon	1996	70.5	103.6	142.4	1.81
Ethiopia	2000	87.2	106	1.3	1.50
Ghana	1998	50.2	223.7	178.9	2.34
Guinea	1994	90.9	94.7	339.3	2.26
Gambia	1998	91.8	106.1	2.4	2.52
Kenya	1997	76.5	121.2	11.8	1.95
Madagascar	2001	48.2	172	530.3	1.11
Mozambique	1996	39.7	144.6	808.0	1.73
Malawi	1997	40.5	150.2	1.5	1.86
Nigeria	1996	36.8	129.3	11.5	0.76
Uganda	1999	88.5	122.4	260.0	1.70
Zambia	1998	48.3	221.6	223.4	1.14
Bangladesh	2000	159.0	235.0	12.7	1.42
India	2000	100.0	168.0	7.0	1.00
Lao PDR	1998	78.0	207.0	209.9	1.09
Nepal	1996	82.0	104.0	9.2	1.11

Source: authors' calculations.

Some countries had more than one poverty line. For instance, if they had separate poverty lines for urban and rural areas, then the lowest poverty line was chosen. The correct procedure would have been to use the weighted average poverty line with a weight proportional to the population of the urban and rural areas.

The national poverty lines so selected were constructed around the mid 1980s. Since then, many countries have revised their local poverty lines (and some have even changed the methodology). This implies that the $1 a day poverty line constructed on the basis of mid 1980s national poverty lines may not be applicable in the new millennium.

The $1 a day line is said to be representative of the poverty lines found among low-income countries. It is obvious that this line should have been derived from a sample of low-income countries. But the Bank's sample of 33 countries consisted of only 10 low-income countries. It included many rich industrialized countries such as Japan, Australia, West Germany, Belgium, Canada and United States, which do not have absolute poverty. They generally use relative poverty lines.

The World Bank attempted to derive the international poverty line by fitting a cross-country semi-log function, relating a country's poverty line with its mean per capita private consumption, both in 1985 PPP dollars. Since econometric analysis failed to yield a reasonable

international poverty line, the Bank then decided to determine the poverty line by eyeballing the scatter plot of this equation. This eyeballing method gave rise to the poverty line of $31 per month, which became well-known as the $1 a day poverty line. The Bank's claim that $1 a day is representative of poverty lines found among low-income countries has a very weak foundation.[2]

4 CHANGING THE PPP BASE FROM 1985 TO 1993

In the late 1990s, the World Bank released the 1993 PPP exchange rates, which are superior to the earlier ones in terms of coverage of countries and are based on prices and consumption baskets constructed by the 1993 International Comparison Project (ICP). The new PPP conversion rates are now available for 110 countries, while the earlier Penn World Tables provided the PPP rates for only 60 countries.

Whilst the new and improved PPP for 1993 are welcome, they also raise some questions, mainly, what should be the poverty line at 1993 PPP dollars that is equivalent to the $1 a day poverty line at 1985 PPP dollars? The inflation rate in the USA between 1985 and 1993 was roughly about 50 percent (about 5.5 percent per annum), which means that the $1 a day poverty line in 1985 would be equivalent to $1.50 a day in 1993. The World Bank did not adopt this poverty line because it was well above the median of the 10 lowest poverty lines in the sample of 33 countries. The ten countries with the lowest poverty lines in 1993 PPP dollars were Bangladesh, China, India, Indonesia, Nepal, Pakistan, Tanzania, Thailand, Tunisia and Zambia. The median poverty line of these 10 countries was calculated to be equal to $1.08 per person per day. Thus, the World Bank adopted $1.08 in 1993 PPP dollars to be its new international poverty line, which is still referred to as $1 a day poverty line.

Many critics have pointed out that the World Bank has lowered the real poverty line. The equivalent poverty line in 1993 PPP should have been $1.50 and not $1.08. The Bank has defended against this allegation by saying that one cannot simply adjust for inflation in the US between 1985 and 1993 to update the poverty line because there has been a PPP devaluation of poor countries relative to the US with the switch from the 1985 to 1993 based PPP, as a result of both the new price data available and better methods of calculating the PPP exchange rates. If this argument holds (for which an adequate explanation has not been provided), the correct procedure would have been to estimate the degree of devaluation and then to determine the equivalent poverty line in 1993 PPP. Instead, the World Bank adopted on an *ad hoc* basis the median of the 10 lowest poverty lines. Thus, $1.08 in 1993 PPP is not equivalent to the original $1 a day line in 1985 PPP.

The $1.08 a day is the median of the poverty lines of the 10 countries with the lowest poverty lines among a sample of 33 countries. It cannot be regarded as a typical poverty line of low-income countries; the countries with the lowest poverty lines are not necessarily the countries with the lowest incomes. For instance, Tunisia is a relatively rich country with per capita consumption of $ 8.00 in 1993 PPP, which is included in these 10 countries. Similarly, Indonesia and Thailand are not low income countries.

5 A COMPILATION OF NEW NATIONAL POVERTY LINES

As noted in the previous section, the national poverty lines compiled by the World Bank were constructed around the mid 1980s. Since then many countries have revised their national

poverty lines (and some have even changed the methodology). This implies that the $1 a day poverty line constructed on the basis of the mid 1980s local poverty lines may not be applicable in the new millennium. It is, therefore, important to fix an international poverty line that can be considered representative of the poverty lines found among low-income countries in the recent past.

To do that, we compiled the national poverty lines for our sample of 19 low income counties, 15 in Sub-Saharan Africa and 4 in Asia. We obtained the national poverty lines from the World Bank's various poverty assessment reports. Most of these poverty lines were constructed in the mid to late 1990s. We converted the national poverty lines from local currency to PPP dollars using the consumer price indices and PPP exchange rates, given in Table 1. These lines are presented in the last column of Table 1.

It is interesting to note that most of the countries in our sample of 19 countries in Africa and Asia have poverty lines that are much higher than $1.08 in 1993 PPP. There are only three countries, namely, Burkina Faso, India and Nigeria, which have lower poverty lines than the World Bank poverty line. Thus, $1.08 a day is not a typical poverty line for poor countries.

In our sample of 19 countries in Africa and Asia, the median poverty line is calculated to be equal to $1.50 in 1993 PPP. Thus, we would regard $1.50 to be a typical poverty line of the low-income countries. The World Bank's poverty line of $1.08 appears to be rather low. Moreover, the poverty lines, which the World Bank has used, were constructed around the period in the mid 1980s; our poverty lines are more recent, from the 1990s.

Using the typical poverty line of $1.50, we computed the percentage and the number of poor for the 6 regions based on the World Bank classification. These estimates are referred to here as the TPL estimates. According to the World Bank poverty line, 1.098 billion people in 2001 lived in poverty, but the TPL estimates show that 1.865 billion people lived in poverty in 2001. Thus, there is a wide divergence in global poverty counts between the World Bank's estimates and our new estimates based on a more typical poverty line among low-income countries.

TABLE 2
Percentage and number of poor by regions in 2001

Regions	World Bank [i]	TPL [ii]	World Bank	TPL
	Percentage of poor		Number of poor (million)	
East Asia and Pacific	14.89	28.54	271.12	519.66
East Europe and Central Asia	3.46	8.63	16.34	40.76
Latin America and the Caribbean	9.96	15.68	52.21	82.19
Middle East and North Africa	2.35	9.04	6.95	26.74
South Asia	31.89	56.58	439.23	779.29
Sub-Saharan Africa	46.38	61.82	312.57	416.63
Total	21.27	36.12	1098.42	1865.26

Source: authors' calculations.
(i) World Bank estimates based on $1.08 per day at 1993 PPP.
(ii) Estimates based on a typical poverty line among low-income countries in the late 1990s.

6 PROPOSED METHODOLOGY BASED ON CONSUMER THEORY

A poverty line specifies the society's minimum standard of living to which everybody in that society should be entitled. Defining a minimum standard of living is not easy. An obvious way to define it is in terms of the utility an average person derives by consuming a given bundle of goods and services. Suppose an international minimum standard of living to which everybody should be entitled exists and, which is measured by a utility level denoted by u^*. Anyone whose actual enjoyment of utility is less than u^* is identified as poor. If u^* is fixed for all countries, then such estimated poverty counts will obviously be internationally comparable. We may define a utility function as:

$$u = u\left[\frac{\mathbf{q}_f}{r}, \frac{\mathbf{q}_n}{n}\right] \tag{1}$$

where $\mathbf{q}_f$ and $\mathbf{q}_n$ are the quantity vectors of food and non-food items of consumption, respectively; r is the average calorie requirement of a country and n is a measure of some other basic needs in a country. In a country with extreme climate, n may be the additional non-food requirement such as expenditure on extra clothing and heating.

It is evident from (1) that if u is fixed at the u^* level for all countries, the food basket and non-food baskets, denoted by $\mathbf{q}_f$ and $\mathbf{q}_n$, respectively, will be different for different countries because the countries differ with respect to their basic needs as measured by r and n. If all countries have the same basic needs, then there will be a single poverty line, which will be internationally comparable.

The utility function given in (1) cannot be directly estimated from household surveys. However, we can make some judgment about its magnitude indirectly. In this study, we have developed a model based on consumer theory, which helps us to arrive at internationally comparable poverty lines. We present a detailed discussion of the model in the Appendix.

With the help of our model, we have demonstrated that the calorie cost in food PPP dollars is a monotonically increasing function of the utility people enjoy. This result implies Lemma 1 (the proof of which is given in the Appendix).

Lemma 1: *If the people in two countries have the same calorie cost in food PPP dollars, then they will enjoy the same level of utility.*

This lemma has an important implication. It tells us that we can obtain internationally comparable food poverty lines if we determine the food poverty line in each country by using a constant calorie cost in food PPP dollars across all countries. Thus, the internationally comparable food poverty line will be obtained by multiplying a country's calorie requirement r by the calorie cost ($ccost^*$) in food PPP dollars. The food poverty lines so obtained for each country will imply the same utility level enjoyed by the people in different countries.

Our model presented in the Appendix also demonstrates that we can obtain the non-food poverty lines by utilizing the food and total expenditure functions derived from consumer theory. The non-food poverty lines estimated in this way would be comparable across countries because they will provide the same level of utility to individuals at the poverty lines but living in different countries. The total international poverty lines will be obtained by summing the food and non-food poverty lines. We describe this procedure using Figure 1.

In Figure 1, the horizontal axis represents utility level and the vertical axis represents expenditures. Figure 1 depicts the food and total expenditure functions, which tell us how much expenditure food and non-food, respectively, will be required in order for the consumers to enjoy a given level of utility. These expenditure functions are monotonically increasing in the utility level u. C is the point that corresponds to the food poverty line on the food expenditure function. Corresponding to point C, we obtain B on the x-axis, which gives the utility level u^* that is implicit in the food poverty line. At this point, consumers will enjoy the minimum basic standard of living, which will meet their calorie requirements.

Corresponding to point B on the x-axis, we obtain point D on the total expenditure function, which gives BD as the total poverty line that is consistent with the utility level u^*. Obviously then, CD will be the non-food poverty line. The non-food poverty line so obtained will be consistent with standard consumer theory. Note that this method of calculating the non-food poverty line is equivalent to Ravallion's (1998) upper poverty line, which he derived using a different methodology.

Ravallion (1998) also suggested estimating the non-food poverty line using the idea that if a person's total income is just enough to reach the food threshold, anything that a person spends on non-food items will be considered as basic non-food needs. According to this idea, the non-food poverty line is the household's non-food expenditure at which the household's total expenditure is equal to the food poverty line. At this point, the household's income is just sufficient to buy only the nutritionally adequate food basket so that any expenditure a household incurs on non-food will be absolutely essential.

In the figure, E is the point at which the total expenditure is equal to the food poverty line. At this point, FE will be the non-food poverty line, which will always be less than CD. The non-food poverty line corresponds to the utility level $\underline{u}^*$, whereas the food poverty line corresponds to the utility level u^*. Thus, the food and non-food poverty lines do not imply the same level of consumer utility. Thus, we say that Ravallion's method is inconsistent with standard utility theory. We recommend using CD as the non-food poverty line.

FIGURE 1

Determination of Non-food Poverty Line
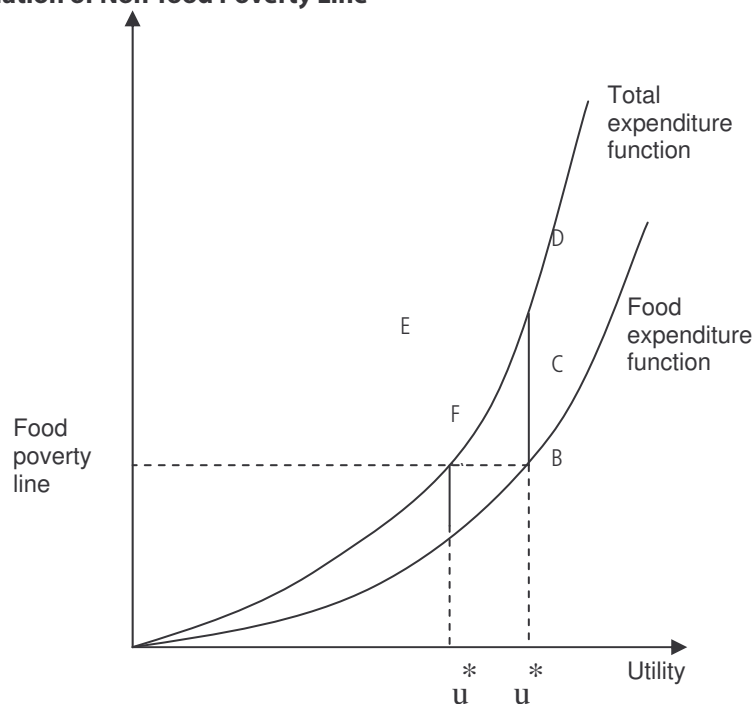
7 ESTIMATES OF A NUTRITION BASED INTERNATIONAL FOOD POVERTY LINE

7.1 CALORIE REQUIREMENTS

We use the basic needs approach to construct the food poverty line. This approach requires caloric requirement (or needs) of individuals. It must be emphasized that these requirements depend on several factors such as age, sex, body weight, climatic conditions and activity levels. The United Nations' Food and Agricultural Organization (FAO) is mainly concerned with the measurement of under nutrition in the world, so it provides calorie requirements for different countries in the world. We compiled the average calorie requirement (per individual per day) for our sample of 19 countries. The first column in Table 4 presents the calorie requirements per person per day.

7.2 CALORIC COST AND THE FOOD POVERTY LINE

The food poverty line of a household can be determined by multiplying the calorie requirement of the household by the calorie cost. It was demonstrated in Section 2 that the calorie cost has a monotonic relationship with the utility level; the higher the utility level, the greater the calorie cost. This means that if we know the calorie cost of the poor, we would also know the utility level enjoyed by the poor. How do we find out the calorie cost of the poor when we do not know who the poor are? We used the following procedure:

First, we want to determine how the calorie cost varies with the standard of living measured by the household's per capita consumption. To do so, we divided the population into five quintiles by ranking the households by their per capita final consumption. The final consumption is defined as a sum of all net cash and in-kind expenditures. We constructed a food basket for each quintile.

Household surveys generally provide us with expenditures and quantities of each food item consumed by households. We determined the average expenditure and average quantity of each food item in each of the five quintiles.[3] Thus, we constructed five food baskets (one for each quintile). We were also able to acquire the quantity to calorie conversions, which provided us with the total calories obtained from these baskets. Since we know the total food expenditure for each quintile and the total calories obtained from the food basket for each quintile, we could calculate the calorie cost for each quintile by dividing the total food expenditure by the total calories. The calorie costs for Bangladesh are presented in Table 3.

TABLE 3

Caloric cost per 1,000 kilo calories in Bangladesh

Quintiles	Takka in 2000	1993 PPP dollars
Quintile 1	7.62	0.41
Quintile 2	9.78	0.52
Quintile 3	11.47	0.61
Quintile 4	13.81	0.74
Quintile 5	19.15	1.02

Source: authors' calculations.

In Bangladesh, people belonging to the first quintile spend 7.62 Takka on food in order to obtain 1,000 calories. The calorie requirement for Bangladesh is 2,080 calories per person per day, so the average food poverty line for Bangladesh would be $7.62 \times 2080/1000$, which is equal to 15.85 Takka per person per day. This is the food poverty line for Bangladesh.

It is noted that the calorie cost increases as we go from a lower quintile to a higher quintile. This result holds for all countries. This supports the conclusion from our model that the calorie cost is an increasing function of the standard of living (measured by the per capita total consumption).[4]

In order to make a comparison of calorie costs across countries, we need to convert the calorie costs in local currency to PPP dollars. This is easily done utilizing the CPI and PPP exchange rates given in Table 1. The caloric cost in Bangladesh for the people in the first quintile is 41 cents in 1993 PPP dollars. This gives the food poverty line for Bangladesh in 1993 PPP dollars as equal to $0.41 \times 2080/1000$, which is 85 cents per person per day. In these calculations, we have made a judgment that the first quintile is a reasonable reference group. It is essential to make such a judgment about the reference group. Using the first quintile as a reference group implies that the food poverty line of 85 cents per person per day is the absolute minimum food requirement in Bangladesh below which meeting the basic nutritional requirement is not possible.

TABLE 4

New nutrition based poverty line at 1993 PPP dollars

Countries	Calorie requirement[*]	Poverty line in 1993 PPP dollars		
		Food	**Non-food**	**Total**
Burundi	2,070	0.85	0.20	1.05
Burkina Faso	2,080	0.85	0.50	1.35
Ivory Coast	2,170	0.89	0.74	1.63
Cameroon	2,170	0.89	0.74	1.63
Ethiopia	2,000	0.82	0.39	1.21
Ghana	2,170	0.89	0.52	1.41
Guinea	2,130	0.87	0.68	1.56
Gambia	2,160	0.89	0.34	1.22
Kenya	2,140	0.88	0.30	1.18
Madagascar	2,110	0.87	0.21	1.07
Mozambique	2,200	0.90	0.35	1.26
Malawi	2,080	0.85	0.30	1.16
Nigeria	2,120	0.87	0.27	1.14
Uganda	2,050	0.84	0.63	1.47
Zambia	2,110	0.87	0.27	1.14
Bangladesh	2,080	0.85	0.38	1.23
India	2,140	0.88	0.41	1.29
Lao PDR	2,000	0.82	0.28	1.10
Nepal	2,120	0.87	0.34	1.21
Median	2,120	0.87	0.35	1.22

Source: authors' calculations.

Note: * Per capita per day.

In the construction of food poverty lines for different countries, our model suggested that we should use the same calorie cost in PPP dollars for all countries. This requirement will ensure that the minimum standard of living remains the same for all countries, which implies that the food poverty line will be internationally comparable.

If our objective is to make an international comparison of poverty rates, then we should use a calorie cost that is typical of the whole world. This would require calculating the calorie cost for all countries in the world and calculating the median calorie cost. This task, clearly, is beyond the scope of the present study. In our view, this is also very unnecessary. We can use the calorie cost of a typical low-income country. In our study, we selected Bangladesh as an anchor country. This selection was partly motivated by the fact that we did not have detailed food baskets for other low-income tropical countries. Thus, the food poverty lines in 1993 PPP dollars for the 19 countries presented in Table 4 were computed by multiplying the caloric requirements of each country by the caloric cost of 41 cents per 1,000 calories.

8 ESTIMATES OF GLOBAL HUNGER

We may define a household to be suffering from hunger if it does not have enough income to be able to meet its basic food needs. Since the food poverty line determines the minimum basic food needs of the household, we can say that the household suffers from hunger if its per capita total consumption is less than the food poverty line. Further, we assume that if a household suffers from hunger, then all its members also suffer from extreme poverty. Under these assumptions, we can calculate the percentage of population that suffers from hunger.

The median food poverty line is 87 cents per person per day (in 1993 PPP dollars). We applied this poverty line to measure the percentage of people suffering from hunger. The estimates are presented in Table 5. It is noted that 13.28 percent of the world population (685.78 million people) suffered from hunger in 2001. The majority of people suffering from hunger are residing in South Asia and Africa.

TABLE 5

Percentage and number of people suffering from hunger in 2001

Regions	Percentage of people (%)	Number of people (million)
East Asia and Pacific	7.99	145.48
East Europe and Central Asia	1.58	7.46
Latin America and the Caribbean	6.4	33.55
Middle East and North Africa	0.93	2.75
South Asia	18.02	248.19
Sub-Saharan Africa	36.85	248.34
Total	13.28	685.78

Source: authors' calculations.

9 NON-FOOD POVERTY LINE

In Section 6, we demonstrated that if we know the food poverty line, we can utilize consumer theory to estimate the non-food poverty line, which takes account of country specific non-food basic needs.

The basic idea of consumer theory is that we determine the non-food poverty at the point where per capita household food consumption is equal to the food poverty line. We have utilized the following non-parametric approach to calculate the non-food poverty line for each country.[5]

(i)   First, calculate the ratio of a household's per capita food expenditure to the food poverty line multiplied by 100. This ratio will be equal to 100 when the household's per capita food expenditure is equal to the household's per capita food poverty line.

(ii)   Arrange the households in ascending order according to the food poverty line ratio (in (i)) using the household survey data.

(iii)   Select the households whose food-poverty line ratio lies between 95 and 105.[6]

(iv)   Calculate the average non-food poverty line for the individuals belonging to these households.

The above procedure provided the non-food poverty line for each country in local currency. To make international comparisons of the non-food poverty lines, we needed to convert them to PPP dollars. This was easily done using the consumer price indices and PPP exchange rates, which are given in Table 1. The non-food poverty lines in 1993 PPP dollars are presented in Table 4.

10 TOTAL POVERTY LINE AND POVERTY RATES

The total poverty lines for 19 countries were obtained by adding up the respective food and non-food poverty lines in 1993 PPP dollars. The median poverty line among 19 low- income countries is calculated as equal to $1.22 (per person per day) varying from $1.05 in Burundi to $1.63 in the Ivory Coast.

TABLE 6

Percentage and number of poor using nutrition based poverty line, 2001

Regions	Percentage of people (%)	Number of people (million)
East Asia and Pacific	19.23	350.14
East Europe and Central Asia	4.96	23.42
Latin America and the Caribbean	11.58	60.70
Middle East and North Africa	4.09	12.10
South Asia	41.13	566.50
Sub-Saharan Africa	52.27	352.26
Total	26.43	1,365.13

Source: authors' calculations.

We have utilized this new international yardstick to compute global poverty counts. These estimates are presented in Table 6. It is noted that 26.43 percent of the world population (1.365 billion people) lived in absolute poverty in 2001. The majority of poor are living in South Asia.

11 CONCLUDING REMARKS

Every society has its own views on what constitutes a minimum standard of living. Strictly speaking, we should not be able to make cross-country comparisons of poverty rates since it would be virtually impossible to agree on a common poverty basket that is acceptable in every country.

In spite of this, global estimates do play an important role in monitoring the level and change in poverty around the world. They can be used as a powerful tool to heighten public awareness about the need to fight poverty and achieve the Millennium Development Goals.

The efforts made by the World Bank to produce global poverty counts based on an internationally comparable threshold must be applauded. Unfortunately, the Bank has paid little attention to improving the methodology for constructing such a threshold. In this paper, we have demonstrated how shaky the World Bank methodology has been. The national poverty lines compiled for the purpose of determining the original international poverty line were constructed around the mid-1980s. Many countries have revised them and some have even changed the methodology for their calculation. It is, therefore, important to fix an international poverty line that is representative of the poverty lines of low-income countries in the recent past.

In this study, we have attempted to address this deficiency by compiling the national poverty lines for a sample of 19 low-income countries, 15 in Sub-Saharan Africa and 4 in Asia. We arrived at a poverty line of $1.50 compared to the World Bank's figure of $1.08. Using this poverty line, we estimated that there were nearly 1.9 billion people living in poverty around the world in 2001. This figure is considerably higher than the 1.1 billion poor reported by the Bank. Our estimates are based on a more typical poverty line prevailing in the mid 1990s among the low-income countries.

However, the main objective of this study has been to compute the international poverty threshold based on the food requirement to ensure adequate calorie intake for the world's poorest. The study proposes a new methodology based on consumer theory to provide a caloric based international poverty threshold. Using this methodology, we computed the international poverty line as being equal to $1.22. According to this new yardstick, almost 1.37 billion people were poor around the world in 2001.

In this study, we have also provided global estimates of hunger. A person is defined as suffering from hunger if he or she does not have enough income to be able to meet his or her basic food needs. According to this definition, 687 million people are suffering from hunger. These estimates will clearly be helpful to international donor agencies that are concerned about achieving the Millennium Development Goal of reducing world hunger.

Our calculations clearly suggest that an effort must be made to improve the methodology for estimating the number and percentage of poor people around the world. In fact, the World Bank's poverty counts are in need of serious adjustment if they are to more accurately reflect the situation of the world's poorest in the new millennium.

APPENDIX: PROPOSED MODEL

This appendix presents the model that helps to arrive at internationally comparable poverty lines.

Suppose $\mathbf{p}_f$ and $\mathbf{p}_n$ are the price vectors of food and non-food items of consumption, respectively; then, using the conventional treatment of consumer choice, we maximize utility function

$$u = u\left[\frac{\mathbf{q}_f}{r}, \frac{\mathbf{q}_n}{n}\right] \tag{A1}$$

subject to budget constraint

$$\mathbf{p}_f \cdot \mathbf{q}_f + \mathbf{p}_n \cdot \mathbf{q}_n \leq x \tag{A2}$$

where x is the total expenditure or income that is available to the consumer. It is assumed that all countries have the same utility as (A1) but different r and n.

This maximization procedure yields the food and non-food demand functions as

$$q_f = rg_f\left(x, rp_f, np_n\right) \tag{A3}$$

and

$$q_n = ng_n\left(x, rp_f, np_n\right) \tag{A4}$$

respectively. These equations are the Marshallian demand functions (Marshall, 1930). Substituting (A3) and (A4) into (A1) yields the expenditure function

$$x = e\left(u, rp_f, np_n\right) \tag{A5}$$

which is the minimum cost of buying the individual utility u at given food and non-food prices.

Further, substituting (A5) into (A3) and (A4) yields the Hicksian food and non-food demand equations (Hicks, 1957):

$$q_f = rg_f\left(u, rp_f, np_n\right) \tag{A6}$$

and

$$q_n = ng_n\left(u, rp_f, np_n\right) \tag{A7}$$

respectively.

The food and non-food poverty lines are then obtained by substituting $u = u^*$ in (A6) and (A7), respectively, as

$$F = p_f q_f = rp_f g_f \left(u^*, rp_f, np_n \right) \tag{A8}$$

and

$$NF = p_n q_n = np_n g_n \left(u^*, rp_f, np_n \right) \tag{A9}$$

Equations (A8) and (A9) give the food and non-food poverty lines at the point where individuals of the country concerned enjoy the same level utility u*. These lines are internationally comparable because they maintain the same utility level across countries. The problem is: How do we determine u*? The following solution is proposed.

The food poverty line should satisfy the requirement that calorie intake is equal to calorie requirement. Suppose c is the vector that converts a food quantity vector q_f into calories. c is fixed for each country depending on the kind of food the county's population is consuming. $c \times q_f$ is the number of calories that are obtained from the food basket q_f, which should be equal to the calorie requirement *r*. Thus, using (A6), we obtain

$$c.g_f(u^*, rp_f, np_n) = 1 \tag{A10}$$

If this equation is to hold for all exogenously determined values of *r*, p_f, *n* and p_n, then the function $g_f(u^*, rp_f, np_n)$ should not contain rp_f and np_n as its arguments, that is, it should depend only on u*. The food poverty line in (A8) will then be given by

$$F = p_f q_f = rp_f g_f \left(u^* \right) \tag{A11}$$

Since the food poverty line can also be written as the product of calorie requirement and calorie cost (which is the expenditure on food per calorie), (A11) immediately gives the calorie cost function as

$$c\,cos\,t = p_f g_f \left(u^* \right) \tag{A12}$$

Thus, the calorie cost of a country depends on two factors, food prices and the utility level u*. The calorie cost in (A12) is in local currency of the country.

The PPP converts prices in local currency of a country to prices in US dollars. Suppose p_f^* is the vector of international food prices, the PPP conversion rate *k* is given by

$$p_f = kp_f^* \tag{A13}$$

which on substituting in (A12) gives

$$c\,cos\,t^* = p_f^* g_f(u^*) \tag{A14}$$

where $c\,cos\,t^* = c\,cos\,t / k$ is the calorie cost in food PPP dollars. Since p_f^* is the international food price (which is same for all countries) and $g_f(u^*)$ is a monotonically increasing function of u*, from (A14) the calorie cost in food PPP dollars is a monotonically increasing function of the utility people enjoy. This proves Lemma 1 given in Section 2.

Lemma 1: *If the people in two countries have the same calorie cost in food PPP dollars, then they will enjoy the same level of utility.*

As pointed out in Section 2, Lemma 1 tells us that we can obtain internationally comparable food poverty lines if we determine the food poverty line in each country by using a constant calorie cost in food PPP dollars across all countries. Thus, the internationally comparable food poverty line (denoting by F^*) will be obtained by multiplying a country's calorie requirement r by the calorie cost ($ccost^*$) in food PPP dollars.

Given F^*, which is in PPP dollars and the food PPP exchange rates, we can determine the food poverty line for each country in local currency, which we denote by F. Substituting F into (A11), we can solve for u^*, which is the utility level enjoyed by people at the food poverty line and is fixed across countries. Further, substituting u^* into (A9), we can solve for the non-food poverty line, NF, which will be the non-food poverty line in local currency. Using the non-food PPP conversions, we obtain the non-food poverty line in international dollars. The non-food poverty lines estimated this way would be comparable across countries because they provide the same level of utility to individuals at the poverty lines but living in different countries. The total international poverty lines are obtained by summing the food and non-food poverty lines.

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NOTES

1. There are two main limitations to PPP. Firstly, as PPP comparisons weigh prices by the share in world consumption, worldwide relative prices closely track relative prices in the United States, Western Europe, and Japan. Using such rich country prices will inflate poor country incomes (and vice versa). As a result, this underestimates world poverty. Thus, if only food prices are used, which our methodology requires, this will reduce the bias.

2. Defenders of a 1$ a day poverty line argue that one of the most important merits of this approach is simplicity. The argument is that if the definition of poverty lines becomes too complex, then the debate on poverty will revolve around technical aspects of how to define the poor and not on the measures and policies necessary to lift them from poverty. On the other hand, policy efforts focused on the wrong target, though simple, may be self-defeating.

3. Quintiles were constructed using household per capita consumption expenditure.

4. An intuitive interpretation of this result is that richer households consume their calories from more expensive food stuffs, for example substituting meat for potatoes. The richer households may also be paying higher prices for the same food items because they generally buy higher quality food items (for example, a superior quality of rice).

5. We are suggesting a non-parametric approach. To implement this methodology, we would require unit record data on household expenditure surveys. One can also use a regression model (as proposed by Ravallion 1998). We believe that the non-parametric approach is more robust.

6. We should select households whose per capita food expenditure is equal to the food poverty line, which means we should select the households at the point where the household's food-poverty line ratio is equal to 100. Since it is impossible to calculate this ratio for a specific point, it is reasonable to select a range in the neighbourhood of 100. We selected a range of the food-poverty line ratios lying between 95 and 105.

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