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Redefining Poverty

A Rights-Based Approach

It should be noted that this paper was finalised in April 2008, before the World Bank/PovCalNet poverty data were updated to 2005 purchasing power parity. All of the analysis and data are therefore based on the previous (1993 PPP) estimates.

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Executive Summary

The World Bank's estimates of global poverty, based on the "$1-a-day" line, have been a major intellectual and technical feat. There can be little doubt that they have also had a major political impact in putting poverty on the international agenda. However, there are a number of important issues underlying the methodology by which they are produced, raising questions about the accuracy and reliability of the picture they present of the level, composition and trends of global poverty.

- It focuses exclusively on income (or more precisely consumption).
- It sets the poverty line at an essentially arbitrary level.
- Poverty estimates are critically dependent on the base year used for price indices, which should make no difference.
- The "$1-a-day" line itself, used as the basis for policy, embodies an implicit moral judgment that this level of income is morally acceptable, which is at best highly questionable.
- It imposes inconsistent standards between countries in terms of living standards, which vary very widely between people living at "$1-a-day" in different countries.
- The conversion factors used to translate poverty lines into local currency incomes are inappropriate, giving much greater weight to the prices of goods and services bought by non-poor than by poor people.
- Purchasing power parity (PPP) estimates for many countries have been based on estimates rather than measurement (although this has improved markedly since the paper was written).
- Updating the poverty line over time is problematic, for example failing to reflect differences in inflation as between rural and urban areas.
- There are further problems in the estimation of poverty in those years in which no surveys have been conducted; and the method of estimating poverty since the last survey are systematically skewed, so that they risk exaggerating the rate of poverty reduction in recent years.

Important as it has been to put poverty onto the global agenda, if the figures on which our view of poverty is based are potentially misleading, then we are in serious danger of adopting the wrong policies. More specifically, given the nature of the methodological problems, we are in danger of being lulled into complacency that the thrust of our global economic system is broadly consistent with reducing, and ultimately eradicating poverty.

We argue that a less arbitrary approach to defining poverty needs to be based on defining an income level consistent with a standard of living which we consider the minimum morally acceptable level. This can in principle be based either on an "inputs" approach (the cost of accessing what is needed to fulfil basic needs), or on an "outcomes" approach (the

level of incomes associated in practice with minimum acceptable levels of indicators of physical well-being). Each of these approaches can be adopted either globally, to produce a single universal poverty line (cf the "$1-a-day" line), or on a country-by-country basis, to generate a poverty line for each country. This gives us four broad categories of non-arbitrary poverty lines.

We review four alternative approaches to defining poverty, corresponding to three of these categories:

- Kakwani and Son's International Food Poverty Line (global/input-based);
- Peter Edward's Ethical Poverty Line (global/outcome-based); and
- Morris et al's Minimum Income for Healthy Living, and Reddy et al's Capability-Based Approach (country-specific/input-based)

However, each of these approaches is, in different ways, problematic.

We therefore propose a new approach to the definition of poverty, which we call the Rights-Based Poverty Line (RBPL), based on the fourth and final category – a country-specific outcomes-based approach. The RBPL approach is based on the estimated statistical relation between income and indicators of well-being which correspond to different economic and social rights (health, nutrition, education, etc). By setting a single universal threshold level of the indicator concerned, and establishing the income at which that level is actually achieved in each country, we can in principle define a poverty line for each country which is at a different level of income, but gives rise to an equivalent standard of living in each country.

This approach, we argue, both avoids the issues arising from "input-based" approaches and resolves the problems inherent in any global poverty line defined in terms of incomes, while maintaining consistency between countries. We present estimates of RBPLs for six countries (Bolivia, Eqypt, India (rural and urban), Nicaragua, Senegal and South Africa) using the infant mortality rate as an indicator of the right to child survival, based on four alternative threshold levels. This demonstrates the wide range of incomes required to achieve equivalent living standards in different countries.

Having established a set of poverty lines, there are two ways in which poverty can be reduced – either by increasing incomes to the level at which rights are fulfilled, or by reducing the income required to fulfil each right.

The picture of poverty this approach presents is much more complex than those generated by other approaches, and particularly the single "poverty headcount" (and largely ignored "poverty gap") figures generated by approaches based on a single global poverty line defined in "dollars per day".

In the RBPL approach, we have multiple dimensions of poverty – health, nutrition, education, housing, access to water and sanitation, etc. In each of these dimensions, we have four indicators – the poverty line itself, the proportion of the population below it, the poverty gap (reflecting the extent to which incomes are below the RBPL) and the rights gap (indicating the extent to which rights are not fulfilled as a result of poverty).

However, this complexity is inevitable if we are to obtain a meaningful picture of the multi-faceted issue of global poverty, and we present a simple graphical approach to present poverty comparisons between countries and over time.

Through this approach, the RBPL can provide us with much more relevant information than the simple headline figures of "dollar-a-day" approaches. For example, we can distinguish the extent to which poverty arises from low incomes and from low living standards at a given level of incomes in

each country, and assess the relative importance in each case of income generation and (for example) improving access to health services or education; we can identify priority areas in which access to services most needs to be improved for low-income households; and we can avoid the misleading interpretation that poverty is falling where rising incomes are off-set by falling living standards relative to income.

At present, the data are not available to estimate RBPLs for all developing countries; and what data exist are far from ideal for the purpose. We therefore present proposals for meeting the data requirements for a more comprehensive and reliable application, building on existing approaches. In view of the potential advantages of this approach it terms of presenting a fuller, more nuanced and potentially more accurate picture of global poverty – which would seem essential to effective policy-making for its reduction – the relatively limited cost of such data improvements would represent a very worthwhile investment.

Introduction

Since the publication of the 1990 edition of the World Bank's World Development Report, discussions of global poverty have been conducted almost exclusively in terms of the so-called '$1-a-day' line[1]. This definition was effectively adopted as the international standard of poverty for policy purposes through the first Millennium Development Goal (MDG) – to 'reduce by half the proportion of people living on less than a dollar a day'[2]. However, this definition has been widely and robustly criticised as arbitrary, artificially low, neglecting non-income dimensions of poverty, and subject to a number of technical flaws which render its results unreliable and potentially misleading.

In this paper we review a number of proposed alternatives, starting from a moral concept of poverty as a level of income below that which provides a morally acceptable standard of living. We go on to present a new approach to the definition of poverty based on this principle: a system of country-specific rights-based poverty lines (RBPLs), estimated on a consistent basis, such that they correspond to an equivalent level of well-being indicators.

What's *Wrong* with a Dollar a Day?[3]

The World Bank's objective in developing the '$1-a-day' definition of poverty was 'to provide a consistent assessment of progress against absolute income poverty in the developing world'.[4] More recently, however, it has been widely and strongly criticised as 'insufficient and monodimensional'[5], 'lack[ing] a solid analytical basis'[6], 'arbitrary [and] not adequately anchored in any specification of the real requirements of human beings' [7] 'too low due to methodological problems'[8], and a 'crude indicator [which] has not turned out to be of continuing value.'[9] As a result, poverty estimates based on the line have been criticised as 'meaningless'[10], 'neither meaningful nor reliable' [11], having 'neither normative value nor empirical relevance' [12] and inherently inconsistent[13]. In consequence, it has been argued that:

> *'There is reason to believe that the Bank's approach may have led it to understate the extent of global income poverty and to infer without adequate justification that global income poverty has steeply declined in the recent period.'*[14]

Problem 1: Exclusive Focus on Incomes/Consumption

According to the 1995 World Social Summit Programme of Action:

> *'Absolute poverty is a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income, but also on access to social services.'*[15]

Thus by focusing only on income (or consumption), the '$1-a-day' line fails to take account of key aspects of poverty such as access to health services, education, water and sanitation. Neither does it consider housing quality, living environments, adverse working conditions or time poverty. While often related to income, variations in these dimensions at a given level of income have a major effect on whether we would, intuitively, consider a household poor.

One possible approach is to develop a ***composite indicator*** of poverty such as UNDP's human poverty indicator (HPI)[16], which combines the percentage of people expected to die before the age of 40, adult illiteracy, access to health services and safe water, and child malnutrition. However, the HPI itself has important limitations, including 'some inescapable arbitrariness' [17] in the selection and weighting of indicators, and inability to distinguish between the incidence of poverty and its depth.

More problematic is that the HPI does not include an income component, so that it is necessarily a supplement to income poverty estimates rather than a substitute. Moreover, by its nature it can provide only population-average figures, rather than identifying individual households as poor. As a result, it can neither be combined with an income poverty indicator, nor its relationship with income poverty assessed, except at an aggregate level. This limits the usefulness of the HPI in terms of assessing the poverty impact of economic policies. Srinivasan concludes that:

> *'Important non-income aspects of poverty, such as deprivations in health, educational attainment and enjoyment of citizenship rights, cannot be meaningfully combined with consumption measures to define a comprehensive poverty indicator of relevance.'*[18]

An alternative approach is to consider other aspects of deprivation, such as disability, chronic illness, poor living or working environments, lack of access to basic services, insecurity, etc as ***shifting the poverty line*** for the individual or household concerned relative to those who do not suffer these deprivations, according to the impacts on their well-being and/or additional costs associated with them. This would, in principle, allow us to incorporate non-income dimensions of poverty, while maintaining a 'moneymetric' measure. This is effectively the approach taken (at the national level) in the rights-based approach we describe later.

Problem 2: Arbitrary Poverty Lines

The '$1-a-day' line was selected in 1990 as the median of the ten lowest poverty lines in a sample of 33 developed and developing countries (including only ten low-income countries). As Chen and Ravallion readily (and repeatedly) acknowledge, 'this was deliberately a conservative choice'.[19]

As Karshenas observes, using the median of the lowest ten poverty lines means that:

> *'Only five countries have poverty lines which are below this norm. The rest of the countries all have poverty lines above the $1 a day in 1985 PPPs. The $1 a day poverty line therefore may be more appropriate for measuring extreme absolute poverty in the poorest countries. For the range of incomes of countries normally included in measuring global poverty trends, the $2 a day poverty line is arguably a more appropriate indicator of extreme poverty on a global basis.'*[20]

Given how the analysis was conducted, as Kakwani and Son observe:

> *'The Bank's claim that $1 a day is representative of poverty lines among low-income countries has a very weak foundation.'*[21]

Many of the national poverty lines used were not official definitions but estimates from independent researchers; they were based on widely

different methodologies; and, where more than one line was used (eg where separate lines were used for rural and urban areas), the lowest was chosen rather than the weighted average. [22] Together with the use of the lowest poverty lines, rather than those of all the developing countries in the sample, this results in an artificially low figure.

Problem 3: Sensitivity to Base Year

Further serious problems arise from the updating of the line from 1985 to 1993 purchasing power parity (PPP) terms, which has been strongly criticised as giving rise to 'egregious errors'[23], and 'play[ing] havoc with the poverty estimates, changing them in ways that have little or nothing to do with the actual experience of the poor'[24]. Others have demonstrated that the results are 'highly sensitive to the arbitrary choice of PPP base year', which 'is completely irrelevant to anyone's standard of living'[25], and that 'poverty estimates for the same country and year can change dramatically purely as a result of shifting the base year'[26].

The scale of the problem can be illustrated by the change in the ratio between the poverty incidence in different regions or countries in the same year as a result of changing the base year. The base-year change from 1985 to 1993 nearly doubled the ratio between Sub-Saharan Africa and Latin America, and increased that between Nigeria and Mauritania from one to nearly 20[27].

The switch from 1985 to 1993 as a base year also significantly lowered the *level* of the '$1-a-day' poverty line in real terms.[28] Rather than adjusting the poverty line in line with US dollar inflation between 1985 and 1993, the Bank instead recalculated the original poverty lines of the original sample of 33 countries, and again took the median of the lowest ten, giving a new poverty line of $1.08 per day at 1993 prices rather than $1.30. The median of national poverty lines in an alternative sample of 19 low-income countries indicates a figure of around $1.50 per day.[29]

According to Pogge and Reddy:

> *'the redefinition has lowered national poverty lines in 77 countries, containing 82% of the population of the 92 countries [for which PPP estimates are available] and raised national poverty lines in only 15 countries.'*[30]

Pogge and Reddy also argue that shifting to a later base year can be expected to lower the poverty line consistently over time, as consumption shifts from commodities such as food, where price differences between richer and poorer countries are relatively limited, towards services, where they are much greater.[31]

Srinivasan suggests that the problems associated with periodic rebasing of PPP exchange rates should be averted by simply increasing the existing '$1-a-day' line progressively over time by national price inflation.[32] Deaton proposes a similar approach, but with an initial poverty line which allows some variation between countries in accordance with local contexts.[33]

However, this leaves two problems. First, as discussed later, national price indicators do not necessarily provide an accurate reflection of the prices of goods bought by the poor. Second, as the updating from 1985 to 1993 PPP demonstrates, poverty lines would remain critically sensitive to which base year was used.

Problem 4: Implicit Moral Judgment

The arbitrary nature of the '$1-a-day' line is particularly problematic because of the moral judgment embodied in poverty lines used for policy purposes. Wagtsaff's estimates of child mortality and under-nutrition rates at the '$1-a-day' line[34] raise serious questions as to whether it can be

considered consistent with a moral concept of poverty. The inter-quartile range of his results suggest that between one in six and one in twelve of all children at this level of income die before their fifth birthdays in a typical developing country (compared with an average of around one in 160 in developed countries), while between one-third and half of those who survive are stunted through chronic malnutrition.[35]

It would seem surprising in the extreme if most people, asked directly, considered that this represented a morally acceptable standard of living. Neither would it appear consistent with the Right to Child Survival established by the 1989 UN Convention on the Rights of the Child Health[36], or the right to the highest attainable standard of health enshrined in the International Covenant on Economic and Social Rights of 1966[37].

Problem 5: Inconsistent Living Standards

As well as the very low level of well-being indicators at the '$1-a-day' line, Wagstaff's results also demonstrate the very wide range of living standards associated with living at the same poverty line in different countries. While this may in part reflect the various shortcomings in the '$1-a-day' measure itself, it also reflects differences in economic, social, geographical, climatic, epidemiological and policy conditions which affect either living costs (eg the cost of additional fuel and clothing in a cold climate) or outcome indicators at a given level of income (eg the health effects of malaria or access to health services).

Such differences make the very concept of a single global poverty line, fixed in monetary terms, problematic in terms of a moral concept of poverty as we have outlined it. Even if it is set on the basis of a morally acceptable standard of living, a single global poverty line will *inevitably* mean either that some people whose living standards are above this level will be classified as poor, or that some whose living standards are unacceptably low will be classified as not being poor.

Problem 6: Inappropriate Conversion Factors

Because they are designed for comparing national accounts figures rather than for estimating poverty, PPP exchange rates are based on *overall* consumption patterns rather than those of poor households. Since the great majority of consumption is by non-poor households – even where the poor represent a large majority of the population – they therefore reflect predominantly the prices of goods and services bought by the better-off, which are very different from those of the poor. As a result:

> *'The use of such PPPs is quite inappropriate for poverty assessment and severely distorts the resulting poverty estimates.'*

Worse, this introduces a *systematic* distortion into the analysis[38]. Since poor households typically spend a disproportionate amount of their income on food, particularly staples, while non-poor households tend to spend much more on services, the former are under-represented in the PPP consumption basket, and the latter over-represented, compared with the consumption patterns of poor households. Moreover, the less tradable nature and high local labour content of most services means that they tend to be much cheaper in poorer countries relative to basic foods and other necessities.[39] This suggests that converting the '$1-a-day' poverty line at the overall PPP exchange rate will result in a poverty line well *below* $1 in poorer countries, and therefore in a serious under-estimation of poverty. Pogge and Reddy estimate that using an index for bread and cereal prices in place of overall PPP estimates would increase poverty lines in poor countries by an average of 30-40%, suggesting a figure of around $1.40-1.50.[40]

A project is currently being undertaken by the World Bank, in collaboration with the International Comparison Programme, with the aim of constructing price indices based on the consumption patterns of the poor. This, however, raises an issue of circularity: as Reddy observes, 'it is impossible to know what commodities the poor consume… without first identifying *who* the poor are'[41].

Problem 7: Estimated PPPs

A further problem is that direct estimates of PPP exchange rates, based on actual price data, exist for only 110 countries for 1993, so that 'a massive element of guesswork and gap-filling'[42] is required. Figures for other countries are estimated indirectly on the basis of the estimated relationship of these rates with other variables such as GDP per capita, providing at best very approximate figures.

The level of uncertainty attached to PPP estimates (direct as well as indirect) can be gauged by comparing those used by the World Bank with the corresponding figures from the Penn World Tables (PWT6.1), the other major source of PPP exchange rates. According to Karshenas,

> *'Close to fifty per cent of the World Bank estimates diverge by at least 20 per cent on either side from the PWT6.1 PPP estimates in 1993. In more than 15 per cent of the countries the World Bank estimates are higher than the PWT6.1 figures by 40 per cent or more.'*[43]

This gives rise to a considerable level of uncertainty regarding global poverty because China is among the countries where the PPP exchange rate is estimated indirectly, while that for India in 1993 is based on a benchmark survey conducted eight years previously[44]. According to Reddy and Pogge 'the current estimates of PPPs for China that are considered plausible differ by a factor of two'. [45]

India and China together account for 44% of the population of the developing world, and more than half of the World Bank's estimates of total poverty at the '$1-a-day' level (down from two-thirds in 1981). The potential effect on the time trend of poverty is also considerable, particularly in the case of China[46]. According to the Bank's estimates, the incidence of ('$1-a-day') poverty fell from 63.8% in 1981 to just 9.9% in 2004, while poverty in the rest of the world fell by only one-third, from 31.3% to 20.7%.[47].

Problem 8: Updating the Poverty Line

Just as general PPP exchange rates are not necessarily an accurate measure of cross-country differences in the prices of goods purchased, so the use of national price indices to adjust the poverty line from the base year to the survey year will not necessarily reflect changes in these prices over time.

They may also mask inter-regional and rural-urban differences. Thus Srinivasan records that

> *'India's official poverty estimates, which use price indices for updating, show diverging trends in urban and rural poverty between 1987-88 and 1993-94. When these estimates were recalculated using commodity weights and unit values based on household surveys, no great difference was found in the rate of decline of urban and rural areas between those years.'*[48]

The global figures are also distorted by not taking account of rural-urban differences in living costs. In presenting the World Bank's latest estimates, Chen and Ravallion estimate the impact of this effect:

> *'More than 100 million people are added to the global count of the ['$1-a-day'] poor when we allow for the higher cost of living in urban areas,*

and about half of the 100 million come from South Asia and one third from [Sub-Saharan Africa].'[49]

While Chen and Ravallion's finding that this 'makes much less differences to the trends over time' is true in aggregate, this masks significant effects at the regional level – and in all probability still stronger effects at the national level. Thus one-third of the reduction in poverty in Sub-Saharan between 1993 and 2006 appears to be a result of the failure to take account of rural-urban price differences. While the Bank's headline figures suggest that the proportion of people in Africa below the '$1-a-day' line fell from 45.5% to 42.6%, correcting for rural-urban price differences indicates both a higher level and a smaller reduction, from 49.2% to 47.2%.

As Ravallion emphasises:

'comparisons of absolute poverty across regions, sectors or dates can be misleading unless the poverty line has constant purchasing power (based on a cost-of living index appropriate to the poor).'[50]

Problem 9: Filling the Gaps

Since household surveys are generally conducted only at long and irregular intervals, extrapolation and interpolation are required to estimate poverty in each country in non-survey years as a basis for global and regional estimates. While interpolation provides a reasonable approximation, forward and backward extrapolation is more problematic.

Poverty estimates are projected backwards and forwards from the period covered by household surveys on the basis of the overall growth rate of consumption in the national accounts statistics, assuming a constant distribution of income. In practice, however, most developing countries have experienced a systematic increase in inequality since 1980[51]; and there is a large and widening divergence between consumption as measured by national accounts statistics and as measured by household surveys, the former growing substantially faster than the latter[52,53].

While the Bank's estimates effectively assume that the discrepancy between national accounts and household survey figures for consumption arises primarily because of under-reporting by better-off households in household surveys, so that poverty data are not substantially affected[54], it almost certainly arises at least partly because the definition and measurement of consumption in the national accounts statistics are different from those used in household surveys. National accounts statistics on consumption include expenditure by non-profit organisations and imputed rents for accommodation (the rental value of owner-occupied properties) which are not generally included in the household survey/poverty definition; and they generally do not effectively capture subsistence production and informal sector activity.

Both these factors suggest that forward and backward projection will result in the rate of poverty reduction being systematically over-stated, this effect occurring primarily in the earlier and later parts of the period covered by the Bank's estimates (1981-2004). In 1981, 97% of total poverty outside China and India (at the '$1-a-day' level) appears to have been estimated in this way. Only from 1987 is even a quarter of the total based on actual survey data or estimates based on surveys before and after the year in question. The problem in the most recent years is limited to some extent by the increased frequency of household surveys; but in 2004, the latest available estimate, 90% of '$1-a-day' poverty outside India and China appears to have been estimated by forward projection[55].

The problem is most acute due to the limited number of surveys conducted in the 1980s, notably in Sub-Saharan Africa[56], which accounts for more than 30% of estimated global poverty, and nearly two-thirds of poverty outside China and India.[57] Moreover, the 1980s were both a particularly

important period and a particularly uncertain one for poverty in the region, given the combined effects of the debt crisis and the early stages of the structural adjustment period. The absence of data for this period, and the strong likelihood of an optimistic bias in the estimated trend in poverty, is therefore particularly unhelpful.

Since it is inevitable that the Bank's estimates of poverty outside India and China for the most recent years will *always* be based very largely on forward projections, this optimistic bias means that they will consistently tend to present an artificially favourable picture of recent developments.

Does it Matter?

The World Bank's estimates of global poverty have an importance beyond the actual numbers they produce. Increasingly, what matters to policy-makers is what is measured; and, by highlighting the scale of global poverty, the '$1-a-day' estimates have unquestionably succeeded in raising the profile of the issue and the resources devoted to it. Thus, as Srinivasan observes

> *'The politics of resource mobilization may demand the use of international poverty lines that sound comparable, even when they are not.'*[58]

In terms of focusing decision-makers' attention on global poverty, the *existence* of estimates of its extent may thus matter more than their accuracy or reliability.

However, if the numbers do not accurately reflect actual levels, patterns and trends of poverty, they may distort decisions about *what* should be done, *how* it should be done and what *priority* it should be given. As Kakwani and Son observe, 'policy efforts focused on the wrong target, though simple, may be self-defeating'.[59] If, as the above discussion suggests, the poverty line is set too low, the extent of poverty is under-estimated and/or the rate of poverty reduction is exaggerated, this gives rise to a risk of complacency.

In fact, civil society commentators have argued that '$1-a-day' poverty estimates have been deliberately used as a means of defending the current model of commercial globalisation.

> *'The main use of the USD 1 per day indicator is ideological and political. The indicator has led World Bank researchers to claim that 'globalization is working', since it seems to imply that the proportion of people living in poverty in the world as a whole is declining at a rate that will make Millennium Development Goal (MDG) 1 achievable.'*[60]

This sceptical view receives some support from a recent independent review of World Bank research, though not in the specific context of the '$1-a-day' poverty estimates. While the review (with some justification) highlights the Bank's work in developing global estimates of poverty among the 'outstanding work in the Bank's portfolio', it also notes with respect to the Bank's 'extremely visible work on globalization, on aid effectiveness, and on growth and poverty', on which many of its pronouncements on poverty reduction are made:

> *'The panel had substantial criticisms of the way that this research was used to proselytize on behalf of Bank policy, often without taking a balanced view of the evidence, and without expressing appropriate scepticism.'*[61]

Alternative Approaches: General Principles

The above discussion suggests that the current approach to poverty analysis does not provide an adequate basis for the estimation of poverty; and that international decision-making on issues affecting poverty may be distorted as a result. This indicates an urgent need for an alternative approach.

Poverty as a Moral Concept

Setting a poverty line as a basis for policy and the measurement of progress represents an implicit moral judgment. As Ravallion observes,

> *'poverty lines are inherently subjective judgements people make about what constitutes a socially acceptable minimum standard of living in a particular society.'*[62]

By adopting a particular poverty line for policy purposes, we are thus effectively saying that it is morally acceptable for people to live *at* (but not *below*) that level of income; and that further increases in income beyond this level no longer matter from a poverty reduction perspective.

If we view poverty from a moral perspective, our definition should therefore reflect the reasons for our moral concern about it; and our moral concern arises, not from people *having* unacceptably low incomes, but rather from the *consequences* of their having low incomes. Income is important, not intrinsically but instrumentally, as a means of achieving objectives (whether we describe them in terms of rights or of capabilities) whose fulfilment we consider to be a moral entitlement.

We thus start from Peter Townsend's argument that

> *'The determination of a poverty line cannot be based on an arbitrary selection of a low level of income. Only scientific criteria independent of income can justify where the poverty line should be drawn. The multiplicity and severity of different types of deprivation can constitute those criteria. The key is therefore to define a threshold of income below which people are found to be thus deprived.'*[63]

Thus a household should be defined as (income) poor if its income is insufficient to achieve what is considered to be a minimum morally-acceptable standard of living.

This raises the issue of what constitutes a minimum morally-acceptable standard of living, in terms of the relevant *dimensions* of living standards, and the appropriate *threshold level* of acceptability in each dimension. While such moral judgments are necessarily subjective, we propose as a framework the basic economic and social rights established by UN Conventions and other international human rights instruments which have been signed and/or ratified by all or almost all countries.

There are various ways of translating such an approach in practice, which can be summarised by two dichotomies.

- First, one can adopt either an ***input-based definition*** of poverty, based on estimating *the level of income required* by a household to achieve a consumption pattern that provides an adequate standard of living; or an ***outcome-based definition***, based on the *living standards actually achieved* by households at a given level of income.
- Second, one can establish either a ***single universal poverty line***, defined in money terms at the global level, which is then converted into local currency units in each country; or a set of ***country-specific poverty lines***, defined according to specific local contexts, in such a way that they correspond with equivalent *living standards* in each country.

Below, we discuss four existing proposals corresponding with three different combinations of these approaches, as summarised in Table 1, before presenting our own proposal for a rights-based poverty line (RBPL), which corresponds with the remaining category – country-specific outcome-based poverty lines.

Input-Based Approaches

With the notable exception of Edward's Ethical Poverty Line, as discussed later, most attempts to set poverty lines in developing countries have been input-based. As Ravallion notes, going back to Rowntree's work in the UK in the late 19th century,

> *'The most common approach in defining an absolute poverty line is to estimate the cost of a bundle of goods deemed to assure that basic consumption needs are met in the specific domain of the poverty comparison. The difficulty lies in identifying what constitutes 'basic needs.'*[64]

This requires us to define what minimum consumption needs *are* in some universally applicable sense. This is, in principle, feasible for absolute physical needs such as nutrition, protection from the elements, health care and physical security. However, estimating appropriate threshold levels for such needs is necessarily subjective; and the bundle of goods and services which would be required to *fulfil* these needs would differ very considerably between – and often within – countries, for example between hot and cold climates or rural and urban areas, or according to the local availability of different basic foods. Such variations also apply at the household level, for example according to demographic factors.

Table 1: Typology of Morally-Based Approaches to the Definition of Poverty.

	Input-based			Outcome-based		
Universal poverty line	International Food Poverty Line (IFPL)	Nanak Kakwani and Hyun Son[65]	right to adequate nutrition	Ethical Poverty Line (EPL)	Peter Edward[66]	right to health, narrow definition
Country-specific poverty line	Minimum Income for Healthy Living (MIHL)	Jerry Morris et al[67,68]	right to health, broad definition	Rights-Based Poverty Line (RBPL)	David Woodward and Saamah Abdallah (this paper)	multiple rights, with right to child survival as illustration
	Capability-Based Approach	Sanjay Reddy et al[69]	multiple rights, with right to adequate nutrition as illustration			

Moreover, human needs go far beyond this most basic physical level, and simply defining a set of goods which a household requires for its continued physical existence excludes equally fundamental needs, such as social interaction and mental stimulation. Even people unable to fulfil their physical needs may well value the fulfilment of such non-physical needs as highly as those which might, to an outside analyst, be considered 'necessities'. The requirements of such non-material needs in terms of goods and services are likely to be still more context-specific, and their definition more intractable.

As a result, even within a particular national context, as Srinivasan observes:

> *'Unavoidably, determining which goods and services are to be included in a poverty bundle, and in what amounts, is an arbitrary decision.'*[70]

Perhaps the most rigorous approach to developing an input-based poverty line is the Minimum Income for Healthy Living approach developed by Jerry Morris and others at the London School of Hygiene and Tropical Medicine, which seeks to define poverty on the basis of 'attainable levels of health as a human right and prime goal of society' [71].

Starting from epidemiological evidence (supplemented by 'pragmatic judgments'), they assess the material needs for a healthy life for a specific demographic group, covering diet and nutrition, housing, physical activity, medical care (where not available free from the National Health Service) and social integration, and estimate 'cautious pragmatic, representative minimal costs per week'[72] of meeting these needs in a particular national context. For 'single, healthy men, 18 to 30 years, living away from their family and on their own' in the UK, they found costs varying between £106.47 and £163.86 per week (average £131.86) in different regions at 1999 prices[73]; and for 'people aged 65 and above, living independently (ie in non-assisted housing), retired from employment and without significant defined disability', £131 for a single person and £208 for a couple in April 2007[74].

These figures are far above any figure contemplated for developing countries – in the order of $25-50 per person per day. In fact, an equivalent figure in a developing country context would be still higher, as Morris et al's figures exclude the value of subsidies such as free health services, free or subsidised public transport (for people over 65 in many areas) and free television licences (for people over 75).

The scale of the difference largely reflects the much higher standards of living which are regarded as the minimum acceptable in developed countries. Thus the costs included for those over 65 include, under the heading of 'psychosocial relations/social inclusion/active minds', expenditures which would not normally be considered in a developing-country context, such as:

> *'a telephone, occasional gifts to grandchildren and others, modest recreational and entertainment costs, membership fees, a television set (and licence for those under 75), a daily newspaper, an annual UK holiday and a little money for hobbies.'*

The results also highlight the specificity which is required in this type of approach. Beyond the distinction between 18-30-year-olds and those over 65, each sub-group is further defined, the former to exclude couples, families and those living with their parents or sharing accommodation, and the latter to exclude 40% of the age group who have disabilities and 'are likely to have extra personal costs that require further *ad hoc* study'. Even within the narrowly-defined 18-30 group, there are wide regional variations, largely as a result of differences in housing costs.

The MIHL is probably the most comprehensive attempt yet to evaluate a country-specific poverty line based explicitly on consumption needs associated with the right to health – although some arbitrariness inevitably remains in the assumptions about both the consumption basket and the prices. No equivalent appears to have been attempted in a developing country setting, no doubt partly reflecting the substantial country-specific data requirements, and the extent of the analysis required to estimate poverty lines at a sufficient level of regional and demographic disaggregation. Such constraints almost certainly render such a comprehensive approach impracticable in this context.

The failure to apply this type of approach in developing countries also arguably reflects in part the implicit abandonment of the right to health in the developing world in the face of poverty on a scale which makes it unthinkable in any meaningful sense for the majority of the world's population. At best, considerations of health in this context fall far short of the definition established by the constitution of the World Health Organisation's constitution in 1948: 'not merely the absence of disease, but a complete state of physical, mental and social well-being'. Rarely, in practice, does the definition in developing countries extend beyond 'the absence of [physical] disease'.

Most attempts to define input-based poverty lines in developing countries instead adopt a short-cut approach based on the estimated cost of minimal nutritional needs, together with an allowance for non-food expenditure based on actual expenditure patterns among poorer households. This largely reflects the serious constraints of data and analytical capacity in developing countries, and

> *'the absence of any consensus on what non-food capabilities are of concern, on the characteristics of the commodities which promote them, on the transformation function that relates these characteristics to capabilities, and on the levels of each capability that ought to be deemed minimally adequate.'*[75]

Nutritional needs, in turn, are generally simplified to the fulfilment of calorie requirements, which can readily be assessed on the basis of food purchases, using standard calorific values.

The general approach is to assess minimum nutritional needs (generally based on average calorie requirements); to estimate the cost of this calorie intake, on the basis of the average cost of food per calorie for a reference group of the population; and to add an allowance for non-food expenditure, based on actual expenditure patterns among poorer households.

However, this is in practice less straightforward than is generally assumed. Firstly, as noted above, calorie contents are only one aspect of the nutritional value of food, and of people's nutritional requirements. From a health perspective, an adequate nutritional intake also depends on other attributes of food, such as its contents of vitamins, minerals and other micronutrients, and its energy density (of particular importance for weaning children[76]). In addition, there are other aspects of food which may also be valued by households as much as their calorie content, even if they are below minimum calorie intakes, for example taste and variety (again particularly important for weaning children), and time required for preparation (particularly for time-poor households).

Such differences among foods in terms of non-calorie attributes (nutritional and non-nutritional) give rise to a considerable variation in average costs per calorie between income levels, even below the level at which adequate nutritional intakes are reached. In the case of Bangladesh, for example, Kakwani and Son find that the cost per 1,000 kilo calories to the richest quintile is 150% higher than that of the poorest, increasing steadily across the whole income distribution[77]. This makes it critically important which

income group is used as the reference group to estimate per calorie costs. This is a key issue in Kakwani and Son's own attempt to develop an International Food Poverty Line, as discussed below.

In addition, calorie requirements not only vary substantially between individuals, but do so in ways that are systematically related to income levels. Important variations arise from differences in demographic attributes (age, gender, pregnancy and lactation), levels of physical activity and health status (particularly parasitic diseases which reduce the body's utilisation of nutrients relative to measured intakes) [78]. These income effects operate in conflicting directions: while demographic factors tend to increase calorie requirements for poorer households (to the extent that they include more children and older people, and fewer men of working age), they typically have higher levels of physical activity (both in paid work and household activities such as collecting water and pounding grains) and poorer health, as well as a higher incidence of pregnancy and lactation.

While the scale of the effects suggest that the net effect may be significant, its size, and potentially its direction, will thus be context specific. It is clear, however, that the result will be to distort findings on the *composition* of poverty. Specifically, it is likely to result in methods based on national averages for nutritional requirements under-estimating poverty in rural and mining areas, among the elderly and in areas with a high incidence of parasitic and other diseases; and to over-estimate it among families with above-average numbers of children and female-headed households.

There is also a more fundamental challenge to calorie-based approaches, in terms of the hierarchy of human needs. Calorie consumption, together with drinking, is the most basic human need which requires financial resources (others, such as breathing and sleep, being costless). The imperative for survival therefore means that some level of calorie intake (though not necessarily the notional minimum requirement) will be met, if necessary, at almost any cost in terms of other needs.

However, if we are interested in a broader definition of income poverty – that is, if we think that people also have a moral entitlement to the fulfilment of material needs other than an adequate calorie intake – then this does not provide the appropriate criterion. Rather than setting the poverty line at the point where the *first* human priority is met in full, we should be seeking to define the poverty line as the point at which the *last* of the needs which we consider to be an entitlement is fulfilled. On this basis, by definition, a poverty line based on calorie intakes inevitably represents a minimalist approach to defining a 'moral' poverty line.

Outcome-Based Approaches

The key distinction between input- and outcome-based definitions of poverty is that between potential and achievement. While input-based approaches seek to assess whether a household has, in principle, sufficient resources to achieve a certain standard of living if they are allocated 'appropriately' (or at least no less appropriately than the average), an outcome approach considers the standard of living households actually achieve in practice at a given level of income. It is thus implicit in an input-based approach that non-poor households which fail to achieve the standard of living deemed adequate do so, not as a result of inadequate resources, but rather because they misallocate the resources available to them. In effect, their needs are not met because they *choose* not to meet them. If they are poor, they are part of the 'undeserving' poor.

If we were able to estimate input-based poverty lines accurately, there could be a case for such an approach. Should we define a household as poor when it has an income which would be sufficient to meet its needs,

but fails to do so because the head of household spends his or her income wastefully? Possibly not.

However, there are a number of problems. As discussed above, there are good reasons to believe that input-based approaches may not, in practice, estimate consumption requirements reliably; that those based on the estimated cost of calorie requirements are likely to be lower than would be required by a broader concept of needs; and that both needs and costs vary significantly between households. Equally, deviation from the average pattern of expenditure allocation does not necessarily represent *mis*allocation. For example, even if many households at the poverty line economise by not sending their children to school, a household which does so cannot be considered to be allocating its resources wastefully.

Most importantly in the present context, consumption is only one part of the link between income and living standards. In order to avoid reducing consumption below what it considers to be minimum level, a household in poverty may well sacrifice some aspects of non-financial living standards in order to generate additional income. Such options include employment in unhealthy or dangerous occupations such as scavenging and prostitution, excessive working hours, children working rather than attending school, rural-urban or cross-border migration (including family separation), financially-motivated (and often high-risk) sexual relationships, etc.

The costs associated with sustaining consumption in this way are as much part of our reason for concern about poverty as low consumption; but they are not taken into consideration by input-based poverty lines. Even if the additional income generated is sufficient to compensate the household for the non-financial costs, the exclusion of such costs from the analysis means that input-based approaches will under-state poverty in terms of outcomes.

This suggests that an outcome-based definition should, in principle, be preferred to input-based definitions. This is, in any case, a closer match to our reasons for concern about poverty: if our concern arises from the living standards of those in poverty, it makes sense intuitively to base our definition of poverty on the level of income at which an acceptable living standard *is* achieved rather than (a potentially unreliable estimate of) the level of income at which it could or should *theoretically* be achieved.

This represents a shift from the consumption-based approach favoured by the World Bank to Sen's capabilities approach.

> *'The capabilities a person has, are the substantive freedoms he or she enjoys to lead the kind of life he or she has reason to value. In this perspective, poverty must be seen as the deprivation of basic capabilities rather than merely as lowness of incomes, which is the standard criterion of identification of poverty'.*[79]

Developing this approach, Martha Nussbaum has established a list of ten core human capabilities, deprivation of which she interprets as constituting poverty. These capabilities are life; bodily health, bodily integrity; senses, imagination and thought; emotions; practical reason; affiliation; other species; play; and control of one's environment.[80] From an *income poverty* perspective, however, this list presents some difficulties: while income may be a significant influence on some aspects of most items of the list, in many cases it is not a primary cause of deprivation, and its influence is critically dependent on context. The use of these capabilities as a basis for an input-based poverty line is still more problematic, due to the intractable problems inherent in quantifying many of the capabilities, and the very limited availability of relevant data in developing countries[81].

The most practicable of Nussbaum's capabilities for the current purpose are life and bodily health. Health outcome indicators such as life

expectancy and infant and child mortality are widely recognised, and estimates are available for most countries are readily available (though of very variable reliability). They also reflect (albeit in the most extreme form) the impacts of a broad range of income-related deprivations – of adequate nutrition, of access to health services, safe water and sanitation, poor living environments, etc, and in the case of life expectancy occupational risks and lack of access to basic education.

At the same time, it is universally accepted that there is a systematic relationship between incomes and health indicators, and that low incomes are an important causal factor in this relationship[82]. While there are various factors at play, as Angus Deaton argues:

> *'poor health in poor countries is not because of lack of medical or scientific knowledge about effective treatment, because the means of treatment are known, often long known. Low incomes are a more plausible explanation of poor health.'*[83]

At the same time, the problems of estimating the costs of attaining a given level of health, as discussed above, suggest that outcome-based approaches may be more practicable than input-based approaches as a means of estimating a health-based poverty line.

As Ravallion notes:

> *'It is undeniable that there exist levels of consumption of various goods (food, clothing and shelter) below which survival beyond short periods is threatened, though it is less clear what these levels exactly are for any given individual.'*[84]

This suggests the possibility, in principle, of establishing a cut-off point in terms of consumption levels which corresponds with a specified risk of mortality – but also the intractability of defining such a point.

The question is what level of threat (ie what probability of death) should we consider acceptable, and how long is 'a short period'? Evidence of a relationship between income levels and mortality indicators extends even to the upper part of the global income distribution, including in developed countries[85]. While it seems reasonable to adopt a lower threshold than a serious and immediate threat to life, for example from starvation, requiring a zero income-related risk would classify all but a few per cent of the population of the richest countries as poor, rendering the concept of poverty meaningless. It is thus necessary to establish a threshold level of mortality which is both realistic and consistent with a reasonable interpretation of moral standards.

Global versus Country-Specific Poverty Lines

The concept of a single global poverty line is a relatively recent phenomenon, springing from a desire for a common standard to allow poverty to be aggregated and compared between countries on a consistent basis. This no doubt reflects a growing conception of poverty as a global phenomenon and of developments in a globalising world economy as causes of and/or potential solutions to the problem.

There is a general assumption that aggregation and comparison require a global poverty line to be fixed in monetary terms and converted into national currencies as a comparator for household-level data on income or consumption. For Ravallion, this is the very foundation of the definition and measurement of poverty.

> *'When trying to make a global comparison of absolute poverty in terms of consumption, there is (in my view) a compelling case for using the same real consumption level as the poverty line in all countries.'*[86]

'For our global poverty counts, we have but one overriding concern – that two people with the same standard of living, measured by command over commodities, be treated the same way no matter where they live.'[87]

However, it is not clear that this is the only possible approach to setting a non-arbitrary poverty line – or even, necessarily the most viable means of doing so. Even if the problem of conversion factors appropriate to the consumption patterns of the poor can be satisfactorily resolved, the basket of goods a household needs to buy in order to achieve a given standard of living is very different in Nepal, for example, as compared with Vietnam; and, as Wagstaff's results on child health at the '$1-a-day' poverty line confirm[88], welfare indicators at the same level of income vary very widely between countries. Thus, if a single global poverty line is set at the right level on average, it will necessarily be too high in some cases and too low in others, whether based on an input or an outcome approach.

From the perspective of a moral concept of poverty, and a primary concern with the *consequences* of low incomes, this is problematic. To set a poverty line which implicitly allows different living standards, by our chosen criterion, in different countries is, in effect, to apply inconsistent moral standards between populations. In this sense, a set of national poverty lines estimated on a consistent basis, whether on an inputs or an outcome basis, would seem a more appropriate approach, as it better reflects the *reasons* for our concern with poverty.

Ravallion envisaged the possibility of developing country-specific poverty lines as a means of dealing with inter-country differences in outcomes at a given level of income as long ago as 1992.

'One way of dealing with the possibility that the living standards indicator does not properly reflect differences in well-being at a given consumption level is to set different poverty lines.'[89]

UNDP appears sympathetic to this idea in principle, but has not pursued it for practical reasons.

'An alternative [to a universal poverty line] is to use different poverty lines in different countries. But it is not easy to decide what the appropriate variations would be and how the respective poverty lines could be estimated…. The general need for a variable cut-off line of poverty is easier to appreciate than it is to find adequate values for variable poverty lines in different countries.'[90]

However, Ravallion rejects the idea as

'a rather restrictive way of dealing with differences in needs, since it need not yield meaningful comparisons across different needs groups for those below the poverty line; comparability is only assured at the poverty line.'[91]

Nonetheless, if a country-specific approach is more consistent with our conception of poverty, it is not clear that this is an adequate reason to reject such an approach. Ravallion's concern applies primarily to the question of comparing the *depth* of poverty across different contexts. However, poverty gaps are relatively little used in practice; and it is not obvious that they are any less comparable using consistent country-specific poverty lines than with a single global poverty line. Even if we were to convert it at a PPP exchange rate appropriate to those living at the poverty line, the consumption patterns of those living on lower incomes – and therefore the relative prices they face – would be different. Again, this implies that comparability is assured only at the poverty line, and not necessarily below it.

Alternative Global Poverty Lines: Three Examples

Kakwani and Son's 'International Food Poverty Line'

In an approach broadly similar to that developed for use in the United States by Mollie Orshansky in the mid-1960s[92], Kakwani and Son first estimate a 'food poverty line' for an anchor country (Bangladesh) by multiplying the national average calorie requirement for Bangladesh by the average cost per 1,000 kilo calories in the food expenditure of the poorest income quintile. They then add a non-food allowance based on the average ratio of non-food to food and expenditure in the 10% of households centred on the income level where predicted food expenditure equates to this level.

They then estimate poverty lines in 19 low-income countries by converting the cost per calorie estimated for Bangladesh into the currencies of other countries at 1993 PPP, adjusting this for subsequent inflation, and applying this to the average calorie requirement in each country. This is again translated into an overall poverty line in each country by adjusting for the non-food spending of households whose food expenditure is equal to the food poverty line in each country. The resulting lines range between $1.05 and $1.63 per day at 1993 PPP in different countries, and the median ($1.22 per day) is adopted as a single global poverty line.

This approach thus offers a possible method for either a global or a country-specific input-based poverty line.

As noted above, the reference group used to estimate the food component of the poverty line is of critical importance – and Kakwani and Son's use of the poorest quintile for this purpose is seriously problematic. The rationale for applying the non-food/food ratio at the food poverty line to determine the food component is the assumption that this indicates the level of non-food expenditure which provides marginal benefit equivalent to that of satisfaction of calorie needs. However, if we consider the increasing per-calorie cost of food consumption as income rises as reflecting the purchase of non-calorie attributes of food (nutritional and non-nutritional), then the same logic applies.

This suggests that the appropriate per-calorie cost is that attained at the income where calorie requirements are just met; and in most low-income countries this is likely to be well above the lowest income quintile. Using a lower reference price discriminates unjustifiably between non-calorie attributes of food and non-food expenditures. This also means that the non-food component of the poverty line is itself under-valued. Because an artificially low reference price is used, households whose food expenditure is at the poverty line are in fact consuming well below the required level, implying that the marginal benefit of their non-food expenditure is also less than it would be at this level of consumption (though higher than that of the non-calorie attributes of their food consumption).

Further problems arise in the application of the Bangladesh results to other countries, as it is not self-evident that the spending patterns of the poorest 20% of the population in Bangladesh are an appropriate reference point to estimate food costs in other countries. This effectively sets an arbitrary standard in terms of non-calorie attributes of food unrelated to the experience of any other countries.

One could envisage an alternative approach, using the per calorie costs of the poorest quintile in each country as a basis for the estimation of its own poverty line. However, this is equally problematic, as the extent to which the poorest 20% of the population in each country will sacrifice non-calorie attributes of food will depend largely on the depth of poverty that country. In an extreme case, they may on average satisfy their calorie needs, and thus no sacrifice may be entailed; conversely, they may have incomes half that at which calorie requirements are met, in which case non-calorie attributes will be very low.

Thus the use of the poorest quintile as the reference group for per-calorie costs faces us with a choice between two options, neither of which generates a satisfactory result: either we can use the poorest quintile in each country, and thus generate country-specific poverty lines which imply inconsistent standards between countries; or we can use the poorest quintile in an anchor country, which (in principle) provides a consistent standard, but at an arbitrary level, depending on the anchor country selected.

There thus appears to be little choice but to use per calorie costs at the income level at which calorie requirements are just met. While this should ideally be done on a country-specific basis, if it were necessary to adopt an anchor country approach for reasons of data inadequacy, this would at least substantially reduce the variation arising from arbitrary selection.

Further problems arise from the conversion of the 'anchor country' food poverty line to other countries. While the theoretical part of their paper rests on using food PPPs, Kakwani and Son appear to use *general* PPPs in their actual estimates. As noted above relative food prices differ systematically from other relative prices, distorting the results. Even using food PPPs, the problem remains that these will be dominated by the consumption patterns of non-poor households, and therefore may not accurately reflect differences in the prices of (mostly basic) foods purchase by poor households. The potential effect of this is considerable: in 1993, the ratio of the food PPP to the all-consumption PPP varied by a factor of two between different developing countries, and the corresponding ratio for cereals and bread (which may be more representative of basic foods) by a factor of three.[93]

Finally, the principle of converting the country results into a global poverty line demonstrates the problems inherent in this approach. The country results range from $1.05 per day for Burundi to $1.63 for Cote d'Ivoire and Cameroon, and the global poverty line is set at $1.22 per person per day, the median level. (Since per calorie costs are held constant, the range of average calorie requirements used is relatively narrow (2,000 to 2,200 per day), and the analysis is limited to low-income countries, these differences is driven mainly by the wide range of non-food shares in total spending at the food poverty line, from 18.7% to 45.4%.)

Taking the results at face value, this means that a household in Cote d'Ivoire or Cameroon would be considered not to be poor even if its income were nearly a quarter less than what is estimated to be required for an adequate nutritional intake, while a household in Burundi could have an income 16 per cent above this level and still be considered poor. It is thus inevitable that the generation of a single global poverty line from a range of country-level results will give rise to an inconsistency in living standards at

the poverty line. Moreover, the discrepancy would almost certainly be considerably wider if the same approach were extended globally, including to middle-income countries.

Reddy, Visaria and Asali: the 'Global Capability-Based' Approach[94]

Reddy et al seek to develop a consistent set of country-specific, input-based poverty lines founded on a moral concept of poverty, based on

> *'identifying a set of elementary income-dependent capabilities which an individual ought to be able to afford in order to be deemed non-poor. Once this set of capabilities is agreed at the global level, the specific resources required to achieve them would be identified at the country level…. The resulting poverty lines will, by construction, refer to a common criterion for identifying the poor and thereby permit meaningful comparison and aggregation of poverty estimates across countries.'*[95]

In practice, however, faced with data constraints, Reddy et al again adopt a nutrition approach. Like Kakwani and Son's analysis of Bangladesh, this is based on calorie requirements, using per calorie costs and food/non-food expenditure ratios based on a reference group based on per capita income. Reddy et al readily acknowledge the limitations of this method from a capabilities perspective.

> *'The sense in which the approach to poverty assessment proposed here is capability-based is admittedly a limited one. It focuses on explicitly specifying a single capability (the ability to be adequately nourished) while making indirect allowance for the other relevant capabilities. It also takes a rather restricted approach (based on food energy requirements) to the operationalization of that capability. Finally, no allowance is made for variations in the commodities required for achieving basic capabilities, as is ultimately required in a capability-based perspective.'*[96]

Despite the similar basis of their approach, however, Reddy et al circumvent the problems discussed above, first, by calculating country-specific poverty lines, and second by using the income level at which average calorie requirements (albeit global figure rather than national averages) are met. It would thus appear, in principle, to provide a much closer approximation to the ideal of a country-specific input-based approach.

Applying this method to three countries, Reddy et al estimate surprisingly low poverty lines of $0.54 per day for Tanzania and $0.75 for Nicaragua, but a much higher line of $1.84 for Vietnam (all at 1993 PPP)[97].

It will be noted that, despite the much smaller sample, this represents a much wider range of results than that found by Kakwani and Son, with a ratio of 3.4 between the maximum and minimum figures, as compared with 1.55. Since the main difference in methodology is Kakwani and Son's use of a reference price per calorie based on the average cost to the poorest quintile in Bangladesh converted at 1993 PPP, rather than country-specific figures for households whose calorie requirements are just met, this may be viewed as an indication of the considerable scale of the differences arising from these alternative methods.

Testing Nutritionally-Based Poverty Lines against Nutritional Outcome Indicators

If our concern with poverty arises primarily from the living standards associated with living in poverty, then one test of country-specific poverty lines based on food consumption is to compare their results with anthropometric nutritional outcome indicators. Applying this test raises important questions about both of the approaches described above.

In Figures 1 and 2, we compare the incidence of poverty implied by Kakwani and Son's 19 estimated national poverty lines (as applied to the World Bank's PovCalNet database[98]) in each of the years in which income data are available, and compare these with World Bank figures for the incidence of malnutrition in each country for the nearest available year, in terms of height-for-age and weight-for-age[99].

Figure 1: 'Food Poverty' and Malnutrition (Height/Age).

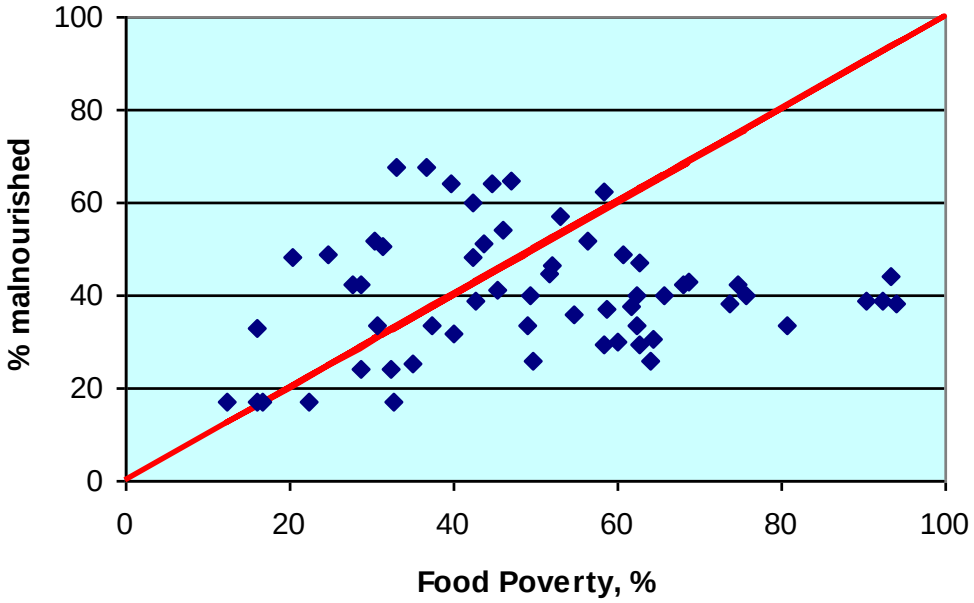
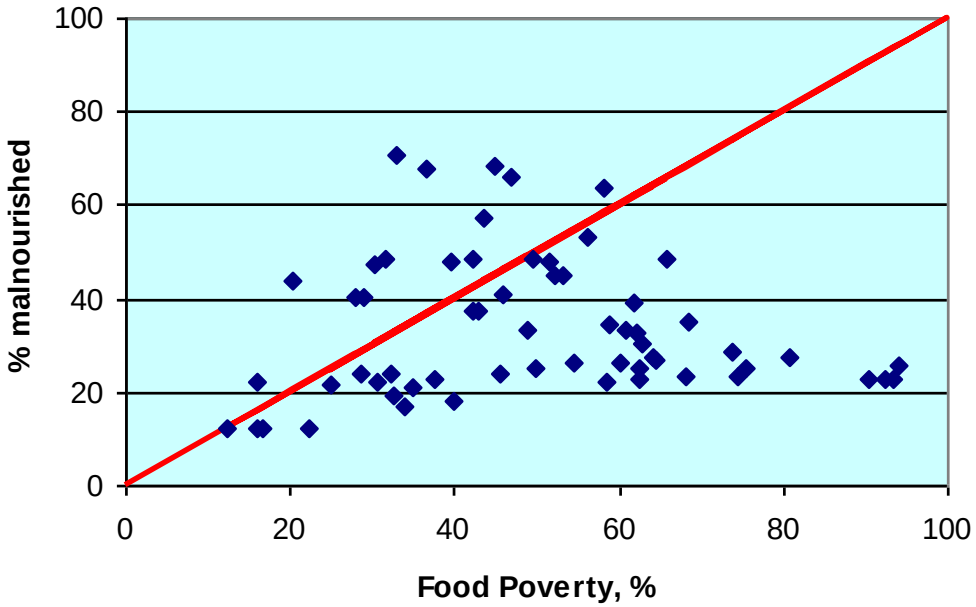


Figure 2: 'Food Poverty' and Malnutrition (Weight/Age).



Two features stand out from these graphs. First, there is no systematic relationship between the proportion of households defined by Kakwani and Son's method as poor, and the proportion of children who suffer from malnutrition. In fact, the countries with the highest rates of malnutrition have 'food poverty' rates in the middle of the distribution, while those with the highest rates of 'food poverty' have average (height-for-age) or below-average (weight-for-age) 'food poverty' rates. This suggests that the

method does not effectively reflect differences in nutritional standards between countries.

Second, in many cases the incidence of malnutrition is much higher than the estimated incidence of poverty (indicated by points above the red 45º line). This means that, in some countries, many children are classified as nutritionally non-poor despite being seriously malnourished – whereas by any reasonably standard, one would expect even moderately under-nourished children to be classified as poor, so that all the points on the graph were substantially *below* the 45º line.

Moreover, these cases include five of the six observations for Kakwani and Son's 'anchor' country, Bangladesh, for both of the anthropometric indicators. This suggests that the problem does not arise merely from the means used to apply the method to other countries.

The sole exception is 2000, the year on which Kakwani and Song's analysis is based. Even in this year, however, their estimated poverty line of $1.23 per day at 1993 PPP would give rise to a poverty headcount ratio of 51.5% based on the World Bank's PovCalNet database[100]. This is only slightly above the malnutrition rates of 48% in terms of weight-for-age and 45% in terms of height-for-age in the same year[101]. Moreover, since both indicators generally change relatively slowly over time, the substantially higher figures for both 1999 and 2001 (55% and 49% for height-for-age, and 61% and 52% for weight-for age) suggest that this may be a significant under-estimate of the actual malnutrition.

Although it appears better methodologically, Reddy et al's Global Capabilities-Based Approach fares little better against the yardstick of nutritional outcome indicators. While they estimate a poverty line of only $0.54 for Tanzania, Wagstaff's analysis indicates that, even at *double* this income, 36.4% of children are malnourished in terms of weight-for-age, and 48.4% in terms of height-for-age. In the case of Nicaragua, the estimated at poverty line is $0.75 per day, 30% below the level at which Wagstaff estimates 21.8% of children to be malnourished in terms of weight-for-age, and 43.2% in terns of height-for-age. Moreover, these malnutrition rates are significantly above the national average in Tanzania, and around double the average in Nicaragua, clearly indicating that they is poverty-related, at least in the latter case.

Besides casting doubt on the levels of these lines, set against what might be considered reasonable nutritional standards, these results also cast doubt on the equivalence of the living standards at these two poverty lines. This is most clearly demonstrated by the weight-for-age figures: while the estimated poverty line in Tanzania is 50% below a level of income at which 36.4% of children are malnourished by this criterion, that in Nicaragua is only 30% below an income at which many fewer children (21.8%) are malnourished.

While corresponding figures are not available for Vietnam, and the estimated poverty line is substantially higher at $1.84, the poverty incidence this implies (28.9% in 1998), is well below the national malnutrition rates of 36% in terms of height-for-age and 40% in terms of weight-for-age. This implies that, here too, a substantial proportion of people are necessarily classified as non-poor by this measure despite suffering from malnutrition.

Given the general parameters of nutritionally-based approaches to setting poverty lines, it is difficult to see how Reddy et al's method could be improved upon. These results therefore cast doubt on whether it is possible for this method to generate poverty lines which allow living standards which are both adequate and consistent between countries, even if considered exclusively in terms of nutritional outcomes.

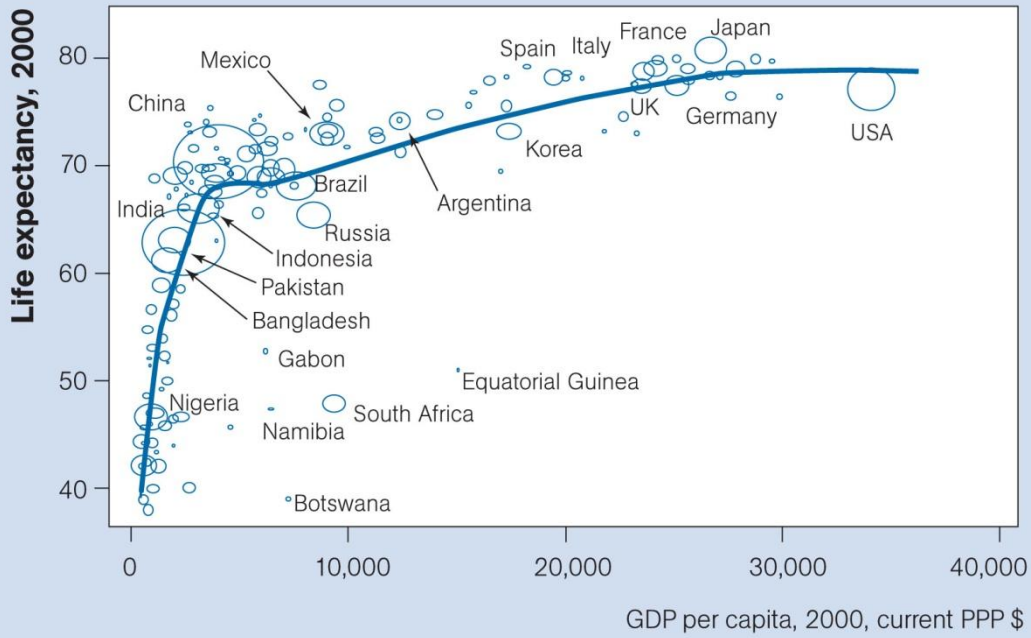
Peter Edward's 'Ethical Poverty Line'

Peter Edward's 'Ethical Poverty Line' (EPL) is an attempt to estimate a global outcome-based poverty line focused on health. Edward takes as his starting point the Preston curve showing the relationship between national income per capita and life expectancy at birth[102] (Figure 3), focusing particularly on a perceived 'kink' in the curve, beyond which further increases cease to increase life expectancy significantly. Assuming a similar pattern *within* countries, but with a zero gradient above the 'kink', Edward experiments with alternative specifications of the curve at lower incomes, using national income distribution data, to find which provides the closest match between predicted and actual life expectancies at the country level. The EPL is then defined as the income level corresponding with the 'kink' in the individual-level curve.

It is important to emphasise that Edward is deliberately conservative in his estimates (including the upper as well as the lower end of his estimated range). This is largely a reflection of his motivation, which is less to estimate a precise value of the EPL but to demonstrate that any plausible estimate would be substantially above the '$1-a-day' line, and that the true costs of 'making poverty history' in a meaningful sense are thus seriously under-estimated[103].

On this conservative basis, Edward estimates the minimum value of the EPL to be between about $2.90 and $4.20 per day at purchasing power parity (at 1993 prices)[104]. The World Bank's PovCalNet database suggests that 50-60% of the world's population (60-71% of the population of the developing world) was poor by this definition in 2004[105].

Figure 3: The Preston Curve, 2000



Source: Deaton (2003) op. cit.

The EPL approach represents a considerable step forward in the definition of a poverty line, from a moral perspective, being based on the principle of

> *'deriving a poverty line… directly from globally standardised and ethically justifiable well-being outcomes.'*[106]

In this respect, it is arguably the best approach yet devised to setting a single 'moneymetric' global poverty line. However, some issues remain about this approach.

Issue 1: Is there a 'Kink' in the Individual-Level Preston Curve?

Edward's approach appears to have been inspired by the existence of a 'kink' in the Preston curve – a clear point at which a very sharp gradient becomes a very shallow one. He then hypothesises that this reflects a similar pattern in individual-level Preston curves. Since disaggregated data for life expectancy by income are not available, this requires consideration of the reasons for the 'kink' in the cross-country curve, and to what extent these factors are likely to be replicated at the individual level.

As Preston observed, there is every reason to expect the curve to be non-linear, reflecting diminishing returns to income in terms of life expectancy. However, this is not sufficient to account for the 'kink' in the 2000 curve, with no apparent increase in life expectancy as GDP per capita increases from around $3,500 to $6,000. The absence of this feature from Preston's original findings for the 1960s or the 1930s (which showed an essentially smooth relationship, though with a considerable reduction in gradient above GDP per capita of around $200 at 1963 prices)[107] raises a real question as to whether this is an intrinsic feature of the relationship, or whether it arises as a result of particular circumstances at present.

Deaton suggests two such interpretations – that the 'kink'

> *'shows the adverse effects on life expectancy of HIV/AIDS, particularly though not exclusively in African countries… as well as the less catastrophic but still significant decline in life expectancy in some of the formerly socialist countries of Eastern Europe and Central Asia.'*[108]

However, two caveats are in order here. First, many of the former socialist economies suffered major declines in GDP as well as in life expectancy. The effect on the Preston curve is therefore limited to the excess of the reduction in life expectancy beyond that which would be predicted as a result of the fall in per capita income, dampening this effect significantly. Many, in fact, particularly Central Asian countries with relatively low incomes, have life expectancy well *above* that predicted by the Preston curve, possibly reflecting the lagged effect of higher incomes in the past. Thus, while Russia and Turkmenistan are conspicuously below the global Preston curve, Albania, Armenia, Azerbaijan, Georgia, Kyrgyz Republic, Moldova, Mongolia, Tajikistan and Uzbekistan are clearly above it. Thus the issue is not that life expectancy is below that predicted by the global Preston curve, but rather that the Preston curve for transition economies is much flatter than for the rest of the world.

Similarly, the Sub-Saharan effect arises not from the region as a whole, but from a sub-group of middle-income countries whose GDP is in a range immediately above the level at which the transition from steep to shallow gradient occurs (South Africa, Botswana, Namibia, Swaziland, Equatorial Guinea and Gabon). Moreover, as discussed later, HIV/AIDS is by no means the only factor depressing life expectancy relative to income in these countries: other factors include particularly acute inequality, and low levels of immunisation and basic education relative to other countries at similar income levels.

At least as important in defining the 'kink' is the role of China. Because the revised Preston curve is weighted by population (unlike the original 1960s version), China's position significantly above the 2000 curve, is likely to play a major role in forming the 'kink'.

At the individual level, we would again expect to see diminishing returns to increasing income in terms of life expectancy; but it is less clear that the nature of this effect, in terms of the gradient of the Preston curve, will

necessarily be the same as at the cross-country level, particularly as the country-level effects are likely to arise at least partly from the implications of higher per capita income for social provision as well as through higher private consumption.

The role of specific countries in defining the 'kink' is altogether more problematic, as there is clearly no reason to expect similar considerations to arise at the individual level. While we may well see a marked deceleration in the gradient of the curve over a relatively narrow range of incomes, there is therefore little reason to expect a single, clearly defined cut-off point such as that indicated by the 2000 Preston curve.

We are thus more likely to find a marked reduction in the gradient of the individual-level Preston curve over a range of incomes rather than a clearly-defined 'kink'. This both makes the identification of a specific income at which the gradient changes more difficult, and, since an upward-sloping upper segment of the curve is modelled as horizontal, may result in biased estimates. The likelihood that this will bias estimation of the poverty line *downwards* is, however, consistent with Edward's attempt to produce a minimum feasible level of the EPL rather than a neutral estimate. The latter could in principle be approximated by dividing the curve into two portions with different gradients; but given the methodology (and the data constraints on alternative methodologies), this would require too many variables for an EPL to be estimated.

Issue 2: Does the Gradient of the Individual-Level Preston Curve Change at the Same Income in All Countries?

Edward's analysis assumes, not only (explicitly) that there is a 'kink' in the individual-level Preston curve, but also (implicitly) that it occurs at the same level of income in every country. (It also appears to assume that the individual-level Preston curve below the 'kink' has the same functional form in all countries.) In practice, however, there are a number of reasons to expect that this will not be the case.

First, as discussed above, there are wide discrepancies in living standards at the same income levels (in PPP terms) in different countries – not least in terms of infant and child mortality rates, which are major determinants of life expectancy. Thus, even if we assume a constant ceiling on attainable life expectancy, the income at which it will be reached is also likely to vary widely.

Second, if there were a single universal relationship between real consumption and life expectancy, one would expect the turning point to be determined by equivalence of purchasing power over the goods purchased by households at the corresponding level of income. As noted above, however, this will not necessarily be accurately reflected in general PPP exchange rates, because the consumption patterns of poorer households are both significantly different from national averages and underweighted in their estimation. The effect of this factor is likely to be much more limited in absolute terms for the EPL than for the '$1-a-day' line, as the former is substantially closer to average income levels. However, variations in the discrepancy between estimated and actual purchasing power are likely to be correlated with country characteristics which themselves influence the relationship between actual income and life expectancy, particularly GDP per capita and inequality.

Third, the use of consumption at (national) PPP in the analysis implies that it must also be used to convert the global poverty line into local currency terms. However, this introduces considerable noise and potential distortion into the analysis, as well as the problems arising from sensitivity to the base year. As noted above, feasible estimates of the PPP exchange rate in China vary by a factor of two. Equally, re-basing PPP estimates from 1985

to 1993 raised the poverty line for Nigeria in 1993 by 42%, while lowering that for Mauritania by 61%, changing the ratio between the two (in the same year) by a factor of 3.7[109]. Such wide margins of uncertainty as to the 'true' level of real incomes seriously complicate the identification of a threshold level of income on this basis.

Neither would the use of PPP exchange rates which reflect the consumption patterns of households near the poverty line appear to be an appropriate or viable option in this context. Apart from the issue of circularity – the impossibility of defining households close to the EPL until the EPL itself has been determined – the analysis required covers the whole of the income distribution; and the PPP exchange rate relevant at the poverty line will be based on consumption patterns different from those at higher or lower incomes.

Therefore, even if the hypothesis of a universal ceiling on life expectancy were valid, we would expect to find a wide range of income levels – whether measured in PPP terms or otherwise – at which it was attained. The EPL can thus only be interpreted as an indicative global *average* figure, with a wide variation between countries as to the income level at which either the 'kink' in the Preston curve or the global ceiling level of life expectancy is attained. This brings us back to the problem inherent in the estimation of a single global poverty line: that it will inevitably give rise to living standards below our threshold of acceptability in some countries.

Issue 3: Changes in the EPL over Time

As Preston himself highlighted, as well as the movement of countries along the Preston curve over time as their incomes rise (or fall), the curve itself also shifts upwards – a feature generally linked to technological advances in health (broadly defined to include, for example, primary health care, oral rehydration therapy and mass vaccination campaigns).[110] To the extent that this is a parallel upward shift of the curve, it will not necessarily change the EPL itself, although it will raise the life expectancy with which it is associated. However, the upward shift of the curve is a result of the evolution of incomes and life expectancy in different countries; and there is no fundamental reason to think that the EPL will *not* change.

Although it is not stated explicitly in his published paper, Edward sees the EPL as moving over time to reflect such changes in the relationship between per capita income and life expectancy, and thus requiring estimation at regular intervals based on updated data.[111] This is appropriate; and we adopt a similar principle in the rights-based approach presented later. If the EPL were fixed, it would become progressively further out of line with the 'true' value; and its level (and poverty estimates based on it) would depend on the year for which it was calculated. This would reintroduce problems comparable to (but less serious than) the base-year dependency of the '$1-a-day' line, as discussed above.

However, in view of the methodological issues discussed above, allowing the EPL to move over time may also prove problematic. As a result of the complexity of the analytical method, and the artificiality of the assumption of a clear 'kink' and plateau in the individual-level Preston curve, it is by no means clear that estimates of the EPL over time will necessarily provide an accurate reflection of the evolution of the income-life expectancy relationship over time. It would seem well worth repeating the analysis for different years over a long period to assess this.

Issue 4: Why is Africa Different? (or isn't it?)

One curiosity of Edward's analysis is the effect of Sub-Saharan Africa on the results, and his response to it. In his initial analysis, he found

'a number of outliers where actual life expectancy was more than 15 years lower than predicted by the model… all Sub-Saharan Africa countries in the grip of the AIDS epidemic.'

To avoid the possibility of an upward bias in his estimate of the EPL as a result of 'a significant number of countries in Sub-Saharan Africa, where problems such as AIDS and civil war lead to premature death', Edward repeated the analysis separately for the world excluding Sub-Saharan Africa. The result was a substantially lower 'world-excluding-SSA' EPL ($2.05 per day, as compared with $2.90, using the same functional form), but at a similar level of life expectancy (72 years). He also repeated the analysis for SSA only, finding the 'kink' to occur at a much lower income ($0.65 a day) and life expectancy (48 years).

Clearly, separating out one particular region from the analysis would be inconsistent with a morally based analysis – and this is not Edward's intention[112]. This would imply the application of a very different moral standard to Sub-Saharan Africa than to the rest of the world in terms of acceptable living standards. The SSA result thus cannot be seen as a 'regional EPL', but rather as a crude indicator of just how far conditions in SSA would need to improve in order to bring these countries up to the morally justifiable life expectancy and income levels of the global EPL.[113]

Nonetheless, these results have potentially important implications for the EPL approach, which Edward was (inevitably) unable to explore within the confines of his original paper. Specifically, they raise three key questions:

- is the problem such as to justify remedial measures in a neutral estimation of the EPL (as opposed to a deliberately conservative estimation of its lower bound)?
- is the exclusion of SSA an appropriate response in this context, or are there better alternatives? and
- does the exclusion of SSA countries introduce other distortions into the analysis?

While there is no doubt that the impact of HIV has had a considerable effect on life expectancy relative to income in some countries, it is at best questionable whether conflict has a sufficient impact to justify exclusion from the analysis, as the direct effect on life expectancy of conflict-related violence is relatively limited. WHO estimates that violence accounts for only 1.5% of disability-adjusted life years lost in African countries, even including criminal and domestic violence[114]. Thus the direct consequences of conflict can account for only a very small fraction of the observed discrepancies in life expectancy. While effects on health through impacts on income levels are likely to be substantially greater, these should be captured in the analysis. In the worst affected countries, other indirect impacts, notably through effects on health services, are likely to be more substantial; but such countries are in any case unlikely to have sufficient data on household incomes for inclusion in the analysis.

In the countries with the highest incidence of HIV, the impact on mortality has clearly been considerable, with reductions in life expectancy between 15 and 25 years in Swaziland, Botswana, Lesotho, Zimbabwe, Namibia, South Africa and Zambia. However, some caution is required in attributing low life expectancy in these countries exclusively to the effects of HIV.

- Shortfalls from the overall Preston curve of a similar order of magnitude could be observed in South Africa and Namibia (and in two other African countries with relatively high GDP per capita, Angola and Gabon) as long ago as the early 1960s[115], long before the HIV/AIDS pandemic reached sufficient proportions to have a significant effect on life expectancy.

- The reduction in Zambia's life expectancy began as early as 1982, again before HIV could be expected to have a significant effect.
- Other SSA countries with relatively high GDP per capita (Gabon and Equatorial Guinea) are as far from the 2000 Preston curve as those with the highest HIV prevalence, despite being much less affected.
- Life expectancy in Mozambique and Malawi (HIV prevalence 14-16%) has fallen by only two years and six years respectively, compared with 14-15 years in counties in countries with prevalence of 17-19%.
- Life expectancy is systematically lower in SSA than other developing regions even among low-income countries with similar HIV prevalence rates (0.5-3.0%): those countries with the shortest life expectancy outside SSA (Laos, Cambodia, Papua New Guinea and Haiti) have levels comparable with the African countries with the longest life expectancy (53-57 years), while all others have substantially longer lives (61-70 years).

This suggests a much more complex pattern than that envisaged by Edward, in which HIV, though clearly a major factor in unexpectedly low life expectancy in some African countries, is far from being the sole reason[116].

Moreover, the prevalence and impact of HIV are not exogenous. There are good reasons to think that the incidence of HIV is linked both to overall income levels (eg through the resources available for health services) and to the extent and severity of poverty[117]; and that individual incomes may materially affect the probability of exposure to infection (eg through education, access to condoms and reliance on commercial sex or financially motivated sexual relationships), the probability of infection when exposed (through the effects of under-nutrition on the immune system), and/or the impact of infection on life expectancy (through nutrition, exposure to secondary infections and access to treatment). While historical accident may play a role, the greater importance of HIV, as a sexually-transmitted disease, in SSA than in other regions may also be regarded at least partly as a product of a number of marked differences with other regions in health determinants particularly affecting reproductive health and communicable diseases, as discussed below. In this sense, HIV might more appropriately be interpreted as *a specific instance* of the health effects of poverty, and a manifestation of a different, but nonetheless relevant, income/health relationship in SSA, rather than a distortion to be eliminated from the analysis.

Excluding the entire of SSA from analysis therefore seems both unnecessary and inappropriate. Better alternatives might include:

- introducing the prevalence of HIV into the analysis as a control variable, or using a dummy variable for countries with exceptionally high prevalence rates;
- adjusting life expectancy for the estimated impact of HIV; or
- excluding countries above a specified threshold of HIV prevalence, rather than on a geographical basis.

The effect of the last approach can be gauged by another recalculation performed by Edward, excluding only the eight countries whose predicted life expectancy deviates from the actual figure by more than 15 years. Excluding these countries alone barely affects the estimated EPL, which is reduced only from $3.00 to $2.90, indicating that some 90% of the reduction in the EPL as a result of excluding Sub-Saharan countries thus results from the exclusion of countries which are not outliers. This would appear to confirm that the effects of excluding Sub-Saharan Africa as a

whole from the analysis reflect a broader regional pattern rather than simply the removal of distortions arising in a smaller group of countries.

Besides higher incidence of HIV, there are a number of other systematic differences between countries in Sub-Saharan Africa and countries at similar overall income levels in other regions which might be expected to give rise to substantial differences in the relationship between income and life expectancy. Three such differences are illustrated in Figures 4-9, separating low- and middle-income countries – although a number of other indicators, in varying degrees, follow a similar pattern. Sub-Saharan countries are shown in red and countries in other regions in blue, the arrows indicating the respective medians for the two groups.

- Inequality is systematically greater in African countries than in other regions (Figures 4 and 5). This has a potentially important effect on the relationship between income and health both in terms of national averages and potentially at the individual level.
- Girls' primary education is also generally substantially more limited in Sub-Saharan Africa (Figures 6 and 7). This is one of the most important determinants of infant and child mortality, and therefore has a considerable effect on life expectancy.
- Immunisation rates are also systematically lower in Sub-Saharan countries (Figures 8 and 9), increasing the risk from preventable diseases.

Two other points are noteworthy. First, the only cases where middle-income countries in Sub-Saharan Africa have indicators better than the median for the rest of the world are small island economies which are very different from the region's mainland countries (Cape Verde, Mauritius and the Seychelles). Second, the four non-African low-income countries where life expectancy overlaps with that in SSA at similar levels of HIV prevalence (Haiti, Laos, Cambodia and Papua New Guinea) are also among the worst performers on these indicators among countries outside the region.

This suggests that there would be significant differences in the relationship between income and health in Sub-Saharan Africa and in other developing regions even without a higher incidence of HIV, primarily as a result of differences in communicable diseases and reproductive health. Since both disproportionately affect poorer households, this is likely to affect the *shape* of the individual-level Preston curve *within* African countries – and thus potentially the location of the estimated EPL – as well as their position relative to the cross-country Preston curve.

Edward's estimate that the 'kink' in the Preston curve for SSA occurs at such a low level of income ($0.65 per day at 1993 PPP), and the implication that gains in life expectancy as a result of increases in income above this level are minimal, are very surprising. Only 19.6% of the population of Sub-Saharan Africa had incomes below this level in 2004 (22.5% in 1999). This is only half the continent's malnutrition rate in terms of height-for-age (39% in 2005), and a third less than that for weight-for-age (30%)[118]. In no other region does more than 3% of the population live below this income level.

Neither does Edward's argument that this 'may well indicate that, only for those in the most extreme poverty do the risks of premature death from lack of consumption outweigh the very high risks of death from other causes' seem satisfactory. Even at the '$1-a-day' line – an income level some two-thirds higher – Wagstaff estimates that between 7.4% and 35.1% of children die before the age of five in different African countries, and that between 20% and 53% suffer from malnutrition[119]. There can be very little doubt that this is very largely a result of the low incomes of those concerned, or that it contributes to shortening their life expectancy: in most

Figure 4: Gini Coefficients, LICs (closest year to 2000)

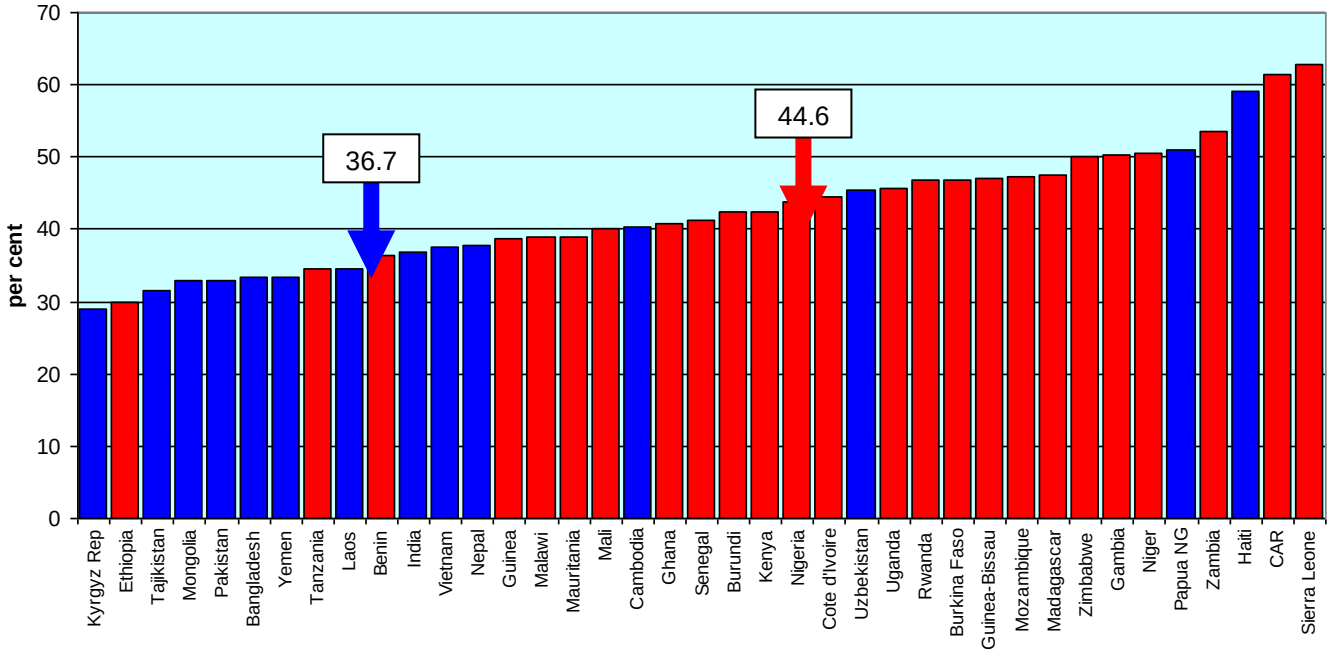
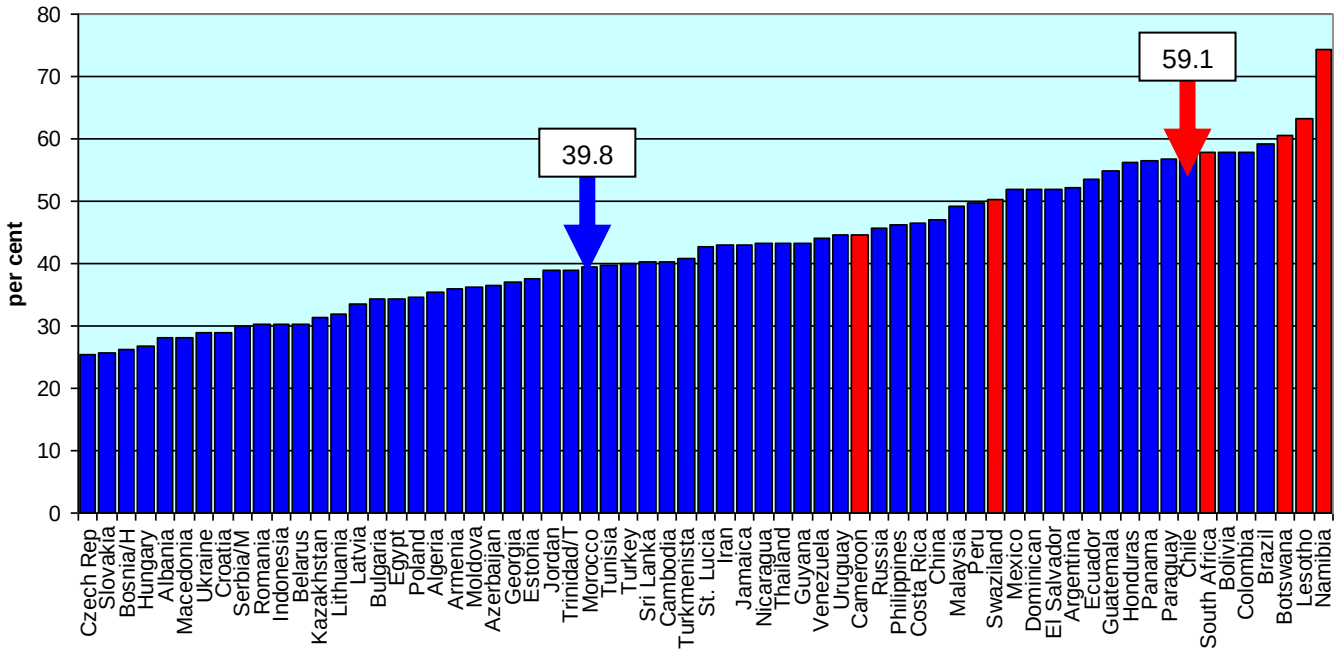


Figure 5: Gini Coefficients, MICs (closest year to 2000)



Key to figures 4-9:

Red	Sub-Saharan Africa
Blue	Other

Figure 6: Female Primary Completion Ratios, LICs (closest year to 2000)

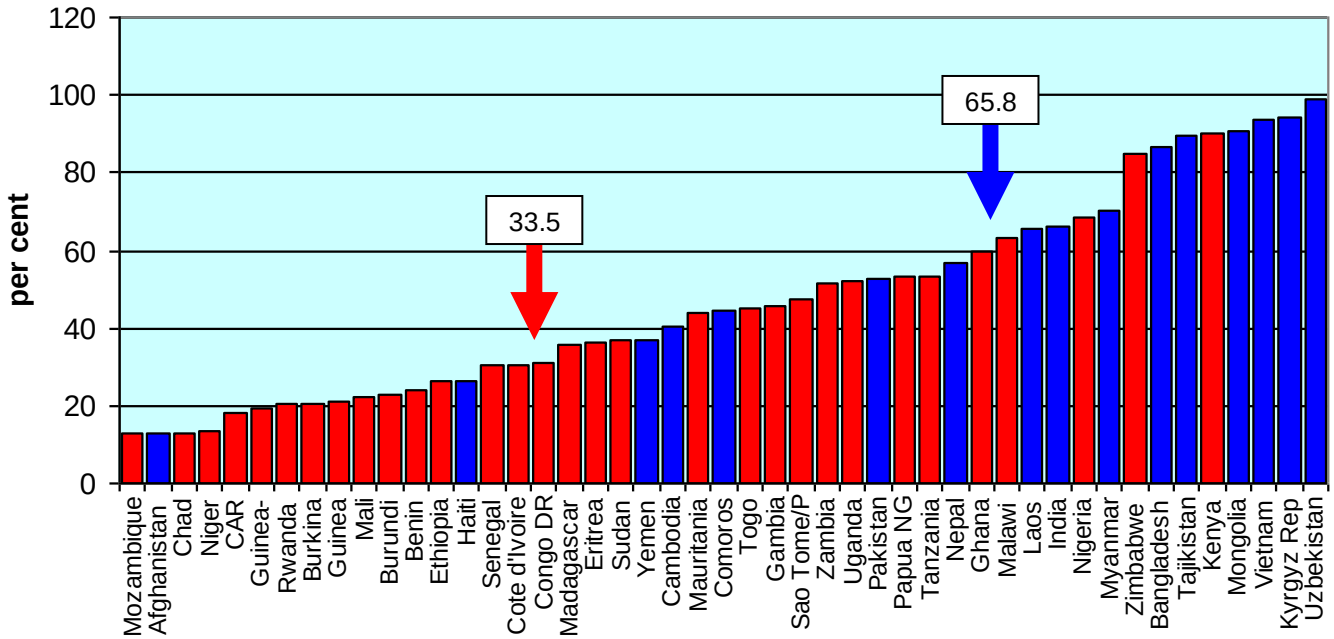


Figure 7: Female Primary Completion Ratios, MICs (closest year to 2000)

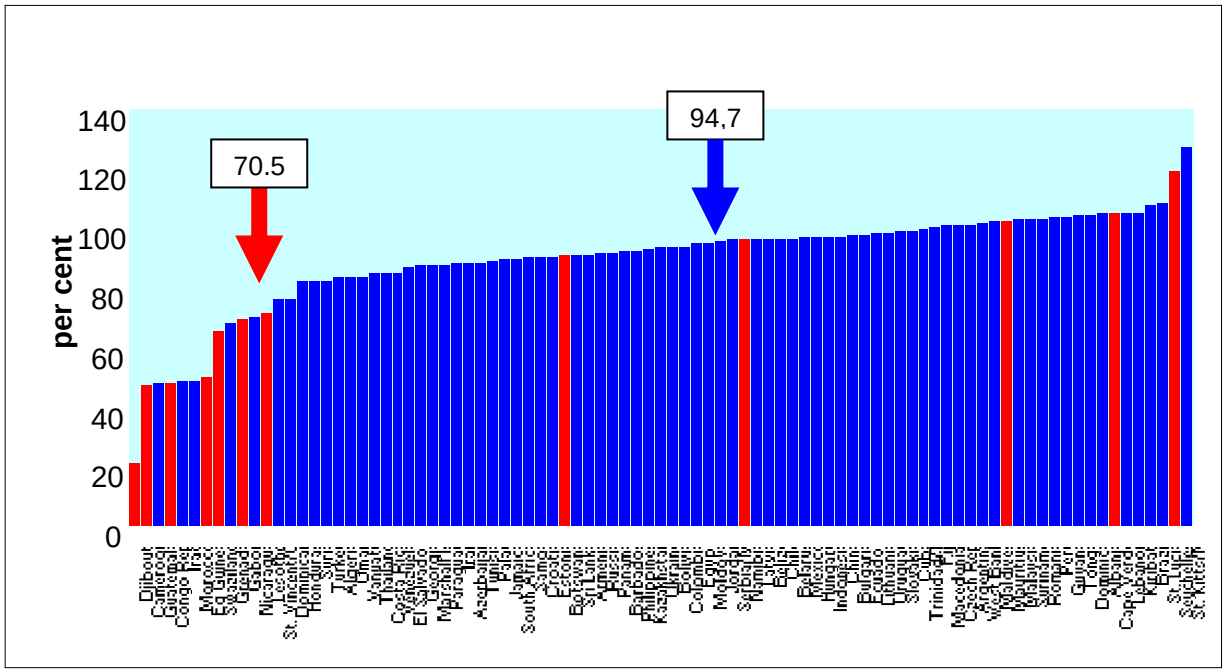


Figure 8: Measles Immunisation Rates, LICs (closest year to 2000)

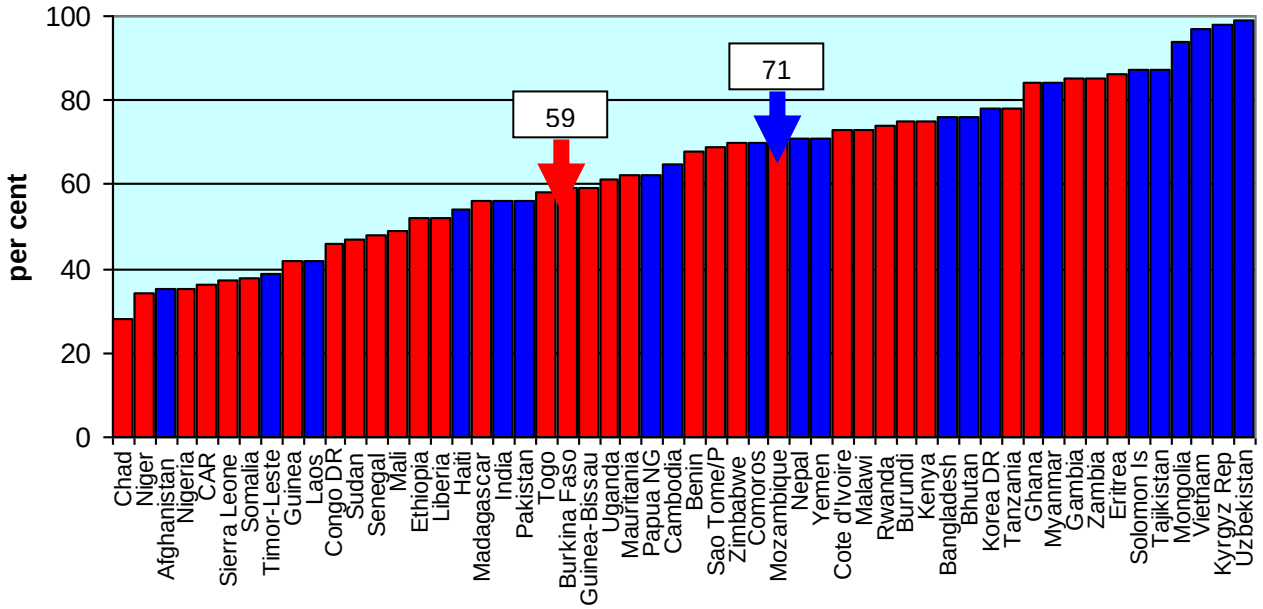
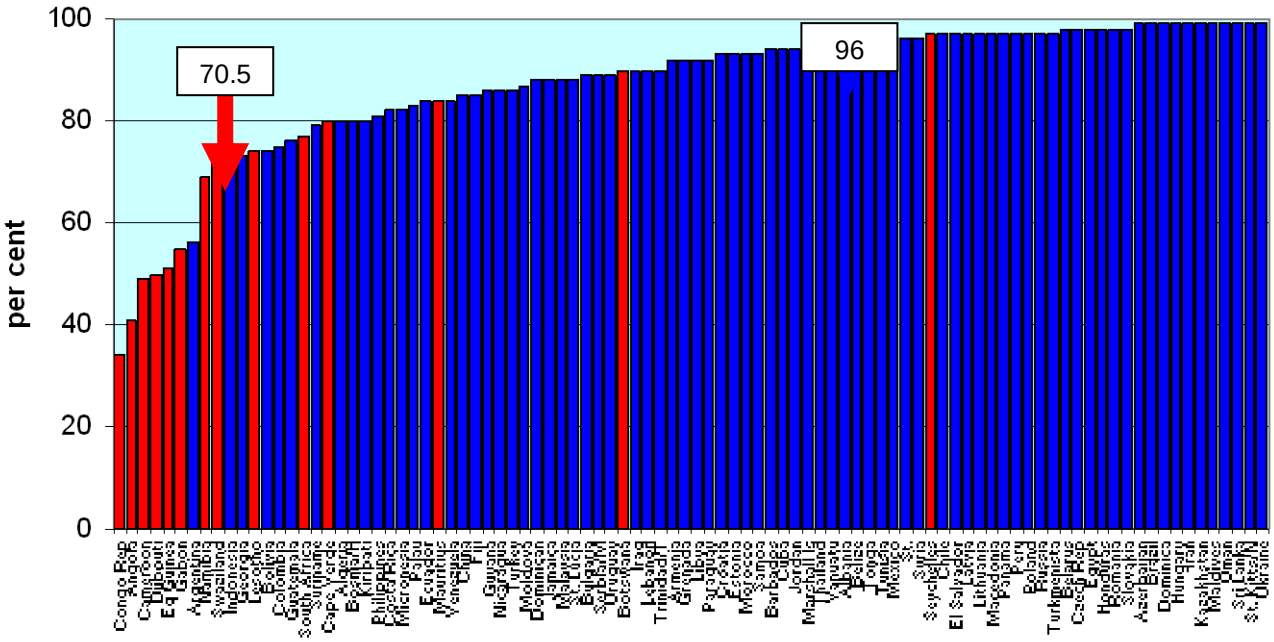


Figure 9: Measles Immunisation Rates, MICs (closest year to 2000)



cases, these figures are well above national averages. The reasons for the surprising results of applying the EPL method to SSA data would seem to merit further investigation.

While there may be important differences in the relationship between income and life expectancy between SSA and other developing regions this does not mean that the region should be excluded from the analysis as an aberration. Apart from excluding a set of countries which display systematic differences from other regions in a number of important determinants of health, removing Sub-Saharan countries from the analysis seriously skews the sample, by omitting 25 of the 35 countries (for which data are available) with more than 50% poverty at the '$2-a-day' level, but only three of 62 other developing countries. The result is to reduce the weight of such countries in the sample from 36% to 14%, so that the analysis becomes much more strongly dominated by countries with lower poverty rates.

The exclusion of SSA thus means greatly reducing the weight in the analysis of countries with high inequality and low female education and immunisation rates, and of countries with high poverty rates. These countries, by definition account for a disproportionate share of poor people, so that the setting of the poverty line is of particular importance.

It also seems reasonable to hypothesise that there are systematic differences between individual-level Preston curves in countries with higher and lower rates of poverty. Higher rates of poverty are likely to be associated with a higher incidence of communicable diseases, and thus a higher risk of infection (and adverse outcomes) to an individual at a given level of income, particularly at the lower end of the distribution. This would tend both to lower the individual Preston curve overall, and to make it steeper, by worsening the health of the poor disproportionately. This effect may be compounded by other distinguishing features of Sub-Saharan countries, notably low immunisation rates.

A strong case can therefore be made, not only that the exclusion of SSA from the analysis is unnecessary, but also that it goes beyond far beyond avoiding a potential upward bias to introducing serious distortions which result in a substantial under-estimation of the EPL.

Conclusion

Notwithstanding the issues discussed above, the direct link with a broadly-defined indicator of living standards makes Edward's EPL the best approach yet devised to establishing a single global poverty line grounded in moral considerations. If we are to continue with the principle of a single global poverty line defined in monetary terms, further work should be undertaken to refine and develop this approach. This could usefully include efforts to produce neutral rather than conservative EPL estimates and time series estimates based on historical data, in both cases including Sub-Saharan Africa.

However, the problems inherent in applying a single global poverty line – particularly those associated with conversion into local currencies, and differences in living standards at the same income in different countries – remain. We therefore propose that consideration should also be given to alternative methods of standardising poverty lines between countries, with a view to achieving greater congruence with a morally-based definition of poverty. In the remainder of this paper, we outline one possible approach, based on the principle of a poverty line which seeks to standardise national poverty lines on the basis of living standards – that is, in terms of the typology presented earlier, a country-specific outcome-based approach.

Towards an Alternative Approach – a Rights-Based Poverty Line

The problems discussed above not only suggest a need to get away from the use of purchasing power parity and arbitrarily set poverty lines, but also from the very concept a single global level of income below which people are considered 'poor' and above which they are considered 'non-poor'.

Srinivasan suggests rejecting the principle of a universal global poverty line altogether:

> *'It seems that finding a poverty line that is representative and comparable across countries and regions is an impossible task. Global poverty counts have neither normative value nor empirical relevance for analyzing the determinants of poverty. It may be preferable to abandon the search for an international yardstick altogether, and stick to national poverty lines instead.'*[120]

However, such an approach would be dangerous. As noted above, for all their failings, the World Bank's estimates of '$1-a-day' poverty and the Millennium Development Goal of halving it have undoubtedly increased the attention devoted to poverty by policy-makers at the global level.

Starting from a moral concept of poverty, the question is threefold:

- how can we define a poverty line which makes explicit the moral judgments it embodies?
- how can we ensure that the moral standards we apply are consistent between countries and congruent with our (implicit or explicit) definition of economic and social rights or entitlements? and
- how can we define poverty in such a way as to be genuinely *comparable* between countries, while also taking account of the major differences in living standards at the same income level in different countries?

The General Approach

In what follows, we outline an alternative approach, seeking to combine the benefits of Edward's outcome-based Ethical Poverty line (in providing a moral definition of poverty and averting the need to define and cost the inputs needed for a given living standard) with those of Reddy et al's country-specific 'Global Capability-Based' approach (in taking account of differences in local conditions).

We therefore propose to standardise poverty lines between countries, not on the basis of a fixed level of income or consumption, as proposed by Ravallion, but according to the standards of living actually achieved at a particular income level.

In order to deal with the absence of consensus on which capabilities are of concern in the definition of whether a household is poor, and to provide a

moral anchor for the minimum levels of capabilities, we move away from the language of capabilities to that of rights. A number of economic and social rights are established in international instruments which have been signed and/or ratified by most or all countries; and many of these rights have a well-established relationship with income levels. We interpret this as indicating that a consensus exists that each individual has a right to the attainment of a certain level of these capabilities, and therefore to an income consistent with their attainment. While the level itself may not be generally agreed, this approach could help to encourage more explicit consideration of this issue, which would be beneficial in itself.

Accordingly, we propose the establishment of ***a set of country-specific poverty lines based on the statistical relationship between income (or consumption) and indicators of economic and social rights in each country***. More specifically, we propose the use of indicators of the fulfilment or otherwise of economic and social rights – including (but not limited to), infant and child mortality rates (right to child survival), life expectancy at birth[121] and disease prevalence (right to health), primary school enrolment and completion rates (right to education) and nutritional indicators (right to food). For each indicator, a global target level should be set, seen as representing the fulfilment of that right; and the poverty line in each country would be defined as the income at which that level of the indicator is achieved (on average) in that country.

In principle, there is almost no limit to the indicators which could be included in this approach, in that each right can be disaggregated into components and/or linked to determinants of its fulfilment. For example, the right to education can be disaggregated into enrolment, attendance, completion and various quality indicators at each level of education; and the right to health into age-specific mortality rates, disability indicators and the incidence of different diseases, and linked to access to and quality of health services, education, nutritional standards, etc. This could usefully be linked to the ongoing development of indicators corresponding with human rights norms, for example in relation to the right to health[122], by adopting the selected outcome indicators as a basis for RBPL analysis (subject to data availability). In this context, the RBPL approach might be seen as a logical extension of the process beyond the recommendations for disaggregation by socioeconomic status (inter alia) and the benchmarking of standards for population sub-groups.

The general RBPL approach for a particular indicator is illustrated in Figure 10, for the case of the right to child survival. The curve represents the estimated statistical relationship between income and child mortality in a particular country and the horizontal line the level of child mortality judged to be consistent with the right to child survival. The income level indicated by the point at which these two lines intersect is then defined as the poverty line.

Clearly, deciding on the level of child survival consistent with the right to child survival is a thorny issue, and inevitably includes a considerable element of subjective judgement. However, this issue arises inevitably from making our moral judgements explicit. We can only avoid it by continuing to avoid the question of what the right to child survival actually means – and as long as it remains undefined, it will remain no more than a vague aspiration rather than a right in any meaningful sense.

Figure 11 extends this approach to different countries. While the income/child mortality curves differ, the rights threshold is the same for all countries, resulting in a different (but consistent) poverty line for each country.

Having established the poverty line, we can assess the incidence of poverty in a particular country by adding a frequency distribution of income

per capita below, as shown in Figure 12. The proportion of the population in poverty, based on the RBPL, is then the area,between the income curve and the poverty line (area A).

The RBPL might be seen as a (partial) step towards operationalising the concept of a capabilities approach to poverty, or at least as a mid-point between an income and a capability approach. A capability approach suggests that:

> *'the standard of living enjoyed by people must be seen in terms of individual achievements that are feasible and not the means individuals possess to achieve them…. If a person is not able to be well-nourished, adequately clothed and sheltered and not able to avoid preventable morbidity, then he or she can be classified as deprived of basic capabilities. Those capabilities that relate to health, education, shelter, clothing, nutrition and clean water can reasonably be regarded as capabilities that we can agree are basic…. From a capability perspective, poverty arises when basic capability failure is caused by inadequate command over resources, whether through markets, public provision or other non-market channels…. The choice of a poverty line should reflect the cost of achieving basic human needs.'*[123]

In this context, the approach proposed here defines basic capabilities in terms of dimensions of living standards considered as rights in international instruments – a list broadly similar to Kakwani's above; and it follows other poverty measures in assessing command over resources in terms of income or consumption

However, the RBPL differs from other capabilities-based approaches in three important respects.

- First, it considers *demonstrable* feasibility – the income level at which a particular capabilities are achieved in practice in a particular context – rather than *notional* capabilities based on (potentially unreliable) estimates of purchasing power.
- Second, it takes account of *public provision and other non-market channels*, not by integrating them into income (as should in principle be done, but generally is not, in the application of standard-income lines), but rather by their role in defining the poverty line. For example, free provision of high-quality education and health services will lower the level of income required to achieve given health and educational outcomes, and thereby lower the poverty line.
- Third, the RBPL also takes account of different levels of need according to inter-country variations in context relevant to the fulfilment of basic capabilities, such as geography, climate and epidemiology

It should be noted, however, that this is still only a *partial* step towards a true capabilities approach. While it takes account of differences between national (or potentially local) contexts, it does not take account of differences in the circumstances of individual households within these contexts – for example, the greater resources which might be required to achieve a given standard of living if one or more household members have disabilities or suffer from chronic illness. This might best be achieved through an appropriate adjustment to the estimation of household per capita income, for example through differential weighting of household members. (In effect, this amounts to a broader interpretation of the 'adult equivalent' approach, which generally only differentiates between individuals on the basis of demographic considerations.) However, the available data are as yet a considerable way from permitting this type of approach.

Figure 10: Establishing the Poverty Line (single country)

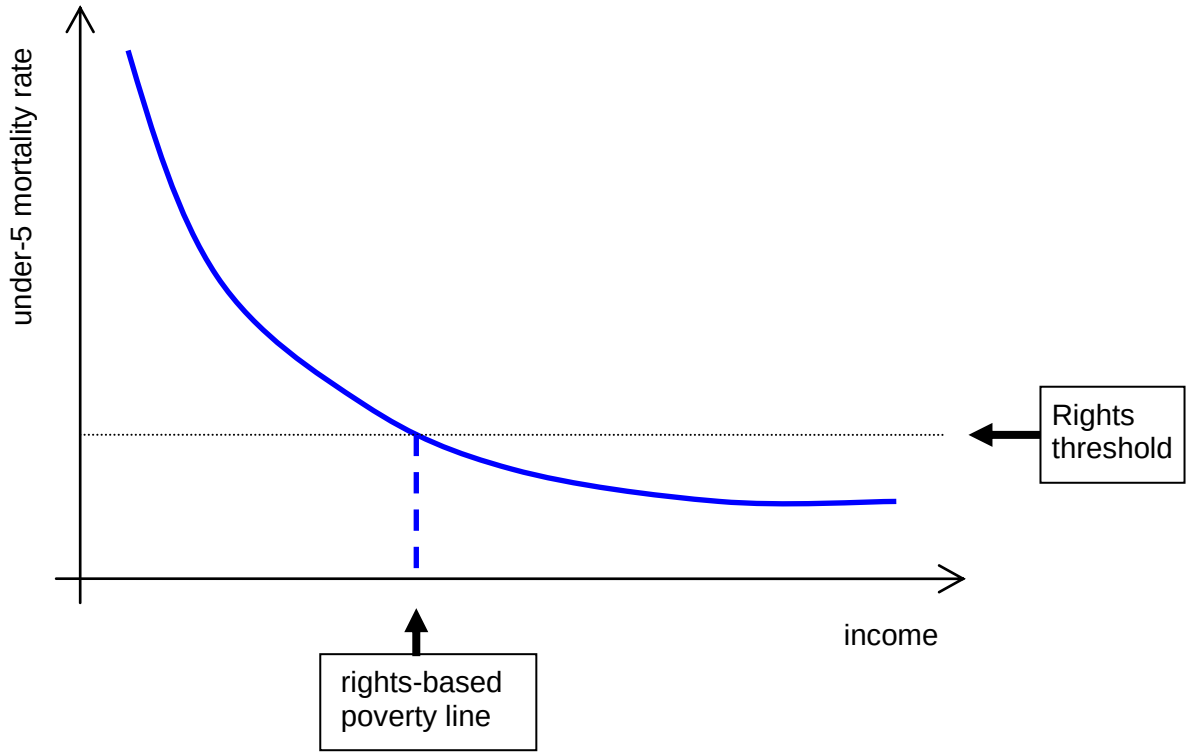


Figure 11: Establishing the Poverty Line (multiple countries)

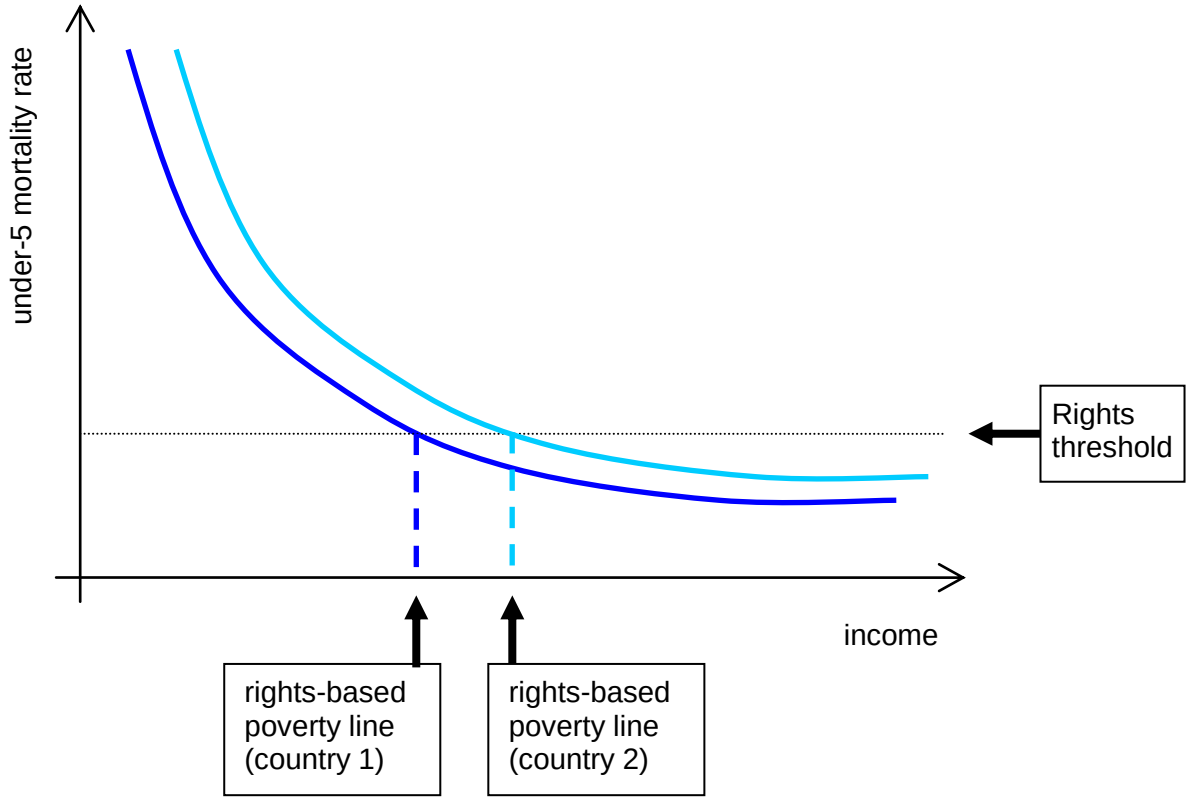
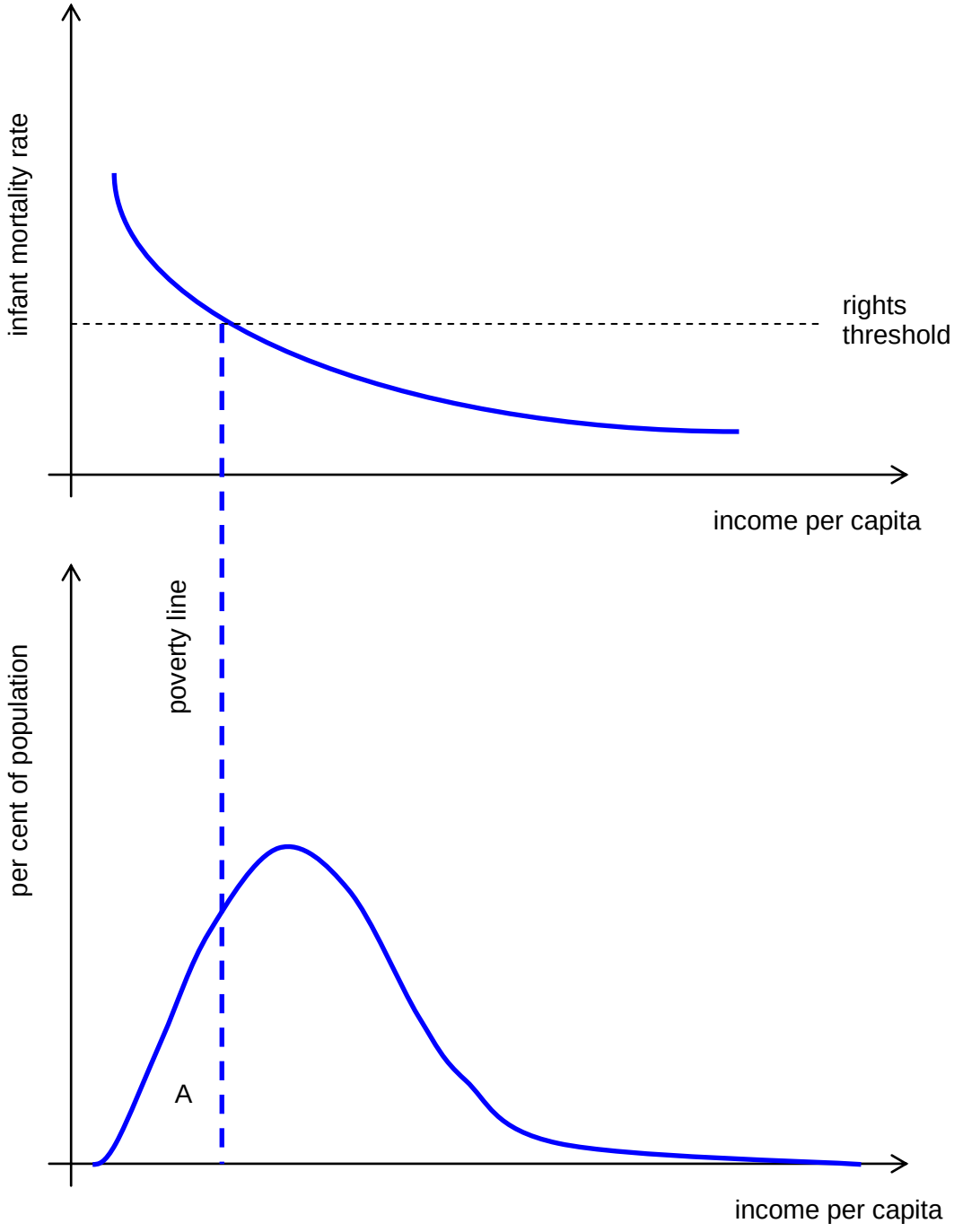


Figure 12: Assessing the Incidence of Poverty



Benefits of the Proposed Approach

At a conceptual level, the rights-based poverty line concept has a number of advantages over the current standard-income approach. Because it links the level of the poverty line directly and explicitly to indicators of living standards, and more specifically economic and social rights, the rights-based approach also makes the moral judgment embodied in the poverty line explicit, and helps to ensure that it is consistent with judgments as to what constitutes the fulfilment of economic and social rights. In the future, should internationally agreed criteria for the fulfilment of such rights be established, it would allow a poverty line to be set in accordance with these criteria.

At the same time, while the RBPL provides a means of ensuring consistency and comparability between countries, it does so according to living standards, which are much more important to households than a notional dollar value of income or consumption. It also avoids the methodological problems associated with PPP exchange rates, since the poverty line is estimated separately in each country; but it is still measured in terms of income, which facilitates economic analysis.

By measuring the poverty line in terms of income/consumption, but defining it explicitly in terms of other (ie non-income) dimensions of poverty, this approach might also be seen as resolving another problem: that of broadening the definition of poverty beyond income, while avoiding the problems of composite indicators such as the Human Poverty Indicator, as discussed above. In effect, rather than being added on to an income-based indicator, non-income aspects of poverty shift the poverty line itself in a particular country, raising or lowering the threshold level of income in proportion to the impact on living standards.

Linking the poverty line to social indicators also ensures that changes in poverty, as measured, reflect changes in living standards, rather than changes in income which may or may not be associated with improvements in living standards. Thus, if poor households maintain real consumption levels in the face of declining incomes by increasing working hours (at the expense of education or health-promoting household activities), or shifting into unhealthy or dangerous occupations, this would shift the poverty line upwards (though in some cases with a time lag). With a fixed poverty line, by contrast, the benefits of the higher income would be considered, but not the non-financial costs of achieving it.

In principle, the RBPL approach could also help to limit problems of comparability in estimating the incidence of poverty, between countries or over time, even if different estimation methods are used (for example the use of income or consumption, per capita or per adult equivalent, different recall periods, etc). The effects of such differences can be considerable. According to Deaton, for example, ‘when the Indian NSS experimentally changed the recall period for food from 30 to 7 days, the estimated poverty rate was cut by half’[124]. While this may partly reflect short-term fluctuations in food expenditure (resulting in greater variation between households over shorter than longer periods), it is also likely that it is partly attributable to significant under-reporting of food expenditure when longer recall periods are used. This represents a potentially serious distortion in approaches based on nutritional intakes, as well as in the ‘$-per-day’ approach.

In the case of the RBPL, the effect of such differences would in principle be to change the poverty line. Because the same households would be below the income level associated with the threshold level of rights fulfilment, the same proportion of the population would be recorded as poor. This would apply even if under-/over-reporting were systematically greater or less among poorer households, or even if the effect were negative for poorer households and positive for better-off households (as might be the case

with differences between income- and consumption-based survey methods, for example). Distortions would arise only to the extent that the rank ordering of households was affected.

Finally, on a more general level, the RBPL approach has the potential both to integrate poverty analysis more effectively into the broader human development agenda, and to strengthen the focus on living standards and economic social rights, not merely as *consequences* and/or *causes* of poverty, or as motivations, contributors and/or impediments to its reduction, but as *defining factors* of poverty itself.

The predominance of economists in the definition and measurement of poverty has arguably both skewed our conception of poverty towards an economistic one (based on equivalence of 'purchasing power' at some essentially arbitrary level) rather than a moral one (based on minimum acceptable living standards), and may have contributed to the relegation of poverty from a primary moral concern to an often secondary adjunct to other considerations such as economic stability and growth and the financial viability of business. By shifting the locus of the definition and measurement of poverty to other disciplines such as health, nutrition and education, the RBPL approach has the potential to empower these disciplines in debates about poverty, and to give poverty greater weight relative to goals which are instrumental rather than intrinsically beneficial.

Interpreting the RBPL

Unlike standard-income approaches, the RBPL provides two pieces of information about a country:

a) the *incidence of poverty* indicates the proportion of the population living on an income insufficient for the fulfilment of a particular right (or capability); and

b) the *poverty line* itself provides a summary indicator of the level of fulfilment of that right relative to income.

It is also possible to develop two types of poverty gap. First, one can readily estimate an income poverty gap in the conventional way (as the proportion of people below the RBPL multiplied by the average shortfall in their incomes, divided by the population multiplied by the poverty line). This is illustrated in Figure 13, where the poverty gap is area A as a percentage of the total of areas A, B and C.

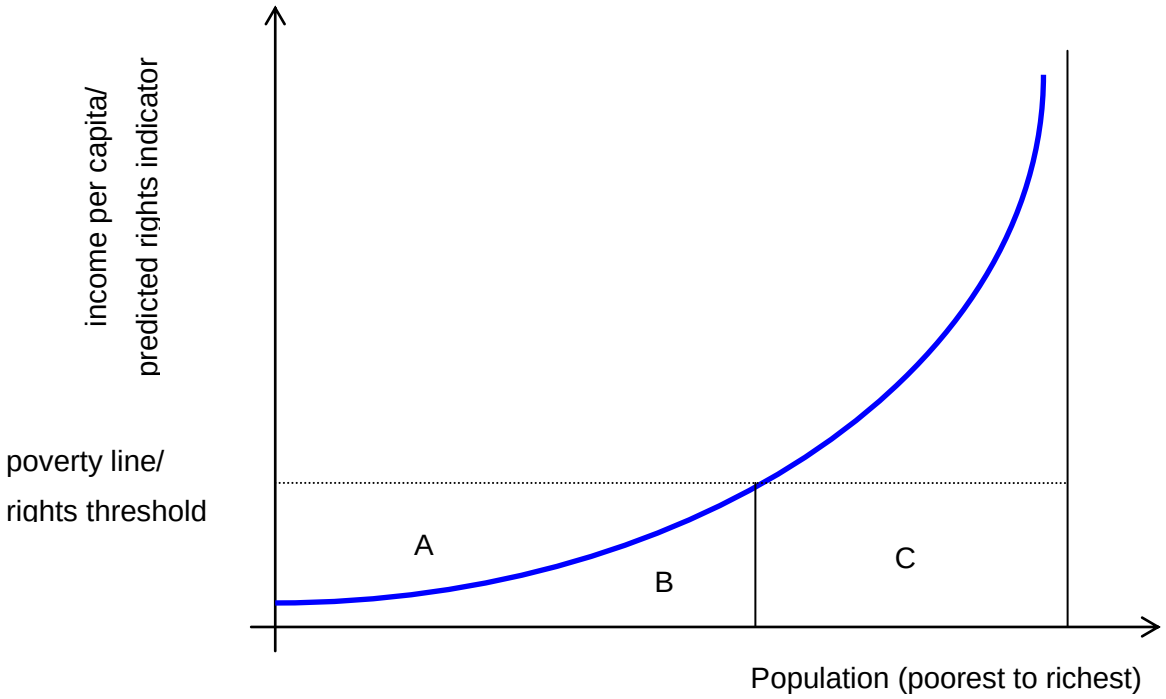
In principle, however, one could also calculate an 'income-based rights gap', showing the extent to which rights are not fulfilled as a result of income poverty. To do so, we follow a similar process as in Figure 13, but substituting the predicted level of the rights indicator at a particular level of income for per capita income, and the relevant rights threshold for the poverty line.

The different starting point of the RBPL as compared with more conventional standard-income approaches gives rise to important differences in its interpretation, and particularly in the nature of changes in poverty (as measured) over time.

A fall in '$1-a-day' poverty, for example, clearly indicates that the incomes of some people have risen above the '$1-a-day' line – but does not necessarily say anything about their living standards. A fall in rights-based poverty, by contrast, means unambiguously that the attainment of rights has improved; but this may have been achieved in either of two ways (or a combination of both):

a) incomes may have risen, allowing some households to move along the income/rights curve, from the section below the poverty line to the section above the line; and/or

Figure 13: Estimation of a Conventional Income Poverty Gap

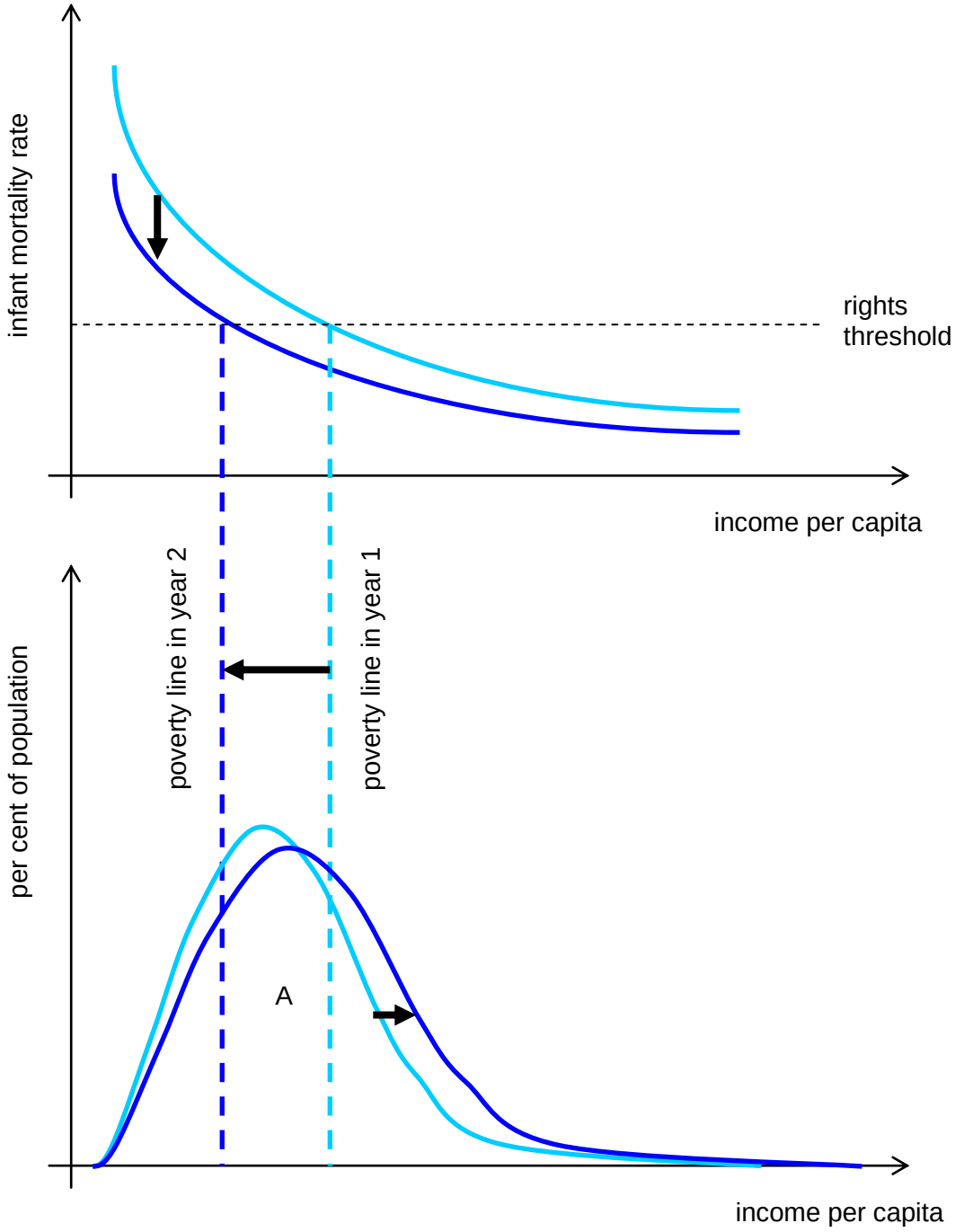


b) living standards (in the dimension under consideration) may have risen at a given level of income, giving rise to an downward/leftward movement of the income/rights curve itself, resulting in a lowering of the poverty line.

The relative importance of the two can in principle be assessed by comparing the overall change in poverty with the change in poverty assessed on the basis of the original RBPL, adjusted by a price index reflecting consumption patterns at that level of income. This is illustrated in Figure 14. In year 1, the relationship between income and child mortality is shown by the light blue line in the upper part of the figure, and the income distribution by the light blue line in the lower part. As a result of improvements in overall health standards, infant mortality for a given level of income is lower in year 2, indicated by a shift to the dark blue line in the upper part of the figure. This results in a leftward shift of the RBPL, to a lower level of per capita income. Even without any changes in incomes (that is, retaining the light blue curve in the lower part of the figure), this would result in a lower incidence of poverty. However, changes in incomes have an additional effect, demonstrated by the shift from the light blue to the dark blue income curve in the lower part of the figure. The overall change in poverty (a reduction in this case) is thus equivalent to area A.

However, it is important to distinguish between *intrinsic* and *policy-related* differences between the positions of the rights/income curve, and therefore the RBPL in different countries, particularly in cross-country comparisons[125]. Clearly, economic and social policies, such as the level and quality of social provision of health and education services, policies affecting the prices of basic goods and services, etc, will affect the level of the income/rights curve in a particular country, while other influences are clearly beyond the control of government. For example, epidemiological conditions will be different in tropical climates as compared with temperate climates, affecting the income/health (and indirectly for example the income/education) curve, while income needs will be increased by the greater need for expenditure on shelter and clothing in colder climates.

Figure 14: Changes in Poverty over Time



In principle, there is therefore a different 'ideal' (best feasible) position of the curve in each country. In using the RBPL approach for inter-country comparisons, whether in terms of the level or rate of change of the poverty line, we should therefore be comparing the movement or position of the actual curve relative to the 'ideal' for each country. In practice, however, the 'ideal' is unknowable empirically, partly because every country is unique; partly because no country's performance can be considered ideal; and partly because of the impossible data requirements for estimating an 'ideal' curve.

Even on a conceptual level, the definition of the 'ideal' curve is made more problematic by the issue of timeframes. For example, a major factor determining the position of the income/health line is the incidence of diseases such as HIV/AIDS, tuberculosis and malaria. In the short term, there are serious constraints to the rate at which the incidence of such diseases can be reduced. However, they are in part, and in varying degrees, a result of the cumulative effects of the interaction between past government policies (in public health, health services, education, the economy, social protection, etc), past levels of poverty and the geographical and social context . Moreover, even in the long term, both past policy and past poverty are partly a result of discretionary government decisions, and partly of financial and political constraints, and exogenous economic influences. This makes the definition of an 'ideal' income/health curve, let alone its estimation, at best highly problematic.

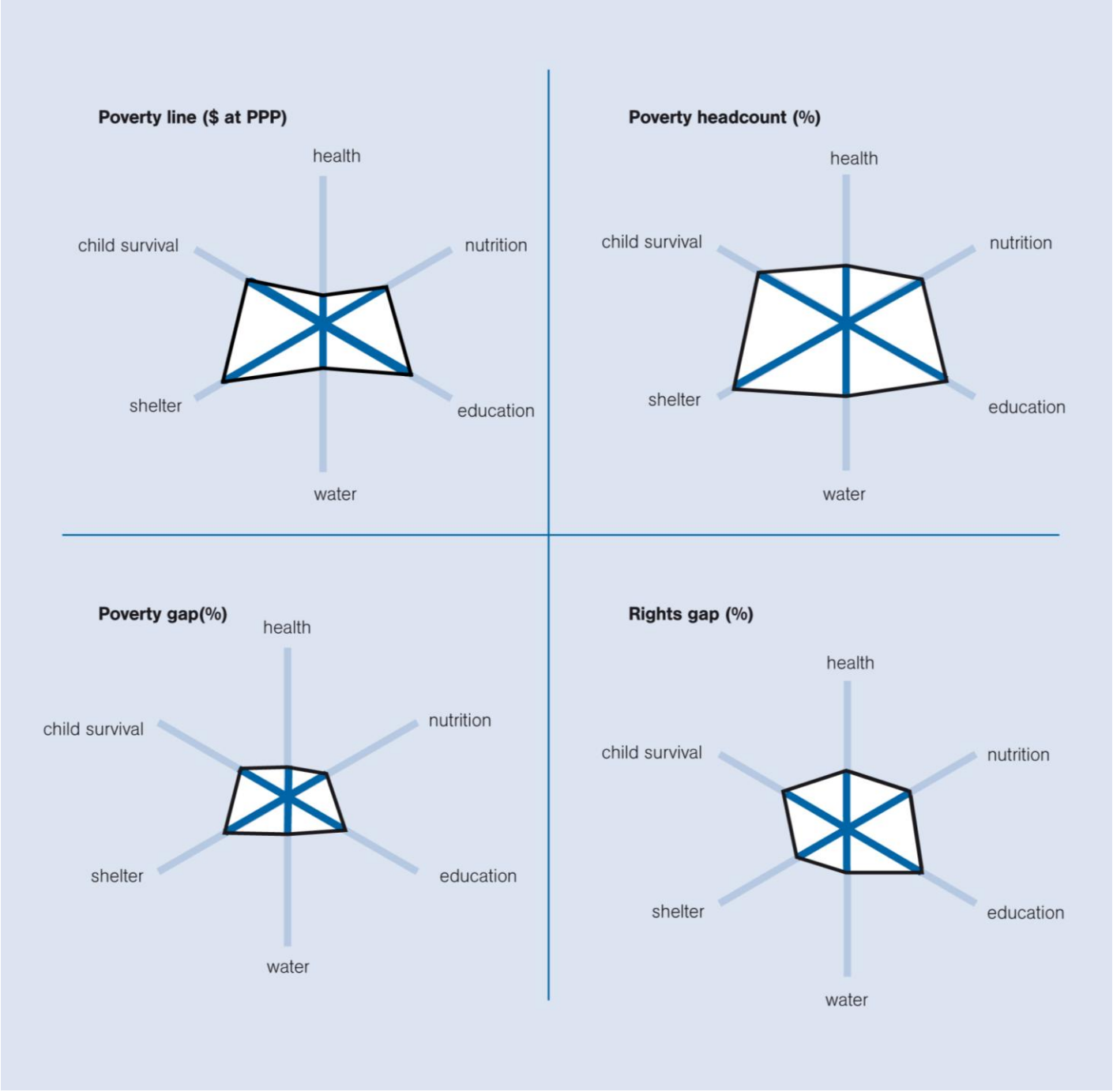
One approach would be to base cross-country comparisons of the level of, or changes in, rights-based poverty lines on a comparison, not of the absolute levels of the lines in different countries, but of their deviation from estimated levels based on a cross-country regression against indicators which are largely unaffected by government policies in the short term, or against average levels estimated at a sub-regional level. While this would not provide an estimate of the 'ideal' line for each country, it allows at least some adjustment according to country circumstances.

Combining RBPLs

Since there is a multiplicity of economic and social rights, there are potentially many different RBPLs, even with a single agreed threshold level for each. This multi-dimensional nature of poverty measures has the potential to provide a much richer basis for the analysis of poverty reduction, living standards and human development in the context of cross-country comparison, performance assessment and policy design. However, it raises the question of whether these lines should be combined, and if so how this could best be done.

In terms of providing the maximum information, clearly the poverty line, poverty incidence, poverty gap and income-related rights gap corresponding with each right should be included. For ease of presentation, this could be done by a series of polygons, akin to the World Bank's 'development diamonds', one for each indicator (as shown in Figure 15). In each case, the distance from the central point would be proportional to that indicator for the country concerned (in PPP $ for the poverty line; in per cent for the other indicators). We have proposed calling these polygons 'Poverty Snowflakes', since the objective of policy is to melt them to nothing.

Figure 15: RBPL 'Snowflakes'



While we have presented these 'snowflakes' with six dimensions (health, nutrition, education, water, shelter and child survival), this is purely illustrative, and certainly is not intended as a comprehensive or definitive list of relevant rights or capabilities. Clearly, it would be possible both to change the dimensions and to increase (or reduce) the number, although there is a limit to how many dimensions could be included without a loss of presentational clarity.

As with 'development diamonds', the size of the polygon provides an indicator of the overall situation, while its shape shows the relative scale of the problems as between different rights. Specifically, the snowflakes for each country provide a picture of five aspects of poverty in that country – smaller always being better:

- the overall *severity* of poverty (the size of the 'poverty gap' snowflake);

- the overall *extent* of poverty (the size of the 'poverty headcount' snowflake);
- the overall *depth* of poverty (the size of the 'poverty gap' snowflake relative to the 'poverty headcount' snowflake);
- living standards at a given level of income (the size of the 'poverty line' snowflake); and
- the overall extent to which rights are not fulfilled as a result of poverty (the size of the 'rights gap' snowflake); and
- the relative situation in each of these dimensions with respect to different rights (the relative size of the different arms of each snowflake).

However, there are some contexts in which a single summary indicator would be more useful. This is potentially problematic, because RBPLs based on different rights are likely to give rise to widely different poverty lines in the same country.

On a global level, this problem could be eased to some extent by selecting threshold levels for rights which are attained at broadly similar levels of income. However, this may not correspond with moral judgements about different rights – for example, we might consider the level of educational attainment typically reached an income of $2 per day as more than acceptable, but the standard of health at the same income level wholly unacceptable. Moreover, even if thresholds correspond with broadly similar income levels on average at the global level, there is no reason to think that this will necessarily be the case in individual countries. For example, a country may very well have a strong educational tradition, lowering the education-based RBPL substantially relative to the 'typical' level; but a high incidence of HIV/AIDS, malaria and tuberculosis, greatly increasing the health-based RBPL.

One might consider using the median poverty line for each country as a summary indicator, as being representative of the overall state of poverty. (A similar approach at the global level, to select a single RBPL for application to all countries, would be problematic, as the rank ordering of poverty lines would differ between countries for the reasons outlined in the last paragraph, so that the selected poverty line would be above the actual median for some countries, and below it for others.) Alternatively, one could in principle take the geometric mean of the different RBPLs for each country.

However, a strict interpretation of the concept of a rights-based approach would rather imply adopting the *highest* poverty line as the summary measure. The underlying principle is that all people are entitled to the means to achieve *all* their economic and social rights. If a household's consumption is enough to fulfil, say, five rights but not a sixth, their rights remain unfulfilled, and its members must be considered poor.

In terms of the incidence of poverty, the poverty gap and the rights gap, however, an alternative approach is preferable, as the objective is to provide an overview of the extent of poverty across the spectrum of living standards. For these indicators, the arithmetic mean of the corresponding indicator for each of the RBPLs would therefore be more appropriate.

Preliminary Estimates of RBPLs for Selected Developing Countries

The remainder of this paper presents a preliminary attempt to develop and apply a statistical method of estimating a rights-based poverty line for six countries in different regions and at different levels of development: Bolivia, Egypt, India, Nicaragua, Senegal and South Africa. While the results leave something to be desired, it is hoped that it will be possible to refine this method and to extend the analysis in the future.

For simplicity, the analysis has been limited to a single right – the right to child survival, as established by the United Nations Convention on the Rights of the Child. This was selected as a right for which there are very clear indicators – infant and child mortality rates – on which the necessary data are available to undertake such an analysis (subject to the caveats discussed below) for a substantial number of countries.

Variables and Thresholds

The ideal approach to estimating a RBPL for the right to child survival would be to estimate the relationship between household income per capita and the rate of under-18 mortality. However, we are constrained by two factors. First, this would require data on income (or consumption) per capita and data on mortality rates for the same households. However, household surveys conducted for poverty analysis do not include data on mortality, while the demographic and health surveys on which mortality estimates are based do not include income per capita.

To overcome this problem, we use data from demographic and health surveys which include asset scores. In effect, we make the simplifying assumption that the ranking of households by asset scores is closely related to their rankings in terms of income poverty. (The validity of this assumption is discussed later.) Combining this with data on income distribution from the World Bank's PovCalNet database[126], we can thus estimate each household's income per capita from its ranking by asset scores. While this is by no means a perfect solution, and this clearly needs to be borne in mind in interpreting the results, it appears to be the best approximation available from existing data.

The second problem is the difficulty of estimating age-specific mortality rates across a wide age range from DHS data. This is particularly problematic because of relatively small sample sizes. DHS surveys are designed to provide estimates of mortality rates for the population as a whole, and the samples are generally large enough to do this. By (in effect) disaggregating the population by asset scores, however, we effectively split the sample to a size too small for accurate estimation. This problem is particularly acute at the upper end of the income distribution, where incomes are more widely spaced (so that sample sizes for a given income range are smallest), and mortality rates are typically lowest; and at higher ages, where mortality rates are again much lower than in early childhood.

Again, we are only able to limit this problem rather than resolving it. We do this by using infant mortality rates (deaths before the age of 12 months per 1,000 live births), where mortality rates are highest; and including deaths over a period of up to four years prior to the survey rather than in the previous 12 months only.

Neither of these approaches is wholly satisfactory. By limiting ourselves to infant mortality rates, we effectively ignore mortality after the first 12 months. It is important to emphasise that this is a necessary approximation, and does not constitute a definition of child survival. Since mortality rates decrease rapidly with increasing age in childhood, infant mortality constitutes the greatest single part of total mortality during childhood. However, the relationship between the two is by no means exact, as the causes of death above the age of 12 months are significantly different.

The case for considering the relationship between asset scores and infant mortality (rather than income and overall childhood mortality) is strengthened by a third problem – that of timelags. In the absence of longitudinal data, we only have information on household's current economic status, and their mortality rates in the recent past. However, childhood mortality is influenced by historical experiences (eg of nutrition, environment, episodes of ill-health, etc), and thus by the household's income over the course of the child's life – and the greatest effect arises from the earliest part of childhood (and prior to birth). Since household incomes may vary substantially over time, current incomes and may not be an accurate reflection of past incomes; and the likely discrepancy will increase as the age at which we consider mortality increases. A household which is well above the poverty line now may well have been below it 15 years ago – and, through its effects on the health and nutrition, this will influence the survival chances of today's teenagers.

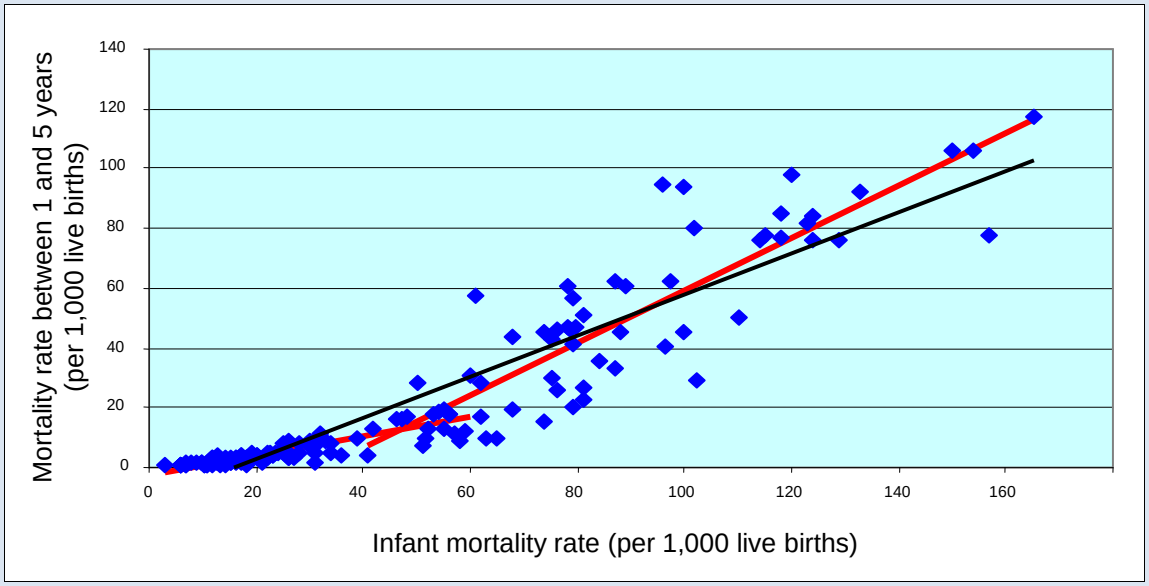
In this context, the use of infant mortality minimises the problem, by limiting the period over which household income is relevant to the analysis. Moreover, while this is off-set by the need to consider infant mortality over a number of years, asset scores may be a better indicator of household income over the relevant period than are measures of current income or consumption, as they reflect the cumulative effect of the household's past ability to acquire, keep (rather than sell) and maintain assets.

In the analysis, we set a number of alternative threshold levels for the infant mortality rate, intended to represent a feasible range of what might realistically be considered to correspond with the right to child survival. We set the lower bound at 20 per 1,000 live births, and the upper bound at 50. These thresholds are approximately three times and eight times the average levels typical of developed countries respectively, and between 14 and 33 times the lowest local rate in the UK[127].

Box 1. Infant and Under-Five Mortality Rates

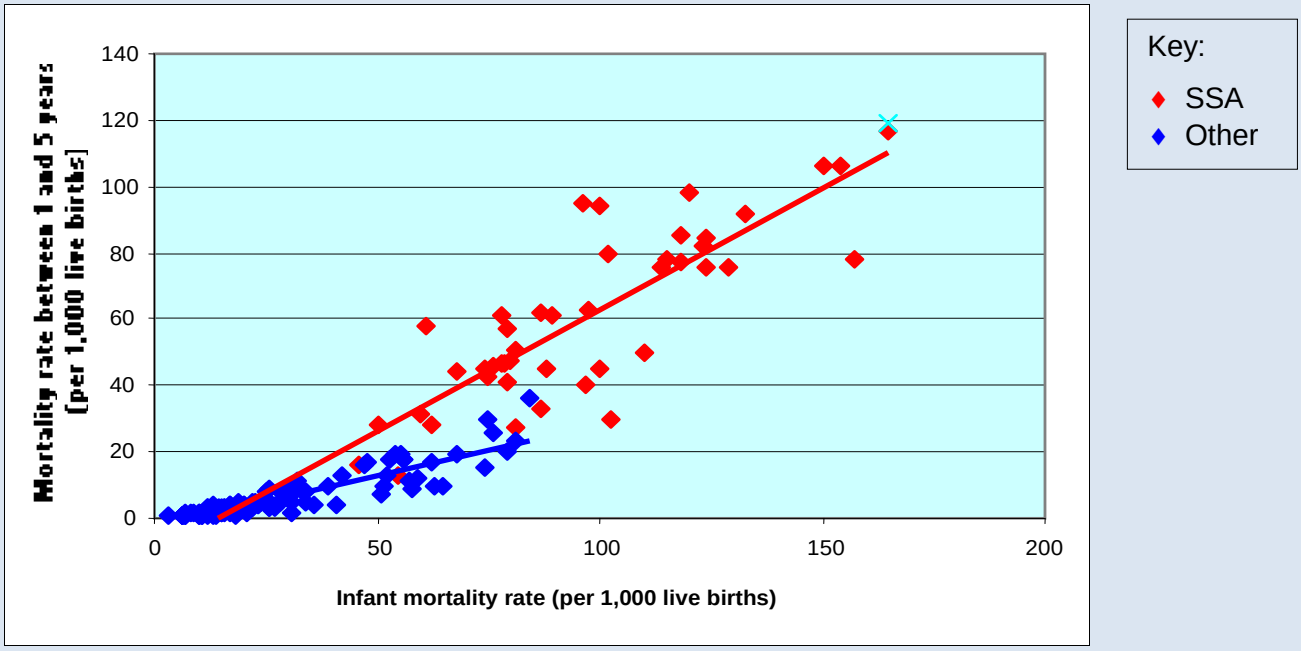
Some idea of the level of approximation entailed in using infant mortality rates as a proxy for overall childhood mortality can be obtained by considering the relationship between national estimates of mortality rates below the age of 12 months and between 12 months and five years (estimated as the difference between under-5 and infant mortality), as shown in Figure 17. The correlation coefficient is 0.927, indicating that the two are closely related; and infant mortality represents an average of 77% of total under-5 mortality. While mortality rates after the age of five may well be less closely correlated with infant mortality, they are also generally substantially lower, limiting their impact.

Figure 16: Infant and 1-4 year Mortality Rates in Developing Countries, 2005



However, some caution is required because of the nature of the relationship between infant mortality and mortality between one and five years. As can be seen in Figure 18, there is a significant 'kink' in the curve, at an infant mortality rate between about 40 and 60. Up to that point, the curve is relatively flat; above, the gradient is significantly steeper, as indicated by the red trend lines (for countries with infant mortality rates below 60 and above 40 respectively).

Figure 17: Infant and 1-4 year Mortality Rates in SSA and Other Developing Countries, 2005



Box 1. Infant and Under-Five Mortality Rates (continued)

A universally applicable non-linear relationship between infant and 1-4 mortality does not seem a wholly satisfactory explanation. Rather, there appears to be a systematic difference between Sub-Saharan and other developing countries, as shown in Figure 18. Two key features are evident in this graph. First, both infant and child mortality rates are systematically higher in SSA than in other developing countries. In fact, *all* countries with IMRs above 84 or 1-4 mortality rates above 36 are in this region, and only a handful of SSA countries are below both these thresholds. Thus the trend-lines for the higher and lower IMRs broadly reflect those for SSA and the rest of the world respectively. However, a comparison of those countries in the overlapping range of IMRs (around 45-85) shows substantially higher 1-4 mortality rates in SSA, which argues strongly against a universal non-linear relationship.

While it is possible that this difference between SSA and other developing regions is partly explained by the higher prevalence of HIV/AIDS in most African countries, there is no obvious reason to expect HIV to impact disproportionately on mortality between the ages of one and four years rather than before 12 months; and the positions of SSA countries relative to the regional trend line are not obviously related to the incidence of HIV. The other systematic differences between SSA and other developing regions, as discussed above ('Why is Africa Different? (or isn't it?)'), are a more likely explanation – particularly lower immunisation rates, which impact primarily on the 1-4 age group.

Alternative Analytical Methods and Results

In order to estimate RBPLs, we define population deciles by asset scores, estimating the infant mortality rate for each from DHS data, and imputing average incomes on the basis of data from PovCalNet[128] (based on a simplifying assumption that the ranking of households by incomes corresponds with ranking by asset scores). In the case of India, rural and urban populations are analysed separately, reflecting the presentation of income data in PovCalNet. We then apply various alternative methodologies in turn to the resulting seven sets of observations.

The regression approach is based on regression of infant mortality rates on incomes. Since there is no prima facie reason to anticipate any specific functional form (or even for the functional form to be consistent across countries) we consider four options independently for each country:

- linear ($M = a.Y + b$);
- logarithmic ($M = a.\ln(Y) + b$);
- exponential ($M = ae^{bY}$); and
- power ($M = aY^{b}$),

where M = average infant mortality rate and Y = average income per capita for each population decile.

We then adopt whichever of these functional forms provides the best fit, as measured by R^2, and define the RBPL as the predicted income level associated with the threshold level of infant mortality in the resulting estimated relationship. These results are shown in Figures 18-23 and Table 2.

Table 2: Estimated RBPLs – Single Regression Approach

	RBPL				Regression results	
	50	**40**	**30**	**20**	**functional form**	**R^2**
Bolivia	1.51	3.21	6.84	14.58	logarithmic	0.8524
Egypt	*0.80**	1.35	2.64	6.78	power	0.7511
India (rural)	2.18	3.29	*5.58**	*11.74**	power	0.8525
India (uban)	1.40	1.98	3.08	5.76	power	0.8459
Nicaragua	*0.24**	0.38	0.69	1.57	power	0.7462
Senegal	3.58	5.02	6.89	*9.52**	exponential	0.8563
South Africa	2.14	3.70	7.49	20.28	power	0.8006

**Note: ***figures in italics are based on extrapolation beyond the range of decile income averages.

Figure 18: RBPL Estimation (Regression Approach) - Bolivia

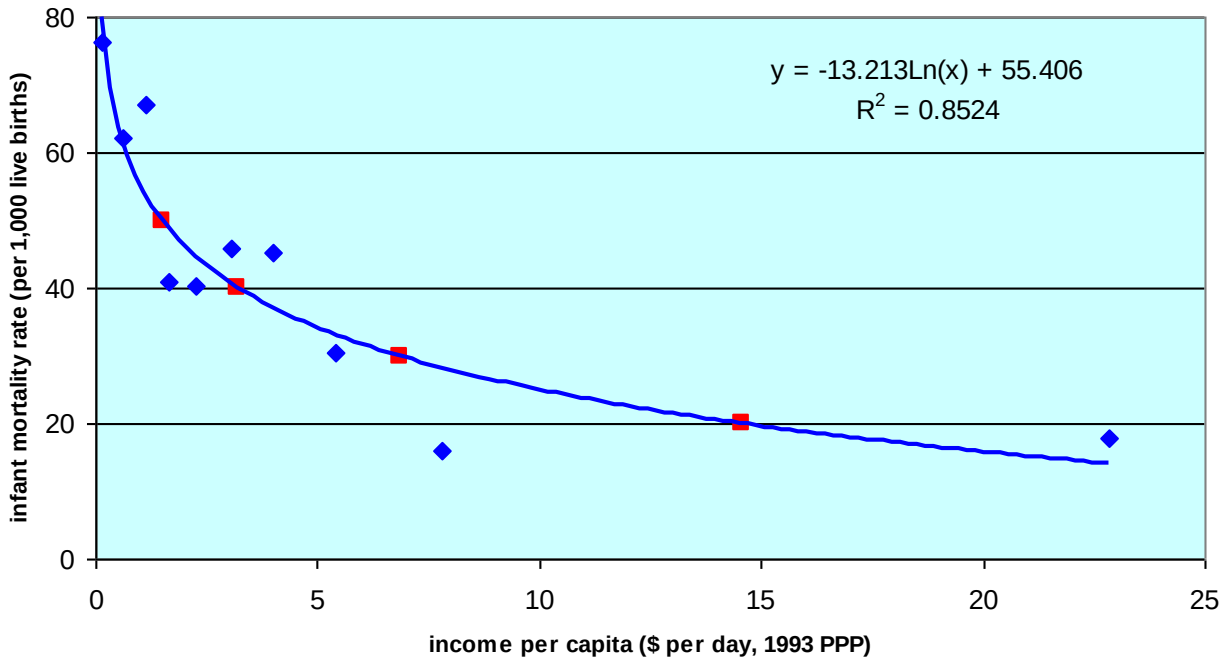


Figure 19: RBPL Estimation (Regression Approach) - Egypt

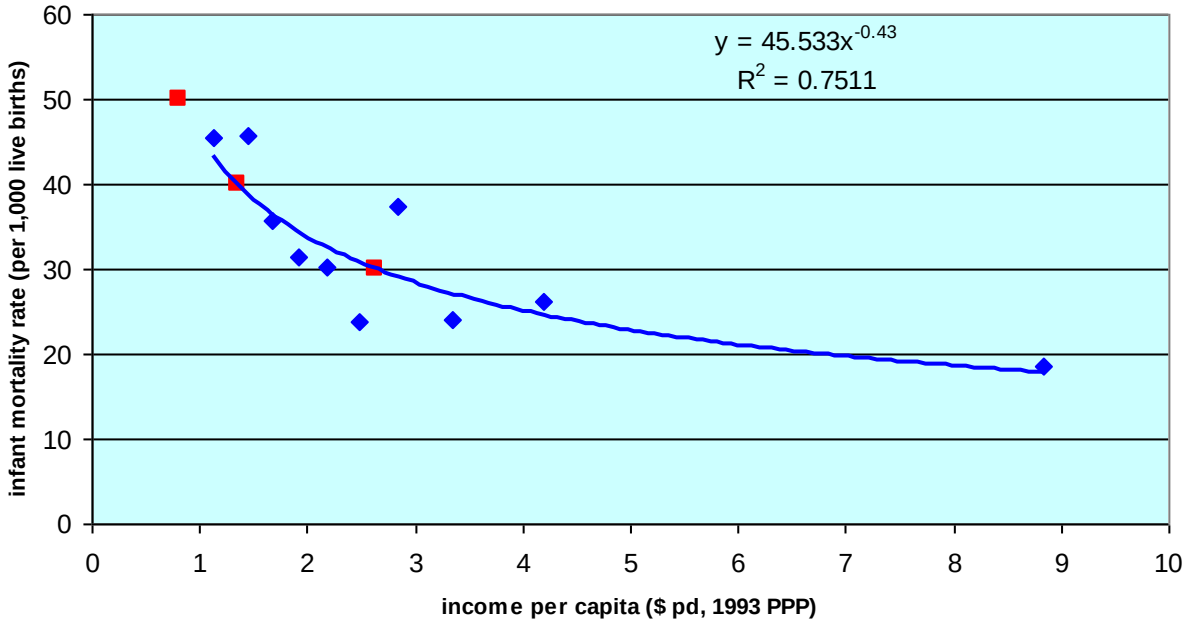


Figure 20: RBPL Estimation (Regression Approach) - India

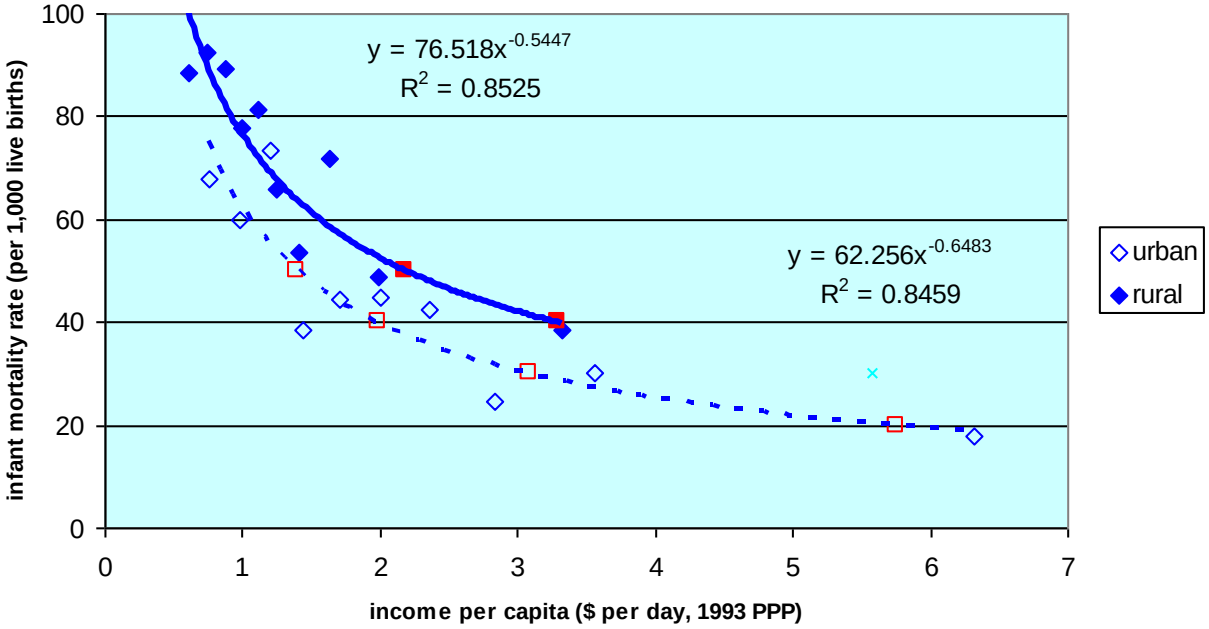


Figure 21: RBPL Estimation (Regression Approach) - Nicaragua

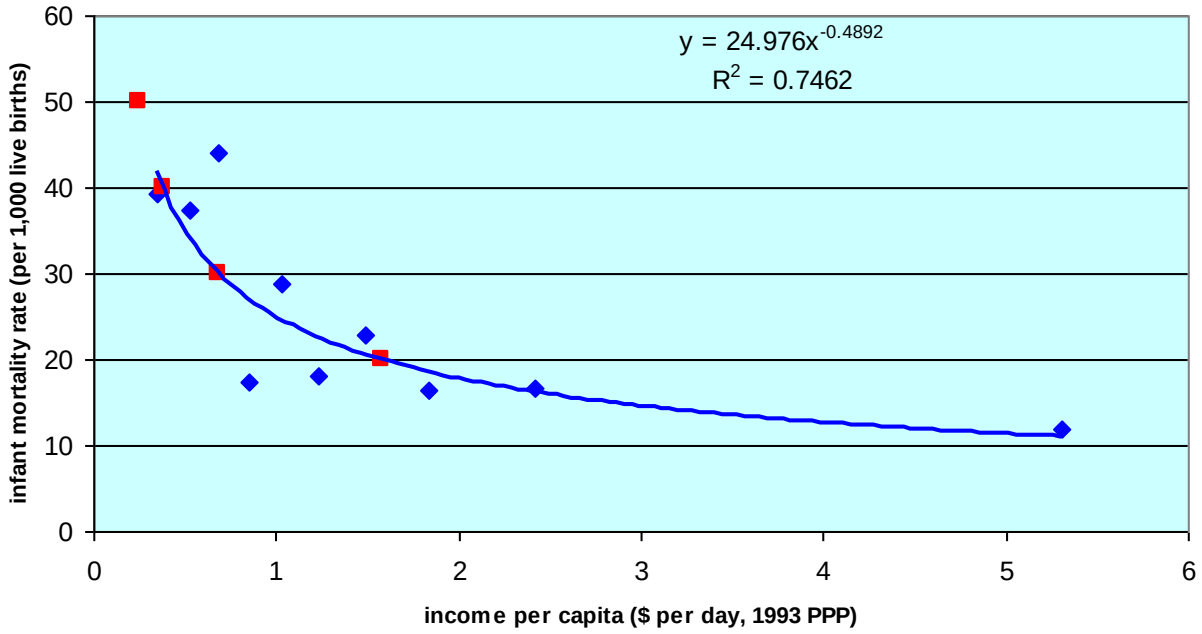


Figure 22: RBPL Estimation (Regression Approach) - Senegal

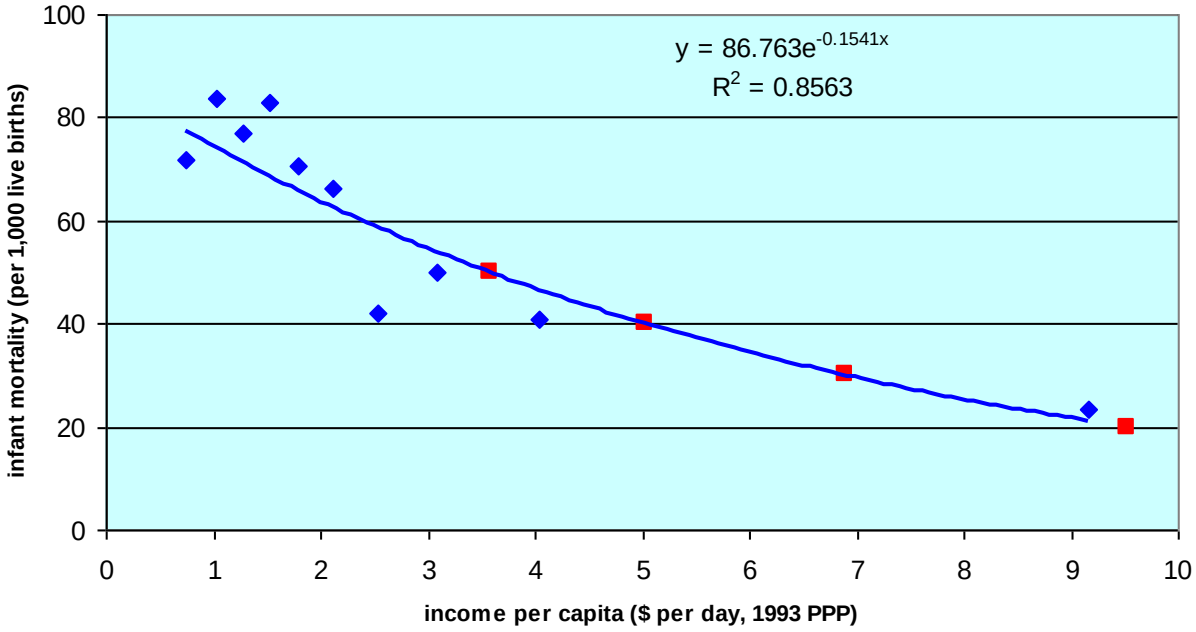
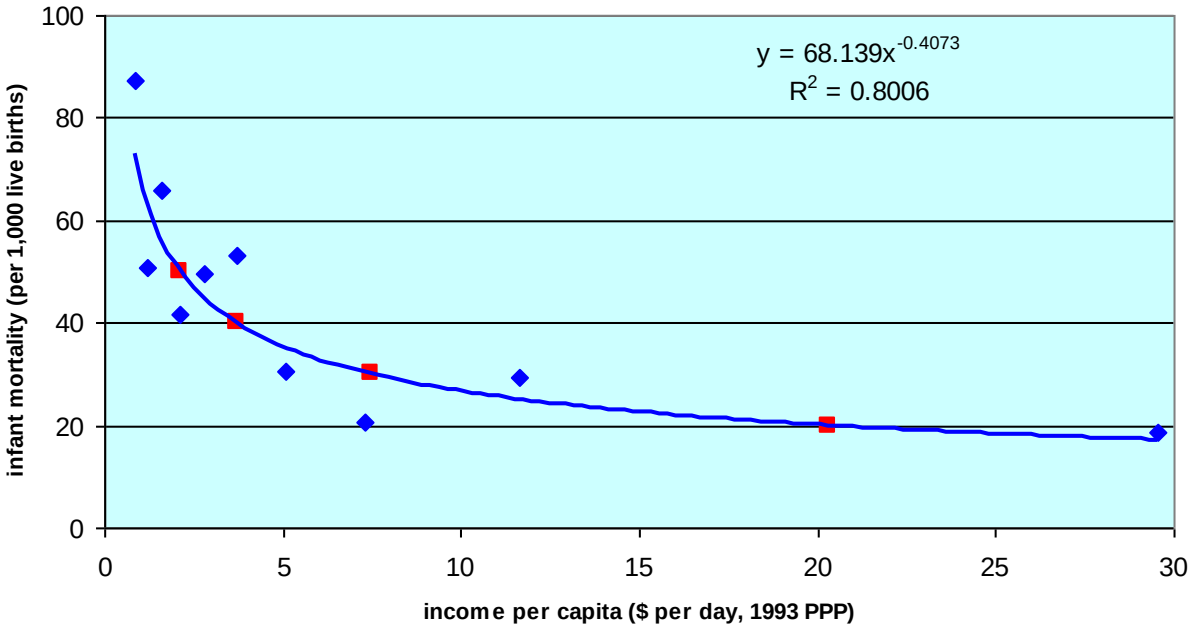


Figure 23: RBPL Estimation (Regression Approach) – South Africa



The regressions perform relatively well in these cases ($0.74<R^2<0.86$). (It should be noted, however, that not all country data sets from DHS generate such favourable results, and that the sample countries were selected in part on this basis.) The power function is the best-performing functional form in five of the seven cases, and second-best in the other two (to the log function in Bolivia and the exponential function in Senegal, where its R^2 is only marginally lower). This suggests that this should be the preferred option if it were considered necessary to impose a unique functional form in all cases.

While this approach in principle allows us to generate a complete set of estimates, five are based on extrapolation below the average income of the poorest decile or above that of the richest (by a considerable amount in the case of the lower thresholds in rural India), rendering the results potentially unreliable.

Comparison of the results with the decile-by-decile observations suggests some important apparent inconsistencies between the results and the observed patterns of incomes and infant mortality rates. In Bolivia (Figure 18), for example, RBPL(40) is estimated at $3.21, although the fourth quintile has an income of $4.00 and IMR of 45.1/1,000. Conversely, RBPL(20) is estimated at $14.58, but the second quintile has an IMR of only 16.1 at an average income little more than half this level ($7.79). In Senegal (Figure 22), while RBPL(50) is estimated at $3.57, the average income of the highest-income decile with an IMR above 50 is only $2.12, and there are two population deciles with incomes below the estimated RBPL(50) but IMR below 50.

These inconsistencies arise in part from the inevitable scatter of observations around the estimated relationship (particularly given relatively small sample sizes), which may be accentuated by imperfections in the performance of asset scores as a proxy for income, giving rise to a risk of misallocation of households between income deciles. In some cases, however, discrepancies appear to arise in part from a failure of the functional forms considered here to reflect adequately the non-linearity of the relationship between income and infant mortality (eg in the case of Senegal), which it might be possible to rectify by considering a wider range

of functional forms ,and/or from irregularities in the relationship at different levels of income. In the case of Bolivia, for example, there is an apparent plateau of IMRs in a range of 40-45 between the fourth and seventh deciles (income per capita between $1.65 and $4.00); in Senegal, there appears to be a ceiling on IMR of around 70-85/1,000 at very low incomes.

This leads us in two possible directions. To the extent that discrepancies arise from irregularities in the functional form, we might move towards methods which do not rely on the estimation of the relationship across the whole income distribution. To the extent that problems arise from small sample sizes and/or the misallocation of households in terms of income, on the other hand, we might move towards the use of average figures for consecutive deciles. Alternative approaches to deal with these two problems are considered below.

We might hope to limit problems arising from irregularities in the relationship between income and IMR by conducting regressions separately over the upper, middle and lower income ranges, which we interpret here as meaning deciles 1-5, 3-7 and 6-10 respectively. Where the regression lines intersect, the point of intersection is interpreted as the point of transition between the two estimated relationships. Where they do not intersect (as in the case of rural India, for example), the arithmetic mean of the results implied by the two relationships is used in the income range in which the two samples overlap.

The results of this exercise, which we term the segmented regression approach, are shown in Figures 24-29 and Table 3.

Figure 24: RBPL Estimation (Segmented Regression Approach) – Bolivia

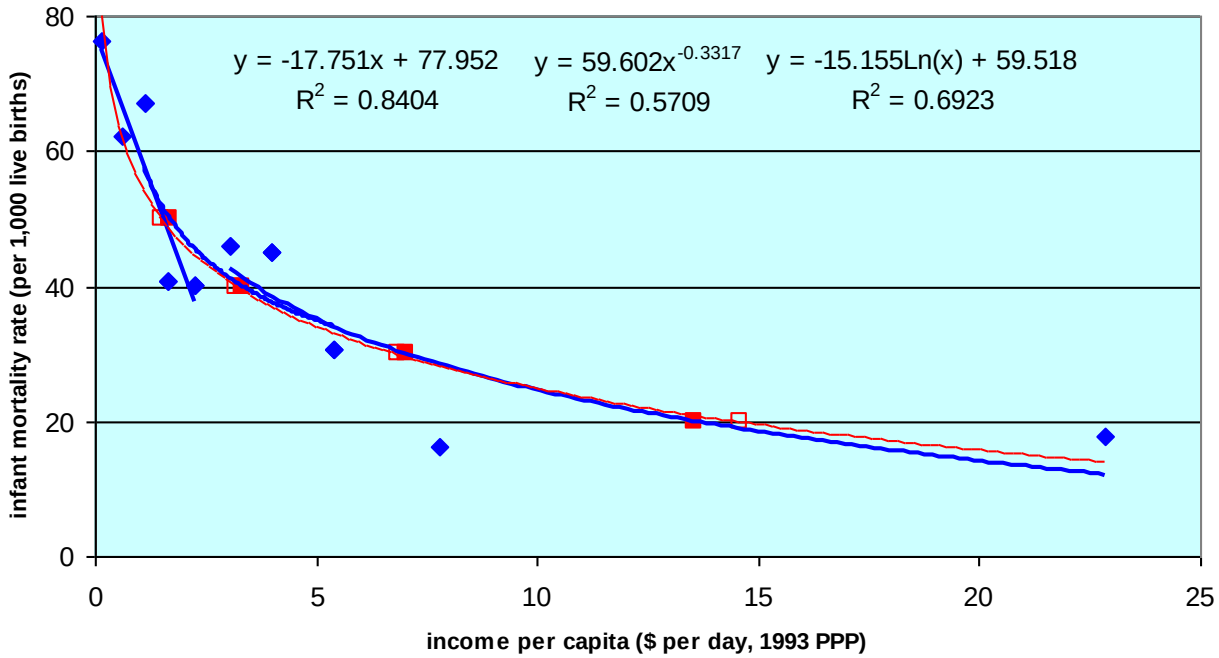


Figure 25: RBPL Estimation (Segmented Regression Approach) – Egypt

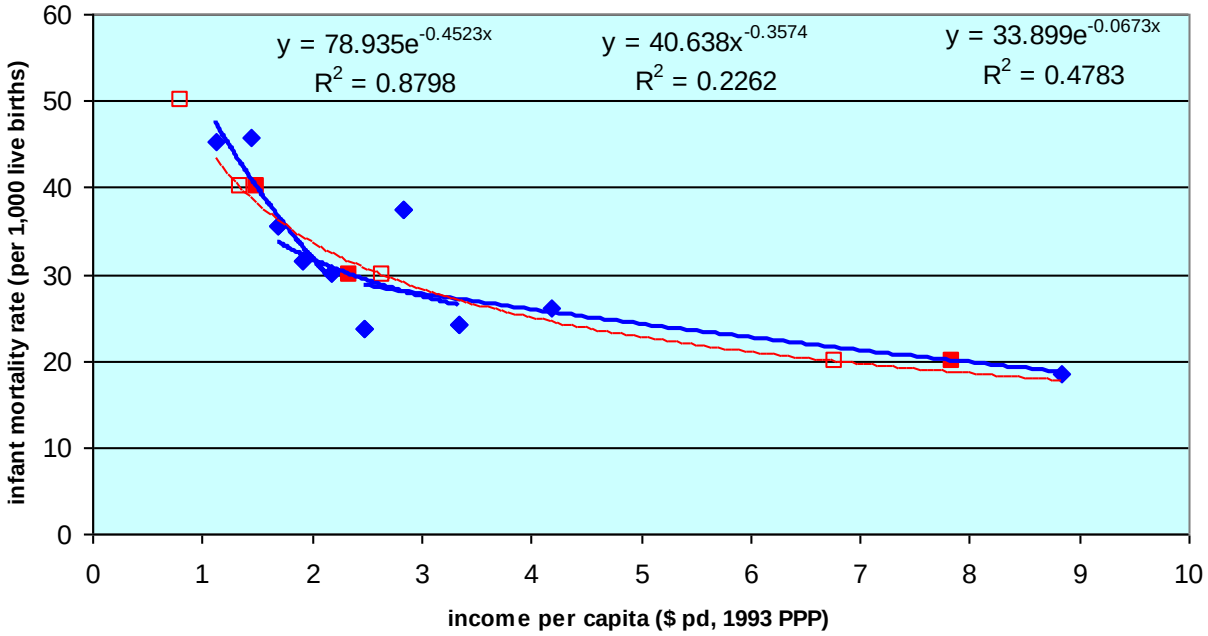


Figure 26: RBPL Estimation (Segmented Regression Approach) – India

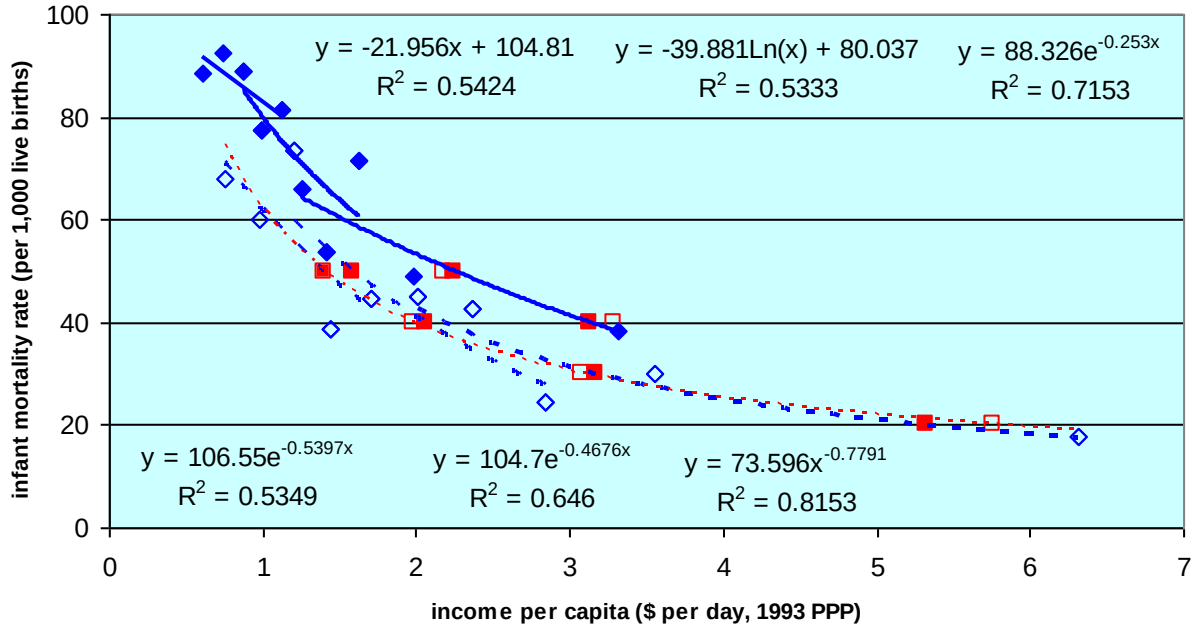


Figure 27: RBPL Estimation (Segmented Regression Approach) – Nicaragua

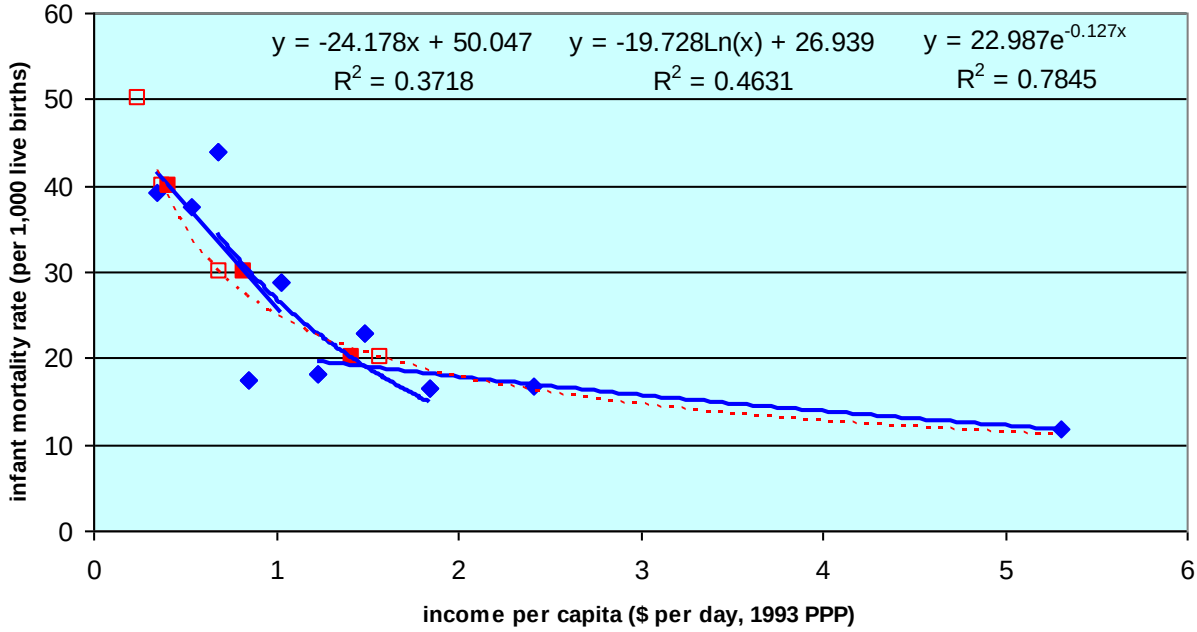


Figure 28: RBPL Estimation (Segmented Regression Approach) – Senegal

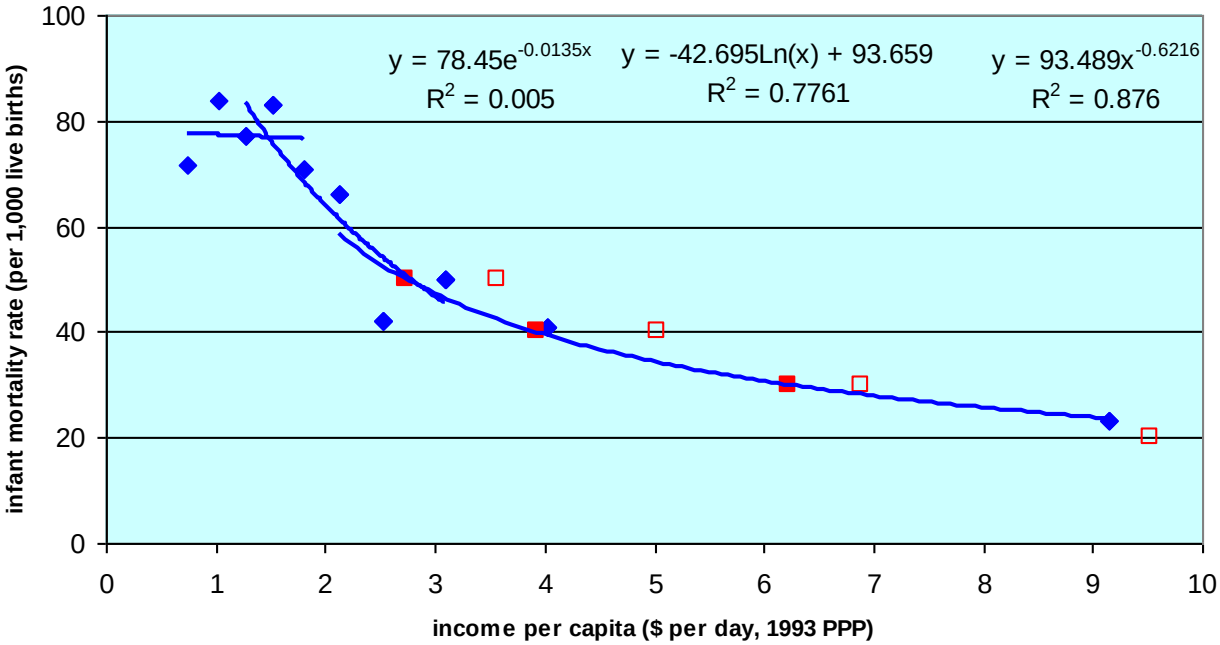


Figure 29: RBPL Estimation (Segmented Regression Approach) – South Africa

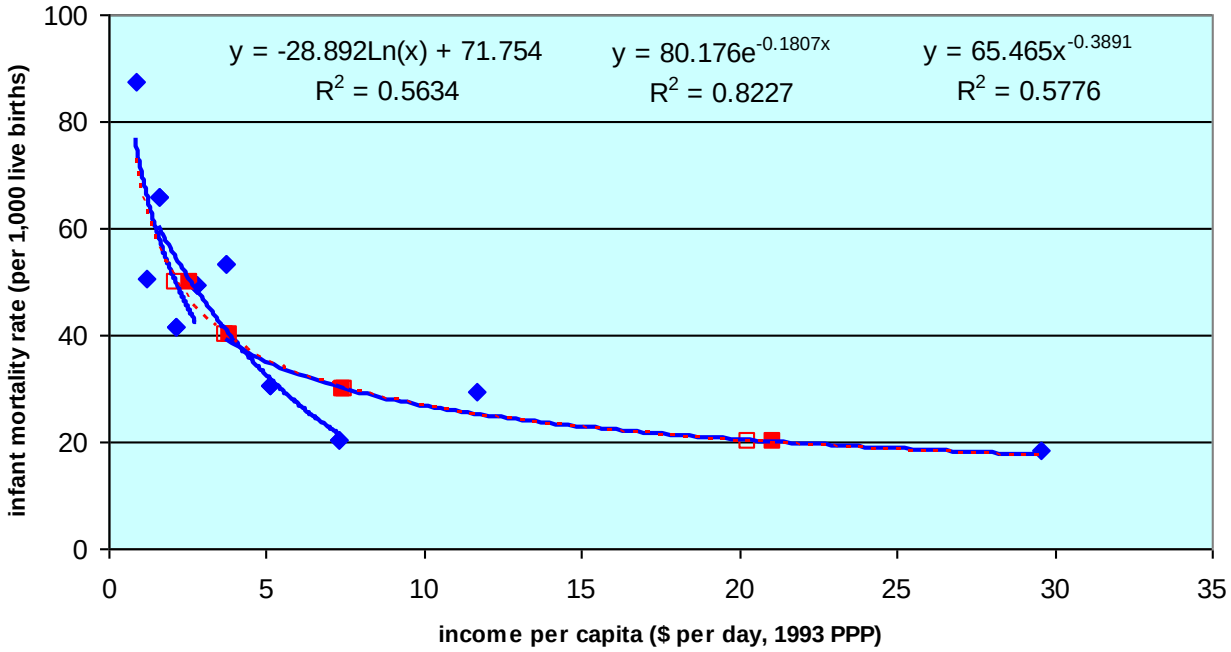


Table 3: Estimated RBPLs – Segmented Regression Approach.

	RBPL				Regression results					
					functional forms			R^2		
	50	40	30	20	low	mid	high	low	mid	high
Bolivia	1.70	3.33	7.01	13.57	linear	power	log	0.8404	0.5709	0.6923
Egypt		1.50	2.34	7.84	exp	power	exp	0.8798	0.2262	0.4783
India (rural)	2.25	3.13			linear	log	exp	0.5424	0.5333	0.7153
India (urban)	1.58	2.06	3.16	5.32	exp	exp	power	0.5349	0.6460	0.8153
Nicaragua		0.42	0.83	1.42	linear	log	exp	0.3718	0.4631	0.7845
Senegal	2.74	3.92	6.23		exp	log	power	0.0050	0.7761	0.8760
South Africa	2.61	3.85	7.43	21.06	log	exp	power	0.5634	0.8227	0.5776

In the cases of Bolivia and South Africa, this generates a smooth relationship similar to the overall regression, but slightly more non-linear in the former case and slightly less so in the latter. This results in generally very small differences between in results between the two methods (±1-13%). (While there is a somewhat larger difference between the two in the case of RBPL(50) in South Africa (+22%), this arises because this narrowly falls on the lower rather than the middle income regression curve.) The results for Bolivia thus do little to ease the discrepancies between the overall regression approach and the decile observations as discussed above.

In the case of urban India, there is also a smooth relationship similar to the overall regression, but with a discontinuity between the lower and middle-income regressions. (This highlights a further issue with this approach: the definition of the ranges covered by the different regressions in terms of incomes gives rise to the possibility of ambiguous results, with two income levels at which IMR is predicted to be at the threshold level according to the regression which applies at that point. This occurs in the case of RBPL(50) in urban India, which could thus equally validly be interpreted as $1.40 or $1.58.)

In the cases of Egypt and Nicaragua, by contrast, the segmented regression approach indicates a clear articulation between two almost linear curves, for the lower and the middle/upper income ranges in the former case, and the lower/middle and upper income ranges in the latter case. In the case of Egypt, this result is made less robust by the relatively weak performance of the regression for the middle income range (R^2 = 0.226) – but the markedly steeper gradient of the low-income segment appears much more robust. This gives rise to significantly larger discrepancies between the two approaches (±10-20%).

Rural India and especially Senegal show a different pattern, with a relatively slow reduction in IMR in the lowest income group accelerating in the middle-income range before slowing again as expected at higher incomes. In the case of Senegal, the result is both substantial differences between the two sets of results (±10-30%), and substantially greater sensitivity of RBPLs to the IMR threshold in the segmented regression approach. This largely resolves the apparent discrepancies observed in the case of the overall regression approach.

However, the failure of this approach to resolve this problem in the case of Bolivia suggests that it still leaves something to be desired. Since this concern arises from the discrepancy between relationships estimated by regression analysis, this suggests the possibility of avoiding the need for regression altogether by basing our estimates purely on the ten observations provided by income deciles.

In both Bolivia and Senegal, while the regression method generates apparent inconsistencies with the data, there is a clearly-defined range of incomes for each of the IMR thresholds considered such that every decile with an income below that level has an IMR above the threshold, and every decile with a higher income has an IMR above the threshold. In such circumstances, it is reasonable to define the RBPL as falling between the average incomes of the deciles immediately above and below the threshold level of IMR. For simplicity, we can then define a specific RBPL by linear interpolation between the average incomes and IMRs of these quintiles.

This allows us to identify 17 of the 28 RBPLs required by the seven cases and four thresholds. In a further five cases, either all deciles have IMRs above the threshold level, indicating that the RBPL is below the average income of the poorest decile, or all have IMRs below the threshold, indicating an RBPL above the average income of the richest decile. While this is not necessarily the case, these instances correspond exactly with

those where the regression approach results in an extrapolated rather than an interpolated result.

The remaining six cases are less straightforward, however, requiring more careful consideration of how to define the RBPL. We propose the application of four rules to identify a cut-off point between deciles at which the RBPL might be considered to lie:

1. that the IMR in the decile immediately *below* the cut-off should be *above* the threshold level;
2. that the IMR in the decile immediately *above* the cut-off should be *below* the threshold level;
3. that there should be no combination of consecutive deciles above the cut-off and including that *immediately* above the cut-off in which the average IMR is above the threshold level; and
4. that there should be no combination of consecutive deciles *below* the cut-off and including that immediately below the cut-off in which the average IMR is *below* the threshold level.

Once the cut-off point has thus been determined, the incidence of poverty may again be estimated by linear interpolation between the observations for the deciles immediately above and below it. The results of this approach are shown in Figures 30-36 and Table 4.

Table 4: Estimated RBPLs – Non-Regression Approach.

	RBPL			
	50	**40**	**30**	**20**
Bolivia	1.51	3.21	6.84	14.58
Egypt		1.58	3.12 (2.19)	7.96
India (rural)	1.96	3.11		
India (urban)	1.36	2.43	2.69	5.84
Nicaragua		0.71	0.77	1.64 (1.20)
Senegal	2.39	4.27	7.21	
South Africa	1.92 (3.91)	4.51	5.17	27.25

Note: figures in brackets are non-preferred options where results are considered ambiguous.

Figure 30: RBPL Estimation (Non-Regression Approach) – Bolivia

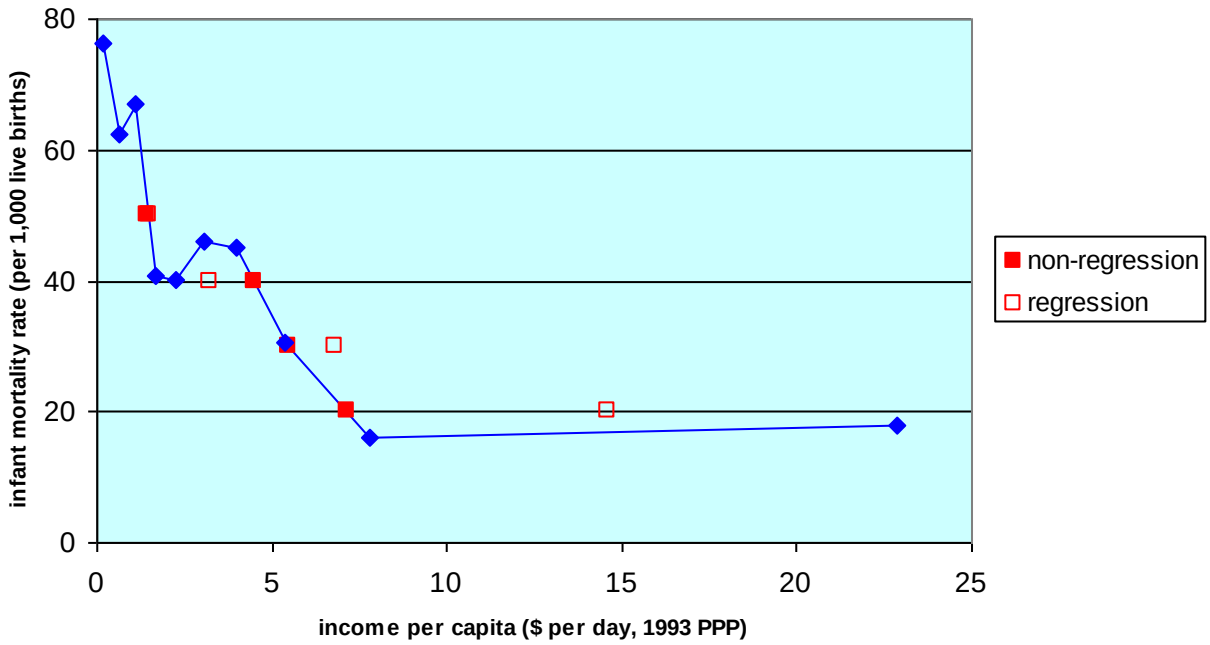


Figure 31: RBPL Estimation (Non-Regression Approach) – Egypt

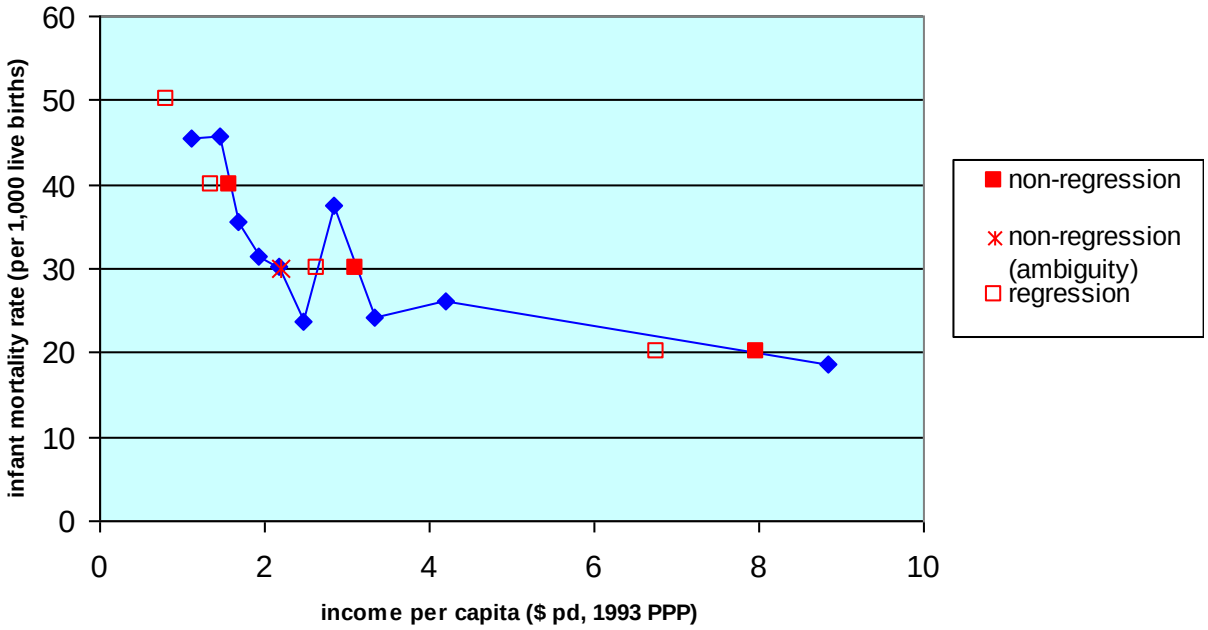


Figure 32: RBPL Estimation (Non-Regression Approach) – India (rural)

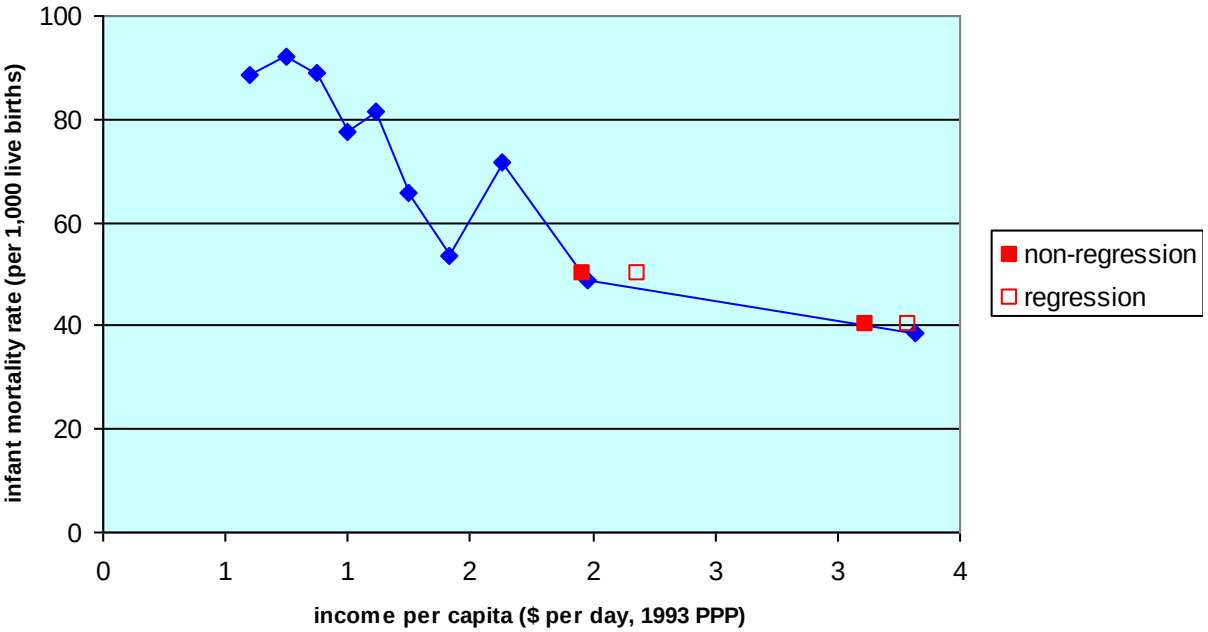


Figure 33: RBPL Estimation (Non-Regression Approach) – India (urban)

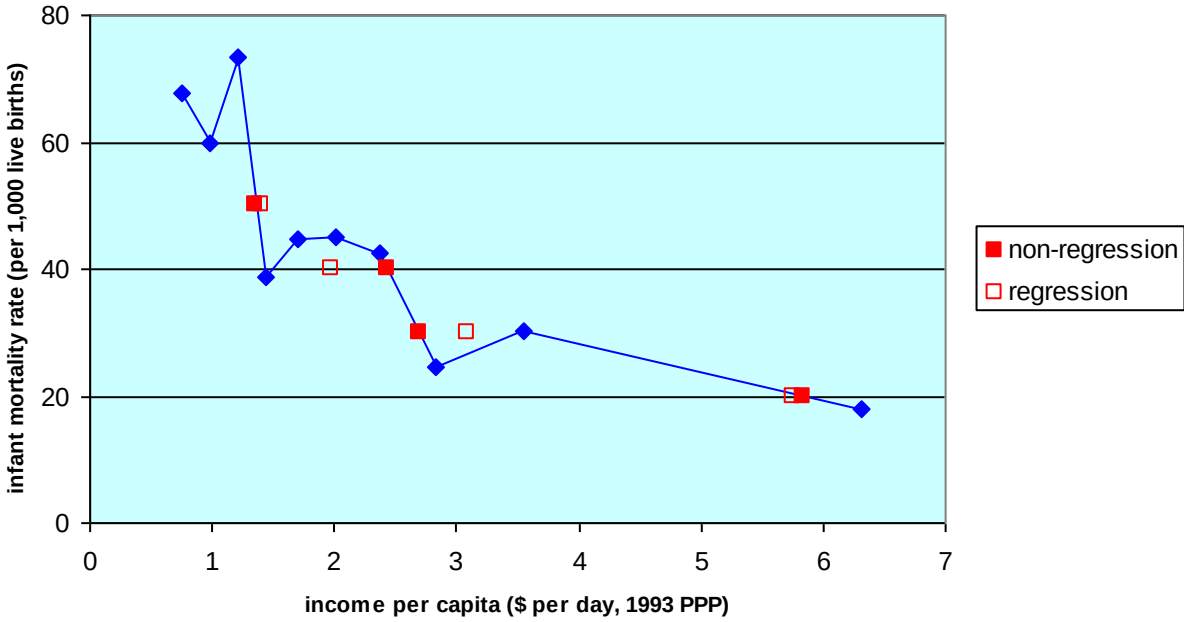


Figure 34: RBPL Estimation (Non-Regression Approach) – Nicaragua

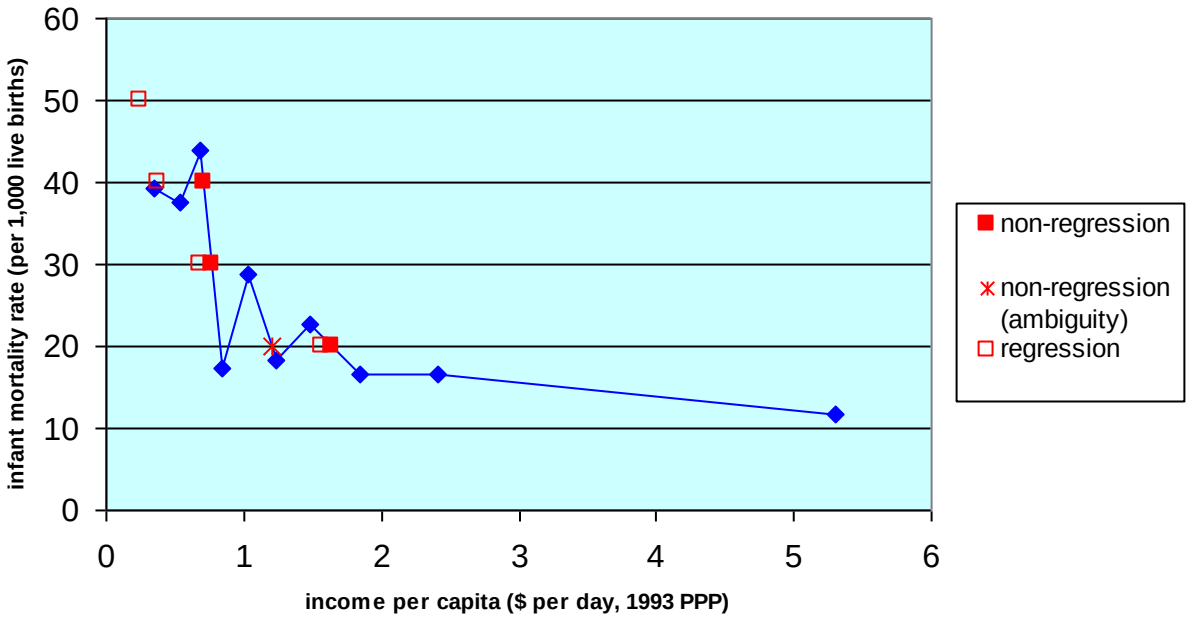


Figure 35: RBPL Estimation (Non-Regression Approach) – Senegal

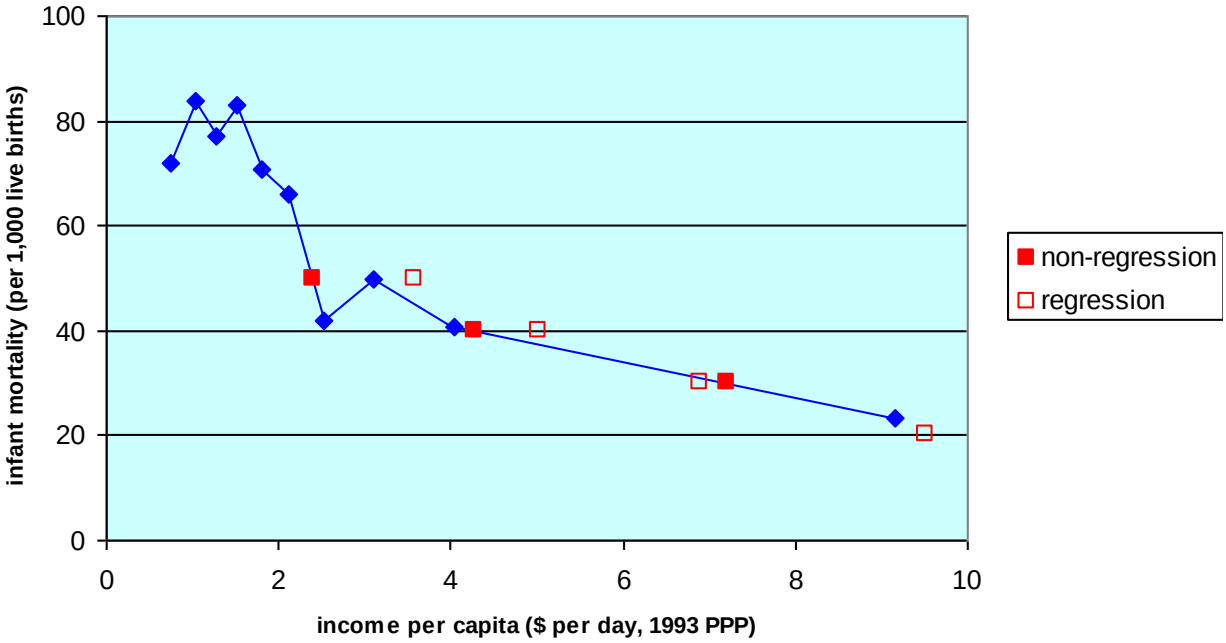
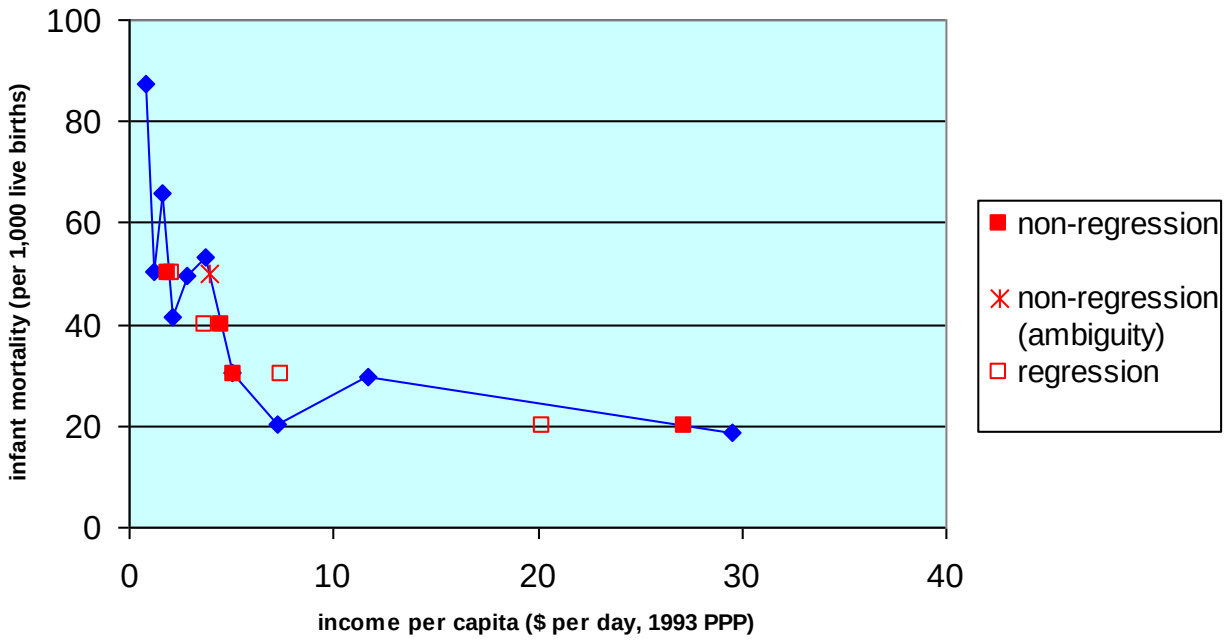


Figure 36: RBPL Estimation (Non-Regression Approach) – South Africa



In some cases, these results are clear-cut. In the case of RBPL(40) in urban India, for example, the seventh quintile has an IMR below the threshold level (38.6), but the next three higher quintiles all have IMR above the threshold by a larger margin (42.5-45.0), making the interval between the third and fourth deciles a clearly preferable cut-off to that between the sixth and seventh deciles. Similarly, the IMR for the second decile is only marginally above the IMR = 30 threshold (at 30.1), and that for the third decile below the threshold by a substantially wider margin (at 24.5), suggesting that the cut-off should be set between the third and fourth rather than the first and second deciles.

In other cases, however, (Egypt at IMR = 30, Nicaragua at IMR = 20 and South Africa at IMR = 50), the results are more ambiguous. The associated

range of possible RBPLs according to which cut-off-point is selected is also considerable. In the most extreme case, RBPL(50) in South Africa varies by a factor of more than two, from $1.92 to $3.91, according to which cut-off is used. In the case of RBPL(40) in Nicaragua, there is an ambiguity between whether the cut-off should be between the seventh and eighth deciles (RBPL = $0.71) or whether the income should be considered to be below the average income of the lowest decile (RBPL < $0.35).

While this ambiguity arises in a relatively small proportion of cases, the scale of the uncertainty – and the possibility that it may arise more widely in a broader sample of countries – seems unsatisfactory. We therefore also experiment with a hybrid approach, combining elements of the regression and non-regression methods outlined above.

Like the segmented regression approach, the hybrid approach is based on regression across a sub-set of deciles. However, these are identified separately for each threshold in each country. In the cases where there is a single unambiguous cut-off point (as defined above), this sub-set is defined as the two deciles immediately above and the two immediately below the cut-off. In other cases, it is defined as a range from the second decile below the poorest with IMR below the threshold to the second decile above the richest with IMR above the threshold. By narrowing the income range over which regression is conducted, the hope is that this will provide greater allowance for irregularities in the relationship, and avoid potential distortions arising from deciles outside the relevant income range.

Regression is conducted using the same four functional forms used in the regression approach outlined above, again selecting the best-performing form defined according to the R^2, and the RBPL is defined as the predicted income associated with the threshold IMR on the basis of this estimated relationship. The results of this approach are shown in Figures 37-43 and Table 5.

Table 5: Estimated RBPLs – Hybrid Approach.

	RBPL				Regression results							
					functional forms				R^2			
	50	40	30	20	50	40	30	20	50	40	30	20
Bolivia	1.48	4.23	6.49	13.73	exp	lin	log		0.7454	0.9672	0.5713	
Egypt		1.49	2.14	7.72		exp	exp	exp		0.8307	0.1320	0.8687
India (rural)	2.23	3.01			exp	pow			0.6538	0.8611		
India (uban)	1.41	2.03	3.16	5.66	exp	pow	pow	exp	0.4579	0.6518	0.8513	0.6798
Nicaragua		0.42	0.81	1.49		lin	pow	log		0.3718	0.5935	0.3476
Senegal	2.72	4.21	6.37		log	pow			0.6583	0.9995		
South Africa	2.30	4.21	7.54	26.84	exp	exp	log	exp	0.7855	0.9187	0.4706	0.2633

Figure 37: RBPL Estimation (Hybrid Approach) – Bolivia

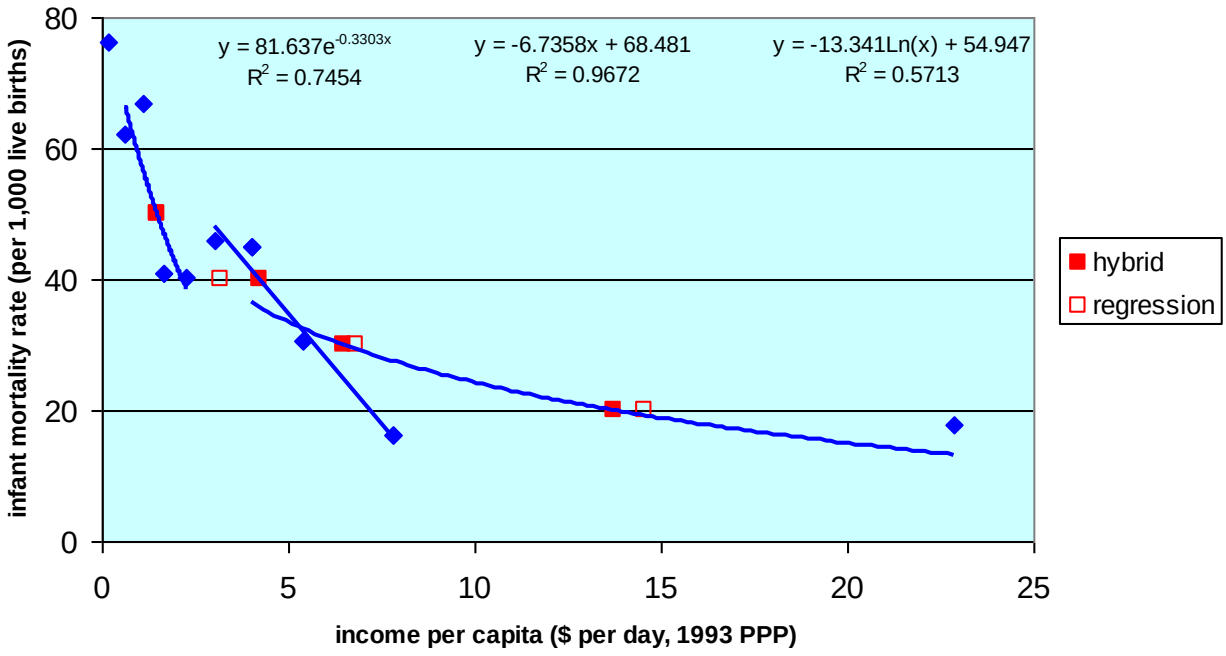


Figure 38: RBPL Estimation (Hybrid Approach) – Egypt

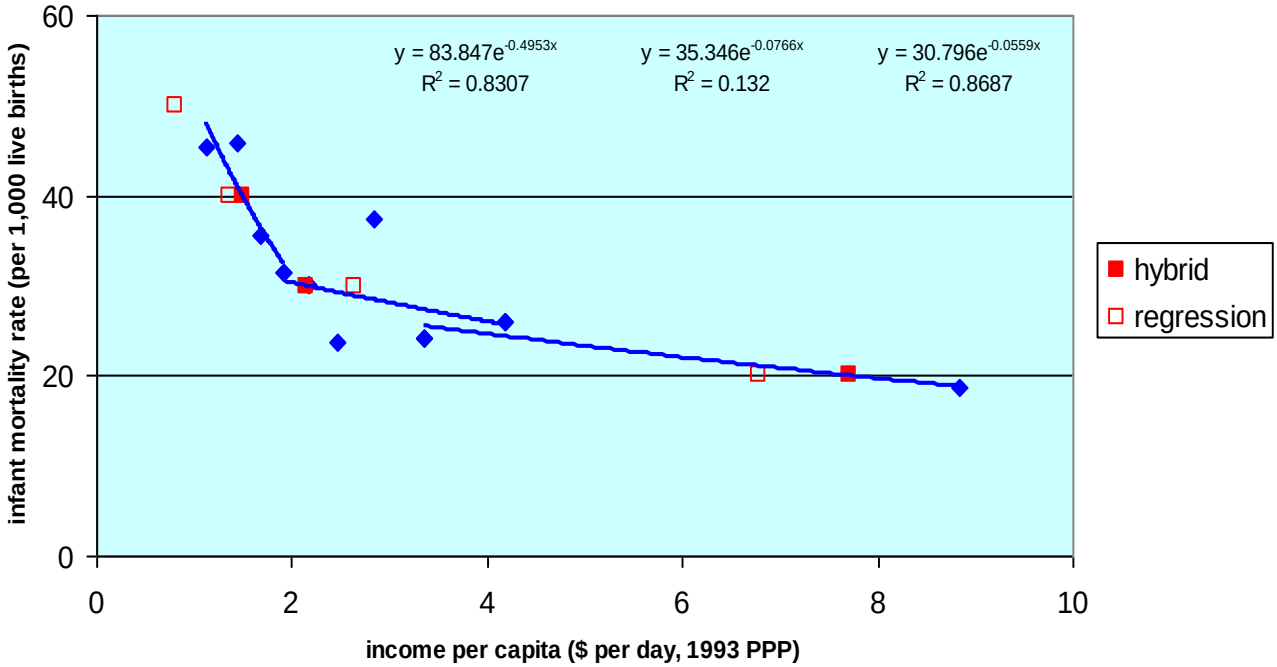


Figure 39: RBPL Estimation (Hybrid Approach) – India (rural)

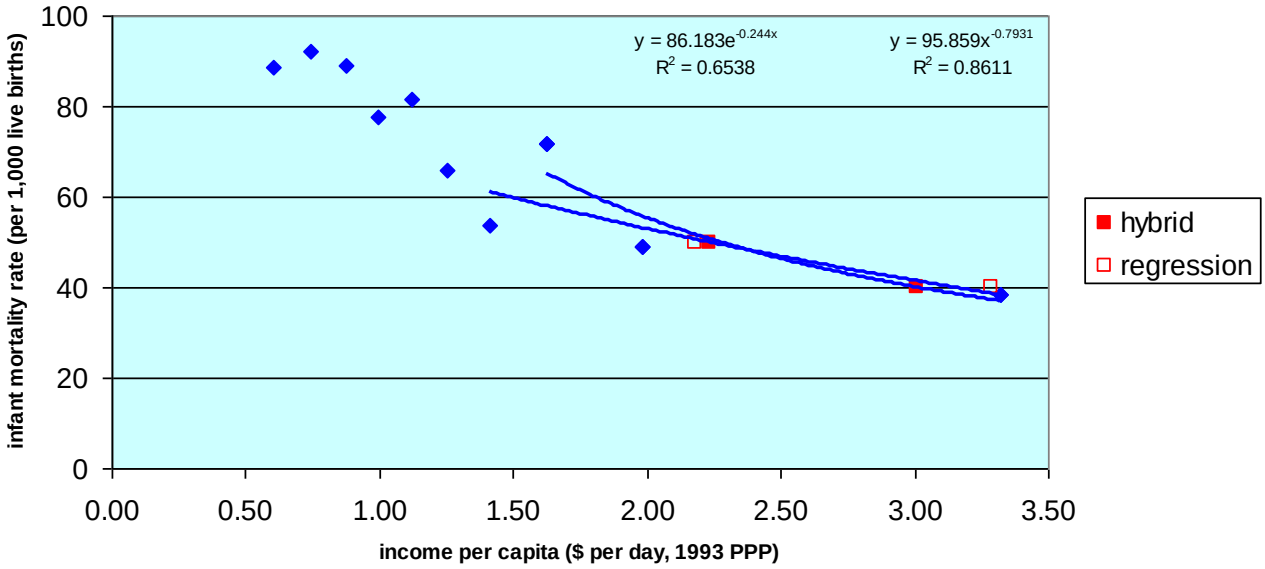


Figure 40: RBPL Estimation (Hybrid Approach) – India (urban)

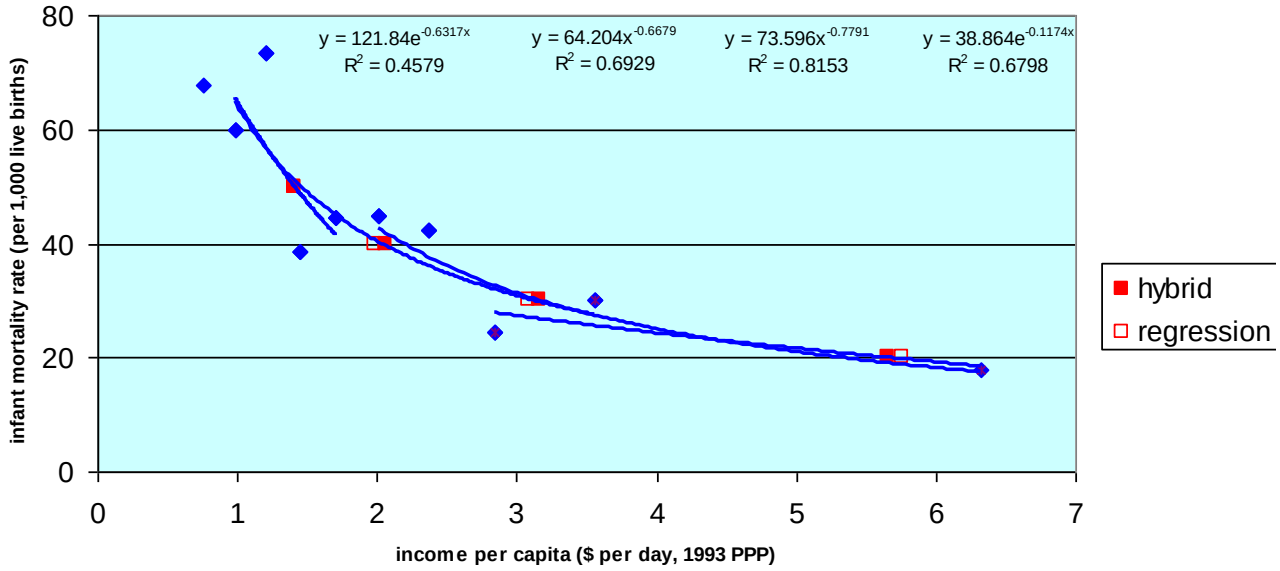


Figure 41: RBPL Estimation (Hybrid Approach) – Nicaragua

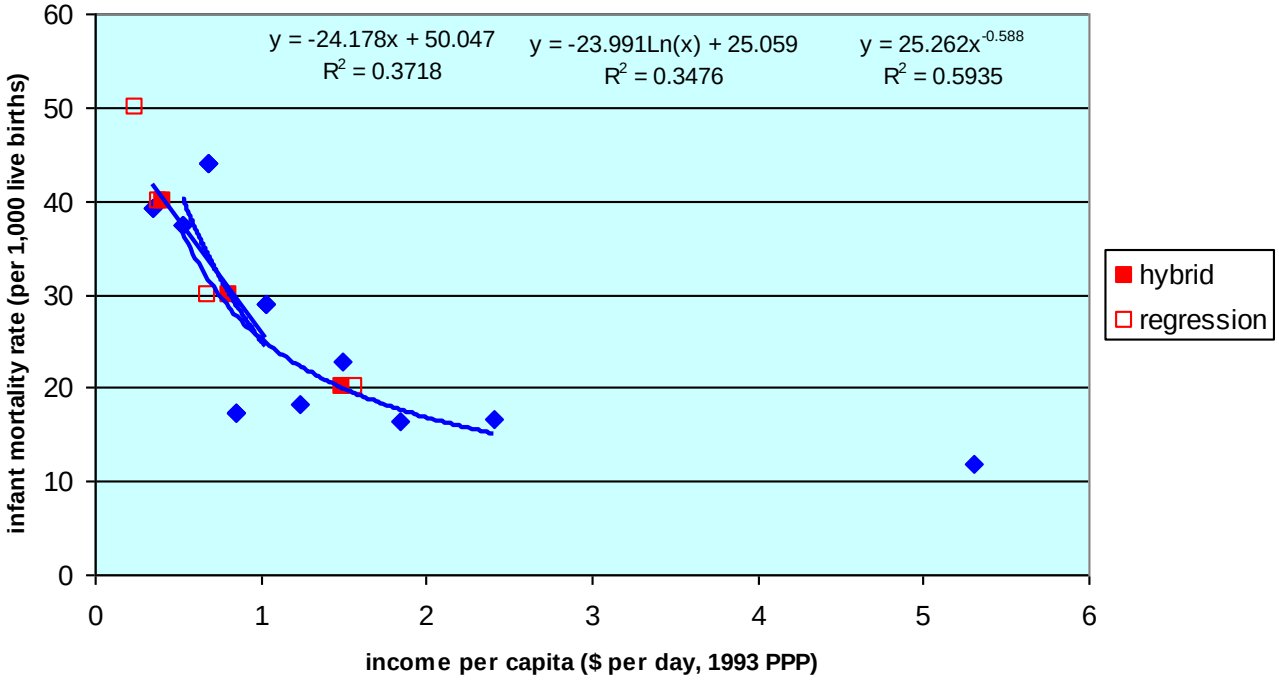


Figure 42: RBPL Estimation (Hybrid Approach) – Senegal

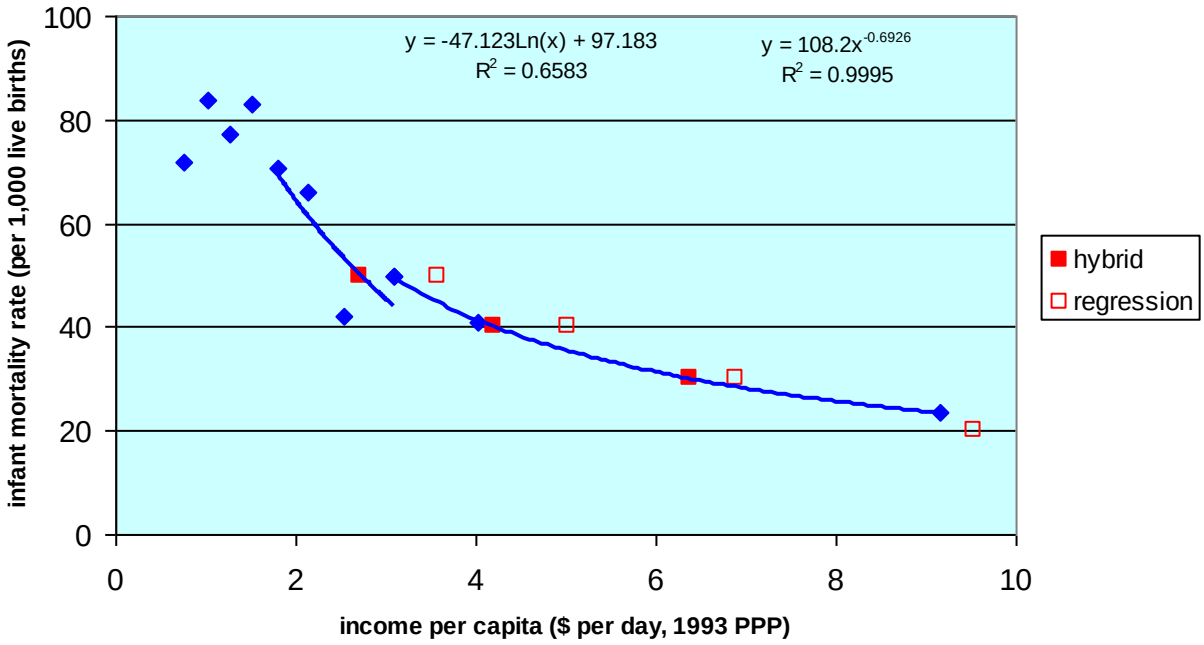
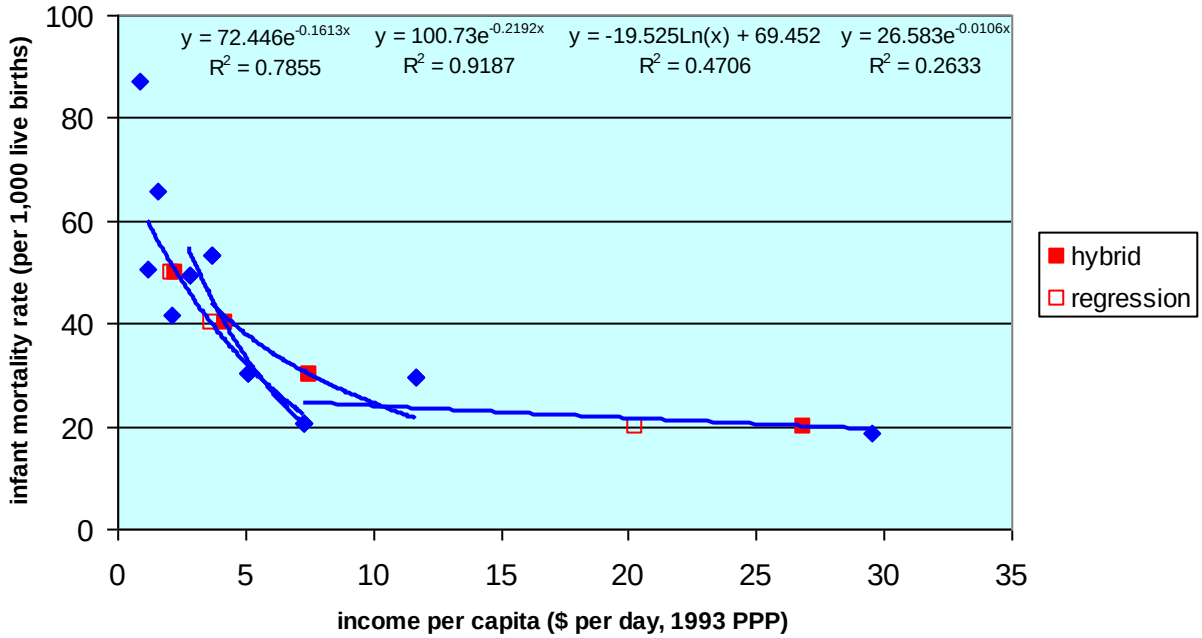


Figure 43: RBPL Estimation (Hybrid Approach) – South Africa



As might be expected with such small samples, the regression results vary widely ($0.132 < R^2 < 0.9995$), although most (13 of 21) have $R^2 > 0.65$, and only two $R^2 < 0.35$. In general, the results show a much more regular pattern than those of the non-regression method. However, they again give rise to some apparent discrepancies with the observations. In urban India, for example, the fourth decile has both income above RBPL(40) and IMR above 40 without the one lower decile with IMR marginally below the threshold level self-evidently justifying this. Conversely, the third decile has income below RBPL(30) but IMR below 30 although the IMR of the second is only marginally above the threshold. In rural India, the estimate for RBPL(50) is $2.23, although the non-regression approach places it

unambiguously below the average income of the second decile ($1.98), whose average IMR is 48.9.

The hybrid approach may therefore be seen as a compromise – though perhaps a slightly uneasy one – between the regularity of the regression approach and accordance with the intuitive interpretation of the observations (at least for the unambiguous cases) of the non-regression approach.

Interpreting the inconsistencies in the results as arising primarily from a misallocation of households among income deciles suggests the alternative of smoothing the pattern of observations, for example through the use of moving averages. Here, we experiment with a three-decile moving average, replacing the second decile observation with the arithmetic mean of the incomes and IMRs of the first to third deciles, the third with the mean of the second to fourth, etc. To avoid giving excessive weight to the first and tenth deciles, they are replaced with weighted averages of the first and second and ninth and tenth deciles, giving a weight of two the first/tenth decile and one to the second/ninth. These averaged observations can then be combined with any of the four methods described above.

The results of this approach are shown in Table 6 and Figures 44-50.

Table 6: Estimated RBPLs – Moving Average Approach.

	RBPL			
	50	**40**	**30**	**20**
Bolivia	1.63	4.23	6.14	14.12
Egypt	n/a	1.55		n/a
India (rural)	2.46	n/a	n/a	n/a
India (uban)	1.51	2.25	3.30	n/a
Nicaragua	n/a	0.86	1.47	n/a
Senegal	2.75	4.72	7.26	n/a
South Africa	2.55	4.54	6.94	n/a

Figure 44: RBPL Estimation (Moving Average Approach) – Bolivia

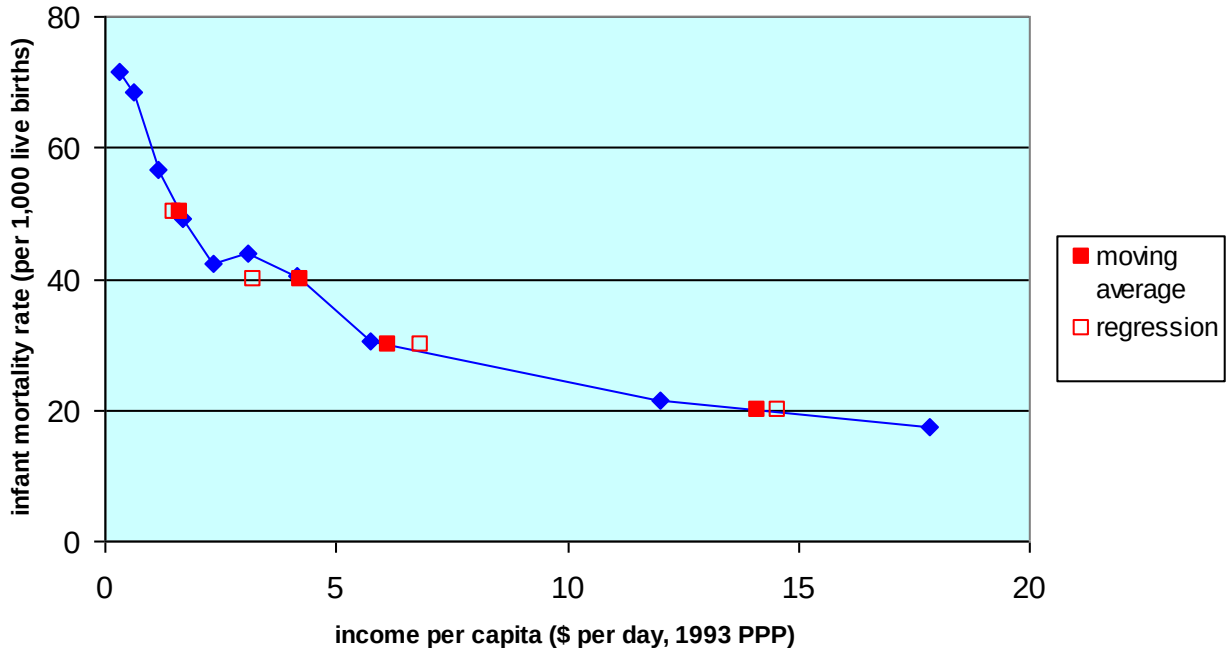


Figure 45: RBPL Estimation (Moving Average Approach) – Egypt

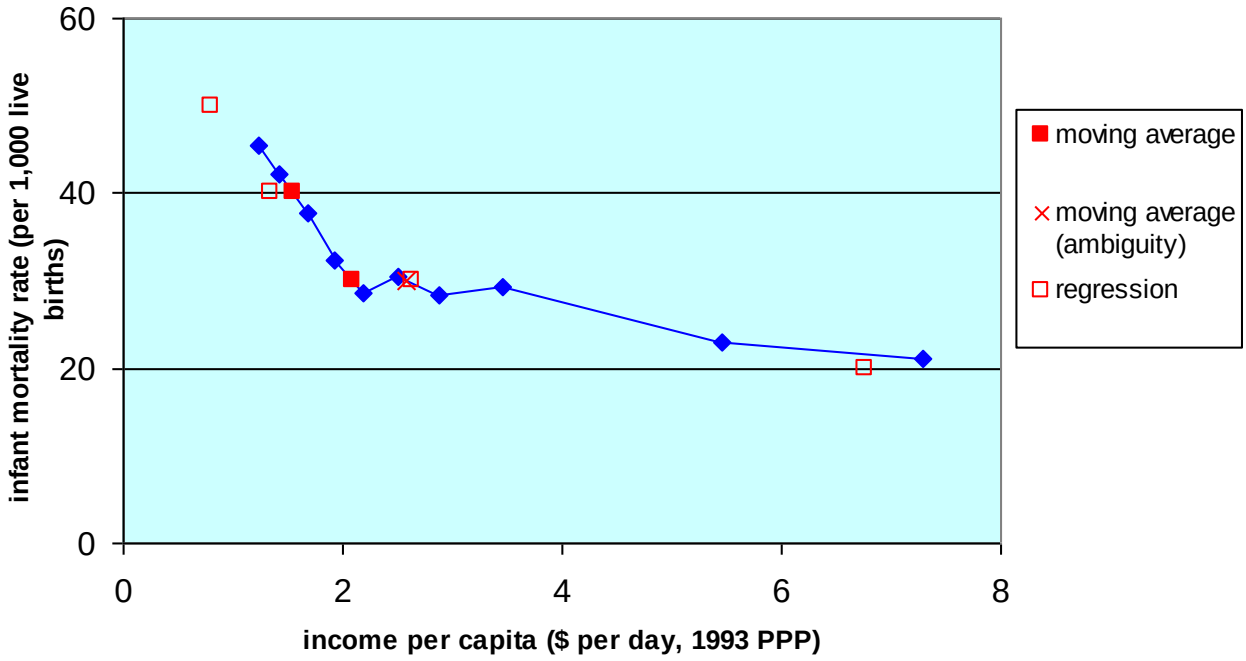


Figure 46: RBPL Estimation (Moving Average Approach) – India (rural)

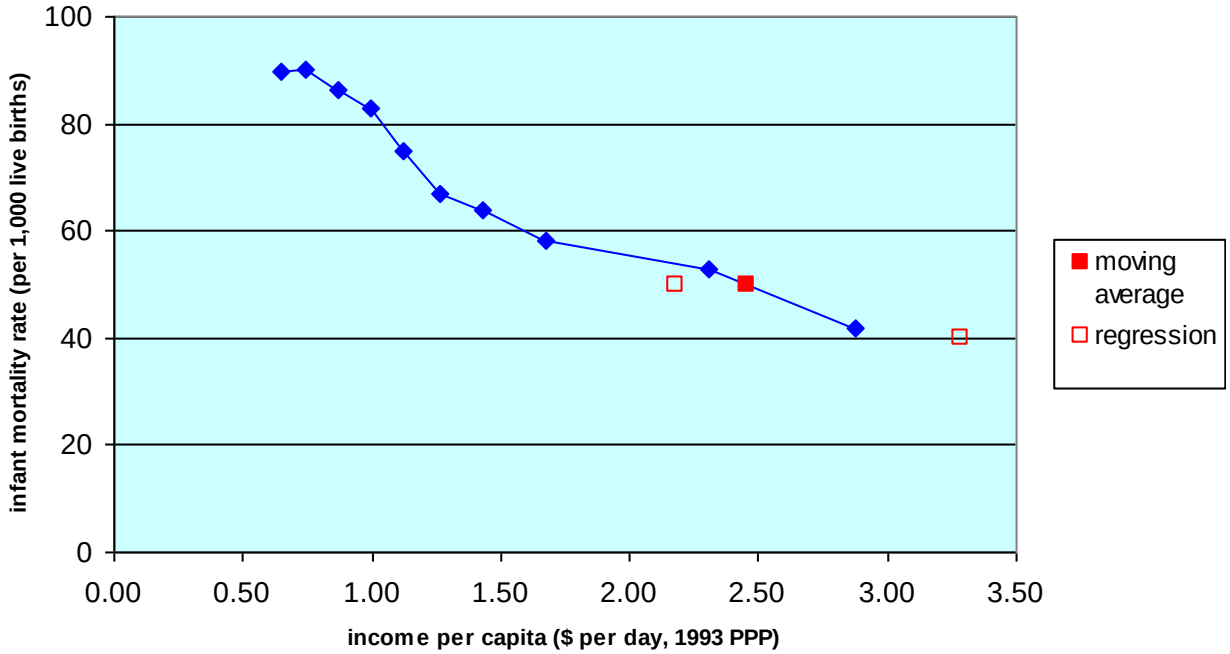


Figure 47: RBPL Estimation (Moving Average Approach) – India (urban)

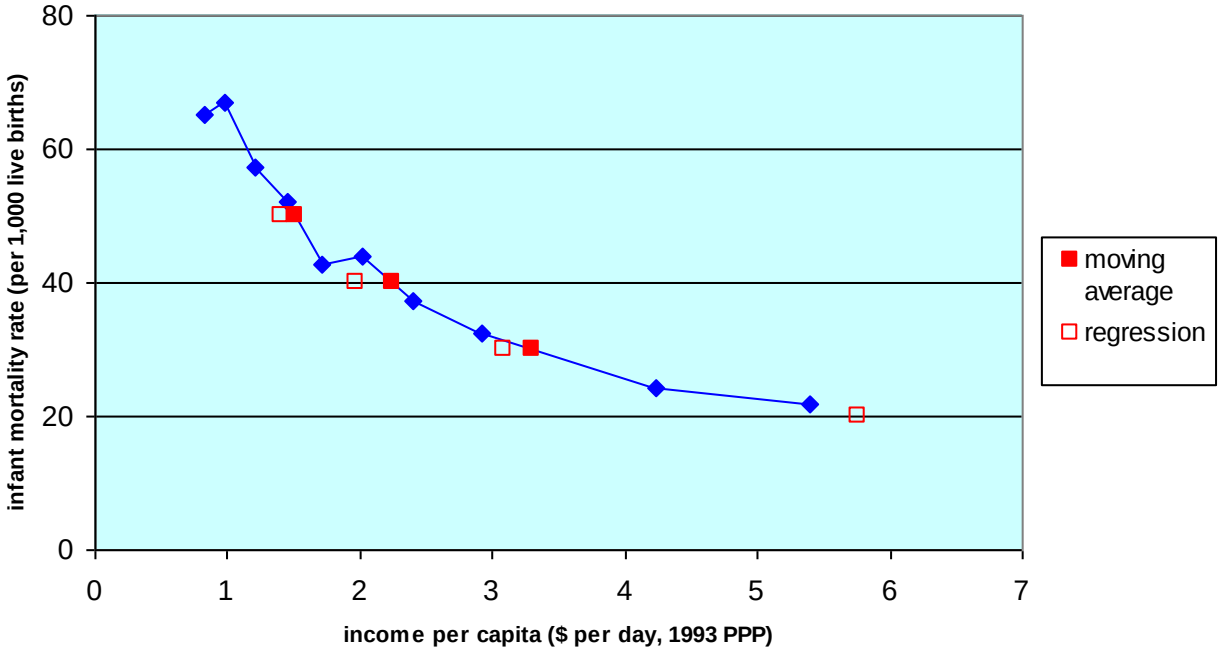


Figure 48: RBPL Estimation (Moving Average Approach) – Nicaragua

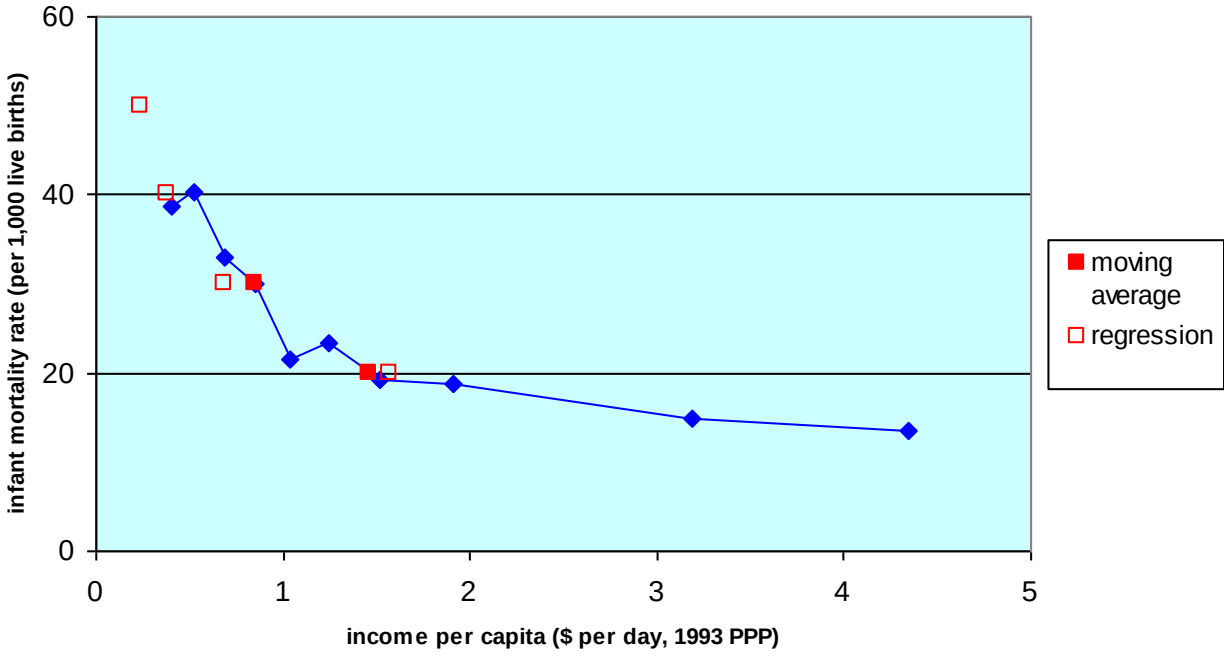


Figure 49: RBPL Estimation (Moving Average Approach) – Senegal

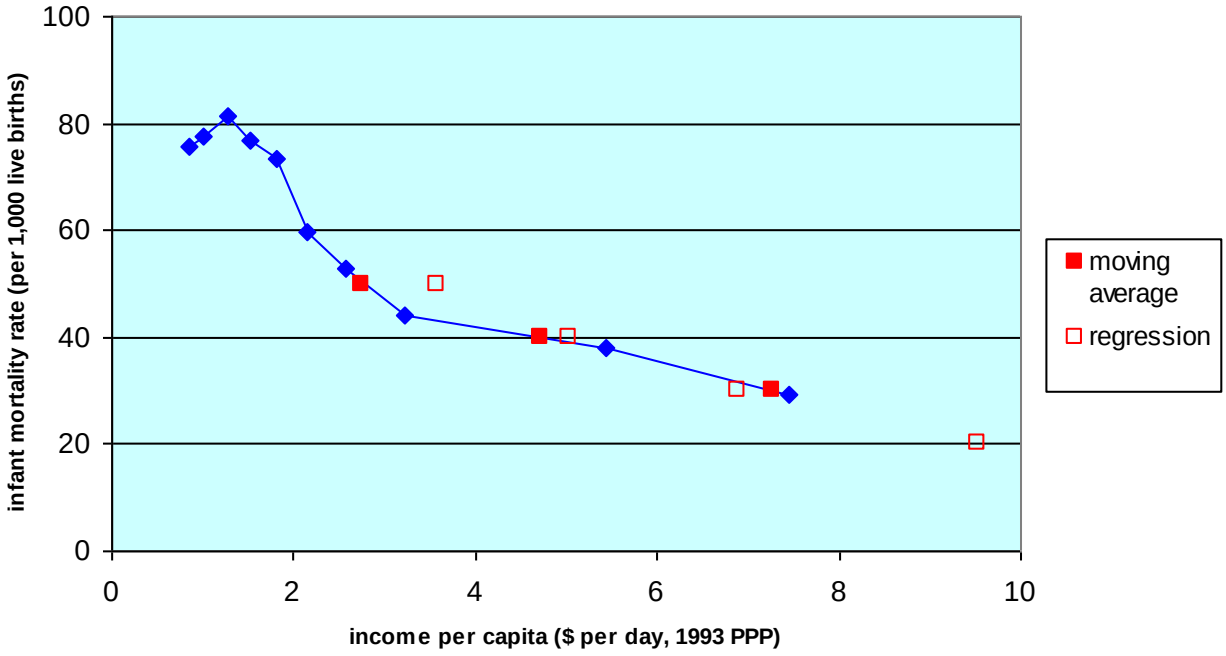
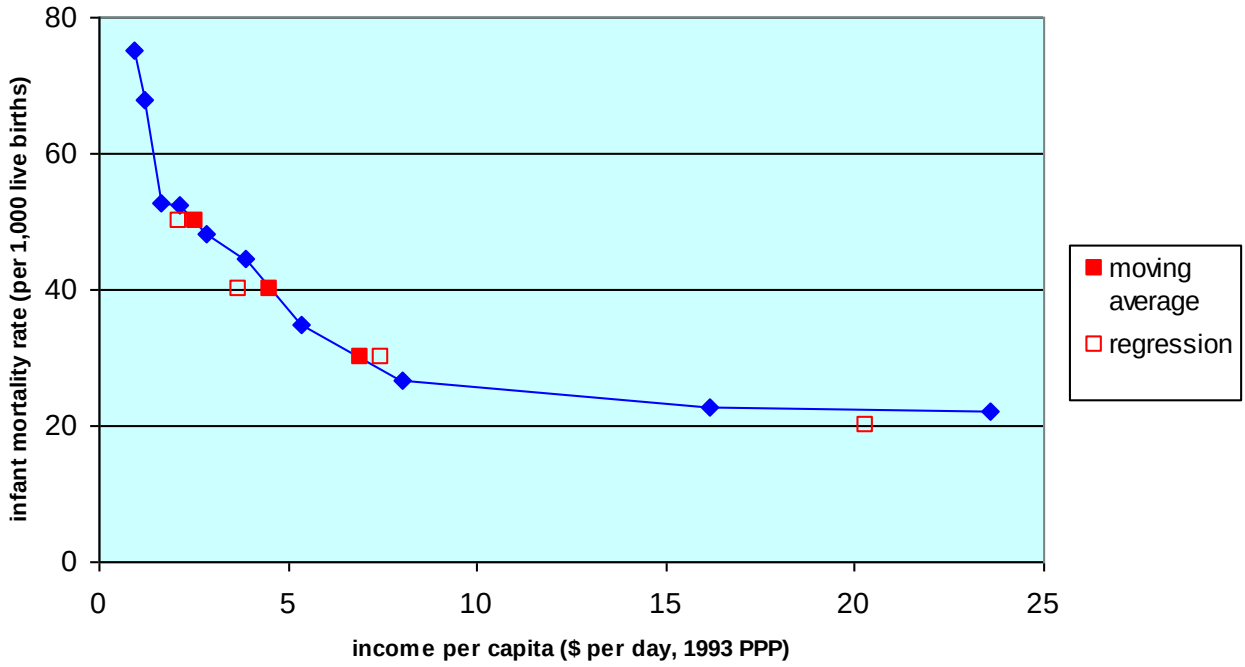


Figure 50: RBPL Estimation (Moving Average Approach) – South Africa



This approach has two very visible effects in comparison with the non-regression approach. The first is to reduce the number of observations where the result is ambiguous, from five to two (RBPL(30) in Egypt and RBPL(40) in Nicaragua). The second, less helpfully, is that the effective truncation of the income range associated with the changed observations for the first and tenth deciles is to increase the number of country/threshold combinations for which an RBPL cannot be interpolated, from five to nine (nearly one-third of the total).

Proposed Approach to Estimation of RBPLs

The five analytical approaches presented here show a high level of correlation, and the variation between different methods for the same country/threshold combination is much less than that between countries at the same threshold, or between thresholds in the same country, for any of the methods. Nonetheless, there are significant differences in the results between the five methods – and in some cases, particularly in the upper part of the income distribution, where the income/IMR relationship is flattest, these are very considerable. This makes the results quite sensitive to the choice of method. In order to generate a definitive set of results, we therefore need to identify a particular approach to estimation.

Where the non-regression approach provides an unambiguous result – as in the majority of cases considered here – there seems no good reason to prefer any of the other methods, all of which, as noted, produce results in some cases which appear at odds with an intuitive interpretation of the data without self-evident justification. In some cases, however, the results of this approach are ambiguous, effectively forcing us to choose between two (or potentially more) alternative RBPLs. In some such cases (eg urban India at IMR = 30 or 40), as noted above, the non-regression result appears clear-cut, but the other methods generate counter-intuitive results. In such cases, there would again seem a strong case for adopting the non-regression method.

In other cases, however, there is a genuine ambiguity, in that there is a markedly different candidate RBPL which only marginally fails to qualify. In the case of Egypt at IMR = 30, for example, the cut-off is defined as lying

between the third and fourth deciles (where it is estimated at $3.12), because the average IMR for the fourth and fifth deciles is 30.6. However, this is only marginally above the threshold level, and well within the margin of error. If it were marginally below 30 rather than marginally above, the cut-off would be defined as being between the fifth and sixth deciles, and the RBPL would be estimated at $2.19. A more plausible interpretation would seem to be that the 'true' RBPL lies somewhere between these two points. This suggests that one of the other methods might be preferable in such cases.

If we accept the principle that the non-regression approach represents the first-best option where it generates an unambiguous result, then we are left with two questions:

a) how should we define the point at which the results generated by the non-regression method are sufficiently ambiguous to require the use of a second-best method? and

b) which second-best method should be applied in these cases?

We propose as a criterion to determine the ambiguity or non-ambiguity of the non-regression results, the ratio between the aggregate excess and the aggregate shortfall from the IMR threshold of deciles within the relevant range of income. That is, we define a range of ambiguity from the lowest-income decile with IMR below the threshold level to the highest-income decile with IMR above the threshold level; we calculate the sum of the differences between the observed IMR and the threshold IMR for all deciles within this range with IMR above the threshold (Σ_1), and the equivalent figure for all deciles with IMR below the threshold (Σ_2); and we take the ratio ($R = \Sigma_1/\Sigma_2$) between these two. Where this ratio is less than 0.25, we select the lower candidate RBPL; where it is greater than four, we select the higher candidate RBPL; and where it lies between the two, we consider the result to be ambiguous.

In our sample, this defines two results as ambiguous (RBPL(30) in Egypt (R = 1.19) and RBPL(50) in South Africa (R = 0.37)) while indicating decisive results for two others (RBPL(40) and RBPL(30) in urban India, with R = 8.64 and 0.22 respectively). While further consideration could be given to the appropriate threshold levels for this ratio, these findings would be robust to any threshold level within a range of 2.7 to 8.6.

In terms of the second-best method, there seems little reason to prefer the overall regression approach to the segmented regression method. The former gives rise to the risk that the results will fail to reflect trends over the relevant range of incomes as a result of the pattern of observations at much lower or higher incomes. In the case of Senegal, for example, the overall regression results are substantially affected by the observations of the lowest four deciles (with per capita income of $0.75-$1.52), so that the gradient of the estimated curve for the first to fourth deciles (income per capita $2.53-$9.15), where all of the IMR thresholds lie, is clearly steeper than that indicated by the observations themselves. The result is a clear over-estimation of the RBPLs. We therefore reject this method as a second-best option.

Equally, there seems little reason in principle to prefer the segmented regression approach, which relies on regression over fixed income ranges, over the hybrid approach, which applies regression over a range specific to (and as far as possible symmetrical about) the threshold under consideration. In the particular case of Egypt at IMR = 30, however (and potentially in other cases if the method were more widely applied), the hybrid approach performs very poorly, with $R^2 = 0.132$, which makes it somewhat questionable to rely on the results. It also produces a result

slightly *below* the range implied by the two possible estimates generated by the non-regression approach ($2.14), which is again counterintuitive.

This leaves the option of the moving average approach. Here, however, there are two disadvantages. First, as noted above, the income range considered is somewhat truncated, so that there are more thresholds for which the RBPL is undefined. Second, while the pattern of observations is somewhat smoother, the possibility of ambiguous results remains – as, for example, in the case of RBPL(30) in Egypt. This would require us to adopt a third-best method for use in such cases, which makes the process unduly complex.

We therefore propose the adoption of the hybrid approach as the second-best method. In cases where the regression over the relevant income range is performs too poorly for the result to be regarded as reliable (say $R^2 < 0.4$), we propose to allow the sample considered to be widened or narrowed (since there are by definition at least six observations in ambiguous cases), by adding or removing one decile at each end of the range. In the particular case of RBPL(30) in Egypt, narrowing the sample is counterproductive, lowering the optimal R^2 still further to 0.033; but increasing the sample increases it to a much more satisfactory level (0.62). This also gives a result ($2.38) within the range of $2.19-3.12 implied by the non-regression approach.

We thus propose the following process for the estimation of RBPLs:

1. The non-regression method should be applied to all cases in the first instance.
2. Where this provides an unambiguous result, this should be adopted as the RBPL.
3. Where this condition is not fulfilled, the hybrid approach should be applied, and the result used where the R^2 is greater than 0.4.
4. Where R^2 is less than 0.4, the sample should be extended or narrowed as described above to optimise the performance of the estimated relationship, and the RBPL should be estimated on this basis.
5. Where R^2 remains below 0.4, the sample should be widened progressively until R^2 reaches this level.
6. If R^2 remains below 0.4 for all regressions (implying that this is also the case for the overall regression approach), the regression with the highest R^2 should be used, and the result adopted as the RBPL.
7. Where all deciles have IMR above the threshold level, this should be indicated as interpreting that the RBPL lies above the average income of the highest-income decile.
8. Where all deciles have IMR *below* the threshold level, this should be indicated as interpreting that the RBPL lies *below* the average income of the *lowest*-income decile.

While this leaves RBPLs indeterminate for country/threshold combinations where all deciles have average IMRs either above or below the threshold level, this is inevitable without both more detailed distributional data and larger sample sizes.

For our sample of six countries, this generates the results shown in Table 7.

Table 7: Estimated RBPLs – Final Results

	RBPL			
	50	**40**	**30**	**20**
Bolivia	1.51	3.21	6.84	14.58
Egypt	<1.12	1.58	*2.14**	7.96
India (rural)	1.96	3.11	>3.32	>3.32
India (uban)	1.36	*2.06**	*3.16**	5.84
Nicaragua	<0.35	*0.42**	0.77	*1.49**
Senegal	2.39	4.27	7.21	>9.15
South Africa	*2.30**	4.51	5.17	27.25

Note: * figures in italics are based on the hybrid approach; others are based on the non-regression approach.

These results indicate very wide differences in estimated RBPLs – between $0.42 and $4.51 per day at an IMR of 40/1,000, the only threshold which falls within the range of decile income averages in all nine samples . Of course, the identification of different poverty lines in different countries is the objective of the exercise – and the wide range of living standards at an equivalent level of income (in PPP terms) which these results represent can be seen as reinforcing the case for a country-specific and outcome-based poverty line. However, the scale of the differences is perhaps surprising.

This variation may, in part, reflect problems in the estimated PPP exchange rates. It is noteworthy, for example, that Nicaragua has estimated RBPLs far below any of the other countries (65-75% below the next lowest). Together with the surprisingly low capability-based poverty line found by Reddy et al[129], this may indicate that the estimated PPP conversion factor does not accurately reflect the purchasing-power of poor households.

Otherwise, as noted above, the differences may be interpreted as reflecting inter-country variations in living standards (and more specifically, in the present context, health outcomes) at a given level of income. Thus the high RBPLs in South Africa and Senegal (relative to the other countries in the sample) may in part be a result of the marked differences between Sub-Saharan and other countries discussed earlier – the differences between the results for these countries and Bolivia and rural India seem broadly commensurate with this interpretation.

Equally, the higher lines in rural than in urban India are likely to reflect differences in access to health services, education, etc, in rural areas. It should be noted that this is a reversal of the result of a purchasing-power approach, which implies a higher line in urban areas as a result of generally higher prices.

One issue we have not addressed is the appropriate level of the IMR threshold. Viewing this pragmatically, one could argue that our results provide a case for setting this at 40 per 1,000 live births, as the one level at which there is a clear result in all our countries. However, we would argue that this is inappropriate, for three reasons.

- First, such a pragmatic criterion for setting the threshold would be at odds with the explicitly moral base which underlies this approach.

- Second, the absence of definitive results for some thresholds in some countries is a result only of data deficiencies – it amounts only to saying that the threshold should lie between the lowest IMR for the lowest-income decile and the highest IMR for the highest-income decile in any country. There is no obvious rationale for this, beyond the purely pragmatic one of maximising the number of definitive results which can be estimated on the basis of existing data.
- Third, while a threshold of 40 maximises the number of definitive results within the current sample, this would not necessarily be the case for a larger sample or for developing countries as a whole. In the latter case, it seems inevitable that no threshold would allow the estimation of definitive poverty lines for all countries on the basis of existing data.

It will be easier to discuss this issue when more results are available. In principle, however, we would argue on moral grounds for a threshold no higher than 20/1,000. While it is not realistic to require as a right that all households should have the lowest IMR currently obtainable by any income group in any country, it would seem difficult to argue that they do not have a right to an IMR no more than three times the average level in the developed world.

Directions for Future Research

The analysis presented above can only be considered to be a first tentative step towards the development of rights-based poverty lines, and the results, while indicative, leave much room for improvement.

The most obvious next step is the application of the methodology proposed above to a wider sample of countries, including those where the relationship between asset scores and infant mortality is less strong. This will provide a useful indication of the viability of the proposed approach, and may indicate useful modifications and/or refinements.

A second step is the application of the method to other income-sensitive indicators of rights attainment covered by DHS surveys. These might include, for example, nutrition (eg based on low birthweight, height-for-age, weight-for-age and/or weight-for-height) and education (eg based on primary school attendance and/or completion).

In both cases, it would also be instructive to conduct comparable analyses for the same countries on the basis of earlier (and future) DHS surveys, to assess the consistency of the estimates and trends in rights-based poverty lines and poverty incidence over time. More comprehensive coverage would also provide a basis for an investigation of the determinants of differences in country performance in terms of the levels and trends of different RBPLs and the incidence of poverty based on them.

It would also be useful to investigate the feasibility of conducting more detailed analysis of the upper and lower parts of the income distribution as a means of estimating RBPLs which occur near the top or the bottom of the income distribution (ie above the average income of the second decile or below that of the ninth), so as to allow the estimation of definitive RBPLs in a greater proportion of countries. However, the potential for this approach may be limited in view of the limited sample sizes in most DHS surveys.

In view of the difference in the results between rural and urban India, consideration could also be given to separate analyses of rural and urban areas – although limited sample sizes would again be a constraint. (India has the largest sample of any DHS survey country, by a wide margin.) The relatively large sample in India could also provide a basis for separate regional analyses, if income distribution data are also available on this

basis, as a means of assessing possible regional variations elsewhere – although the size and diversity of India means that caution would be required in assessing the implications of the results for other countries.

Other refinements to the analysis which might usefully be considered include:

- the possibility of using samples combining two or more DHS surveys where these are conducted within a relatively short period, in order to ameliorate problems of limited sample sizes;
- the possible need to adjust asset scores for household size and composition, and appropriate means of doing so;
- the appropriateness or otherwise of introducing rural-urban dummy variables into the analysis.

Even with such refinements, however, there are limits to how rigorous the analysis could be on the basis of existing data, partly because of limited sample sizes, but also because of the need to rely on asset scores as a proxy for overall income. The ideal would, of course, be to combine DHS surveys with household expenditure surveys, so that data on income and mortality (and other health indicators) would exist for the same households, allowing direct estimation of their relationship. However, the scale and complexity of both types of survey are like to make this impracticable.

A second-best option, which might be more feasible, would be to include in household expenditure surveys a range of income-sensitive asset variables included in demographic and health surveys. Direct estimation of the relationship between asset scores and incomes, on the basis of multiple regression analysis, would then provide a basis for more reliable income estimates from DHS data. This could substantially improve the reliability of the analysis.

In the absence of such data, it may be useful to experiment with alternative approaches based on the existing data, and to compare the results. One possibility would be to rank households in terms of the relevant outcome indicator, and assume exact rank correlation with per capita income[130]. This would again be an approximation, but not necessarily a less reliable one than the assumption of rank correlation between income and asset scores, and one which would by definition strengthen rather than weaken the estimated income/outcome relationship.

This approach would not be feasible for infant mortality, as the ‘on-off’ nature of the household-level data (each child either dying or not dying before 12 months) means that household ranking by outcomes does not give sufficient gradation to provide a mapping against incomes. The same problem would apply to some other indicators, such as school enrolment (each child either attending or not attending school). However, this approach would in principle be viable for indicators which are continuous in nature, for example nutritional indicators.

Conclusions

Developing the '$1-a-day' poverty line, and estimating global poverty on this basis, has been a major technical feat, and has helped considerably in raising the profile of poverty as a global issue. However, the actual numbers must, for a number of reasons, be regarded as unreliable and potentially misleading as to the level, pattern and trends of poverty, raising serious risks of ill-informed policy conclusions. Specifically, the headline poverty numbers presented (and heavily promoted) by the World Bank seriously under-estimate the extent and severity of poverty, and are likely to exaggerate its rate of reduction, by any definition of poverty consistent with tenable moral judgments or interpretations of economic and social rights. While some other proposed approaches offer some promise in principle (the most promising, in our view, being Peter Edward's Ethical Poverty Line), they fall short of resolving the fundamental problems in the current approach.

In this paper we have presented an alternative 'rights-based' approach, based on the principle of standardising poverty lines between countries, not on the basis of fixed real per capita consumption levels (given serious problems of comparability and conversion factors), but rather according to the level of income which is *in practice* associated with the attainment of a threshold level of income-sensitive indicators of economic and social rights in each country. We have also made a preliminary attempt to estimate poverty lines on this basis, using the infant mortality rate as an indicator, in a number of developing countries.

The actual results presented in this paper should be treated with some caution. Our primary objectives have been to develop the concept of rights-based poverty lines, to make a first step in the development of a method for estimating them, and to identify possible next steps in its refinement, and the data needs for a more rigorous analysis.

Nonetheless, our results do demonstrate the order of magnitude of the differences in living standards associated with incomes considered by a fixed global poverty line to be equivalent. This casts serious doubts on the appropriateness of 'money-metric' approaches which seek to standardise poverty lines across countries in terms of a specified level of 'real' consumption, however the international standard is set. If our concern with poverty arises because of its implications for living standards, and the same level of 'real' consumption implies widely differing living standards in different countries and contexts, it is difficult to justify such an approach.

This represents a strong justification for the type of approach adopted in this paper. Clearly, however, there is a need to improve the analytical methods from the base we have established. We have proposed some steps in this direction which might be possible on the basis of existing data; but a more rigorous approach would require additional data, and changes in household survey methods.

There is also a need for empirical studies to establish poverty lines based on other rights. The right to universal access to primary education would be a high priority, given its importance to other rights (notably to health) and to development, as well as its importance as a means of reducing income poverty (and lowering RBPLs based on health and child survival), coupled with the availability of data which would allow a similar approach to that used in this paper.

Endnotes

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[92] Mollie Orshansky (1965) 'Counting the Poor: Another Look at the Poverty Profile'. *Social Security Bulletin* 28:3-29.

[93] Sanjay Reddy and Thomas Pogge (2005) op. cit., Table 6B.

[94] Sanjay Reddy, Sujata Visaria and Muhammad Asali (2006), op. cit

[95] Sanjay Reddy (2004) op. cit.; Sanjay Reddy (2004) op. cit.

[96] Sanjay Reddy, Sujata Visaria and Muhammad Asali (2006), op. cit., p3.

[97] It should be noted that the country-specific nature of Reddy et al's approach means that it is not dependent on PPPs as a basis of cross-country comparison. Rather, the figures given here should be interpreted only as an indication of the discrepancy between the '$1-a-day' line and that estimated by Reddy et al for each country.

[98] PovCalNet, World Bank. http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp

[99] However, recent analysis suggests that some caution may be required in cross-country comparisons of height-for-age (and by implication, because it is correlated, weight-for-age) on a global level. See Angus Deaton (2007) 'Height, Health and Development'. *Proceedings of the National Academy of Sciences* 104(33), August.

[100] PovCalNet, World Bank. http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp

[101] World Development Indicators Online, World Bank (www.worldbank.org).

[102] Samuel Preston (1975) op. cit.

[103] Peter Edward, private communication.

[104] While the figures used by Edward, and generally quoted elsewhere, are $2.70 and $3.90, these are in fact multiples of the '$1-a-day' line – that is, of $1.08 per

day at 1993 PPP. In the interests of consistency, we have adjusted all Edward's results to 1993 PPP.

[105] PovCalNet, World Bank. http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp

[106] Peter Edward (2006) op, cit., p383.

[107] Samuel Preston (1975) op. cit. p835.

[108] Angus Deaton (2006) op. cit.

[109] Thomas Pogge and Sanjay Reddy (2006) op. cit.

[110] For a dramatic visual illustration of this, and of the evolution of the relationship between GDP per capita and life expectancy more generally, see www.gapminder.org.

[111] Peter Edward, private communication.

[112] Peter Edward, private communication.

[113] Peter Edward, private communication.

[114] WHO (2004) *World Health Report, 2004: Changing History*. Geneva: World Health Organisation. Annex Table 3.

[115] www.gapminder.org

[116] It should also be noted that the impact of HIV/AIDS on life expectancy in Sub-Saharan Africa may be accentuated to the extent that access to anti-retroviral therapy is more limited than in other developing regions.

[117] Roberto De Vogli and Gretchen L. Birbeck (2005) 'Potential Impact of Adjustment Policies on Vulnerability of Women and Children to HIV/AIDS in Sub-Saharan Africa'. *Journal of Health, Population and Nutrition*, 23(2):105-120.

[118] Deaton, Angus (2007) op. cit.

[119] Adam Wagstaff (2003) op. cit.

[120] Srinivasan (2004) op. cit.

[121] In practice, results for life expectancy at birth would closely mirror those for infant and under-5 mortality. However, while the ideal would be to calculate age-specific mortality rates, the data requirements make such an approach infeasible.

[122] ECOSOC (2006) 'Economic, Social and Cultural Rights: Report of the Special Rapporteur on the Right of Everyone to the Enjoyment of the Highest Attainable Standard of Physical and Mental Health, Paul Hunt'. United Nations Economic and Social Council, New York, 3 March. E/CN.4/2006/48. http://www2.essex.ac.uk/human_rights_centre/rth/docs/CHR%202006.pdf

[123] Nanak Kakwani (2006) 'What is Poverty?' One Pager No. 22, UNDP International Poverty Centre, September.

[124] Angus Deaton (2002) , 'Poverty for Monitoring the Poverty MDG'. Mimeo, Research Programme in Development Studies, Princeton University, p14, as quoted in Karshenas (2004) op. cit.

[125] The authors are grateful to Adam Wagstaff of the World Bank for highlighting the importance of this issue.

[126] PovCalNet, World Bank. http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp

[127] BLISS (2006) 'Top Ten Worst Places in Britain for Infant Mortality'. Press Release, 28 March, BLISS National Charity for the Newborn, London. http://www.bliss.org.uk/pagebuild.php?texttype=press280306.

[128] PovCalNet, World Bank. http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp

[129] Sanjay Reddy, Sujata Visaria and Muhammad Asali (2006), op. cit.

[130] The authors are grateful to Peter Edward for this suggestion.