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August 2007

IIDE discussion paper 200708-01

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WEIGHTING DIMENSIONS OF POVERTY BASED ON PEOPLE'S PRIORITIES

Constructing a Composite Poverty Index for the Maldives

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Abstract

Whilst recognising that poverty is a multidimensional concept, many poverty studies fall back to one dimension when it comes to quantifying poverty. A multidimensional concept of poverty raises the question of how to quantify the various dimensions of poverty and how to weigh these dimensions to measure overall poverty. Existing attempts to solve the intractable weighting problem are unsatisfactory because they assign arbitrary (usually equal) weights to each component or obtain weights from the data using factor type analysis which may substantially differ from people's perceptions about priorities. In the present paper the aggregation problem is solved by using a weighting structure that is derived directly from population preferences. It uses explicit information on the ranking of poverty dimensions as obtained from household surveys. These ranking are transformed into *priority weights* for each dimension so that a composite index can be obtained. An empirical application to the Maldives is given for the years 1997/8 and 2004, which allows for observing changes in the poverty situation over time for each dimension, for each region and for overall poverty.[3]

JEL classification: D31, D63, I32

Keywords: poverty measures, living standard dimensions, aggregation, composite index, Maldives

1. Introduction

Proper measurement of poverty at worldwide, country or regional level is not without problems. Poverty can be defined as deprivation in well-being, which lacks precision in terms of what this constitutes. The now traditional view of poverty – as reflected in the Human Development Reports and World Development Reports since the early 90s – is that it has many dimensions, both monetary (as measured by income or consumption) and non-

monetary (including lack of access to health, education, social relations, lack of voice, and so on). [4]

Defining poverty as a multidimensional concept subsequently raises the question of how to measure overall poverty and how to weigh the different dimensions. Several solutions to the aggregation problem have been proposed, but all have been unsatisfactory on one or more accounts. On the one hand, composite indices, such as the Human Development Index (HDI) of the UNDP, assign arbitrary, usually equal, weights to each dimension.[5] These, as well as the pre-selected dimensions, do not bear any correspondence with population preferences and the realities of the country or region under study.[6] On the other hand, Principal Components Analysis (PCA), or more generally factor analysis, allows the available data to determine the relevant living standard dimensions and optimal weights associated with each dimension, rather than making *a priori* assumptions. Nevertheless, these approaches have drawbacks as well.[7] Firstly, although objective, the thus obtained weights are very rigid and may not necessarily be appropriate for the country concerned. Weights should ideally reflect the relative importance of each of the dimensions. But since PCA weights may substantially differ from people's perceptions about priorities, this is not guaranteed. Secondly, they cannot be compared with other countries or regions since no indicator of poverty is derived. Thirdly, PCA weights are more complex and laborious to derive, and lack transparency. Studies aimed at informing governments, donors and international organisations about changes in the poverty situation in a country and across regions should use simple and transparent methods that are easily comprehensible.

In this paper we develop a new index, the Human Vulnerability Index (HVI), which does not suffer from these deficiencies. The HVI uses a weighting structure which is derived directly from population preferences, so that it can be tailored to country-specific circumstances.[8] It does so by using explicit information on the ranking of living standard dimensions according to the priorities of the population, as may be obtained from household survey data. The score for each dimension is weighted with the corresponding 'priority weight' so as to obtain the aggregate HVI.

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[4]   World Bank (2001), Chapter 1.
[5]   UNDP (2004), Technical Note 1, World Bank (2001), Chapter 1, Box 1.6.
[6]   Bibi (2005), Collicelli and Valerii (2000).
[7]   Booysen (2002), Ferro Luzzi et al. (2006) and Ram (1982).
[8]   In this respect it bears close similarity with the literature on measuring happiness. See for example Clark and Oswald (2002).

The HVI is subsequently derived for the Maldives, using data from the Vulnerability and Poverty Assessments carried out in 1997/98 and 2004.[9] In both years, respondents were asked to rank living standard dimensions according to their relative importance in determining the overall standard of living or level or poverty. The case study of the Maldives illustrates the richness of analysis possible with this method in terms of measuring not only aggregate poverty, but also decomposing it into the relevant dimensions, accounting for gender differences, and being able to show cross-regional differences and changes over time.

Delimitations of our research are that we do not look at the issue of inequality within or across households (although some general observations may be made with regards to the case study of the Maldives). Furthermore, poverty is defined as deprivation according to relevant living standard dimensions *at a certain point in time*. Hence we abstain from modelling what is usually called vulnerability, i.e. the risk that a household or individual will experience an episode of poverty over time.[10]

The remainder of the paper is organised as follows. Section 2 develops the Human Vulnerability Index and compares this with the other, most popular poverty measures. Section 3 presents an application to the Maldives at aggregate and regional level, for 1997 and 2004, and distinguishing between twelve living standard or poverty dimensions. The final section concludes.

2. Methodology: constructing the Human Vulnerability Index

This section develops a new method of measuring poverty based on population perceptions, culminating in a new measure of poverty. Since reference will be made to other often used poverty indicators, a brief overview will be given of the most popular poverty measures in the literature.[11]

2.1 Frequently used poverty indicators

In the past several simple, but appealing, poverty indicators have been developed, most notably the headcount ratio and the average income shortfall. The former has been used from

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[9]   Republic of Maldives (1999, 2005).

[10]   In fact, this will be the topic of a second paper. See also Coudouel et al. (2002), World Bank (2001), Chapter 1, Box 1.3.

[11]   This section draws upon Bibi (2005), Collicelli and Valerii (2000), Coudouel et al. (2002), Foster et al. (1984), Ferro Luzzi et al. (2006), Ravallion (1996) and World Bank (2001), Chapter 1 which together provide a comprehensive overview of the literature.

early on and measures the incidence of poverty, i.e. the proportion of the population under the poverty line. The latter measures the depth, i.e. how far away the poor are from the poverty line, or how poor the poor really are.

The headcount ratio is defined as follows:

$$H = \frac{q}{n} \tag{1}$$

where H is the headcount ratio or headcount index, $0 \leq H \leq 1$, q is the number of poor and n is the total population size.

The average income shortfall is given by:

$$I = \left(\frac{1}{q}\right) \cdot \sum_{i=1}^{q} \frac{z - y_i}{z} = 1 - \frac{\mu_q}{z} \tag{2}$$

where I is the average income shortfall, $0 \leq I \leq 1$, y_i is the living standard indicator of the household i, z is the poverty line and μ_q is the living standard indicator of the average poor.

As one can see both H and I measure poverty along one dimension (usually in monetary terms, such as per capita income or consumption). Apart from this they are each other's complements: H gives an indication of the number of poor, but ignores the depth of poverty. Similarly I gives an indication of the depth of poverty, but ignores the number of poor. A more sophisticated indicator, which combines these two, is the poverty gap ratio (PGR). It is constructed by normalising the average income shortfall to the total population size rather than to the number of poor.

$$PGR = \left(\frac{1}{n}\right) \cdot \sum_{i=1}^{q} \frac{z - y_i}{z} = H \cdot I \tag{3}$$

A variant of this is the squared poverty gap ratio (SPGR) developed by Foster et al. (1984), which measures the severity of poverty. The SPGR is able to take into account inequality among the poor by placing a higher weight on those households further away from the poverty line.

$$SPGR = \left(\frac{1}{n}\right) \cdot \sum_{i=1}^{q} \left[\frac{z - y_i}{z}\right]^2 \tag{4}$$

From the mid-1970s onwards, composite measures have been developed that take into account the multidimensional character of development and its antipole poverty. These include the Physical Quality of Life Index (PQLI)[12] and the Human Development Index (HDI), the Gender Development Index (GDI) and the Human Poverty Indices (HPI) of the UNDP.[13] Such measures are able to account for the fact that poverty is not only associated with respect to insufficient income or consumption, but also with insufficient outcomes with respect to education, health, insecurity, lack of social relations, lack of voice and so on.

Whilst composite indices are more complete measures of development or poverty, they suffer from the drawback of having to deal with the aggregation problem, i.e. the problem of finding appropriate weights for each of the monetary and non-monetary dimensions so as to form one single aggregate measure of development or poverty.[14] Ideally such weights are based on population preferences in line with a welfare function approach. However, since these cannot be discerned, arbitrary, usually equal, weights are assigned to each dimension.[15]

Another drawback of composite measures is that they are generally constructed to measure and compare living standards across all countries in the world. As a consequence they are assembled using only a few generic dimensions for which data can be found. These include income, life expectancy, literacy rates, enrolment rates, access to health services and safe water, and height and weight of children. Whilst useful on their own account, this implies that, when applied to a specific country, composite indices do not provide full insight into all relevant dimensions of development or poverty in the specific country under scrutiny.[16]

The next subsection presents a new index, which provides a solution to these two drawbacks by (1) using a weighting structure derived from population preferences, so that (2) it can be tailored to country-specific circumstances.

Before we continue with the derivation of this index, it should be mentioned that in the past other methods have been developed to address aforementioned problems, most notably

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[12] Morris (1979).

[13] See UNDP (2004), Technical Note 1 for an overview of how the Human Development Indices of the UNDP are composed.

[14] See for example World Bank (2001), Chapter 1, Box 1.6.

[15] One could also proceed by counting as poor everybody who is poor on any of the dimensions. This approach can easily be criticised since it would imply that a person with very high income but falling short in another dimension is poor.

[16] See also Collicelli and Valerii (2000). More specific criticism regarding the HPI of the UNDP is that (1) it does not account for the monetary dimension of poverty, (2) it ignores the correlation between its different dimensions and (3) it is not being able to avoid double counting individuals who are poor on more than one dimension. See Bibi (2005).

Principal Components Analysis (PCA), which is a variant of the more general method of factor analysis.[17] These multivariate statistical tools have the advantage of allowing the available data to determine the relevant living standard dimensions and optimal weights associated with each dimension, rather than making *a priori* assumptions.[18] Subsequently, the poor can be identified using cluster analysis.[19] Nevertheless, these approaches are not without problems because the thus obtained weights are very rigid and may substantially differ from people's perceptions about priorities and therefore not necessarily reflect the relative importance of each of the dimensions in the country concerned. Also, they bear little linkage to the more commonly used poverty indicators so that comparing outcomes with poverty analyses for other countries or regions is not feasible. This is not the case with our proposed index. As the next sections illustrate our new index is also less laborious, less complex and more transparent, and easy to derive.

2.2 The Human Vulnerability Index

Let $n_d \geq 1$ be the number of dimensions d of living standards or poverty which can be observed in a country. Let I_d denote the average shortfall for dimension d, calculated according to equation (2), H_d denote the headcount ratio for dimension d, calculated using equation (1), and let PGR_d be the poverty gap ratio for dimension d, as calculated in equation (3).

We subsequently rank the living standard dimensions according to the priorities of the population.[20] A dimension is assigned a ranking, r_d, of 1 if it has the highest priority, a 2 if it has a slightly lower priority,....., and the number n_d if it has the lowest priority. We can then construct the weight for dimension d as follows:

$$w_d = \frac{1 + n_d - r_d}{\sum_{d=1}^{n_d} (1 + n_d - r_d)} \qquad (5)$$

[17] See Collicelli and Valerii (2000) for an application to Switzerland and Ferro Luzzi et al. (2006) for an application to the Mediterranean.

[18] PCA is a multivariate statistical method which derives from the available data a set of new factors, which are linear combinations of the original variables. These factors are themselves uncorrelated and each represent a unique dimension of poverty. The weights associated with the factors are derived from their power in explaining the variability or variance of the original data.

[19] Collicelli and Valerii (2000), Ferro Luzzi et al. (2006). Cluster analysis is a technique used in multivariate statistics by which statistical units are grouped in homogeneous clusters by minimising the variability within each cluster and maximising that between different clusters.

[20] Obtained from carrying out a household survey. See next section for an application to the Maldives.

where $0 < w_d < 1$ is the priority weight attached to dimension d. Equation (5) shows that the priority weight for a dimension is obtained by subtracting the ranking of the maximum number of dimensions + 1, i.e. by taking the complement of n_d and dividing this by the sum of all complements.

Figure 1 shows how the weighting structure varies with the number of dimensions.

Figure 1 Priority weights for one, two, four, six, eight and ten dimensions
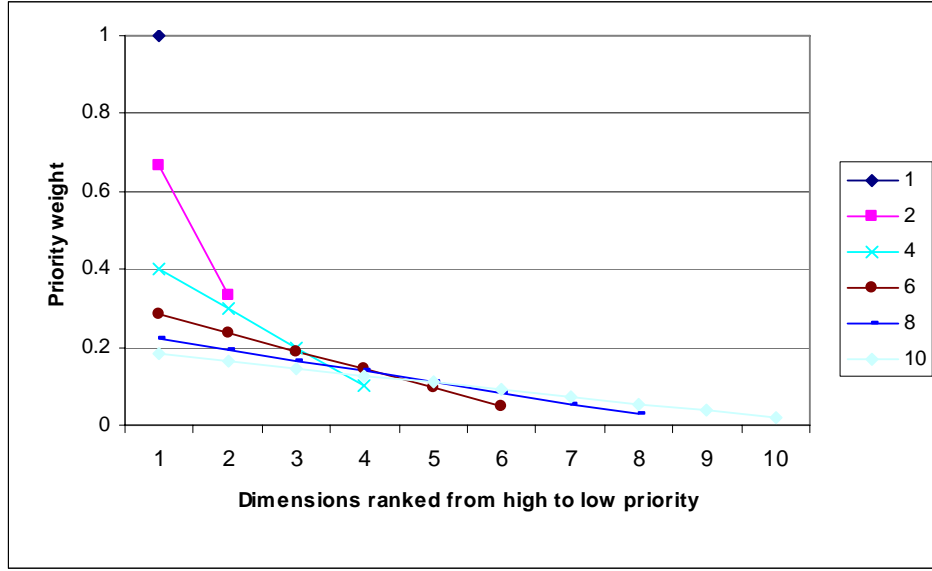
The Human Vulnerability Index can now be constructed as a weighted average of the poverty gap ratios, PGR_d, with weights w_d:

$$HVI = \sum_{d=1}^{n_d} \left(w_d \cdot PGR_d \right) \qquad (6)$$

If the population is poor on all fronts, i.e. $PGR_d = 1$ for all d, HVI will take on the value of 1. At the other extreme, if the population is not poor on any of the dimensions, i.e. $PGR_d = 0$ for all d, HVI will take on the value of 0.

The next subsection illustrates the HVI for the Maldives, an island state with large distances between remote islands and the nearest economic centre.

3. Results: an application to the Maldives

Before applying the HVI methodology to a specific country, the relevant dimensions of living standards or equivalently poverty first have to be defined. Naturally, each dimension may have several quantifiable indicators or components by which the dimension can be measured. This section illustrates how to proceed with a case study of the Maldives.

3.1 Dimensions of poverty in the Maldives

We construct the HVI for the Maldives using the data from the Vulnerability and Poverty Assessment (VPA) studies carried out in the Maldives in 1997/8 (VPA I) and 2004 (VPA II).[21] The assessment presents a HVI especially tailored for the Maldives, where large distances exist between remote islands and the nearest economic centre and where the vulnerability of the island population is extremely critical to overall development.

Table 1 presents the set of living standards dimensions and their indicators relevant for Maldives. Estimates of those indicators are based on several thousand household questionnaires and on interviews with all 200 development committees, 200 women's committees and 200 island chiefs.[22] These quantitative indicators provide the means to construct the HVI for the Maldives in aggregate and at regional level.

3.2 Poverty gap ratios by living standard dimension for the Maldives

Each indicator gets a score between 0 and 1 depending on the severity of deprivation of the household, 0 if there is no deprivation, 1 if there is 100 percent deprivation. The total of these so-called penalty points for each dimension is capped at 1 per household.[23] The sum thereby measures the shortfall for this household in terms of the dimension that is observed. Using household survey data one can subsequently obtain the PGR for all dimensions, calculated as in equation (3) by multiplying the headcount ratio by the average shortfall. Table 2 presents the PGR for each living standard dimension for the island population for the years 1997 and 2004. A high score corresponds to poor performance.

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[21] Republic of Maldives (1998, 2005). The purpose of these studies is to assess the incidence and depth of poverty dimensions relevant to the Maldives and to assess regional progress in poverty reduction over the period 1997-2004.

[22] See appendix II for detailed information on VPA I and VPA II.

[23] So if a household is 100 percent poor according one indicator of a dimension, then being poor in terms of another indicator of the same dimension cannot increase this household's poorness.

Table 1 Living standard dimensions and their indicators for the Maldives

Living Standard Dimensions	Indicators	Penalty Points
1. income poverty	poverty gap index	0-1
2. electricity	no electricity	1
	electricity for six hours or less per day	0.5
3. transport	more than 100 persons per dhoni per island	0.25
	three or fewer dhonis per week to atoll capital	0.5
	the island is not always accessible	0.5
4. communication	no public telephone on the island	0.75
	distance to public telephone is more than 2 hours	1
	no newspaper available on the island	0.25
	no radio in the household	1
5. education	no trained teacher in primary school	1
	more than 100 pupils per trained teacher	0.5
	between 50 and 100 pupils per trained teacher	0.25
	highest grade on the island is grade 5	0.5
	highest grade on the island is grade 6 or 7	0.25
	no nursery school	0.25
	no drinking water in the school	0.25
	no toilet facilities in the school	0.25
6. health	No trained doctor, health worker, nurse or midwife on the island	0.25
	no access to drugs	0.5
	no hospital, private clinic or health centre on the island	0.5
	travel time to hospital or health centre is more than 2 hours	1
7. drinking water	insufficient access to drinking water	1
	no access to safe drinking water	1
8. consumer goods	more than 100 persons per shop on the island	0.5
	no sewing machine	0.5
9. housing	material of the house, thatch wall or sand floor	1
	living space of less than 40 square feet per capita	1
	no compound	0.5
10. environment	coast erosion on the island	0.5
	no facility for garbage disposal	0.5
	no toilet in the house	1
	using firewood for cooking	0.5
	Population density per island	0-1
11. food security	food insecurity in the previous year	1
	significantly stunting of children between 1 and 5 year	1
12. employment	unemployed, no income earner in the household	1
	unemployed, at least one earner in the household	0.5
	underemployed, looking for more work	0.5
	no income generating community activities	0.25

Source: VPA 1

Differences between the individual PGRs and changes in the PGRs over time reveal important information in terms of where the extent of deprivation is highest (lowest) and where progress has been made (or is lacking). Below, we briefly elaborate on the observed differences and changes.

Table 2 PGR by dimension for the Atolls, Maldives, 1997 and 2004

PGR	1997	2004	Progress
Environment	1.00	1.00	0%
Transport	0.43	0.44	-2%
Employment	0.23	0.39	-70%
Drinking Water	0.36	0.33	8%
Health	0.57	0.30	47%
Food security	0.50	0.29	42%
Communication	1.00	0.27	73%
Consumer goods	0.46	0.26	43%
Education	0.50	0.24	52%
Income	0.29	0.14	52%
Housing	0.16	0.12	25%
Electricity	0.23	0.01	96%

Source: VPA I and II

Table 2 shows that most progress has been made in the field of communication, health, education, income and electricity. Since practically all households on all 200 inhabited islands[24] now have 24-hour access to electricity, the penalty score on the electricity dimension is almost zero.

Progress in the area of communication can be explained by the high priority that has been given to the development of the telephone network. All islands have public telephones, now. In Male', two-third of the population has a regular telephone in their household, while in more than three-quarter of all households at least one person has a mobile telephone. Although the penetration rate is far lower in the atolls, where telephone exchanges for landlines have been installed only on the larger islands, one in six persons in the atolls is

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[24]   See Appendix 1 for a list of islands and atolls of the Maldives.

now living in a household that has a fixed telephone in the house. Mobile phones have spread much wider and nearly half the households report at least one. In Gnaviyani and Seenu more than three-quarters of the households actually have a fixed telephone line which is a much higher penetration rate than Male'. Finally, in addition to the rapid uptake in both mobile and regular telephones, the ownership of radio and television has spread very fast. In 2004, eighty five percent of the households throughout the atolls reported a radio or a television, or both. This development has served to take the island population out of its near total isolation of a few decades ago.

As for the health index, between 1997 and 2004 the number of islands that scored no penalty points (and so showed no deprivation in terms of health) increased from 10 to 31, while the number scoring more than 0.5 decreased from 150 to 130, representing 26 percent of the population. Over the same period the number of islands with 1.0 penalty points decreased from 30 (accounting for seven percent of the population) to nine (accounting for one percent of the population). These nine islands have very limited access to health services, as they have no health centre, clinic or hospital and residents have to travel for more than two hours to reach the nearest health centre or hospital.

For education the overall situation is fairly positive. Between 1997 and 2004, the proportion of the population living on islands with a full penalty point (maximum extent of deprivation) has decreased from about 10 percent to less than 4 percent. At the same time, the proportion of the population living on islands that score no penalty points has increased from less than 40 to about 60 percent of the country's total population. As a result, the average education index in the atolls improved from 0.50 to 0.29 – and the total number of islands that scored more than 0.5 penalty points fell from 83 to 47. In both years, 45 percent of the islands scored a full penalty and could be considered 'education poor'. At the atoll level, the poorest atolls with regard to education were Haa Dhaalu (0.64), Alifu Dhaalu (0.50), and Alif Alifu (0.44).

Table 2 further shows that no progress has been made in the field of employment, transport and environment (indeed the first two living standard dimensions show a deterioration). The Maldives faces major challenges in providing its workforce with sufficient employment. The society has been changing fast and a higher proportion of new job entrants have a reasonable standard of education. In the past most school leavers would have been absorbed by the

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Government. However, nowadays this is no longer feasible. Moreover, they also find it difficult to move to higher education since the country offers such few opportunities. Between 1997 and 2004 the overall PGR for transport for all atolls did not change much. Half the atolls had a higher index score; half had a lower score. At the island level however there were some changes. Between 1997 and 2004 the number of islands with an index of 1 increased from 27 to 35, while the number that scored 0.75 declined from 23 to 19, and the number that scored 0.5 declined from 90 to 72. On the other hand, the number of islands without transport problems decreased from 44 to 38. Overall, although there has been progress in island accessibility, this has been offset by deterioration in the number of vessels available, as well as in the frequency of transport. It should be noted, however, that one reason for reduced frequency of travel to atoll capitals could be that having better facilities on the islands and improved communications has actually reduced the need for such travel.

Environmental challenges, both due to the insular nature of the country as well as the lack of land resources for its growing population, is likely to become the main concern over the coming years. Beach erosion is increasing vulnerability in practically all islands. This and the anticipated sea level rise present unprecedented challenges.

3.3 Priority weights by living standard dimension for the Maldives

Priority weights are obtained by asking men and women in the households to rank the list of living standard dimensions in the order of their priority.[25] If they are of the opinion that the availability of drinking water is their biggest problem and should, therefore, get the highest priority, drinking water gets ranking number 1, etc. Table 3 shows the overall ranking of priorities according to male and female household members in 1997 and 2004. The value 3.9 for education for women means that on average women had given education a ranking number of 3.9 on a scale from 1 (highest priority) to 12 (lowest priority) in 1997. That is the lowest ranking number in the list and has therefore the highest priority according to females.

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[25] As per instructions, the questions were generally asked independently to men and women, without the other's presence. In some cases this wasn't feasible. In these cases the responses were obtained simultaneously from the spouses.

Table 3 Female and male priority rankings for the Atolls, Maldives, 1997 and 2004

Ranking (r_d)	1997			2004		
	Women	Men	Average*	Women	Men	Average*
Education	3.9	4.2	4.1	3.8	4.4	4.1
Health	5.1	4.9	5.0	4.2	4.5	4.4
Housing	5.2	4.9	5.1	5.2	4.8	5.0
Employment	6.5	6.4	6.5	5.3	5.1	5.2
Income	6.3	6.3	6.3	5.9	5.8	5.9
Environment	8.3	8.4	8.4	7.3	7.3	7.3
Drinking Water	6.7	6.9	6.8	7.2	7.5	7.4
Electricity	5.7	5.8	5.8	7.6	7.6	7.6
Transport	7.3	6.9	7.1	7.8	7.5	7.7
Communication	7.4	7.5	7.5	7.9	7.8	7.9
Food security	7.3	7.4	7.4	7.9	8	8.0
Consumer goods	8.3	8.2	8.3	8.3	8.2	8.3

Source: VPA I and II. * Calculated as the simple average of the rankings for women and men, since the number of men and women in the Maldives is approximately equal.

It is remarkable that women and men gave practically identical overall rankings.[26] Furthermore, a comparison of the responses for 1997 and 2004 learns that the top three priorities have remained identical. Electricity, however, which had been the fourth priority in 1997, slipped to eighth position, because many islands had since received electricity. Also, employment and income generation switched rankings. The most striking change, however, has been the rise in prominence of concern about the environment. Bottom of the list in 1997, it rose to number six, for both men and women. Note that this was before the tsunami. This is in line with the finding that the PGR for the environment dimension remained the worst of all, with almost all islands scoring the maximum penalty point of one.

Given the number of dimensions $n_d = 12$ and rankings r_d given in Table 3 and using equation (5), the reader can verify that the female and male priority weights for each dimension for 1997 and 2004 are as shown in Table 4.

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[26] The same is true when calculating priority rankings and weights for the most vulnerable islands, defined as the (90 out of 200) poorest islands according to a HVI constructed using equal weights, together accounting for 20 percent of the population. The only significant difference between the weights and rankings for all islands and those for the most vulnerable islands is that the latter give a relatively high priority to electricity (which they are relatively more deprived of).

Table 4 Female and male priority weights for the Atolls, Maldives, 1997 and 2004

Priority weights (w_d)	1997			2004		
	Women	Men	Average	Women	Men	Average
Education	0.117	0.113	0.115	0.119	0.111	0.115
Health	0.101	0.104	0.102	0.113	0.110	0.112
Housing	0.100	0.104	0.102	0.101	0.106	0.103
Employment	0.083	0.084	0.084	0.099	0.102	0.101
Income	0.086	0.086	0.086	0.091	0.093	0.092
Environment	0.060	0.059	0.060	0.073	0.074	0.074
Drinking Water	0.081	0.078	0.079	0.075	0.071	0.073
Electricity	0.094	0.092	0.093	0.070	0.070	0.070
Transport	0.073	0.078	0.076	0.067	0.071	0.069
Communication	0.072	0.070	0.071	0.066	0.067	0.066
Food security	0.073	0.072	0.072	0.066	0.065	0.065
Consumer goods	0.060	0.061	0.061	0.061	0.062	0.061
Total	1	1	1	1	1	1

The priority weights displayed in Table 4 compare with equal weights, as used for example by the UNDP when constructing the HDI, of $1/12 = 0.083$ for each dimension. Since priority weights significantly differ from 0.083 we expect the HVI for the Maldives to differ from a HVI constructed using equal weights.

3.4 Human Vulnerability Index for the Maldives

Applying equation (6) and using the data contained in the previous subsections we can calculate the HVI for the atolls of the Maldives.[27] Table 5 displays the HVI for the years 1997 and 2004 at regional level, at atoll level, and – combining the HVI for all atolls with that of Male' – for the Maldives as a whole. For illustrative purposes the table also displays the HVI when it is constructed using equal weights.

Table 5 shows that the HVI is generally lower with priority weights than with equal weights. This implies that there is relatively less poverty for high priority living standard dimensions like education and health than for perceived lower prioritised issues like consumer goods and communication. This counterintuitive result may be explained by homogeneity in preferences. The Maldives is one of the most homogenous countries in the world

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[27] Small differences may occur due to rounding errors.

characterised by one common language, religion and culture; there are no tribal or caste divisions. The government thus knows the preferences of the population and can respond to poverty challenges quickly.

Table 5 Human Vulnerability Index (HVI) by region, 1997 and 2004

Region		Equal weights			Priority weights		
		1997	2004	Progress	1997	2004	Progress
North		**0.50**	**0.32**	**36%**	**0.47**	**0.31**	**34%**
	Haa Alifu	0.50	0.31	38%	0.48	0.30	38%
	Haa Dhaalu	0.49	0.29	41%	0.46	0.29	37%
	Shaviyani	0.52	0.38	27%	0.49	0.36	27%
Central North		**0.47**	**0.34**	**28%**	**0.45**	**0.33**	**27%**
	Noonu	0.50	0.34	32%	0.48	0.33	31%
	Raa	0.45	0.38	16%	0.44	0.37	16%
	Baa	0.47	0.32	32%	0.45	0.31	31%
	Lhaviyani	0.47	0.31	34%	0.44	0.30	32%
Central		**0.41**	**0.31**	**24%**	**0.40**	**0.32**	**20%**
	Kaafu	0.41	0.30	27%	0.40	0.30	25%
	Alif Alifu	0.42	0.33	21%	0.40	0.33	18%
	Alifu Dhaalu	0.40	0.32	20%	0.38	0.33	13%
	Vaavu	0.45	0.30	33%	0.42	0.30	29%
Central South		**0.49**	**0.33**	**33%**	**0.47**	**0.33**	**30%**
	Meemu	0.49	0.31	37%	0.47	0.30	36%
	Faafu	0.52	0.34	35%	0.50	0.33	34%
	Dhaalu	0.47	0.34	28%	0.45	0.34	24%
	Thaa	0.49	0.32	35%	0.47	0.31	34%
	Laamu	0.48	0.35	27%	0.48	0.34	29%
South		**0.43**	**0.25**	**42%**	**0.40**	**0.23**	**43%**
	Gaafu Alifu	0.51	0.33	35%	0.50	0.32	36%
	Gaafu Dhaalu	0.49	0.27	45%	0.47	0.26	45%
	Gnaviyani	0.39	0.16	59%	0.35	0.15	57%
	Seenu	0.37	0.23	38%	0.33	0.21	36%
Atolls		**0.48**	**0.32**	**33%**	**0.46**	**0.31**	**33%**
Male'		0.20	0.21	-5%	0.18	0.21	-17%
Maldives		**0.41**	**0.29**	**29%**	**0.39**	**0.28**	**28%**

As for regional differences, Table 5 shows that, in 1997, the Central Region and the South Region were better off than the other regions according to both equal weights and priority weights. In 2004, the South is much better off, especially Gnaviyani and Seenu, and it seems that inequality between all other regions has declined.

Adding data for Male', where poverty levels are relatively low but have increased since 1997 due to increased housing pressures, the HVI for the Maldives is shown to equal 0.28 in 2004 and 0.39 in 1997. This compares to a HDI of 0.74 in 2004, according to which the Maldives ranks as a country with medium human development.[28] An HDI of 0.74 implies a shortfall of 0.26. This figure is remarkably close to the HVI using priority weights. Nevertheless, the HVI - tailor-made for the Maldives - is much better able to capture the many dimensions of poverty in the country and in the regions than the HDI.

4. Conclusions

This paper presents a new multi-dimensional poverty indicator, which weighs dimensions of poverty using population preferences, where such preferences are derived from priority rankings of household survey respondents.

The so-called Human Vulnerability Index (HVI) is an improvement over existing composite indices by including dimensions of poverty that are relevant for the country or region under scrutiny and by using weights that are based on population preferences, rather than arbitrarily assigned, usually equal, weights. The HVI also forms an attractive alternative to Principal Components Analysis type of methods, as its weights are recognised and appealing, its derivation is transparent and simple, and comparisons at regional level can be made as well as over time.

An application of the HVI for the Maldives illustrates the richness of analysis possible with this method in terms of measuring not only aggregate poverty, but also decomposing it into its relevant dimensions, accounting for gender differences, and being able to show cross-

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[28] UNDP (2006).

regional differences and changes over time. Specifically, respondents in all 200 inhabited islands were asked to rank twelve living standard dimensions – income, electricity, transport, communication, education, health, drinking water, consumer goods, housing, environment, food security and employment – according to their relative importance in determining the overall standard of living or level or poverty.

The individual scores (poverty gap ratios) for the island population on each of these dimensions show that most progress has been made in the field of communication, health, education and electricity. Also, no progress has been made in the field of employment, transport and environment, with the first two showing deterioration. The island population is 100 percent poor on the latter dimension due to the insular nature of the country as well as the lack of land resources for its growing population. Environmental challenges are likely to become the main concern over the coming years, given ongoing beach erosion and the unprecedented challenge of the anticipated sea-level rise.

The resulting priority weights for women and men are remarkably similar for both 1997 and 2004. Electricity, which had been the fourth priority in 1997, slipped to eighth position and again, the most striking change is the rise in prominence of concern about the environment before the Tsunami occurred.

Whereas the priority weights differ significantly from equal weights of 0.083 (for twelve dimensions), the HVI at regional, atoll and aggregate level is remarkably similar to an HVI constructed with equal weights. In general, however, the HVI is lower with priority weights than with equal weights, implying that there is relatively less poverty for high priority than low priority living standard dimensions. This counterintuitive result may be explained by homogeneity in preferences. The government knows the preferences of the population and can respond to poverty challenges quickly.

The overall HVI for the Maldives is shown to equal 0.28 in 2004 (excluding Male': 0.31) and 0.39 in 1997 (excluding Male': 0.46). Hence poverty in the Maldives has declined. The HVI for 2004 compares with a Human Development Index of the UNDP of 0.74 in 2004, implying a shortfall of 0.26 which is remarkably similar. Nevertheless, the HVI - tailor-

made for the Maldives - is much better able to capture the many dimensions of poverty in the country and in the regions than the HDI.

Areas for future work include analyses of the dynamics of poverty or vulnerability, i.e. the risk of the population experiencing an episode of poverty and an assessment of the impact of the Tsunami on poverty in the Maldives.

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Appendix 1 List of atolls and islands, Maldives

Atoll	Island	Atoll	Island	Atoll	Island
Male'	Male'	Haa Dhaalu ctd.	Kuribi	Noonu ctd.	Holhudhoo
			Kuburudhoo		Fodhdhoo
			Kulhudhuffushi		Velidhoo
			Kumundhoo	Raa	Alifushi
			Neykurendhoo		Vaadhoo
			Vaikaradhoo		Rasgetheemu
			Maavaidhoo		Agolhitheemu
			Makunudhoo		Ugoofaaru
Haa Alifu	Thuraakunu	Shaviyani	Kaditheemu		Kadholhudhoo
	Uligamu		Noomaraa		Maakurathu
	Berinmadhoo		Goidhoo		Rasmaadhoo
	Hathifushi		Feydhoo		Innamaadhoo
	Mulhadhoo		Feevah		Maduvvari
	Hoarafushi		Bilehffahi		Iguraidhoo
	Ihavandhoo		Foakaidhoo		Fainu
	Kelaa		Narudhoo		Meedhoo
	Vashafaru		Maakandoodhoo		Kinolhas
	Dhidhdhoo		Maroshi		Hulhudhuffaaru
	Filladhoo		Lhaimagu	Baa	Kudarikilu
	Maarandhoo		Firubaidhoo		Kamadhoo
	Thakandhoo		Komandoo		Kendhoo
	Utheemu		Maaugoodhoo		Maaddoo
	Muraidhoo		Funadhoo		Udoodhoo
	Baarah	Noonu	Hebadhoo		Kihaadhoo
Haa Dhaalu	Faridhoo		Kedhikolhudhoo		Dhonfanu
	Hondaidhoo		Thoihendhoo		Dharavandhoo
	Hanimaadhoo		Maalhendhoo		Maalhos
	Finey		Kudafari		Eydhafushi
	Naivaadhoo		Landhoo		Funadhoo
	Hirimaradhoo		Maafaru		Thulhaadhoo
	Nolhivaranfaru		Lhohi		Hithaadhoo
	Nellaidhoo		Miladhoo		Fulhadhoo
	Nolhivaramu		Magoodhoo		Fehendhoo
			Manadhoo		Goidhoo

Atoll	Island	Atoll	Island	Atoll	Island
	Hinnavaru	Vaavu ctd.	Rakeedhoo	Thaa ctd.	Omadhoo
	Naifaru		Raimandhoo		Isdhoo
Shaviyani	Kurendhoo		Madifushi		Dhabidhoo
	Olhuvelifushi		Veyvah		Maabaidhoo
	Maafilaafushi		Mulah		Mundhoo
	Kaashidhoo	Meemu	Muli		Kalhaidhoo
	Gaafaru		Naalaafushi		Gamu
	Dhiffushi		Kolhufushi	Laamu	Maavah
	Thulusdhoo		Dhiggaru		Fonadhoo
Kaafu	Huraa		Maduvvari		Gaadhoo
	Himmafushi		Feeali		Maamendhoo
	Gulhi		Himithi		Hithadhoo
	Maafushi		Biledhdhoo		Kunahandhoo
	Guraidhoo	Faafu	Magoodhoo		Kolamaafushi
	Thoddoo		Dharaboodhoo		Viligili
	Rasdhoo		Nilandhoo		Maamendhoo
	Ukulhas		Meedhoo		Nilandhoo
	Mathiveri		Badidhoo	Gaafu Alifu	Dhaandhoo
	Bodufolhudhoo		Ribudhoo		Dhevvadhoo
	Feridhoo	Dhaalu	Hulhudheli		Kodey
	Maalhos		Gemendhoo		Dhiyadhoo
	Himandhoo		Vaanee		Gemanafushi
	Hangnameedhoo		Maaeboodhoo		Kanduhulhudhoo
Alifu Alifu	Omadhoo		Kudahuvadhoo		Madeveli
	Kuburudhoo		Buruni		Hoadedhdhoo
	Mahibadhoo		Vilufushi		Nadallaa
	Mandhoo		Madifushi		Gadhdhoo
	Dhagethi		Dhiyamigili		Rathafandhoo
	Dhigurah		Guraidhoo	Gaafu Dhaalu	Vaadhoo
	Fenfushi		Kadoodhoo		Fiyoari
	Dhidhdhoo	Thaa	Vandhoo		Maathodaa
	Maamigili		Hirilandhoo		Fares
	Fulidhoo		Gaadhiffushi		Thinadhoo
	Thinadhoo		Thimarafushi	Gnaviyani	Foammulah
Vaavu	Felidhoo		Veymandoo	Seenu	Meedhoo
	Keyodhoo		Kibidhoo		Hithadhoo

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Atoll	Island
Seenu ctd.	Maradhoo
	Feydhoo
	Maradhoo-Feydhoo
	Hulhudhoo

Appendix 2 Vulnerability and Poverty Assessment I (1997/8), II (2004), Maldives

Survey methodology

Both VPA surveys covered all 200 inhabited[29] islands in the atolls, as well as the capital, Male' – gathering information from all households and then selecting a number of others randomly for in-depth interviews. In the atolls, the survey for VPA-II selected as its sample half the households that had been enumerated in 1997/98 – forming the 'panel' – and the other half from the remaining households.

To supplement the household information, questionnaires were also administered at the community level – concerning physical infrastructure and the availability of social services and economic resources. Most of this information was obtained from the office of the island chief. In addition, members of the Island Development Committees and the Women's Development Committees also provided information on the main problems experienced in the intervening seven years and what they saw to be the priorities for further development.

While the second survey questionnaire largely repeated that of VPA-I, often with identical phrasing, it also included a few changes to correct for weaknesses in the earlier questionnaire and to account for structural changes that had made some questions redundant and required some additions to ensure proper coverage in a changed environment.

At the start of the survey, the staff of the island offices prepared a listing of all households. In the atolls, the household listing was split into two parts: the first consisted of those households that had been enumerated in the survey for VPA-I. The second part consisted of all other households on the island. From both parts, five households were selected at random, along with five others to be used as replacements in cases where the original households could not be found or would not co-operate. On islands with larger populations, the sample was increased to include ten additional households for every 1,500 persons. This method of

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[29] The island universe in Maldives is particularly varied and diverse. The 1,200 islands that make up the Republic form a chain 820 km in length and 130 km at its widest point, set in an area of more than 90,000 sq. km of the Indian Ocean. No fewer than 200 of the islands were inhabited at the time of the surveys. All are very small. Only 33 inhabited islands have a land area of more than 1 sq. km and, in 1997, no fewer than 67 islands – one-third of the total – had less than 500 inhabitants, while 144 islands – 70 percent of the total – had less than 1,000 inhabitants. This gives Maldives a geography that is extreme, even by the exceptional standards of small archipelagic states.
In addition to the 200 inhabited islands, there are about 90 islands in use as tourist resorts. Furthermore, there are a number of industrial, agricultural and official islands. Only the inhabited islands were covered in both surveys. Local employees resident on the resort islands during the survey periods were included in the households to which they belong.

determining the sample size was identical to that used in the first survey. The sample size is about 2,400 households in the atolls and 300 households in the capital Male'.

Data entry, editing and processing

During data entry a large number of items were checked for consistency and plausibility. If this process suggested errors, the data entry operators were prompted to cross-check the information they had entered with that on the forms – reducing the number of data transcription errors to an acceptable level while allowing obvious errors to be corrected at an early stage. Once all the data had been entered, more checks for consistency and errors were carried out until an acceptable level of accuracy was obtained and only limited data gaps remained. This was an iterative process demanding frequent crosschecks with the original forms.

Reliability

Island-specific data like the physical infrastructure or education facilities are representative for the situation on the island, but household-specific data like household incomes are not representative at island level due to the small number of observations. Although on a small island where 50 households are living, 10 households may be a large proportion of all households, they constitute a sample so small that the variance, or standard deviation at island level, is generally beyond acceptable levels. However, when islands are grouped into atolls or regions the number of observations is large enough for reliable estimates.