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How are we doing on poverty and hunger reduction? A new measure of country performance

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ABSTRACT

The paper presents a new composite indicator – the poverty and hunger index (PHI) – to measure countries' performance toward achieving millennium development goal No.1 (MDG1) on halving poverty and hunger by 2015. Building on the statistical structure of the human development index, the PHI combines all five official MDG1 indicators, thereby generating insights on a country's net progress towards its own goal, as opposed to progress measured by a single yardstick. Nonparametric analysis on the PHI components provides further evidence on the nature of the relationship between poverty and hunger measures, while cross-country results show significant variance in progress between and within regions. An extension of the PHI allows for consideration of the rate of progress made by each country in its own terms; that is, based on where it needs to be to attain all 5 MDG1 targets by 2015. Countries needing priority attention are identified, as well as areas for future research and recommendations for post-2015 initiatives.

Introduction

In the year 2000, all member states of the United Nations pledged to support a new global initiative to eradicate poverty, foster development and promote peace while emphasizing the collective responsibility to uphold the principles of human dignity, equality and equity (United Nations, 2000). Such global commitment resulted in the *millennium declaration* which also embodied the *millennium development goals* (MDGs).

The MDGs represent a set of benchmarks covering various dimensions of human deprivation that were derived from a series of single-topic summits during the 1990s, including the World Summit on Children in 1990, the World Summit for Social Development in 1995, and the World Food Summit in 1996. The MDGs were the first global initiative that made explicit the cross-sectoral synergistic nature of developmental problems (and solutions), while also setting time-bound targets to addressing them as a set, rather than individually (United Nations, 2005b). As argued by The Economist (2005, p. 67) "governments are having to frame their policies around specific intended outcomes, rather than policy inputs. It is a bigger change than you might suppose".

Eight MDGs were established, articulated around 18 targets. This article focuses exclusively on the first MDG (hereafter referred to as MDG1), which seeks "to halve, by the year 2015, the proportion of world's people whose income is less than one dollar a day and the proportion of people who suffer from hunger" (United Nations, 2001, p. 19).

How to measure 'poverty' and 'hunger' becomes a first challenge—necessary if we are to effectively assess country performance. In this regard, five official indicators were identified:

1. The proportion of population living on less than US$1/day.
2. Poverty gap ratio.
3. Share of the poorest quintile in national income or consumption.
4. Prevalence of underweight children (under five years of age).
5. Proportion of population undernourished.[1]

The first MDG1 indicator, also known as 'poverty headcount index', defines the percentage of population living below an international poverty line (US$1 per person per day) based on 1985 PPP, or US$1.08 based on the 1993 PPP (UNDG, 2003; United Nations,

[1] Halving global undernourishment by 2015 is also the target of the 1996 World Food Summit and of its follow-up in 2002. However, the WFS target was set in absolute terms and entailed a commitment to lift 412 million people out of undernourishment by 2015 (823.1 million is the 1990 baseline); the MDG1, instead, is expressed in relative (%) terms. The latter would likely be less ambitious to achieve because of population growth.

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2001).[2] This is an intuitive indicator that allows cross-country comparisons. However, it does not capture depth of poverty. The latter is provided by the second MDG1 indicator – the poverty gap ratio – which measures distance from the poverty line (the non-poor being given a distance of zero), expressed as a percentage of the poverty line (Chen and Ravallion, 2004; Deaton, 2003).

The third official MDG1 indicator is an index of inequality that measures how much national income or consumption accrues the poorest subgroup of any population when divided into quintiles. Unlike the widely-used Gini index, this indicator does not seek to capture generalized national inequality but focuses on inequality at the bottom end of the poverty distribution.[3]

The prevalence of underweight, the fourth indicator, reflects the share of preschool children with a low weight relative to their age compared against an international benchmark (calculated at <−2SD from the median value of an international reference[4]) (Chhabra and Rokx, 2004).

Finally, the fifth official measure refers to "undernourishment". This method, developed by the UN Food and Agriculture Organization (FAO), involves the estimation of a distribution function of dietary energy consumption on a per-person basis. The mean of this distribution refers to the usual food consumption level and is estimated by the daily dietary energy supply per capita for a country derived from its food balance sheet (averaged over three years). The variance, as measured by the coefficient of variation, is derived on the basis of food consumption or income data from household income and expenditure surveys. The proportion of undernourished in the total population is defined as that part of the distribution lying below a minimum energy requirement level derived by taking into account the sex and age distribution of the country's population and assuming the minimum acceptable body weight for given height for all sex–age groups and light activity levels for adults.[5]

Despite the fact that these five official measures have equal status, there has been a tendency to conflate them into a general discussion of "poverty".[6] As noted by the FAO, "hunger is often all but ignored in discussions of MDG1, just as it has, for far too long, been all but invisible on the development agenda" (FAO, 2005, p. 37). Putting hunger aside in discussion of MDG1 goals and reducing its metric to "poverty" alone would lead to (a) obscuring the multidimensionality of *both* poverty and hunger; (b) restricting discussion of potential solutions to those that only impact directly on the poverty metric; and (c) masking the fact that policies or investments may support improvement in one of the five official targets, but not others. As a result, there has been a call for action "to refine the methods used for measuring progress toward the millennium development goal" (DFID, 2002, p. 29).

The new poverty and hunger index (PHI) presented here responds to that call. The article is structured as follows. Section 'Methodology' describes the rationale and statistical methodology underpinning the construction of the PHI. Empirical results from cross-country analysis are presented in the third section, while Section 'Conclusions' concludes and sets out implications for the MDG agenda.

Methodology

Taken separately, the five MDG1 indicators provide a fragmented and sometimes contradictory picture: that is, they tell little about net progress towards reaching the overall *goal*. For example, Fig. 1 shows trends in for four Latin American countries during the 1990s. Their performance varied according to the dimension analyzed. Progress in reducing income poverty was remarkable in Guatemala, yet undernourishment rose over the same period by 8% points. Conversely, in Bolivia poverty rose steeply but malnutrition improved. Venezuela also showed diverging trends between undernourishment and malnutrition, while the rate of poverty reduction in Brazil was considerably higher than its success in reducing malnutrition.

Such heterogeneous scenarios limit our understanding of each country's net progress toward MDG1 as a whole—where five dimensions are equally significant. Hence the value of a composite index that can calibrate and complement the information provided by individual measures.

Measuring the level of poverty and hunger

The statistical methodology of the PHI builds on UNDP's Human Development Index (HDI). The HDI was launched in the first *Human Development Report* (UNDP, 1990) which, after a number of fine-tunings and modifications, is widely used to rank countries according to three basic dimensions of human development: a long and healthy life (as measured by life expectancy at birth); human capital (as measured by achievements in education[7]); and a decent standard of living (measured by GDP per capita) (UNDP, 2005).

While UNDP has also introduced gender and poverty-specific composite indicators, empirical contributions have also expanded the original HDI beyond UNDP's dimensions (Chakravarty, 2003; Anand and Sen, 2000, 1996; Noorbakhsh, 1998a; Desai, 1991). More particularly, integration of inequality can be found in Foster et al. (2005) and Hicks (1997), while other analytical contributions focus on 'greening' the HDI with environmental dimensions (Costantini and Monni, 2005; Neumayer, 2001).

There are, to be sure, a number of shortcomings relating with composite indices, mainly to do with the selection of components, their weighting and possible compensations across the board, and the loss of fine detail in the aggregation process (Noorbakhsh, 1998b; Ravallion, 1996; McGillivray, 1991). These concerns are important. However, transparent conceptually-coherent, also have a place in communicating complex ideas and for informing policy decisions that cut across-sectoral domains (Wiesmann, 2006; OECD, 2003; Babu and Pinstrup-Andersen, 1994).

UNDP's HDI combines single indices for each of three dimensions noted above. For each, minimum and maximum values are assigned.[8] The HDI is then calculated as a simple average of the combined indices, formalized by the following basic equation:

$$\mathrm{HDI} = \sum_{i=1}^{3}[(x_i - \min_i)/(\max_i - \min_i)] \cdot 1/3$$

where i is the HDI dimension (i.e. life expectancy, education, GDP per capita), x the actual value of the dimension, and max and min

[2] See Bhalla (2002, p. 51–68) for an intriguing overview of the international poverty line history, and Reddy and Pogge (2005) for a critique.

[3] It should be noted, however, that measures based on income or consumption could differ considerably (Bhalla, 2002; Luchters and Menkhoff, 2000). The distribution of income is typically more unequal than the distribution of consumption; income is generally more difficult to measure accurately, and consumption accords better with the idea of the standard of living than income, which can vary over time even if the standard of living does not (UNDG, 2003).

[4] We only considered children underweight from 0 to 5 years of age to allow consistent comparisons between countries, and not underweight values for different age ranges (i.e. 0–36 months).

[5] See FIVIMS (2002), or http://www.fivims.net/static.jspx?lang=en&page=ISS_exesum#i.

[6] As stated by the World Bank (2005c, p. 2) "... prospects are promising for halving income poverty between 1990 and 2015 – the first MDG". See also Pogge (2004) for a case of restriction in the array of MDG1 indicators to the single US$1/day measure.

[7] The education component of the HDI is itself a composite index that combines adult literacy rate (with a 2/3 weight in the calculation), with the combined primary–secondary–tertiary gross enrollment ratio (with attached weight of 1/3).

[8] For example, life expectancy index is given a range from 25 to 85, while adult literacy rates range from 0 to 100.

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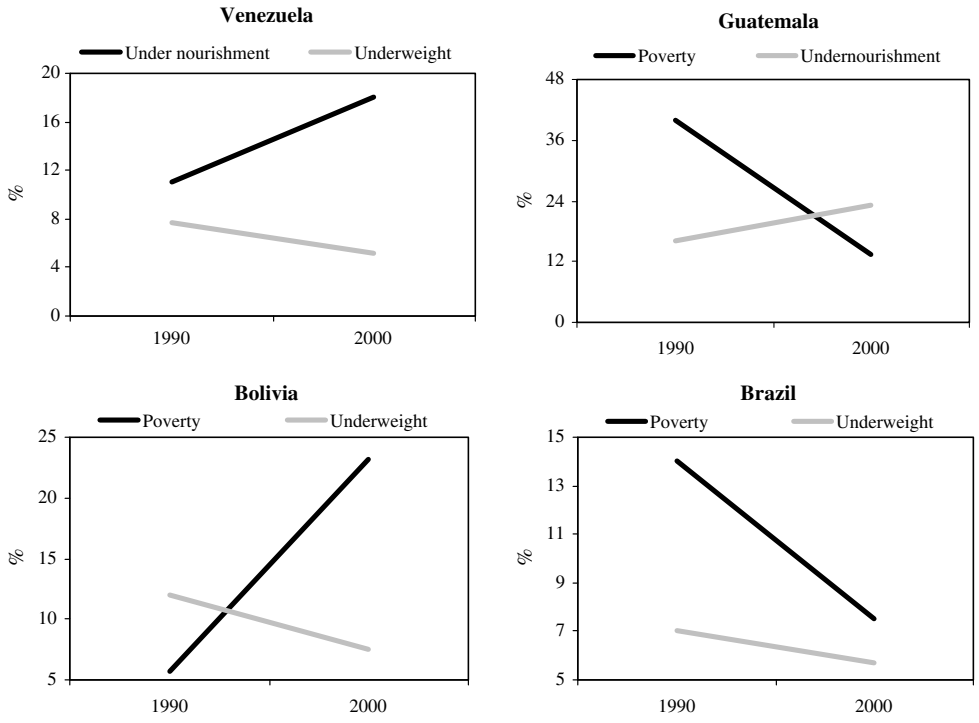

Fig. 1. Poverty and hunger trends in four central and Latin American countries.

its goalposts. The HDI values range from zero (lowest level of human development) to 1, allowing for a ranking of countries on this scale (UNDP, 2005–1990).

Following the same statistical structure, the new PHI combines the five official MDG1 indicators, equally weighted because no hierarchy was envisaged by the framers of the MDGs.[9] Minimum and maximum values were chosen for each underlying indicator (Table 1).

The PHI is then constructed as follows:

$$\mathrm{PHI} = \sum_{i=1}^{5}[(x_i - \min_i)/(\max_i - \min_i)] \cdot 1/5$$

where, similar to the HDI, i represents the PHI dimension, x the actual value of the dimension, and max and min its goalposts.[10] Such an approach generates an index that takes all five separate measures into account simultaneously. Fig. 2 below illustrates the values of the dimensional indices and overall calculation of the PHI for Brazil.

This is already of value, since it demonstrates the nuances involved in tracking the 5 adopted measures of progress. However, as with the HDI, the PHI is a static value. It can show net performance and rank countries accordingly (as is commonly done with the HDI). But the PHI can go further since it relates to defined timebound goals. The next section presents the methodology for constructing the PHI's more dynamic measure of progress (the PHI-P).

Table 1
PHI dimensional goalposts

MDG1 indicator	Max	Min
Proportion of population living on less than US$1/day	100	0
Poverty gap	100	0
Share of the poorest quintile in national income or consumption	20	0
Undernourishment	100	0
Underweight	100	0

Measuring progress in poverty and hunger reduction

A measure of progress (PHI-P) involves scaling the five PHI dimensions in terms of targets set for 2015, based on the MDG baseline year of 1990. The scaling of dimension i (Si) is derived by applying the usual formula involving an observation value (hereafter called '2000i'), and maximum and minimum values or goalposts (2015i and 1990i, respectively). The equation is formalized as follows:

$$Si = (2000i - 1990i)/(2015i - 1990i)$$

While '1990' refers to data closest to year 1990 for all the five dimensions, '2000' stands for 'latest available data' in those dimensions (i.e. the data used to construct the PHI). In this way, it is possible to relate the change between 1990 and 2000 to the desired change between 1990 and 2015.[11] Values range from 1 to $-\infty$, where reaching 1 means reaching the dimensional goal (e.g. halving poverty according to 1990 levels by 2015), 0.5 indicates being on track with the dimensional goal, 0 is equal having made no progress, and negative numbers indicate a reversing trend.

In order to rightly interpret the results, it should be noted that, on the one hand, the MDG framework does not explicitly set a quantitative target for the inequality index, creating an information gap on how to interpret and measure changes over time. Therefore, in line with the 'cutting by half' approach set by the United Nations,

[9] During the process of development of this article, we also investigated the results emerging from different weight configurations. For example, we simulated a scenario with 1/2 weight to the average value of the first three 'poverty-oriented' indexes, and 1/2 to the average value of the other two 'hunger-oriented' ones (underweight and undernourishment). Results were not significantly different from those presented in Section 'Results'.

[10] Note that in order to be consistent with the HDI methodology of 'higher values imply better status', an additional operation had to be undertaken for all the individual indicators – i.e. the ratio had to be subtracted from 1 so that better values tend to 1, and the worse ones tend to zero. This was needed because the relationship between the PHI and its dimensional indices is inverse by construction. This operation does not apply to the third MDG1 index, the share of the poorest quintile, as its higher values already signal better performance.

[11] Our underlying assumption here is that indicators will change linearly.

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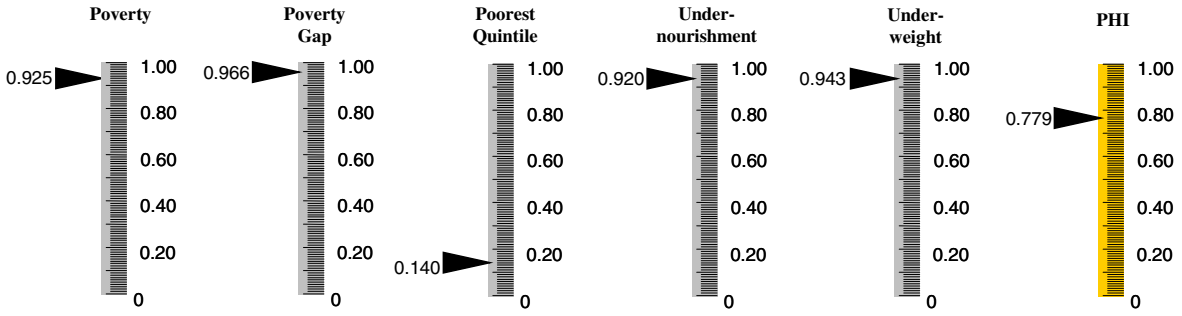

Fig. 2. Calculating the PHI for Brazil.

we set an increase by 50% in the share of the poorest quintile based on the 1990 baseline as the target for 2015.[12] Such operation should be taken into account when interpreting the result from our analysis. On the other hand, the value 1 represents an artificial limit: in the few cases where the dimensional value exceed 1 (i.e. when a country halved the rate already in 2000), corrections were made to equalize it to 1. In other words, value 1 represents reaching MDG1, no matter if the target was reached or exceeded.

Bearing in mind these considerations, for any given country the corresponding PHI-P is calculated as the average of the scaled dimensions, as the following equation shows:

$$\text{PHI-P} = \sum_{n=1}^{5}(S_i) \cdot 1/5$$

Thus, reaching MDG1 is quantified in the form of a single number, value '1' of the PHI-P. A value in the PHI-P of 0.5 indicates being on track to meet MDG1 (or that 50% of the path towards MDG1 has been completed); a 0, again, represents no progress; finally, negative numbers indicate a reversing trend. Note that MDG1 is attained when all five-dimensional indexes are met (i.e. are equal to 1), excluding possible compensations across the board between different components.[13] As for other composite indicators, when MDG1 is not achieved (values lower than 1) compensations are possible. The next section presents empirical results emerging from applying the PHI to country poverty and hunger data.

Results

The results presented in this section are based on data provided by the United Nations and its specialized agencies, and by the World Bank.[14] Detailed data and surveys are reported in Annex 1. The following Sections 'Poverty and hunger levels and Progress toward MDG1' present our empirical findings on countries' poverty and hunger levels and their progress toward MDG1.

Poverty and hunger levels

Data for the five MDG1 indicators were compiled for 83 countries which together account for around 90% of world poverty and 85% of global undernourishment (World Bank, 2007a–1997a; 2007b–1990b; FAO, 2006–1999; WHO, 2007). Applying the statistical methodology described above, the 83 countries for which data are available were ranked in Table 2.

Although the data cover most developing countries, the lack of information for one or more of the five dimensions limits possible analysis, especially when constructing trends. Indeed a key recommendation of this paper is that strengthening country statistical capacity to generate reliable data on MDG1 indicators is important, without which we cannot have a clear understanding of progress in countries like Afghanistan, Angola, Eritrea, Haiti, North Korea, Somalia and Sudan (United Nations, 2005c; Prabhu, 2005; UNDP, 2003).

Based on available data, nonparametric correlation analysis outlined in Table 3 supports most of the research findings from the literature on the relationship between poverty and hunger measures.

The analysis finds that the measurements of poverty and poverty gap (highly correlated by construction), are only weakly correlated with the measure of inequality. This result needs to be interpreted in light of the vast literature on poverty and inequality. While the nature of the relationship between poverty (measuring absolute deprivation) and inequality (capturing relative deprivation) is much debated, evidence suggests that while aggregate economic growth is significantly correlated with reduced poverty, such benefits may not translate in linear fashion into socio-economic improvements for the poorest (Milanovic, 2003; Dollar and Kraay, 2002; Thorbecke and Charumilind, 2002). Indeed, there may still be considerable 'churning under the surface', which in turn warns against making general conclusions based on averages (Ravallion, 2001). That said, there is growing recognition that the trade-offs between equity and efficiency seem less pronounced than often perceived[15] (Ravallion and Lokshin, 2006; Ravallion, 2005a,b). Moreover, recent econometric simulations show that, *ceteris paribus*, reducing inequality may accelerate poverty reduction in longer run (Bourguignon, 2003; De Ferranti et al., 2003).

[12] An alternative would have been to drop the inequality indicator. In both cases, however, an arbitrary choice had to be taken: dropping the index or setting a new target. Given the interlinked nature of poverty, hunger and inequality, we opted for the latter, more inclusive solution. On the methodology side, we deem the 'increasing by half' approach more coherent with the spirit of the MDG1 rather than other options like, for example, doubling the share of the poorest quintile by 2015, filling the gap between the observed value and a value of 20% in 2015, or halving such gap.

[13] For example, Brazil already halved poverty in 2000 based on the 1990 baseline values.

[14] Data on poverty and poverty gap derive from the United Nations Millennium Indicators Database (http://millenniumindicators.un.org/unsd/mi/mi_goals.asp, accessed on April 13th, 2005), while the share of the poorest quintile figures are taken from World Bank's *World Development Indicators* and complemented with data from the *World Development Reports* (World Bank, 2007a–1997a; 2007b–1990b). Data for undernourishment derive from the FAO's *State of Food Insecurity in the World* reports (FAO, 2006–1999). Child malnutrition data derive from national government surveys and available in WHO's Global Database on Child Growth and Malnutrition (GDCGM) (http://www.who.int/nutgrowthdb/). Data were cross-checked, and in some cases complemented by the UNSCN reports on the World Nutrition Situation (UNSCN, 2004, 2000), De Onis et al. (2004), and by UNICEF' *State of Children in the World* report (UNICEF, 2004) and WHO's *World Health Report* (WHO, 2004). We equalized to zero rates for poverty less than 2%, poverty gap less than 0.5%, and undernourishment rates less than 2.5% in line with World Bank and FAO publications.

[15] For example, Ravallion (2007) and Chaudhuri and Ravallion (2006) make an important distinction between 'good' and 'bad' inequalities for sustainable growth: the former reflect the role of economic incentives for innovation and investment, while the latter include those that prevent individuals from connecting to markets and limit investment and accumulation of human and physical capital. Such discussion is related to the relationship between poverty and absolute and relative inequalities, and more generally on 'pro-poor growth' (Ravallion, 2004; Kakwani and Pernia, 2000).

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Table 2
Country rankings by the PHI

High PHI		Medium PHI		Low PHI	
Country	PHI	Country	PHI	Country	PHI
(1) Ukraine	0.884	(27) Indonesia	0.799	(54) Lao PDR	0.693
(2) Romania	0.870	(28) Trinidad and Tobago	0.793	(55) Burkina Faso	0.691
(3) Croatia	0.868	(29) Thailand	0.786	(56) Bolivia	0.680
(4) Egypt	0.861	(30) Mongolia	0.780	(57) Botswana	0.671
(5) Kyrgyz Rep.	0.854	(31) China	0.779	(58) Nepal	0.670
(6) Kazakhstan	0.850	(32) Brazil	0.779	(59) Yemen	0.668
(7) Russia	0.849	(33) Peru	0.771	(60) Ethiopia	0.667
(8) Tunisia	0.847	(34) Dominican Rep.	0.770	(61) Ghana	0.664
(9) Jordan	0.844	(35) Turkmenistan	0.769	(62) India	0.660
(10) Albania	0.842	(36) Swaziland	0.763	(63) Nicaragua	0.659
(11) Algeria	0.839	(37) Colombia	0.763	(64) Mali	0.642
(12) Uruguay	0.835	(38) Sri Lanka	0.754	(65) Lesotho	0.641
(13) Morocco	0.833	(39) Côte d'Ivoire	0.752	(66) Namibia	0.640
(14) Azerbaijan	0.832	(40) Ecuador	0.750	(67) Bangladesh	0.628
(15) Turkey	0.831	(41) Paraguay	0.746	(68) Cambodia	0.624
(16) Chile	0.829	(42) Senegal	0.744	(69) Mozambique	0.621
(17) Jamaica	0.825	(43) Panama	0.742	(70) Tanzania	0.584
(18) Iran	0.821	(44) Venezuela	0.732	(71) Gambia	0.584
(19) Armenia	0.819	(45) Pakistan	0.731	(72) Rwanda	0.564
(20) Malaysia	0.817	(46) El Salvador	0.728	(73) Nigeria	0.564
(21) Mexico	0.809	(47) Cameroon	0.727	(74) Zimbabwe	0.561
(22) Costa Rica	0.807	(48) Philippines	0.725	(75) Uganda	0.512
(23) Georgia	0.807	(49) Honduras	0.718	(76) Madagascar	0.511
(24) Uzbekistan	0.804	(50) Mauritania	0.711	(77) Zambia	0.509
(25) Argentina	0.801	(51) Malawi	0.707	(78) Niger	0.494
(26) Guyana	0.800	(52) Kenya	0.701	(79) Burundi	0.472
		(53) Guatemala	0.700	(80) Central African Rep.	0.472
				(81) Sierra Leone	0.464

Source: authors' calculations.

Table 3
PHI and PHI components: nonparametric correlations

	Poverty	Poverty gap	Share of the poorest quintile	Undernourishment	Underweight	PHI
Poverty	1.000	0.977[b]	0.243[a]	0.683[b]	0.696[b]	0.942[b]
Sig. (2-tailed)	–	0.000	0.029	0.000	0.000	0.000
Poverty gap	0.977[b]	1.000	0.361[b]	0.651[b]	0.631[b]	0.933[b]
Sig. (2-tailed)	0.000	–	0.001	0.000	0.000	0.000
Share of the poorest quintile	0.243[a]	0.361[b]	1.000	0.081	−0.106	0.326[b]
Sig. (2-tailed)	0.029	0.001	–	0.472	0.344	0.003
Undernourishment	0.683[b]	0.651[b]	0.081	1.000	0.603[b]	0.802[b]
Sig. (2-tailed)	0.000	0.000	0.472	–	0.000	0.000
Underweight	0.696[b]	0.631[b]	−0.106	0.603[b]	1.000	0.768[b]
Sig. (2-tailed)	0.000	0.000	0.344	0.000	–	0.000
PHI	0.942[b]	0.933[b]	0.326[b]	0.802[b]	0.768[b]	1.000
Sig. (2-tailed)	0.000	0.000	0.003	0.000	0.000	–

Source: authors' calculations.
[a] Correlation is significant at the 0.05 level (2-tailed).
[b] Correlation is significant at the 0.01 level (2-tailed).

Another finding is that inequality shows insignificant correlation with the measures of undernourishment and underweight (Svedberg, 1999). One explanation is that malnutrition also affects people in higher income quintiles, in the poorest countries. Put differently, greater levels of equality in poorest countries might reflect an equalization of poverty, i.e. that large sections of a population are equally poor[16] (World Bank, 2006; Gillespie, 2002). In fact, significant malnutrition rates have been found to be present also among "non-poor" households, as noted by Appleton and Song (1999).[17] Similarly, Gwatkin et al. (2003) showed that in India malnutrition severely affected the third, fourth and fifth quintiles in the early 1990s (with an incidence of 61%, 60.6%, and 57%, respectively). Another explanation is that other factors besides food availability lead to child malnutrition (Alderman et al., 2006; Behrman et al., 2004; Black et al., 2003; Haddad et al., 2003; UNICEF, 1990; Coates et al., 2003). That the correlation between underweight and undernourishment is one of lowest is in line with a growing body of

[16] Another possible explanation is that the other four MDG1 indicators (poverty, poverty gap, underweight, and undernourishment) are measures of absolute deprivation. Thus, large differentials in GDP per capita may explain why the poorest quintile in Brazil, while only receiving 2.8% of income, may still be better-off than the poorest quintile in Ethiopia, which gets 9.1% of the national income.

[17] By analyzing data from Nepal, Jamaica, Kenya, Pakistan, Romania and Vietnam, the authors claimed that "many of the income poor are not deprived in other dimensions [education and malnutrition] and many of those deprived in other dimensions are not from income poor households" (Appleton and Song, 1999, p. 16).

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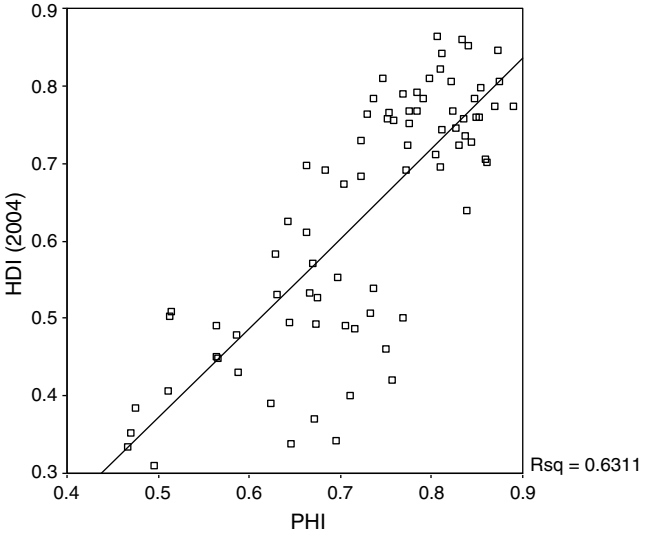

Fig. 3. PHI and HDI.

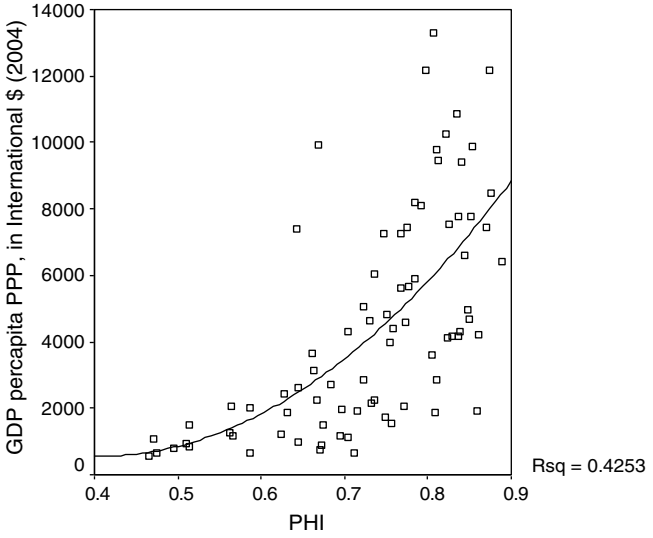

Fig. 4. PHI and GDP per capita.

Table 4
PHI-P and PHI-P components: nonparametric correlations

	Poverty	Poverty gap	Share of the poorest quintile	Undernourishment	Underweight	PHI-P
Poverty	1.000	0.814[a]	0.430[a]	0.067	0.194	0.805[a]
Sig. (2-tailed)	–	0.000	0.001	0.626	0.155	0.000
Poverty gap	0.814[a]	1.000	0.490[a]	0.087	0.129	0.830[a]
Sig. (2-tailed)	0.000	–	0.000	0.526	0.347	0.000
Share of the poorest quintile	0.430[a]	0.490[a]	1.000	−0.090	−0.031	0.612[a]
Sig. (2-tailed)	0.001	0.000	–	0.515	0.822	0.000
Undernourishment	0.067	0.087	−0.090	1.000	−0.155	0.251
Sig. (2-tailed)	0.626	0.526	0.515	–	0.257	0.065
Underweight	0.194	0.129	−0.031	−0.155	1.000	0.234
Sig. (2-tailed)	0.155	0.347	0.822	0.257	–	0.086
PHI-P	0.805[a]	0.830[a]	0.612[a]	0.251	0.234	1.000
Sig. (2-tailed)	0.000	0.000	0.000	0.075	0.086	–

Source: authors' calculations.
[a] Correlation is significant at the.01 level (2-tailed).

Table 5
Country rankings by the PHI-P

Fast		Slow		Reversing	
Country	PHI-P	Country	PHI-P	Country	PHI-P
(1) Azerbaijan	0.766	(20) Pakistan	0.485	(40) Gambia	−0.051
(2) Mauritania	0.733	(21) Mongolia	0.469	(41) El Salvador	−0.062
(3) Chile	0.711	(22) Guatemala	0.436	(42) Lesotho	−0.065
(4) Senegal	0.680	(23) China	0.413	(43) Turkey	−0.140
(5) Kenya	0.656	(24) Philippines	0.369	(44) Costa Rica	−0.191
(6) Russia	0.642	(25) Dominican Rep.	0.361	(45) Sri Lanka	−0.207
(7) Honduras	0.642	(26) Panama	0.361	(46) Uzbekistan	−0.305
(8) Indonesia	0.620	(27) Zambia	0.359	(47) Madagascar	−0.440
(9) Tunisia	0.602	(28) Cameroon	0.347	(48) Lao	−0.510
(10) Malaysia	0.601	(29) Nicaragua	0.347	(49) Côte d'Ivoire	−0.567
(11) Thailand	0.592	(30) Morocco	0.341	(50) Burundi	−0.720
(12) Kazakhstan	0.576	(31) Jordan	0.279	(51) Niger	−1.015
(13) Jamaica	0.566	(32) India	0.273	(52) Colombia	−1.719
(14) Brazil	0.564	(33) Ecuador	0.230	(53) Yemen	−2.841
(15) Egypt	0.552	(34) Ghana	0.209	(54) Bolivia	−7.698
(16) Burkina Faso	0.545	(35) Mexico	0.177	(55) Venezuela	−8.159
(17) Ethiopia	0.538	(36) Peru	0.156		
(18) Romania	0.534	(37) Nigeria	0.152		
(19) Iran	0.515	(38) Uganda	0.094		
		(39) Bangladesh	0.006		

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evidence documenting that sound nutrition does not axiomatically occur in the presence of higher food availability[18] (Smith et al., 2006; Allen and Gillespie, 2001; Haddad et al., 1997). As the World Bank (2006, p. 63) puts it, "reducing income poverty or improving the food supply without changing the way young children are cared for often does little to improve nutrition".

Comparing rankings by PHI and HDI for the same countries is also instructive. While the two composites show a similar pattern, some important differences emerge as shown in Fig. 3. For example, P according to the PHI Egypt ranks 4th, but is only 40th using the HDI, a difference of 36 positions. Similarly, the Kyrgyz Republic ranked 5th in terms of PHI but 39th on the HDI, while Panama, Morocco and Cote d'Ivoire record a difference in positions of 35, 34 and 32, respectively, in the two rankings. Overall, more than 60% of the countries show a difference of more than 10 ranking positions, and 20% had a difference of 20 positions or more. Interestingly, while the bottom five countries are the same in both rankings, there is more variation among the top 10 (only two countries are the same). Arguably, this is because the PHI is correlated with the *worst* manifestations of human deprivation (hunger and poverty), while two of the three HDI dimensions focuses on more positive aspects of life (Anand and Sen, 1996).

This suggests, on the one hand, that the PHI is more sensitive than the HDI to variation at the bottom end of the scale (and hence may be more relevant when assessing progress among poorer countries). On the other hand, there may be scope for combining the perspectives of both indices. For example, a low level in the third HDI dimension (a decent standard of living as measured by GDP per capita) is an important common factor in countries where poverty and hunger are widespread, as pointed out by Fig. 4.

These findings support the idea that countries facing more serious poverty and hunger are also more likely to find themselves trapped into a vicious cycle of self-reinforcing deprivations, including lower GDP per capita (Barrett and Swallow, 2006; United Nations, 2005a).[19] However, while the evidence tells us that poverty traps do exist, the causality and dynamics of such traps (and what policies are more effective for addressing them) are matters of debate (Kraay and Raddatz, 2007; Easterly, 2006; Sachs, 2006).

Progress toward MDG1

Monitoring countries' performances in reducing poverty and hunger over time requires data from at least two points in time. The MDGs took 1990 as a base year against which to measure achievements to 2015.[20] Due to data limitations it was possible to calculate the PHI-P for only 55 of the original 81 countries; nevertheless those 55 countries account for almost 85% of the population of all developing countries. As with the PHI, nonparametric correlations suggests that progress in one MDG measures does not equate to progress in another (Table 4). Progress towards the 2015 targets in terms of underweight and undernourishment is not significantly correlated with the other poverty-related measures.

Table 6
Country performance by PHI-P components

Country	Poverty	Poverty gap	Poorest quintile	Undernourishment	Underweight
Azerbaijan	1.000	1.000	0.176	1.000	0.653
Bangladesh	−0.301	−0.341	−0.170	0.286	0.556
Bolivia	−6.140	−32.000	−1.455	0.357	0.750
Brazil	0.929	0.419	0.435	0.667	0.371
Burkina Faso	0.942	1.000	0.706	0.381	−0.306
Burundi	−0.416	−1.290	−0.709	−0.792	−0.393
Cameroon	0.948	1.000	−0.035	0.485	−0.662
Chile	1.000	1.000	0.111	1.000	0.444
China	1.000	0.000	−0.436	0.500	1.000
Colombia	−3.000	−5.750	−0.529	0.353	0.333
Costa Rica	0.731	−0.462	−0.250	0.667	−1.643
Côte d'Ivoire	−0.990	−2.316	−0.514	0.444	0.542
Dominican Rep.	−0.028	1.000	−0.140	0.000	0.971
Ecuador	−0.107	−0.152	0.063	0.750	0.594
Egypt	0.450	1.000	0.000	0.500	0.808
El Salvador	0.173	−0.268	−0.541	0.167	0.161
Ethiopia	0.530	0.800	0.528	0.492	0.338
Gambia	−0.196	−0.483	0.182	−0.455	0.695
Ghana	0.102	−0.110	−0.328	1.000	0.381
Guatemala	1.000	1.000	0.762	−0.875	0.293
Honduras	1.000	1.000	0.429	0.087	0.693
India	0.359	0.523	−0.094	0.400	0.177
Indonesia	1.000	1.000	0.024	0.667	0.411
Iran	1.000	1.000	−0.038	0.000	0.611
Jamaica	1.000	1.000	−0.172	0.571	0.431
Jordan	1.000	1.000	0.271	−1.500	0.625
Kazakhstan	1.000	1.000	−0.027	−0.080	0.988
Kenya	0.639	1.000	1.000	0.410	0.231
Lao	−0.903	−2.067	−0.313	0.552	0.182
Lesotho	0.311	0.128	−0.846	0.588	−0.506
Madagascar	−0.635	−1.170	−0.078	−0.171	−0.143
Malaysia	1.000	1.000	−0.087	0.000	1.090
Mauritania	0.951	1.000	0.385	0.667	0.664
Mexico	0.846	−1.111	0.205	0.000	0.944
Mongolia	0.446	0.581	0.055	0.353	0.911
Morocco	1.000	1.000	−0.030	0.000	−0.267
Nicaragua	0.117	0.363	0.667	0.200	0.387
Niger	−0.906	−3.440	−1.307	0.439	0.141
Nigeria	−0.392	−0.355	0.500	0.615	0.392
Pakistan	1.000	1.000	0.214	0.083	0.129
Panama	0.746	1.000	0.381	−0.381	0.057
Peru	−0.105	−0.029	−0.679	1.000	0.593
Philippines	0.505	0.619	−0.169	0.538	0.352
Romania	1.000	1.000	−0.180	−0.025	0.877
Russia	1.000	1.000	0.711	0.500	0.000
Senegal	1.000	1.000	1.000	0.000	0.398
Sri Lanka	−0.947	−0.286	−0.444	0.429	0.213
Thailand	1.000	1.000	0.250	0.600	0.108
Tunisia	1.000	1.000	0.034	−0.025	1.000
Turkey	−0.833	−0.667	−0.172	−0.030	1.000
Uganda	0.023	0.092	−0.273	0.417	0.212
Uzbekistan	1.000	1.000	−0.027	−4.500	1.000
Venezuela	−11.704	−27.667	−0.800	−1.273	0.649
Yemen	−7.235	−6.182	0.426	−0.176	−1.040
Zambia	0.025	0.324	1.000	0.042	0.406

In order to identify countries performance, progress was defined in terms of three basic categories: 'on track' is defined as progress equal to, or greater than, the rate needed to meet targets by 2015; 'progress, but not on track' (or slow progress) means progress towards the goal at less than the rate needed to meet the goal; 'reversing' signals countries are falling backwards (see Table 5). Table 6 offers insights on performance by PHI-P components.

Of the 55 countries considered in this analysis, 35% performed at a rate sufficient to meet the MDG1 goal on time (reaching the 50% reduction targets by 2015), 36% recorded slow progress, but 29% showed a negative (reversing) performance. Those with the best progress (net improvement across multiple indicators) were

[18] In fact, food availability is a core component of undernourishment index, as discussed in Section 'Introduction'. Therefore, underweight is a less 'volatile' measure which also impacts more strongly on child deaths associated with diseases such as diarrhea, pneumonia, malaria and measles (Caulfield et al., 2004).

[19] Also in this case, however, there are some outliers, such as the Kyrgyz Republic which shows low levels of poverty and hunger and low GDP per capita, the latter similar to the one of many countries at the bottom of the PHI scale. Conversely, Namibia's GDP per capita is three times higher than that of the Kyrgyz Republic, but also shows much higher levels of poverty and hunger.

[20] For countries that do have two observation points, the most recent data (or '2000') refers to data generally from 1995/1996 onwards, while '1990' to data from 1995/1996 backwards. Analysis on country-specific trajectories based on 'net' number of years between the two surveys could be an area for future research.

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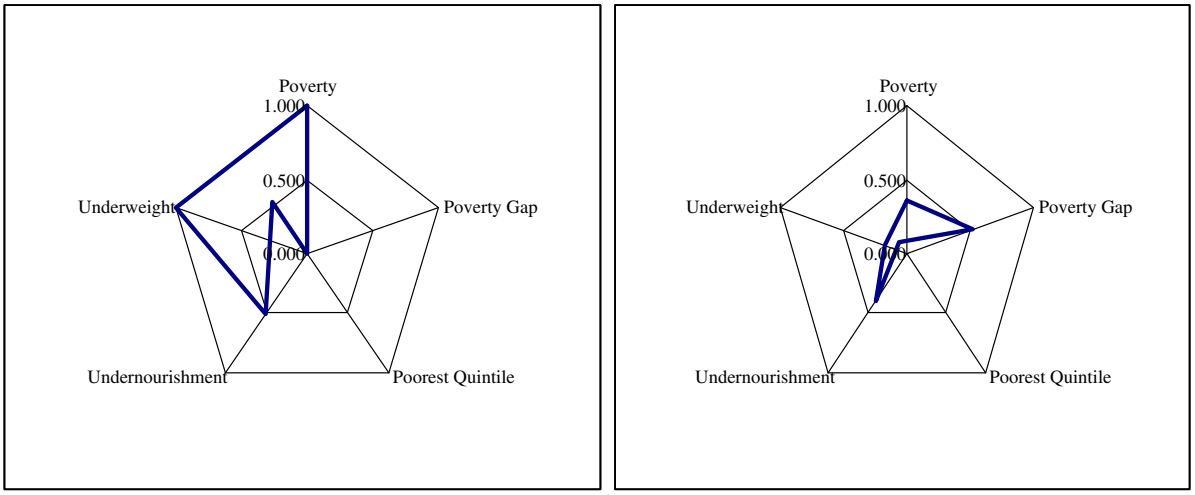

Fig. 5. Progress toward MDG1 by China (left) and India (right).

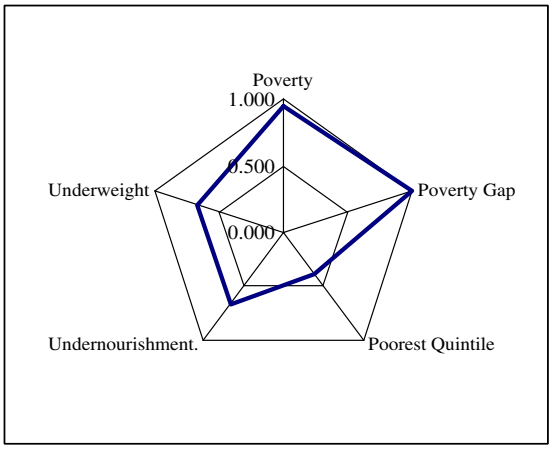

Fig. 6. Progress toward MDG1 by Mauritania.

Azerbaijan and Mauritania, while those with serious reversing trends include Venezuela and Bolivia. It should be noted that the relative nature of the MDG1 approach entails that, in some cases, changes in small numbers may result in significant changes in percentage terms, as shown by some Latin American countries.[21] In other cases, the fact that some countries (i.e. mostly in North Africa and Middle East) were awarded the maximum value of 1 was due to the success in keeping a given dimension at the 2015 target over the 1990s.[22]

Some of these results are consistent with well-known development 'success stories', such as Chile, Vietnam, Indonesia, China, Malaysia, Brazil and Thailand. These include Asia Tiger economies (which continue to grow rapidly), plus some countries that successfully embraced specific macroeconomic and institutional reforms during the late 1980s and 1990s, or that are members of the Cairns Group (i.e. strong agricultural exporting developing countries).

Other results are more surprising, or even counter-intuitive. A few such examples are worth considering in more detail. Mauritania, for instance, emerges as the star performer in terms of net progress to MDG1 relative to where it stood in 1990. Little noticed perhaps, but Mauritania managed to reduce its poverty, undernourishment *and* poverty gap by 6% points between 1990 and 2000. Moreover, its incidence of child underweight was reduced by more than 15% points. It appears that appropriate choices and investments were made at the right time. In 1991/1992 Mauritania established a pluralist democracy after years of military rule and instituted a series of economic reforms that managed to stabilize the economy and improve the judicial and legal environment for business activity. Average economic growth soared from 2.9% in the 1990s to 5% in 2000–2006, while the use of basic social services was fostered, including for example the access to improved water sources which increased from 38% to 53% of the population over the 1990s (UNDP, 2007; World Bank, 2007a,b). The result was a shift in the Gini coefficient (a measure of income inequality across a nation) fell from 0.50 in 1990 to around 0.39 by the end of the decade (World Bank, 2007a). While poverty and malnutrition remain concerns, Mauritania's performance on the 5 MDG1 measures shows that progress is possible, as long as good policy choices and appropriate investments are maintained. Political and environmental shocks affecting Mauritania since 2000 have, however, seriously challenged its early rate of progress.

Then there is Jamaica. Not often held up as a development model, Jamaica achieved major successes during the 1990s, particularly in reducing poverty: its incidence of poverty was reduced from 8% in 1990 to zero in 2000, largely by promoting pro-poor policies that succeed in controlling inflation, reducing food prices, enhancing real wages, building jobs in the private sector and enhancing social conditions. Dollar and Kraay (2002) have called Jamaica's policy framework "superpro-poor", and the results place the country among the world's top performers in terms of progress made. A third case worth considering is Azerbaijan, which cut its poverty by 7% points since 1990 (from 11% to 4%), and undernourishment and underweight by 24% and 3% points, respectively.[23] As in most other former Soviet states, the start of the 1990s saw a massive fall

[21] See for example the case of Colombia. This caveat, as the one reported in the next footnote, should be kept in mind when interpreting the results.

[22] For example, Jordan, Morocco and Tunisia did have less than 2% (or zero) poverty in 1990 and were successful in maintaining such levels over the nineties. In other cases, countries such as Peru did have zero poverty rates in 1990 but then increased over the 1990s. In order to take into account such cases, net changes occurred over the 1990s were measured against the 2015 target, which in those cases coincides with the elimination of poverty, or maintain a zero poverty rate. In such cases, that would imply setting the denominator equal to 1 against which changes in the numerator will be measured.

[23] Note, however, that we can only compare information from the mid-nineties to later data, as data closer to 1990 is not available.

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in GDP, hyperinflation, currency depreciation. By 1995, The best performer, Azerbaijan, showed that gross national product was only 44% of its 1990 level, and household consumption is estimated to have declined by around 50% in the same period. However, 1995 saw a political and economic turn-around. Macroeconomic reforms were implemented on a large scale, land reform allowed for considerable redistribution of assets to the poor, GDP increased 250% between 1995 and 2001, maternal mortality fell from 37 deaths per 100,000 live births in 1995 to only 25 in 2001; infant mortality also fell from 23 (per 1000 live births) in 1995 to 12 in 2001 (World Bank, 2003a).

It could be argued that Azerbaijan has done well because it enjoys oil revenues, but that simple argument alone does not hold. Azerbaijan's agricultural sector also made gains, and industrial output more than tripled in the latter half of the 1990s. What is more, there are many other oil-exporters who did not fare so well, including for example Nigeria (slow progress) and Venezuela (last in the PHI-P rank). In should be noted, however, that baseline data for Azerbaijan refers to mid-1990s (see footnote no. 23), and we do not know how the situation may have been in early 1990s due to data unavailability.

Indeed, data suggest that in too many countries poverty and hunger seem to be worsening; that is, for whom the trend towards MDG1 targets is negative. For example, these include Niger (home of a major nutrition crisis in 2004/2005), Uzbekistan and Ghana. Certainly among countries making insufficient progress or no progress at all there is a large number who have suffered the effects of armed conflict during the period in question, including Uganda, Colombia, and Sri Lanka. And there are those countries that have suffered serious natural disasters or economic instability (Niger, Bangladesh and Philippines).

But these factors alone do not explain all of the trends. For example, Bolivia has a rich endowment of natural resources and it embraced many of the same macroeconomic reforms as its neighbours in the 1980s and 1990s. Nevertheless, there has been little economic growth to show for it, 23.2% of the population continue to live below the 1$/day poverty line (and 42.2% on less than 2$/day), and almost half (47.2%) of country's wealth is concentrated in the hands of the richest 10% of the income distribution (World Bank, 2007a). Agricultural output has (at least) improved since 1990, and access to health services was made free, resulting in health gains. But political and economic uncertainty appears to have constrained the pro-poor growth that was required.

One should also consider the case of countries like Ghana and Uganda, erstwhile darlings of the donor community. Ghana, for example, saw considerable gains during the 1980s, but faced a slow down following in the 1990s (World Bank, 2001a). Price volatility eroded purchasing power, GDP growth "barely exceeded the rate of population growth" (Coulombe and McKay, 2003), and until the late 1990s there was limited attention to poverty reduction as opposed to wealth creation. Export-led agriculture did improve, but the wages of agricultural workers did not keep pace with decontrolled prices. What is more, spending on social sectors (health, education and nutrition) remained low even compared to spending elsewhere in Africa. As a result, the country's Gini coefficient deteriorated over the 1990s from 0.34 to 0.4 (World Bank, 2007a). A recent Poverty Reduction Strategy Paper (PRSP)

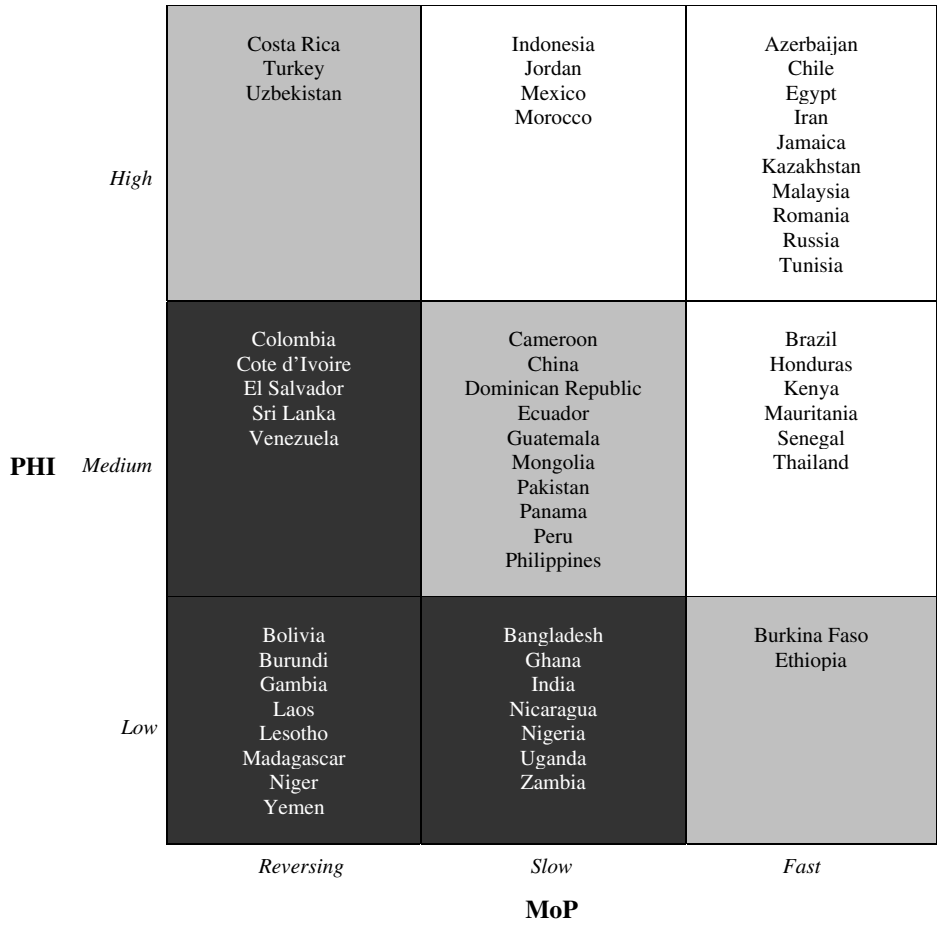

Fig. 7. Country priority matrix.

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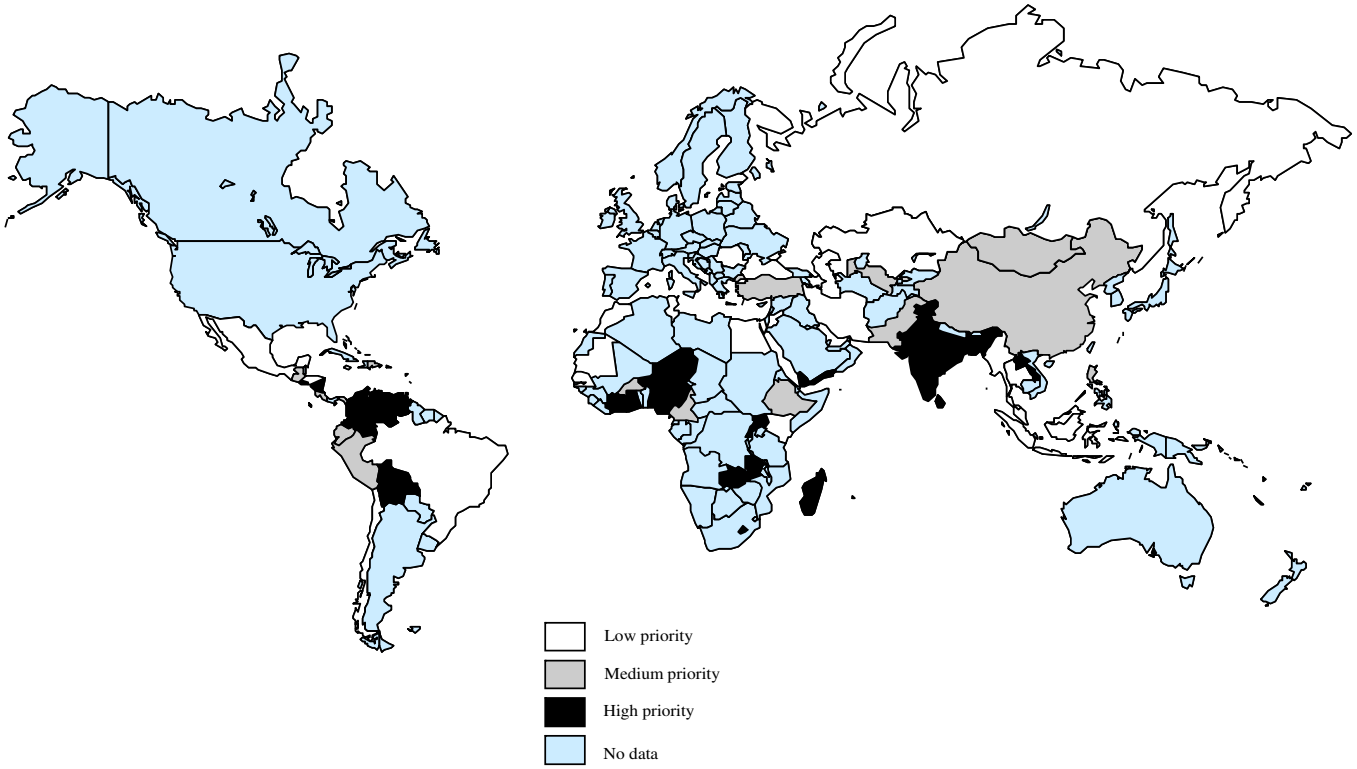

Fig. 8. Country priority map.

highlights that "measures of social deprivation point to a grim state of vulnerability and exclusion in Ghana" (GoG, 2003), while Townsend and Gordon (2002) note that since "40% of the population [are] below the poverty line, a conclusion of mass poverty becomes indisputable". These analyses appear to bear out Ghana's PHI-P position among countries currently unable to keep pace with the MDG1 targets for 2015.

By contrast, Uganda's status is more nuanced. Uganda sits among the countries that are making progress towards MDG1 but at a rate that will not allow them to meet the MDG1 on time. Its economic performance has been impressive. During the 1990s, the economy more than doubled in size, with an annual growth rate exceeding 5%, inflation (over 100% per annum in the 1980s) came down to single digits since 1994, and agriculture has prospered. Nevertheless, according to a World Bank study (2001) it was not until the late 1990s that poverty reduction became an explicit concern of the government (a first Poverty Eradication Action Plan was adopted in 1997), and a greater focus on improved health and education service delivery appears after 2000. As a result, Uganda has made progress, but the number of poor people has not declined, and the benefits of Uganda's high growth have not been evenly distributed across the country (UNECA, 2003; OECD, 2002).

In other words, without explicit attention to the needs and concerns of the poor and hungry macroeconomic gains will not be sufficient to allow countries to attain MDG1. This highlights the important fact that even progress does not mean that governments can sit on their laurels. On the one hand, a high PHI-P ranking does not imply that countries like Uganda no longer have serious poverty and malnutrition – they do, and that still demands urgent attention. On the other hand, although some countries are close to reaching the PHI-P value of '1.0' that does not mean that they have done equally well on all 5 counts of MDG1. Interestingly, in most of the cases where a country is on track with the goal (PHI-P higher than 0.5), it is the measure of inequality that lags furthest behind. For example, during the 1990s China and India made progress in four out of five indicators (except stagnation on poverty gap trends for China), but their inequality worsened (see Fig. 5). By contrast, there are 17 countries (e.g. Mauritania (Fig. 6), Ethiopia, Brazil and Pakistan) that have made substantial progress in *all five* components, including reducing inequality.

This suggests that while a clear focus on reducing *both* hunger and poverty will be needed to achieve MDG1, distributional concerns must have a higher priority in the policy-making agenda, as must net rates of progress. Overall progress will be hindered by inaction on any one of the five components. Since all components are equally important a country that concentrates only on some of them cannot achieve MDG1.

Fig. 7 defines sets of countries in terms of both current level of poverty and hunger (PHI) *and* progress in their reduction as measured by the PHI-P. PHI levels are defined as 'low' (less than 0.7), 'medium' (0.7–0.8) and 'high' (more than 0.8). Cut-off points were identified by looking at the way countries values were distributed.[24] By plotting the two indexes 'high', 'medium' and 'low' priority countries can be identified (listed in the black, gray, and white cells, respectively).

A set of 27 countries in this list fall into the 'high priority' category—those with too slow (or reversing) trends *and* with low or medium current standing on the five indicators. Fig. 8 presents a map of analyzed countries by priority status. Appropriate policies, considerable financial resources, and appropriate human capital

[24] Only twelve countries did have PHI values below the 0.500 benchmark (the HDI benchmark for 'low' human development). In order to better balance countries' distribution, we set the cap at 0.700. However, we maintained the other ranges of the HDI (i.e. 0.800 as the limit for the 'medium' group, and values above 0.800 for the 'high' group). Our approach seems to distribute countries quite uniformly (28 countries with low PHI values, 27 countries with medium values, and 26 countries with high values).

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need to be invested in these priority countries for there to be even remote hope of them meeting MDG1.

Conclusions

While past attempts to measure progress toward MDG1 have mainly focused on individual indicators, or on composite non-official indicators, the analysis here combines all the five official MDG1 indicators, thereby providing insights not only on the separate contexts of poverty and hunger at a point in time but also on relative rates of change. By providing a visually arresting snapshot of trends in poverty and hunger, the PHI and PHI-P together can better inform policymakers about priority areas for action within the MDG agenda.

Our results show that poverty and hunger are related but distinct problems. Even the indicators usually employed for measuring hunger – such as undernourishment and underweight – reflect related but different dimensions of human deprivation. The majority of developing countries made some progress towards MDG1; however, too many countries are still falling behind, most of which in Sub-Saharan Africa. However, a stark contrast *between* and *within* regions also emerges, such as between East Asia and Sub-Saharan Africa, and within Latin America and the CIS cluster. Some of the poorest developing countries performed quite well, while other better-off developing countries are struggling or stagnant in achieving the MDG1, including some high-economic growth countries. Only a limited number of countries made equitable progress on all five dimensions, and much more attention will be needed to the distributional character of poverty and hunger, if this aspect of MDG1 is not to drag back progress on the other four dimensions. More research may be needed to provide further insights on context-specific lessons and driving factors underscoring countries actual successes and failures. Applications of PHI and PHI-P measures at sub-national levels may also be an area for future empirical work.

Achieving the MDG1, however, does not mean that poverty and hunger will have been eradicated. For those countries that will attain MDG1, post-2015 initiatives may be launched to eradicate the second half of poverty and hunger that will still remain. Such phase may also include explicit objectives on reductions in chronic or ultra-poverty (Ahmed et al., 2007; CPRC, 2004).

The relative approach of 'cutting by half' enshrined in the MDG framework poses, however, enormous challenges on countries starting will lowest per-capita incomes and widespread hunger, relative to others better-off (Easterly, 2007): the task of halving a level of income poverty in Zambia (63.8%) may be more difficult than in Brazil (7.5%), and this should be kept in mind when interpreting countries progress toward MDG1. Thus, post-2015 initiatives may need to be more flexible and context-specific in order to enable countries to reach realistic targets aligned and proportioned with the level of poverty and hunger they face (Clemens et al., 2007).

Finally, a number of factors still limit the collection of key data for monitoring MDG1. In some instances, factors are endogenous and inherent in the process of formulation of the MDGs in 2000. Indeed, the establishment of benchmarks for two official indicators – the poverty gap and inequality indices – should have been appropriate to facilitate monitoring and measurement of countries' performance in those domains. Also, some countries reached the goal in a given dimension already in 2000 (before the MDGs were set), hence raising concerns about the appropriateness of setting the year 1990 as the baseline for monitoring progress. In other cases (e.g. complex and instable contexts such Afghanistan, Haiti, and Sudan), factors are more exogenous and speak to countries' capacity to publish accurate MDG poverty and hunger data for multiple time periods, or any data at all. This paper echoes the calls for strengthening (or in some cases building) national statistical capacities to regularly publish official data for documenting progress on the MDGs.

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Supplementary material

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.foodpol.2008.04.005.

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