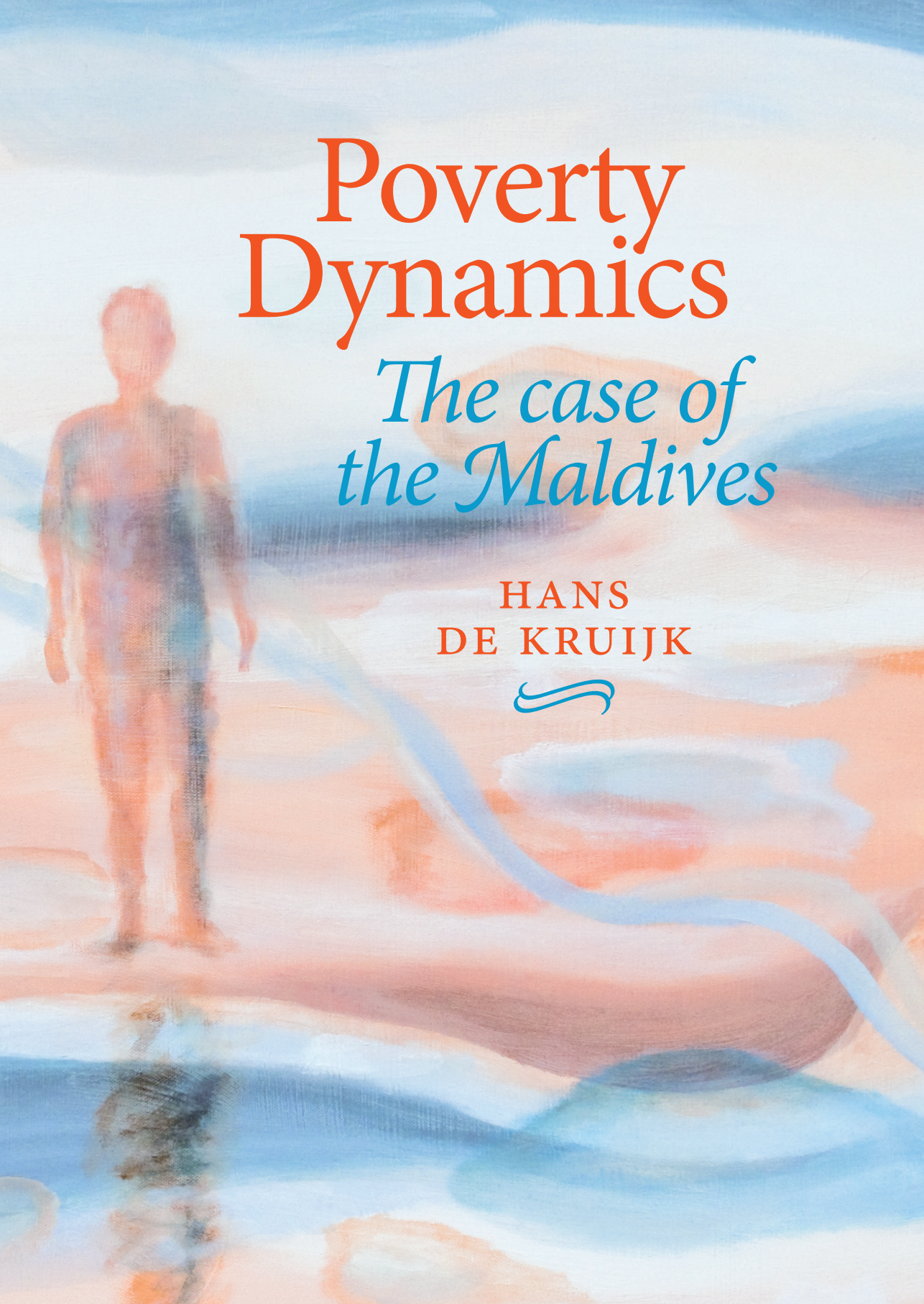

Poverty Dynamics

The case of the Maldives

HANS
DE KRUIJK

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Hans de Kruijk

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Poverty Dynamics

The case of the Maldives

Armoede: ontsnappen en terugvallen

Met een empirische toepassing op de Malediven

Proefschrift

ter verkrijging van de graad van doctor aan de
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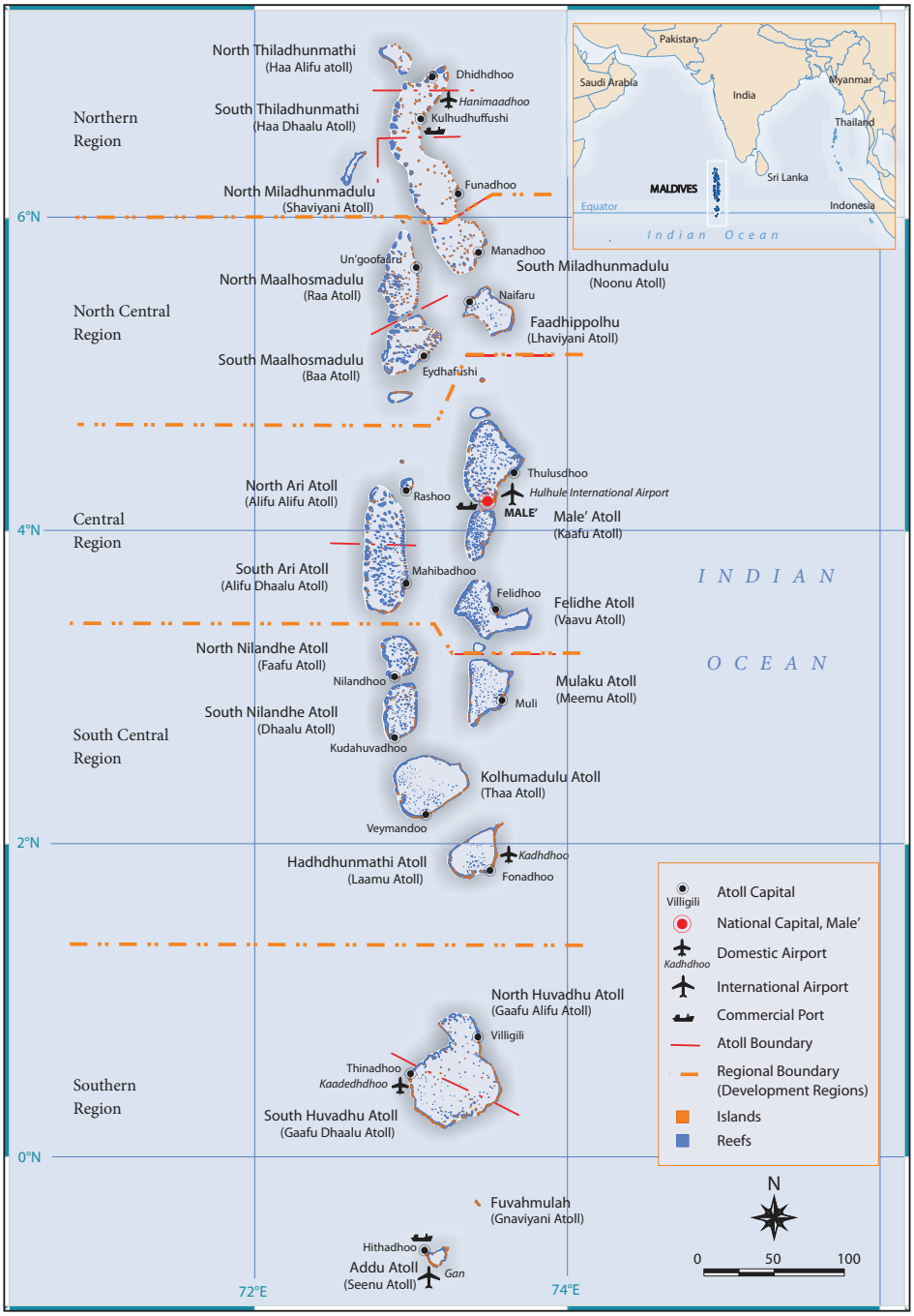
Aan mijn ouders

Aart de Kruijk and Dina Dik

MAP OF THE MALDIVES



Contents

Chapter 1

Introduction

1.1 BACKGROUND

In the beginning of 1997 the United Nations Resident Coordinator in the Maldives requested me to become team leader, together with Willem van den Andel, of the first Vulnerability and Poverty Assessment (VPA-1) to be carried out on all 200 inhabited islands in the Maldives. I was honoured and I agreed without knowing that this request would be the herald of a more than 10-years involvement in the Maldives.

The VPA-1 was the most comprehensive survey ever undertaken in the Maldives at that time, both in terms of geographical coverage as well as the range of development concerns. It provides information on income and non-income dimensions of poverty at island and household level. In addition, it includes opinions on the difficulties faced, and on the ranking of needs and development priorities experienced by households, Island Chiefs, Island Development Committees and Women's Committees of all the islands. It was a substantial project carried out by around 100 persons, mainly enumerators and data entry operators.

Seven years later, in 2004, the United Nations Development Program (UNDP) together with the World Bank requested us to repeat the exercise to assess the progress in poverty reduction over time. These results are published in the second Vulnerability and Poverty Assessment (VPA-2). And then, a few months later, on 26 December 2004, came the tsunami that affected the lives and livelihoods of a significant part of the population and destroyed houses, health posts, schools, harbours, jetties, and personal belongings across the country. To gauge the island-specific impact of the tsunami at household level, UNDP in partnership with the United Nations Population Fund (UNFPA), requested us to do the exercise again in 2005 on all 200 inhabited islands. These results are published in the Tsunami Impact Assessment (TIA). The series of three reports, VPA-1 in 1997, VPA-2 in 2004, six months before the tsunami, and TIA in 2005, six months after the tsunami, provides insights into many aspects of poverty, vulnerability, social and economic conditions and developments in the Maldives, often in great detail.

1.2 MOTIVATION

The motivation of writing this thesis is the idea that some innovative methodologies and techniques that were developed and applied during the three vulnerability and poverty assessments could be interesting for the academic world.

First, a Multidimensional Poverty Index (MPI) was developed covering income and non-income dimensions of poverty including employment, housing, transport, electricity, communication, food security, environmental security, availability of drinking water, consumer goods, access to health and education (Chapter 4).

Secondly, 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 questions 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. We solve the aggregation problem by using a weighting structure that is derived directly from population preferences by using explicit information on the ranking of poverty dimensions as obtained from the surveys. These ranking are transformed into *priority weights* for each dimension so as to obtain a composite index. An empirical application to the Maldives is given for the years 1997 and 2004, which allows for observing changes in the poverty situation over time for each dimension, for each region and for overall poverty (Chapter 4).

Thirdly, the poverty dominance approach was not only applied to income poverty but to non-income dimensions of poverty as well (Chapters 4 and 5).

Fourthly, as longitudinal studies tracing the same households over time lead to a better understanding of poverty than point-in-time studies, this thesis may be an input to the expanding literature on poverty dynamics by presenting empirical results of a panel survey in the Maldives where more than one thousand households have been followed over time.

Apart from applying innovative methodologies, this thesis tries to answer the question: "What are the characteristics of households that manage to escape from poverty and what are the characteristics of households that fall back to poverty?" Despite rapid economic and social development of the Maldives, poverty dynamics is high. Household panel data for the period 1997 – 2004 show that, although the majority of the poor manages to escape from poverty, a substantial part of the non-poor falls back into poverty at the same time. We use Logit regression analysis to reveal influential characteristics of households that manage to escape from poverty and of households that fall into poverty. The results have implications for household coping strategies and government policies (Chapter 5).

Further, we use Logit regressions analysis to discover which characteristics of households escaping from – and falling into – poverty six months after the tsunami are similar as in the previous period and which are different (Chapter 6).

1.3 A SHORT INTRODUCTION TO THE MALDIVES

The island universe in Maldives is particularly varied and diverse. The 1,190 islands that make up the Republic are grouped into 26 natural atolls that together form a double chain of 820 km in length and 130 km at its widest point, set in an area of more than 90,000 square km of the Indian Ocean. One-third of the 300,000 Maldivians live on the – two square km – overcrowded capital island Male' and 200,000 people live on 200 other small islands. Only 33 inhabited islands have a land area of more than 1 square km and no fewer than 75 islands – more than one-third of the total – have less than 500 inhabitants, while 100 islands – 50 percent of the total – have less than 1,000 inhabitants. This gives the 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 100 islands in use as tourist resorts. Furthermore, there are a number of industrial, agricultural and official islands. Only the inhabited islands were covered in the three surveys. Local employees resident on the resort islands during the survey periods were included in the households to which they belong.

There is no abject poverty in the Maldives. Many characteristics of poverty found in other parts of South Asia and in Africa are not in evidence in the Maldives. There is no starvation, although there are serious nutritional problems but there is no link between income and nutrition status. There is no urban begging, even though incomes of many people are low. There are no slum dwellers, although many houses in Male' are getting more and more overcrowded due to continuous and increasing rural-urban migration and on the islands, most of the 12,000 people that were made homeless by the tsunami are still living in temporary shelters.

Thirty years ago the Maldives was far removed and very different from the country today. Most Maldivians lived on islands that were worlds unto themselves. There were no means of communication and there was no electricity. For the vast majority of Maldivians there was no alternative to a life of subsistence fishing and agriculture. The lives of many people on the remotest and least accessible islands had probably more in common with those who had lived 500 years earlier than with those today.

Life was hard and conditions were difficult. As the men were often fishing for most of the daylight hours in their masdhonis, island life revolved around the women. They not only cared for the children, the home and the garden plot, but also undertook the drying and smoking of the fish brought home by the men, producing the only export commodity – Maldive fish. Women were the backbone of the island community. Like the men, they toiled from dawn to dusk for very modest rewards.

Many islands were vulnerable to acute food shortages and experienced long periods of deprivation, especially when fishing seasons proved short or storms devastated subsistence crops. Although rice was available, by no means everyone could afford it, and tubers and millet were an essential part of island diets. Malaria was endemic and claimed many lives, while such diseases as leprosy and filariasis first deformed and eventually killed many people. There was no safe sanitation and nearly everyone – even in Male'– was dependent for their water supply on shallow wells. In populated islands, the lens was often contaminated which gave rise to periodic outbreaks of water-borne diseases like typhoid and cholera.

Modern health infrastructure three decades ago was largely confined to a 40-bed hospital in Male' and the country had just 7 doctors for a population of 150,000 persons spread over 200 inhabited islands. Although medicines and very basic health services were available in some atolls, the majority of the island population was largely dependent on traditional healers as they had been for centuries. Similarly in education, thirty years ago modern education was confined to a few schools in Male', on the islands children were largely dependent on a system of traditional schools with untrained teachers guiding the children through religious texts.

The first tourist resort opened in 1972 on Kurumba Island near Male' and by the expansion of tourism to 675,000 tourist arrivals in 2007, the country has witnessed nothing short of an economic revolution accompanied with tremendous economic and social change. The Maldives transformed from a closed to a very open economy within one generation. The high economic growth rates were temporarily halted by the tsunami but growth has now resumed to pre-tsunami levels or even higher.

1.4 OVERVIEW

This thesis consists of seven chapters. Chapter 2 presents the data base. Chapter 3 discusses concepts and measurement of poverty. Chapters 4, 5 and 6 are three self-contained articles, respectively on weighting dimensions of poverty based on people'

priorities, poverty dynamics, and the tsunami impact on poverty and vulnerability in the Maldives. Chapter 7 summarizes the main findings.

Chapter 2

The Data Base

2.1 INTRODUCTION

The data base consists of primary data collected through three large-scale longitudinal surveys. The first wave was conducted in 1997 (VPA-1) with follow-ups in 2004 (VPA-2) and 2005 (TIA). The surveys were carried out on all 200 inhabited islands in the Maldives as well as on the capital island Male'. In each survey, about 2,700 households were interviewed: 300 households in the capital and 2,400 households in the Atolls. Out of these 2,400 households in the Atolls, more than 1,000 of the same households have been followed over time, permitting a 'panel analysis' to get insight in poverty dynamics in rural Maldives, both before the tsunami during the period 1997–2004 and after the tsunami during 2004–2005.

There are three questionnaires, one for the households, one for the island office and one for the community development committees and the women's committees. The questionnaires are practically the same for VPA-1 and VPA-2 and have a large overlapping part with the same questions for TIA that, of course, has an additional part on tsunami related questions including losses due to the tsunami, tsunami aid received and extra modules on psychosocial and reproductive health.

The household questionnaires for all three surveys provide information on household size and composition, housing status, household durables, property transactions, savings, loans and credits, food shortage, availability of drinking water and electricity, crises and coping mechanisms, and perceptions of economic wellbeing. Further, for each household member data were collected on income including cash income, wages in kind and own produced consumption; employment status, occupation and economic sector; education and health status.

The island questionnaires provide detailed information on the physical infrastructure on each island: its accessibility (harbour, jetty, reef status), availability of ground water and rain water, sewage, electricity, transport and communication; on the availability of social services: education and health facilities; and on economic resources and activities in the community.

The members of the Island Development Committees and the Women's Development Committees were asked to rank the main daily life problems according to their priorities for further development, a question that has also been included in the household questionnaire.

2.2 METHODOLOGY OF THE THREE SURVEYS, SAMPLE SIZES AND COMPOSITION

The samples are drawn from two domains: urban (the capital Male') and rural (the other 200 inhabited islands in the Atolls). The sample design for the 200 islands in the atolls is different from that in the capital. In the atolls, a stratified sampling plan has been applied, the 200 islands being the primary sampling units (PSU) and the households being the secondary sampling units (SSU). In the capital, a two-stage self-weighting sampling design has been applied.

Sampling in the Atolls

At the start of the surveys a fresh list was made on the spot on each island of all households on that island. In this sense, it was a census for the atolls. The list of households was made in a systematic way by choosing a direction how the enumerators walk on the island to make the list (clock-wise or anti-clock-wise). In the first two surveys, VPA-1 in 1997 and VPA-2 in 2004, a minimum sample of ten households was selected on each island with less than 1,500 inhabitants. For islands with a larger population size, the sample was increased by ten households for every 1,500 inhabitants. Table 2.1 shows the VPA-2 sample design for the atolls in 2004 and its sample size and composition.

The final number of households interviewed was a bit lower than planned because some forms appeared to be missing or not completely filled. By mistake, one island was under-sampled by interviewing 50 households in stead of 60 and a couple of islands were over-sampled by interviewing 20 household in stead of 10. Overall, more than 97 per cent of the target households was interviewed.

Table 2.1 Sample design, size and composition, Atolls, 2004

Island size classes in terms of population	Number of islands	Number of households	Island population	Sample design		Actual sample
				Sample size per island	Target no. of sample households	Number of households interviewed
<1,500	170	19,757	113,372	10	1,700	1,702
1,500–3,000	22	6,582	44,755	20	440	404
3,001–4,500	5	2,784	17,946	30	150	135
4,501–6,000	0	0	0	40	0	0
6,001–7,500	0	0	0	50	0	0
7,501–9,000	2	2,838	16,976	60	120	110
9,001–10,500	1	1,373	10,124	70	70	70
Total	200	33,334	203,173		2,480	2,421

The sample households were selected systematically from the list arranged in order of enumeration, using intervals and a random start. Let N be the total number of households on an island and n be the sample size on that island, an interval is defined as $k = \frac{N}{n}$ and a random start is made between 1 and k. A sample taken from a list arranged in order of enumeration creates implicit strata of each interval. For example, to select 10 households out of a total of 60 households on an island, we first determine the interval – which is 6 in this case – and than generate a random number between 1 and 6. Suppose this random number is 4, then the households numbered 4, 10, 16, 22, 28, 34, 40, 46, 52, and 58 are selected to be in the sample. This systematic way of sampling ensures that all parts of the island are covered.

The second survey in the atolls in 2004 selected for its sample half the households that had been enumerated in the first survey in 1997 – forming the 'panel' – and the other half from the remaining households. Accordingly, the fresh list of households on each island was split into two parts: the first consisted of those households that had been enumerated in the survey for VPA-1. 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.

The sample of third survey, TIA in 2005, is basically the same one as used in VPA-2 in 2004 covering all 200 inhabited islands. However, as the third survey focuses on the impact of the tsunami on households, adjustments were made in the sample size of the different classes of islands according to the impact of the tsunami. The National Disaster Management Centre (NDMC) made the following tsunami impact classification, based on five levels, from very high to nil:

1. Very high impact: Population displaced and temporary shelter required (14 islands)
2. High impact: Population displaced and major damage to housing and infrastructure (22 islands)
3. Substantial impact: Damage to more than a quarter of buildings and infrastructure (33 islands)
4. Limited impact: Flooding in few houses but no structural damage (122 islands)
5. No impact: No flooding (9 islands)

The sample of the third survey is composed by taking the VPA-2 sample as a starting-point and adjusting it in two steps. First, by enlarging the sample size of the 14 most affected islands by a factor 3, by doubling the sample size of the next island group and by halving the sample size of the two least affected island groups. Secondly, the sample size islands of the two least affected island groups where at least one third of the population received financial tsunami assistance was kept at the level of VPA-2 rather than reduced by half. Table 2.2 presents the sample design and the actual sample size and composition.

The number of households interviewed is smaller than targeted for a number of reasons. Although most target households could be located including displaced households in their new temporary locations, some households could not be traced. Other households appeared to be broken up and in some cases the responsible household members were absent at the time of enumeration. Further, some forms were missing or not completely filled and due to a coding error during sampling, one island was under-sampled by interviewing 15 households in stead of 60. Overall, 2,181 households were interviewed that is 88 per cent of the target households. Out of this total 1,019 of the same households have also been enumerated in 1997 and 2004.

Table 2.2 Sample design, size and composition, Atolls, 2005

Tsunami impact level	Number of islands	Island population VPA-2 2004	Sample design		Actual sample
			Sample relative to VPA-2	Target no. of sample households	Number of households interviewed
1	14	12,908	3x	480	445
2	22	20,404	2x	540	478
3	33	38,961	same	440	415
4	122	123,520	half or same	795	790
5	9	7,380	half or same	55	53
Total	200	203,173		2,480	2,181

Sampling in Male'

Sampling in Male' is different from that in atolls. First, there is no panel in Male' as population movements over the years had made it unfeasible to locate an acceptable number of households that had been enumerated in earlier surveys. Accordingly, in Male' in each of the three surveys a completely new sample has been drawn.

Secondly, in order to avoid a listing of more than 10,000 households, a two-stage self-weighting design has been applied. Male' is stratified by 5 wards and 317 enumeration blocks. A block is the primary sampling unit (PSU) in the sample design for Male' and the household is the secondary sampling unit (SSU). In the first stage,

within each ward enumeration blocks are selected with a probability in proportion to the size (PPS) of the blocks in terms of the number of households. PPS, a sampling technique commonly used in multi-stage cluster sampling, means that the probability that a particular block will be selected in the sample is proportional to the number of households in the block, so that larger blocks in terms of the number of households have a higher probability of being selected than smaller ones. In formula, the probability that a particular block j will be selected is $p_j = A\frac{N_j}{\sum N_j}$ where A is the number of blocks selected and N_j is the number of households in block j. A fresh listing of households is only made for the selected blocks.

In the second stage, within the selected blocks a fixed number of B households is selected from the list using systematic sampling with a random start ($B = 10$ in 1997 and 2004 and $B = 5$ in 2005). The probability that a particular household h_j within block j will be selected is $p_{h_j} = \frac{B}{N_j}$ where B is the number of households to be selected within a block.

The first stage probability to be selected is proportional to the size a block and the second stage selection is inversely proportional to the size of a block. Such sampling plan results in a self-weighting design, where each household within Male' has an equal probability of being selected. The overall probability that a certain household h within Male' will be selected is $p_h = p_j p_{h_j} = \frac{AB}{\sum N_j} = const.$ and thus the same for all households.

Table 2.3 shows the sample design, sample size and composition for Male' in 2004 and 2005. Household data for the enumeration blocks were available from the Population Census 2000. The VPA-2 sample for Male' in 2004 is composed out of a fixed number of 10 households in each selected block. As Male' was not severely affected by the tsunami, only half the 2004 sample has been included in the TIA in 2005. Respectively, 96 and 97 per cent of the target households in 2004 and 2005 was interviewed. By international standards, such completion rates are high.

Table 2.3 Sample design, size and composition, Male', 2004 and 2005

Wards in Male'	Population size in 2000	Number of households in 2000	Total number of blocks	Sample design			Actual sample	
				Number of sample blocks	Target no. of sample households		Number of households interviewed	
					2004	2005	2004	2005
Henveiru	18,100	2,488	76	8	80	40	75	38
Galolhu	13,878	1,813	59	6	60	30	58	29
Machangolhi	13,589	1,748	57	6	60	30	59	30
Maafannu	22,372	2,928	108	10	100	50	95	49
Viligili	4,291	601	17	2	20	10	20	9
Total	72,230	9,578	317	32	320	160	307	155

Sources: Columns 1–4: Population Census 2000; columns 5–8: VPA-2 and TIA dataset

Raising factors

A raising factor is a weight to raise the unweighted sample results to higher levels. The raising factor of a sample unit is defined as the coefficient of a linear function of the values of the sample units used to estimate stratum or population unit totals.

As the samples in Male' are self-weighting (see above) the raising factors of all sample units within each year (R) should be equal, being the inverse of p_h: $R = \frac{\sum N_j}{AB} = const.$ In 2004, R is about 35 meaning that about three per cent of the population has been interviewed. However, as the actual number of households interviewed in Male' slightly deviates from the original sample design (see Table 2.3), we have adjusted the common raising factor (R) according to the actual sample sizes in the wards. In 2004, the raising factors in Male' range from 32 to 37.

In the Atolls, a non-self-weighting two-stage stratified sampling plan has been applied. On the islands, the total value of variable x on island j is estimated as:

$$\hat{X}_j = \frac{N_j}{n_j} \sum_{i=1}^{n_j} x_{ij}$$

where: $\hat{X}_j$ is the estimated total value of variable x on island j;
N_j is the total population size on island j;
n_j is the sample size on island j;
x_{ij} is the value of variable x of person i on island j;

so that the raising factors of the sampling units on each island are: $R = \frac{N_j}{n_j}$

For example, the 2004 sample on all 200 inhabited islands (apart from the capital) consists of 2,420 households with 14,604 household members while the total island population (apart from the capital) in 2004 is 203,173. This implies that the average raising factor for the island population is about 14. In other words, the sample size on the islands is about 7 per cent of the total island population.

However, in such a sampling design, the raising factors differ per island. They range from 1.9 to 32.8 per island in 2004. The lowest raising factor is found on Didhdhoo in Alifu Dhaalu Atoll which is the smallest island in 2004 in terms of population size. The total population size of this island is 93. The island sample consists of 10 households with respectively 5, 2, 6, 15, 5, 6, 3, 3, 2, and 2 household members. The sample size $n_j = 49$, the population size is $N_j = 93$, so that the raising factor of the characteristics of these households members is $93/49 = 1.9$. The largest raising factor is found on Foakaidhoo island in Shaviyani Atoll with a population size of 1,476, just less than 1,500, so that only 10 households are in the island sample. The household size of the 10 households is, respectively, 2, 5, 5, 6, 5, 3, 3, 5, 5, and 6, implying an island sample size of $n_j = 45$ and, therefore, a raising factor of $R = 1{,}476/45 = 32.8$.

2.3 RELIABILITY AND CONFIDENCE INTERVALS

Reliability

Detailed checks for consistency were carried out during data entry, data cleaning, and even in the data processing stage. Data entry was done using Acrobat PDF forms as screen formats – i.e. exact copies of the questionnaire. This kept the user interface very simple. 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 data had been entered, more checks for consistency and errors were carried out until an acceptable level of accuracy was obtained. This was an iterative process demanding frequent crosschecks with the original forms.

Island-specific data like the physical infrastructure and education and health facilities on an island are, of course, 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. Therefore, islands have to be grouped into regions until the number of observations is large enough for reliable estimates at regional level.

Confidence intervals

To indicate the accuracy of the results, confidence intervals are computed for two important variables: average household income per person per day and the percentage of the population below a certain poverty line (the headcount index) in Male' and in the Atolls for 1997, 2004 and 2005.

1. Household income per person per day

Table 2.4 presents the confidence intervals of average regional household income per person per day in Male' and in the Atolls for the years 1997, 2004 and 2005 in constant prices. Let us take the example of the average household income per person per day in the Atolls in 2005.

The standard deviation of household income per person per day $s_y = \sqrt{\frac{\sum_{i=1}^{N} (y_i - \bar{y})^2}{N}}$

where: y_i is household income per person per day of household i; $\bar{y}$ is average household income per person per day, calculated with raising factors; $\bar{y} = 37$ Rufiyaa (Rf.)[1] in the Atolls in 2005; N is the total population size in the Atolls in 2005; $N = 204{,}912$;
$\rightarrow s_y = 37.2$ in the Atolls in 2005.

The standard error $se_y = \frac{s_y}{\sqrt{n}}$ where n is the sample size being 14,323 persons in the Atolls in 2005 $\rightarrow se_y = 0.31$ in the Atolls in 2005
$\rightarrow$ 95% confidence intervals: $37.0 - 2 * 0.31 < \bar{y}_i < 37.0 + 2 * 0.31 \rightarrow 36.4 < \bar{y}_i < 37.6$.

1. The Maldivian Rufiyaa is pegged to the US dollar at an exchange rate of 12.85 Rufiyaa per dollar. However, as price levels in Maldives are substantially below those in USA especially for non-tradable goods and services, conversion from the Rufiyaa to the dollar against the official exchange rates would underestimate the purchasing power in the Maldives. The purchasing power exchange rate for the Rufiyaa is estimated at 4.34 Rufiyaa equivalent to 1 PPP $. The Household Income and Expenditure Survey 2002–2003 presents details of how this estimate has been derived.

Table 2.4 Confidence intervals of average regional household income per person per day, Male' and the Atolls, 1997, 2004 and 2005

	Male'			Atolls		
	1997	2004	2005	1997	2004	2005
Income per person per day (in Rf.)	46.7	67.7	62.7	25.4	31.0	37.0
Standard error	1.09	1.79	1.31	0.36	0.38	0.31
95% Confidence interval						
Income per person per day max	48.8	71.3	65.3	26.1	31.7	37.6
Income per person per day min	44.5	64.1	60.0	24.7	30.2	36.4

In words: At 95 per cent confidence level, the average regional household income per person per day in the Atolls in 2005 is within the interval 36.4 – 37.6 Rufiyaa. Table 2.4 shows that the accuracy of the estimated average regional household income per person per day is high, especially in the Atolls. This is due to the large sample size.

2. Headcount index

The headcount index is defined here as the percentage of the population below a certain poverty line.

The standard deviation of the headcount index $s_H = \sqrt{\frac{\sum_{i=1}^{N} (H_i - \bar{H})^2}{N}}$

where H_i is the headcount index of all household members of household *i*.

If the poverty line $z = 15$ Rf. per person per day, then $H_i = 100$ for all household members where $y_i < 15$ and $H_i = 0$ for all household members where $y_i \geq 15$.

For example, in the Atolls in 2005 the headcount index $\bar{H} = 20$; the standard deviation

$$s_H = \sqrt{0.20 * (100 - 20)^2 + 0.80 * (0 - 20)^2} = 40$$

The standard error $se_H = \frac{s_H}{\sqrt{n}}$ where n is the sample size being 14,323 persons in the Atolls in 2005 $\rightarrow$ $se_H = 0.3$ in the Atolls in 2005 $\rightarrow$ 95% confidence intervals: $20 - 2 * 0.33 < \bar{H} < 20 + 2 * 0.33 \rightarrow 19.3 < \bar{H} < 20.7$.
In words: At 95 per cent confidence level, the headcount index in the Atolls in 2005 is within the interval 19.3 – 20.7 per cent. Table 2.5 shows that the accuracy of the headcount index is high, not only in the Atolls but also in Male'.

Table 2.5 Confidence intervals of the headcount index, Male' and the Atolls, 1997, 2004 and 2005

	Male'			Atolls		
	1997	2004	2005	1997	2004	2005
Headcount index in percentages	18	15	7	50	34	20
Standard error	0.73	0.72	0.71	0.42	0.39	0.33
95% Confidence interval						
Headcount index max	19.5	16.4	8.4	50.8	34.8	20.7
Headcount index min	16.5	13.6	5.6	49.2	33.2	19.3

Panel data

The three surveys followed a large number of the same households over time – permitting a 'panel analysis'. Of the 2,336 participating households in the TIA in 2005, 1,797 households had also been included in the 2004 survey while 1,019 households are included in all three surveys.

Developments over time measured in a series of surveys consist of both real changes and sampling errors. With independently pooled samples it is nearly impossible to separate these two effects. As we want to measure real changes and not changes in sampling errors, panel data where the same households are followed over time are very useful. They do not display changes in sampling errors but only measure developments over time of that particular part of the population. Although sampling errors of a panel do not change over time, there are sampling errors of the original panel, like in all samples. To see whether the developments of the original panel over time are close to developments of the overall population, they are compared with developments of the full samples of the surveys in Table 2.6.

Table 2.6 Summary information on the sample and panel dataset

Atoll sample\Panel	VPA-1		VPA-2		TIA	
	Atoll sample	Panel sample	Atoll sample	Panel sample	Atoll sample	Panel sample
Number of households in the sample	2,286	1,019	2,421	1,019	2,181	1,019
Average household income per person per day (Rf.)	25	25	31	28	37	37
Wage share in household income	48%	48%	49%	49%	46%	44%
% of households with less than Rf. 15 per person per day	45%	44%	33%	34%	20%	20%

Source: Authors' calculations based on the VPA-1-2-TIA database.

Table 2.6 shows that, over the years, important income characteristics of the panel remain quite close to those of the much larger atoll samples.

2.4 CONCLUSIONS

Since the confidence intervals of average household income per person per day and of the headcount index are very satisfactory, both in Male' and in the Atolls in all survey years, we may conclude that the quality of the data of the three large-scale longitudinal surveys is high, which is mainly due to efficient sampling designs, large sample sizes and detailed consistency checks during data entry, data cleaning and data processing. Further, since the panel results are pretty close to those of the larger samples, we may conclude that the panel is an adequate representation of the Atoll population. This allows us to carry out our income poverty dynamics analyses with panel data in Chapters 5 and 6.

Chapter 3

Concepts and Measurement of Poverty

3.1 INTRODUCTION

Poverty has been defined in many different ways during the last century: *absolute* versus *relative* poverty, *objective* versus *subjective* poverty and *one-dimensional* versus *multidimensional* poverty. This Chapter restricts itself to one-dimensional poverty. Poverty as a multidimensional concept will be discussed in the next Chapter and poverty dynamics will be addressed in Chapters 5 and 6.

The measurement of poverty usually involves three main steps. First, the population is ranked from poor to rich according to a living standard indicator like per capita household expenditure or income. Frequently, per capita expenditure or income figures are corrected for economies of scale within the household and for household composition (age and sex) by using equivalence scales. Second, given a living standard indicator, a poverty line is drawn somewhere. Third, given a ranking from poor to rich according to a selected living standard indicator, and given a chosen poverty line, poverty under the poverty line is added in some way and expressed as a number, a poverty indicator.

This Chapter is organized as follows. Section 2 gives an overview of the three basic poverty line approaches: absolute poverty lines, relative poverty lines and subjective poverty lines. The measurement of poverty – given one or more poverty lines – is discussed in Section 3. Section 4 describes the poverty dominance approach that enables poverty comparisons across regions and over time without using poverty lines. An application to the Maldives is given in Section 5. Poverty determinants are discussed in Section 6.

3.2 POVERTY LINES

The poverty line is the norm below which people are labelled as poor and above which people are considered as non-poor. The higher the poverty line the more people fall under that line. Most disputes, both academic and political, about the incidence and depth of poverty in a country, its regional location and its development over time, focus on the definition of the poverty line as the incidence of poverty can be very sensitive to the level of the poverty line. Being a norm, the definition of any poverty line, is subject to value judgements.

In poor countries, the poverty line is commonly set at subsistence level. In rich countries, poverty is often considered as a relative concept.[2] The level of the poverty line is there often expressed as a percentage of the mean or median. A subjective poverty line approach sets the poverty line on the basis people's perception of their own well-being and their basic needs.

3.2.1 Absolute Poverty Lines

Not all poverty is relative. There is definitely an absolute element in the concept of poverty. The absolute poverty line is usually based on minimum nutritional requirements, supplemented by an allowance for non-food basic needs. This approach was already used by Rowntree in his poverty study in the city of York, UK at the beginning of the 20th century.[3] Rowntree classified household consumption into three groups: food, housing, and household sundries including fuel and clothing. As for food, he constructed a normative standard diet containing the nutrients that are "necessary for the maintenance of physical efficiency" per man per day. Using actual food prices and equivalence scales for household size and composition, he thus estimated the costs of minimal food expenditures for all types of families. As for housing rent, Rowntree preferred to use an objective standard of an accommodation required to "maintain families of different sizes in health" and than take the costs of such accommodation in York. However, he realized that that would have assumed that those accommodations were available and that every family could obtain such an accommodation which was not the case. Therefore, he had to use an alternative approach. He simply took the actual sums paid for rent as the necessary minimum rent expenditure.

The minimum necessary expenditures on clothing were obtained in a subjective way by asking: "What in your opinion is the very lowest sum upon which a man can keep himself in clothing for a year. The clothing should be adequate to keep the man in health, and should not be so shabby as to injure his chances for obtaining respectable employment". It appeared that the bulk of the answers varied only within narrow limits. Further, he asked for the average weekly use of soap, fuel and light. Information about other items was more difficult to obtain. Inquiries about this were usually answered by remarks as: "If we have to buy anything extra, such as pots or pans, we have to spend less on food, that's all". Thus, to derive an absolute poverty line, Rowntree applied a combination of methodologies, using objective absolute norms

2. The USA is an exception.

3. See Rowntree (1901).

for food, subjective norms for clothing, and actual expenditures for housing rent and household sundries such as soap, fuel and light.[4]

The most common approach in finding the absolute poverty line is to start by defining absolute norms for minimum food requirements, translate those into necessary food expenditures and than add an allowance for non-food consumption expenditures in an indirect way. Beveridge,[5] for instance, applied a similar approach as Rowntree for food expenditures based on a minimum diet, but for non-food expenditures being restricted to clothing, housing rent, fuel and light, he simply sets the subsistence level a little lower than the actual average expenditures of the working class, plus some margin for inefficiency in spending. As his estimates of household subsistence levels were intended to be used as a basis for the level of social security payments in Britain, it implied policy restrictions, in the sense that, in any case, the level of his poverty line had to be below the actual wage level for unskilled workers.[6]

Food share poverty lines

The USA was one of the first countries in the world with an official poverty line. The current official poverty line in the USA is based on the line developed by Orshansky[7] in the 1960s, later simply updated for price increases. Orshansky used objective absolute norms for a minimum food dietary to estimate the costs of basic food expenditures for different types of households by using actual prices, but for necessary non-food expenditures, she applied a different approach. She avoided all kind of

4. Rowntree describes the implications of his poverty line as follows: "And let us clearly understand what a merely physical efficiency means. A family living upon the scale allowed for must never spend a penny on railway fare or omnibus. They must never go into the country unless they walk. They must never purchase a halfpenny newspaper or spend a penny to buy a ticket for a popular concert. They must write no letters to absent children, for they cannot afford to pay the postage. They must never contribute anything to the church or chapel, or give any help to a neighbour which costs them money. They cannot save nor can they join a sick club or Trade Union, because they cannot pay the necessary subscriptions. The children must have no pocket money for dolls, marbles or sweets. The father must smoke no tobacco and must drink no beer. The mother must never buy any pretty clothes for herself or her children, the character of the family wardrobe as for the family diet being governed by the regulation, nothing must be bought but that which is absolutely necessary for the maintenance of physical health and what is bought must be of the plainest and most economical description. Should a child fall ill, it must be attended by the parish doctor; should it die, it must be buried by the parish. Finally, the wage earner must never be absent from his work for a single day. If any of these conditions are broken, the extra expenditure involved is met and can only be met, by limiting the diet; or in other words by sacrificing physical efficiency."

5. The Beveridge report on Social Insurance and Allied Services (1942) was the foundation of the social security system in Britain.

6. See Spicker et. al. (2006).

7. Orshansky (1963 and 1965).

problems of defining arbitrary norms for minimum non-food expenditures by taking the reciprocal of the average proportion of the household budget spent on food as a multiplier, and multiplying the costs of the normative minimum food expenditures by this multiplier to get the poverty line. The multiplier is 3 for families with three or more members (meaning that on average three-and-more person households spend one third on food), and 3.7 for two-person households. These multipliers did not change over time and are still operational. The choice of those multipliers, however, is remarkable because they are the reciprocals of the food shares at the mean income and not the reciprocals of the food shares of the poor, which ought to be much lower according to Engel's Law.

The food share poverty line proposed by Rao[8] is based on Engel's Law saying that the proportion of household expenditures spent on food tends to fall as household income rises. Rao compares the average food share of households with their incremental food share. Presuming that some non-food expenditures are inevitable for even the poor and that the poor whose food needs are not met will spend relatively more on food from their incremental income, this will mean that their average food share will increase until a certain income/expenditures level. Beyond this level, the food share will decline. This critical level can be used as the poverty line.

Food Energy Poverty Line

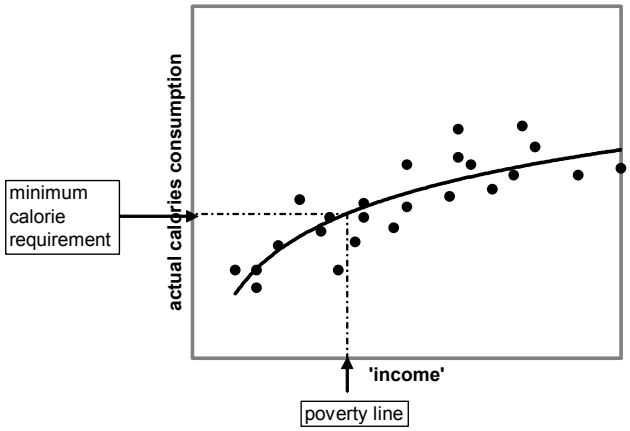
In 1971, Dandekar and Rath[9] presented a new methodology for estimating the absolute poverty line for India. They used regression analysis to estimate the relationship between per capita household calorie consumption and per capita household expenditures and set an explicit minimum calorie norm.[10] The regression line converts the normative calorie poverty line into the actual minimal per capita household expenditures (see Figure 3.1). The advantage of this methodology is that it requires only one normative element: the setting of an absolute norm for daily calorie intake. Neither further estimates with respect to the costs of an adequate diet are needed, nor norms for non-food expenditures such as clothing, housing rent and other household sundries. Given one single norm, the actual consumption behaviour of households is used to estimate the level of the poverty line.

8. See Rao (1971).

9. Dandekar and Rath (1971).

10. 2250 calories per person per day. In 1979, a "Task Force" of the Planning Commission revised the calorie norms to 2400 in rural areas and 2100 in urban areas due to an average lower rate of physical activity in urban areas and in 1993, an "Expert Group" recommended to allow for interstate variations in price levels.

Figure 3.1 Calorie Engel Curve



3.2.2 Relative Poverty Lines

Relative poverty defines the poor in terms of its relation to the standard of living in the societies to which they belong. The official poverty definition in Europe is as follows: "The poor shall be taken to mean persons, families and groups of persons whose resources (material, cultural and social) are so limited as to exclude them from the minimum acceptable way of life in the Member State in which they live".[11] The relative poverty line in Europe is set at 60 percent of the median income of the Member State. Those falling below the line are unlikely to be able to participate fully in their own society due to lack of resources.

Townsend[12] defined poverty as follows: "Individuals, families and groups in the population can be said to be in poverty when they lack the resources to obtain the types of diet, participate in the activities and have the living conditions and amenities which are customary, or at least widely encouraged or approved, in the societies to which they belong. Their resources are so seriously below those commanded by the average individual or family that they are, in effect, excluded from ordinary living patterns, customs and activities". In implementing his approach, Townsend used a list of 12 indicators of deprivation (see Table 3.1).

An individual or household gets for each indicator a score of one point in case of deprivation or zero points when he is not deprived. The scores for the different forms of deprivation are simply added up without applying weights. Thus, the maximum score

11. See EEC (1985).

12. Townsend (1979).

Table 3.1 Townsend's Deprivation Index

Characteristic	% of population	Correlation coefficient (Pearson) (net disposable household income)
1. Has not had a week's holiday away from home in last 12 months	54	0.19
2. *Adults Only.* Has not had a relative or friend to the home for a meal or snack in the last 4 weeks	33	0.05
3. *Adults Only.* Has not been out in the last 4 weeks to a relative or friend for a meal or snack.	45	0.05
4. *Children Only (under 15).* Has not had a friend to play or tea in the last 4 weeks.	36	0.06
5. *Children Only.* Did not have party on last birthday	57	0.07
6. Has not had an afternoon or evening out for entertainment in the last two weeks	47	0.11
7. Does not have fresh meat (including meals out) as many as 4 days a week	19	0.18
8. Has gone through one or more days in the past fortnight without a cooked meal	7	0.07
9. Has not had a cooked breakfast most days of the week	67	0.06
10. Household does not have a refrigerator	45	0.24
11. Household does not usually have a Sunday joint (3 in 4 times)	26	0.17
12. Household does not have sole use of four amenities in doors (flush WC; sink or washbasin and cold-water tap; fixed bath or shower; and gas or electric cooker)	21	0.17

Source: Townsend, cit. Table 6.3, page 250

on the deprivation index is 12, and the minimum is zero. The higher the score, the lower is the participation and the higher the deprivation. After having determined for each household its score on the deprivation index, Townsend tests a possible relationship between his deprivation index and household income. The third column of Table 3.1 presents the Pearson correlation coefficient. They are positive -because households are ranked from rich to poor- and significant in all cases. Townsend hypotheses that in descending the income scale from rich to poor, at a particular point, for different types of families, "a significantly large number of families reduces more than proportionally their participation in the communities style of living. They drop out or are excluded. These income points can be identified as a poverty line".

3.2.3 Subjective Poverty Lines

A subjective poverty line approach sets the poverty line on the basis of people's perception of their own well-being. It is often based on a so-called minimum income question like: "In your opinion what must be the absolute minimum net income for a

household like yours to be able to make ends meet?".[13] The answer will depend on the income level of that household itself. Figure 3.2 presents the relationship between the actual income of the respondents and their own perceived minimum income needs which is an increasing function of income. On average, households with a relatively high income will perceive that the minimum income is below their current income whereas households with a relatively low income will perceive that they earn less than the minimum income. As household at the left hand side of the intersection point of the regression curve with the 45-degrees line perceive that, on average, their income is not sufficient to make ends meet whereas the households at the right-hand side of the intersection point earn more than the minimum according to their own perception, the subjective poverty line is set at the intersection point.

Figure 3.2 Subjective Poverty Line

In most cases, a subjective poverty line will be at a higher income level than that of an absolute or relative poverty line. According to the Rio-Group[14] the subjective poverty line approach has not been used officially in any country or by any institution as the core methodology for the measurement of poverty. Instead it has been employed as complementary to other poverty lines.

13. See e.g. Van Praag and Flik (1992).

14. Rio Group, Expert Group on Poverty Statistics (2006).

3.3 THE MEASUREMENT OF POVERTY

3.3.1 Poverty Indicators

A poverty indicator measures the extent of poverty given a ranking from poor to rich according to a chosen living-standard indicator and given a chosen poverty line.[15]

The Headcount Index

The most popular poverty indicator is the headcount index or headcount ratio, defined as the number of poor as a proportion of the population.

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

where: H is the headcount index, $0 \leq H \leq 1$
q is the number of poor
n is the population size

The headcount index ranges from zero (nobody is poor) to one (everybody is poor). The strength of H is its simplicity and its appeal. Although the headcount index may give a first crude impression of the extent of poverty, it is a meagre poverty index because it completely ignores the depth of poverty. It does not differentiate between extremely low incomes and incomes just below the poverty line. Further, and even more important, is the observation that H is a dangerous poverty indicator if used for analysing the success of anti-poverty policies. Successful anti-poverty policies aimed at persons just below the poverty line will reduce the headcount index, whereas successful policies aimed at raising the well-being of the poorest of the poor will not affect the headcount index if their new living standard is still below the poverty line. In other words, the H makes it more rewarding to support those just under the poverty line than to support the poorest of the poor.

The Average Shortfall

A simple and widely used indicator for the depth of poverty is the average shortfall, defined as the distance of the average poor to the poverty line as a proportion of the poverty line.

15. For an overview of the literature, see e.g. 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.

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

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

The average shortfall ranges from zero (nobody is poor) to one (the living standard indicator of all the poor is zero). The strength of *I*, like that of *H*, is its simplicity and its appeal. As a poverty indicator, *I* is a poor indicator because it completely ignores the number of the poor. Further, like *H*, *I* is a dangerous poverty indicator if used for evaluating the success of anti-poverty programmes. When the income of a person just below the poverty line increases such that he is no longer poor, poverty according to the average income shortfall will increase rather than decline.

Both *H* and *I* are partial poverty indicators. Each indicator describes only one aspect of poverty, and as such they are useful. They are each other's complements: *H* gives an indication of the number of poor but ignores the depth of poverty and *I* gives an indication of the depth of poverty but ignores the number of poor.

The Poverty Gap Index

A more sophisticated indicator, which includes both *H* and *I*, is the poverty gap index (PG). It is constructed by normalising the average income shortfall to the total population size rather than to the number of poor.

$$PG = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right) = H * I$$

The meaning of the PG can be illustrated by the following example. Consider two regions A and B. The poverty line in both regions is set at one dollar per day. Assume that the headcount index in regions A and B are 40 percent and 20 percent, respectively, and that the average income of the poor is 0.8 dollar in region A and 0.6 dollar in region B, respectively. According to PG, region A and B face the same extent of poverty. In region A, 40 percent of the population has an income shortfall of 20 percent, so that PG is 0.08 ($= 0.4 * 0.2$). In region B, 20 percent of the population has an income shortfall of 40 percent, so that PG is also 0.08 ($= 0.2 * 0.4$).

The FGT-index

Foster, Greer and Thorbecke (FGT) developed a class of poverty measures that facilitates the exposing of more poverty with greater inequality among the poor.[16] Considering two incomes below the poverty line, poverty is then more severe if one income is 1 per cent below the poverty line and one income is 99 per cent below the poverty line, compared with a situation with two incomes of 50 per cent below the poverty line.

The class of poverty measures is defined by FGT as:

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right)^\alpha$$

where P_α is the level of poverty; α has a normative value that can be set at different levels according to the relative importance attached to the poorest.

The FGT measure becomes the headcount ratio H if $\alpha = 0$. The degree of poverty is equal for all the poor no matter the size of their poverty gap (see Figure 3.3). The FGT measure becomes the poverty gap index PGI if $\alpha = 1$. The degree of poverty increases in a linear way with the size of the poverty gap (see Figure 3.3). A person 75 per cent below the poverty line gets a weight of 75 per cent, a person 50 per cent below the poverty line gets a weight of 50 per cent. With $\alpha > 1$, a poorer person gets a higher than linear poverty weight than a less poor person. With $\alpha = 2$, the weight of each person is equal to its squared poverty gap implying that a person 75 per cent below the poverty line gets a weight of 56 per cent while a person 50 per cent below the poverty line gets a weight of 25 per cent. The FGT-index with $\alpha = 2$ is sometimes called the squared poverty gap index:

$$SPG = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right)^2$$

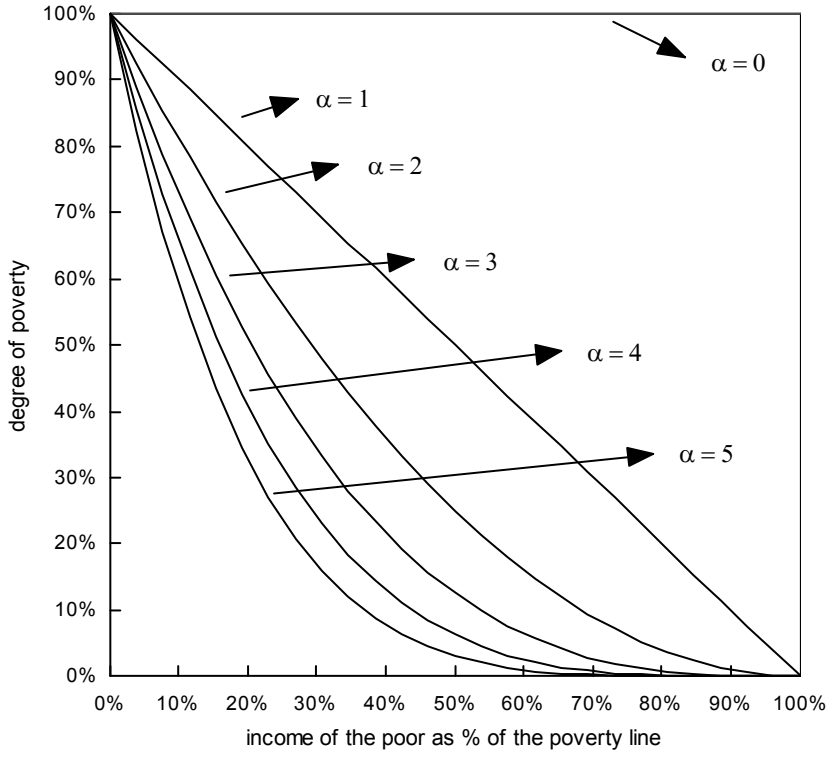
Figure 3.3 presents the degree of poverty according to various values of α. The value of P_α ranges between zero (the case where all incomes of the poor are equal to the poverty line) and H (the case where all the poor have zero incomes). A higher α gives more weight to the poorest and less weight to persons near the poverty line, and the gap between more poor and less poor households becomes larger. As α becomes very large, the FGT measure approaches a situation where poverty is completely deter-

16. See Foster, Greer and Thorbecke (1984).

mined by the income of the poorest. A person with an income of 50 per cent below the poverty line gets a poverty weight of 100 per cent if $\alpha = 0$. That means that he is considered as poor as a person with zero income. With $\alpha = 1$, a person whose income is 50 per cent below the poverty line gets a poverty weight of 50 per cent of the weight of a person with zero income. With $\alpha = 2$, he gets a poverty weight of 25 per cent, with $\alpha = 5$, he gets a weight of only 3 per cent of the weight of a person with zero income.

The FGT-index with $\alpha = 0$ implies that a clear distinction can be made between the poor and the non-poor. A person is considered poor if his income (or other living standard) is below a certain poverty line, and he is considered not poor if he is above that line. Such a sharp distinction between the poor and the non-poor is not very realistic. The strength of the FGT-index with $\alpha > 1$ is its continuity and smoothness at the poverty line (see Figure 3.3) implying a gradual transition from poverty towards non-poverty which is more appropriate. In this case, poverty becomes a non-dichotomous concept.

Figure 3.3: The degree of poverty with alternative values of α.



A drawback of the FGT-index with $\alpha > 1$ is that its interpretation is not easy. The value of these indicators is not appealing. It can only be interpreted in relation to other known values to get a sense of what the index actually is saying.[17]

3.3.2 Adding Up with More than One Poverty Line

A non-dichotomous concept of poverty

A dichotomous concept of poverty implies that a clear distinction can be made between the poor and the non-poor. A person is considered poor if his income y_i is below a certain poverty line z and he is considered not poor if his income is above that line. Such a sharp distinction between the poor and the non-poor is not very realistic. A gradual transition from poverty towards non-poverty seems more appropriate.

One way to cope with this problem is to consider two poverty lines, z_1 and z_2. The first poverty line z_1 is a line below which a person is considered definitely poor. The second poverty line z_2 is a line above which a person is considered definitely not poor. Persons with incomes between z_1 and z_2 are considered partially poor. Another way is to reject the use of poverty lines completely (see section 3.4).

Measuring poverty with two poverty lines

Consider two poverty lines z_1 and z_2 and define the degree of poverty (p_i) of person *i* as:

$$\begin{aligned} p_i &= 1 \quad \text{for} \quad y_i < z_1 \\ p_i &= 0 \quad \text{for} \quad y_i \geq z_2 \\ 0 < p_i &< 1 \quad \text{for} \quad z_1 < y_i < z_2 \end{aligned}$$

Cerioli and Zani call such a gradual transition from poverty towards non poverty '*a fuzzy approach to the measurement of poverty*'.[18] The function describing the degree of poverty is called a membership function. An example of a membership function is:

$$\begin{aligned} p_i &= 1 \quad \text{for} \quad y_i < z_1 \\ p_i &= 0 \quad \text{for} \quad y_i \geq z_2 \\ p_i &= \frac{z_2 - y_i}{z_2 - z_1} \quad \text{for} \quad z_1 < y_i < z_2 \end{aligned}$$

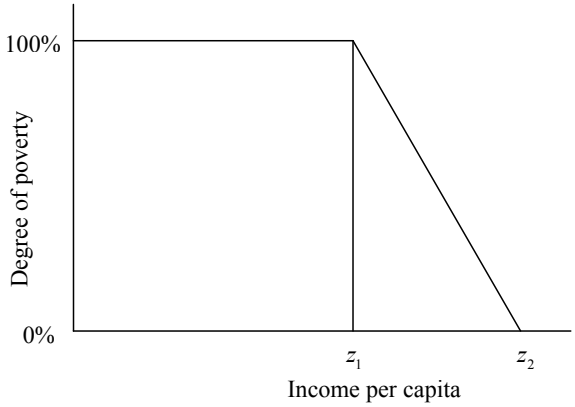
17. See Foster (1994).

18. Cerioli and Zani (1989).

where the degree of poverty is one for the definitely poor, zero for the definitely not poor, and between one and zero according to a decreasing linear function for those whose income lies in between the two poverty lines.

Figure 3.4 illustrates this membership function. Poverty is one for all individuals whose income is less than z_1. Poverty is zero for all individuals whose income exceeds z_2. Poverty is between one and zero between the two poverty lines according to a decreasing linear function.

Figure 3.4: The degree of poverty with two poverty lines z_1 and z_2.



Although this membership function shows a gradual transition from poverty towards non poverty, three drawbacks remain. The first drawback concerns the horizontal part of the membership function left of the first poverty line z_1, representing that everyone below the first poverty line is considered equally poor, no matter their distance to the poverty line. The second concerns the level of the poverty lines z_1 and z_2, which unavoidably continues to be arbitrary. The third concerns the linear shape of the decreasing degree of poverty from one towards zero between the two poverty lines z_1 and z_2.

3.3.3 Measuring Poverty without Poverty Lines

Cheli and Lemmi (1995) try to overcome the drawbacks of setting poverty lines by defining poverty as a completely relative concept. According to that concept everybody is poor except the richest person. All incomes are compared with the highest income. They do not need the arbitrary choice of the location of poverty lines anymore. In fact, the poverty line corresponds with the highest income. Cheli and Lemmi call

this approach *Totally Fuzzy and Relative (TFR)*. They use a membership function that corresponds with the population share above a certain income level:

$$P_n = 0$$

$$p_i = p_{i+1} + \frac{POP_i}{1 - POP_n}$$

where: P_i is the degree of poverty of person i with respect to the richest person n, such that only the richest person is not poor: $P_n = 0$
POP_i is the population share of income group i
POP_n is the population share of the richest income group n

According to this membership function, the degree of poverty P_i corresponds with the cumulative population share counting backwards from the highest to the lowest income group.

Assessing poverty as a completely relative concept with the implication that everyone is considered poor except the richest person is an extreme point of view. Besides, the empirical outcomes of the above membership function are not very satisfactory. According to the above membership function, the degree of poverty of a person with the median income is 50 per cent and the degree of poverty of the poorest of the poor is 100 per cent. This result would imply that two persons with the median income contribute equally to total poverty as one very poor person. Therefore, both on conceptual and empirical grounds, the search for other, more acceptable, membership functions continues (see next section).

3.4. POVERTY DOMINANCE

The previous sections have shown that the choice of the poverty line and the choice of the poverty indicator are not straightforward, but subject to uncertainties and arbitrariness. The question where to set the income poverty line is complex. Efforts to objectively determine a basic minimum needs package for a household always lead to polemical results. No matter how it is constructed, the choice of a single poverty line is always arbitrary, subjective and based on value judgments – and moving the line only slightly can significantly change the incidence of poverty.

However, that does not mean that nothing can be said about poverty comparisons between regions and over time. The poverty dominance approach makes it possible

to compare poverty situations between regions and over time without knowing the level of the poverty line.[19]

Consider two hypothetical regions A and B with their respective income distributions.[20] Figure 3.5a shows the cumulative distribution functions for two regions A and B having the same income range and a common but unknown poverty line *z*. This figure can be read in an alternative way. The x-axis contains all incomes per capita. That means that the unknown poverty line must be somewhere on the x-axis, although we do not know where. If the cumulative frequency distribution of country B is everywhere above that of country A, as in Figure 3.5a, it means that the cumulative population share in B is higher than in A for all income levels, including the unknown poverty line. Interpreted in that way, the y-axis is actually the headcount index H and the x-axis is actually the unknown poverty line z. Therefore, we may conclude from Figure 3.5a that, according to the headcount index, poverty is definitely higher in B than in A. The poverty dominance condition according to the headcount index is called the first-order dominance condition.

Figure 3.5a: Cumulative Distribution Functions for two regions A and B

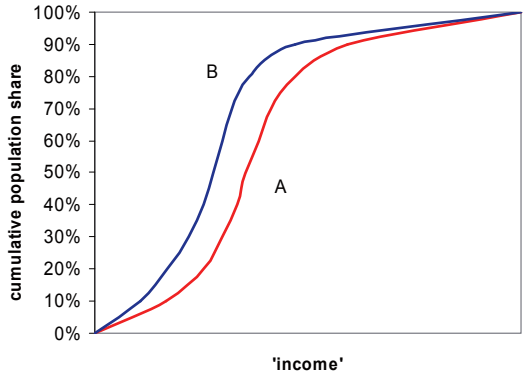


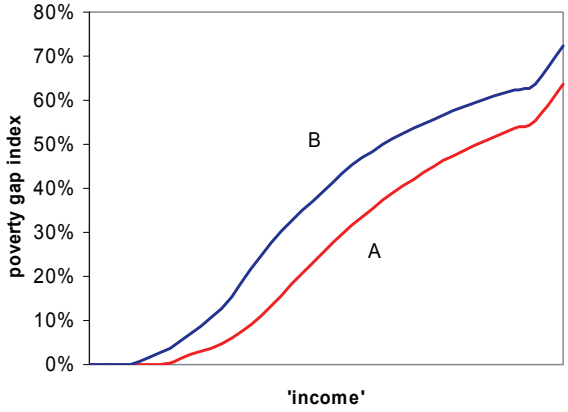
Figure 3.5b shows – for the same regions A and B – the poverty gap index (PG) being the area under respectively A and B of Figure 3.5a for all incomes including the unknown poverty line. As the area under B in Figure 3.5a is always larger than the area under A, the PG of region B is also everywhere above that of region A (the second-order dominance criterion). In other words, poverty dominance of region

19. See also Atkinson (1987), Foster and Shorrocks (1988), Ravallion (1994) and Jenkins and Lambert (1997).

20. The poverty dominance approach is also applicable to non-income living standard indicators as well as to multi-dimensional poverty indicators.

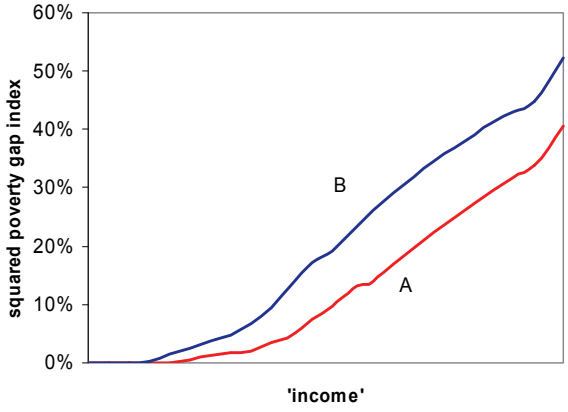
B over A according to the first-order dominance condition implies also poverty dominance of region B over A according to the second-order dominance condition.

Figure 3.5b: Poverty Gap Index for all poverty lines



Similarly, poverty dominance of region B over A according to the second-order dominance condition, implies also poverty dominance of region B over A according to the third-order dominance condition (squared poverty gap index), see Figure 3.5c. This theorem: 'first-order dominance implies second-order dominance implies third-order dominance' is not valid in the reverse order.

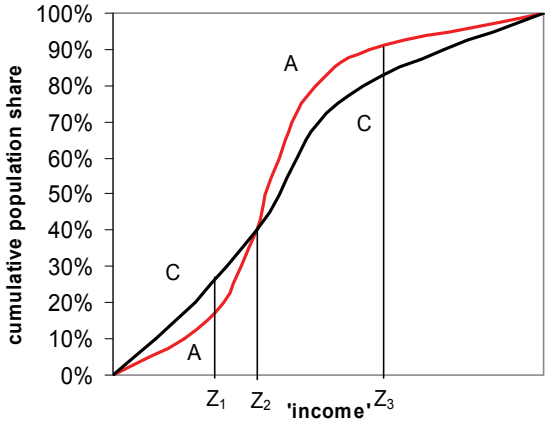
Figure 3.5c: Squared Poverty gap Index for all poverty lines



If the two curves intersect, the income level of the intersection point is relevant (see Figure 3.6a). If they intersect at an income level that is too high to be a reasonable poverty line (if the maximum poverty line $z_{max} = z_1$ in Figure 3.6a), we can still say

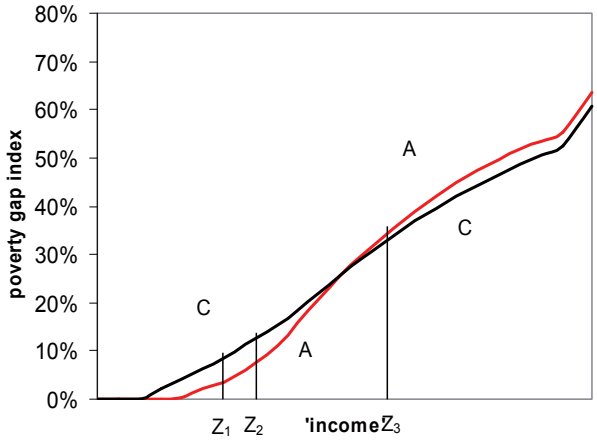
that, according to the headcount index, poverty is higher in C than in A, for all reasonable poverty lines. In other words, the poverty dominance condition according to the headcount index applies for non-intersecting cumulative frequency distributions and for cumulative frequency distributions that do not intersect in the interval $z < z_{max}$, where z_{max} is the maximum poverty line.

Figure 3.6a: Intersecting Cumulative Distribution Functions



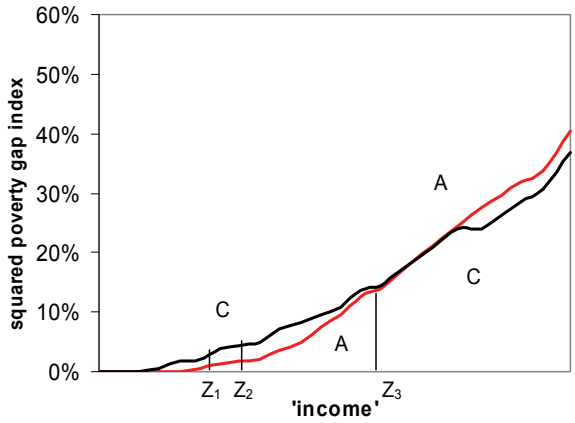
If the two curves intersect at a point that reasonably could be a poverty line (if $z_{max} = z_3$), the ranking is inconclusive according to the first-order dominance criterion. In that case, the second-order dominance condition has to be examined (see Figure 3.6b).

Figure 3.6b: Poverty Gap Index for all poverty lines



If the PG-curves intersect at an income level lower than z_{max} the ranking is also inconclusive according to the second-order dominance criterion and a third-order dominance condition according to the squared poverty gap index (SPG) can be tested (see Figure 3.6c).

Figure 3.6c: Squared Poverty Gap Index for all poverty lines



In Figure 3.6c the SPG of region C is above that of region A for all reasonable poverty lines (if $z_{max} = z_3$).

In the example of Figures 3.5a, b and c we can conclude that there is more poverty in B than in A no matter the poverty line or the poverty indicator. In the case of Figures 3.6a, b and c region C is poverty dominant over region A according to the third-order poverty criterion but not according to the first- or second-order criterion.

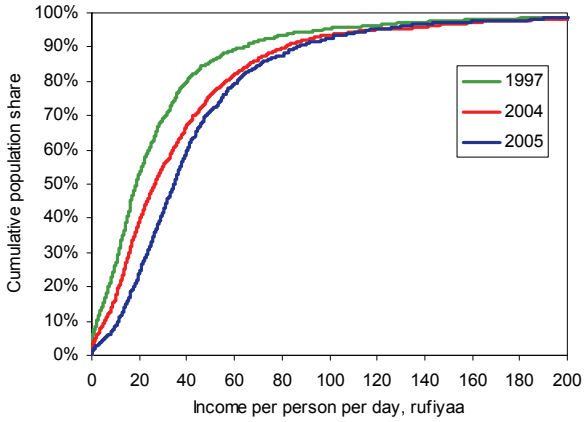
3.5 APPLICATION TO THE MALDIVES

The poverty dominance approach has been applied to poverty analysis in the Maldives. Instead of trying to establish *the* poverty line, we consider a set of all reasonable poverty lines and analyze whether the results of various poverty lines are robust in the sense that the identification of the poor is stable irrespective of the selection of the poverty line.

This is illustrated by Figure 3.7 that represents the Maldives cumulative frequency per capita household income distributions for 1997, 2004 and 2005. The x-axis shows all per capita incomes; the y-axis shows the percentage of the population below each of these income levels (the headcount index). Thus, in 1997 (the green

line) the proportion of the population having less than Rf. 10 per person per day was about 25 percent, in 2004 (the red line) it was less than 20 percent, whereas in 2005 (the blue line) it had come down to less than 10 percent. Similarly, in 1997 the proportion of the population having less than Rf. 20 per person per day was around 50 percent, in 2004 it was about 40 percent, while by 2004 it had come down to around 25 percent.

Figure 3.7: Cumulative population ranked from poor to rich, 1997–2005, Maldives



Source: Tsunami Impact Assessment 2005

As the green line (1997) is completely above the red line (2004) and the red line is completely above the blue line (2005) in the lower and middle income range, it can be concluded that income poverty has declined over time according to all reasonable poverty lines.

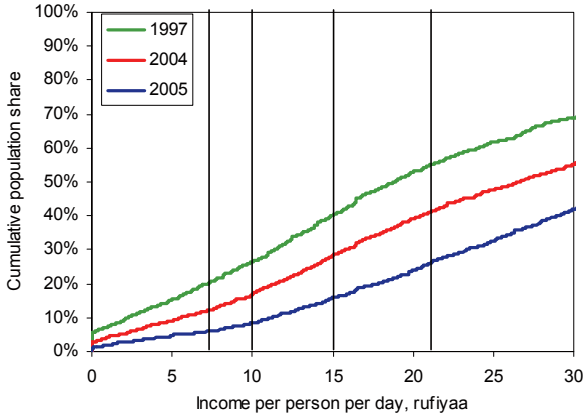
The extent of progress in income poverty reduction is represented by the distance between the coloured lines; the larger the area between them, the greater the progress. The gap between the green and red lines is larger than the gap between the red and blue lines, which indicates that progress was greater during the period 1997–2004 compared with 2004–2005. Since more progress can be expected in seven years than in one year, it is remarkable that after the tsunami such significant progress in poverty reduction was made.

In this framework, a very low poverty line, a relatively high poverty line, and a poverty line drawn somewhere in-between are considered. VPA-1 used the atoll median of Rf 15 per person per day as a kind of maximum poverty line. By definition, half the atoll population falls under that line. Half the atoll median, that is Rf 7.5 per person

per day, was used as the low poverty line and the in-between poverty line was set at Rf 10 per person per day.

It could be argued that the choice of these three poverty lines is still arbitrary and that all possible poverty lines should be considered instead of only three. This is illustrated in Figure 3.8, which is a magnification of Figure 3.7 for the income interval Rf. 0–30 per person per day. Any reasonable poverty line will be in this interval. Figure 3.8 shows that income poverty has declined over time for each conceivable poverty line.

Figure 3.8: Cumulative population ranked from poor to rich, 1997–2005, Maldives



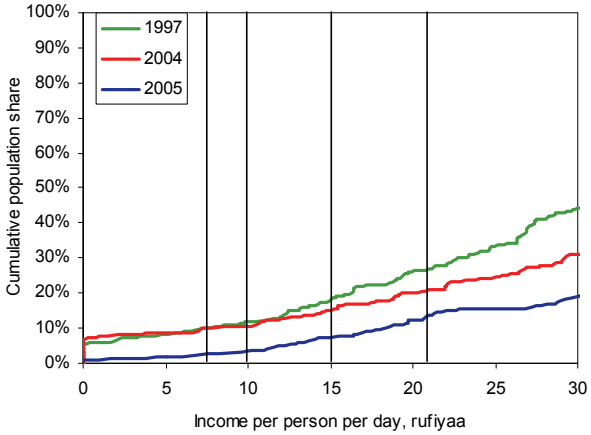
Source: Own calculations based on primary data from VPA-1, VPA-2 and TIA

Figure 3.9a and b, respectively, present the cumulative frequency distributions for Male' and the Atolls for the relevant income intervals. They show that, both in Male' and in the Atolls, income poverty was significantly lower in 2005 than in earlier years, for all reasonable income poverty lines.

From a conceptual point of view, nominal incomes have to be translated into real incomes by taking price differences over time and across regions into account. Price adjustment over time is fairly simple, since in the Maldives over the period 1997–2005 the inflation rate was practically zero.

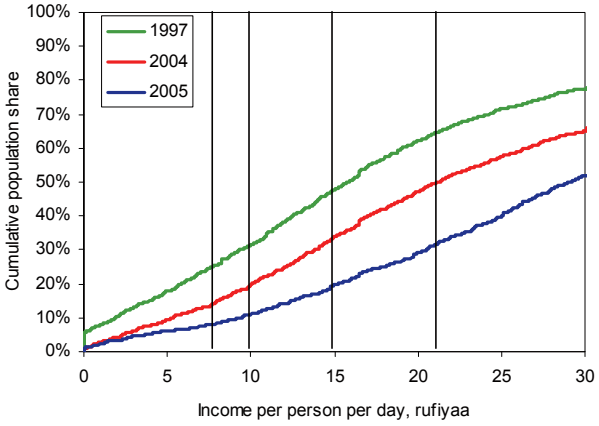
Accounting for price differences between regions is more difficult. Regional purchasing power parities (PPPs) were tried to be estimated based on an average standard consumption basket. But this proved impossible, as there were only a few items that met the two essential criteria: homogeneity and availability and use throughout the country. A fish, for example, is not the same from place to place, nor is a banana.

Figure 3.9a: Cumulative population ranked from poor to rich, 1997–2005, Male'



Source: Own calculations based on primary data from VPA-1, VPA-2 and TIA

Figure 3.9b: Cumulative population ranked from poor to rich, 1997 – 2005, Atolls



Source: Own calculations based on primary data from VPA-1, VPA-2 and TIA

Moreover, although housing is basically free on the islands due to the absence of a housing market, it is expensive in Male', but medical care on the other hand is more expensive on the islands due to high transportation costs to Male'. The basket also had to exclude luxury goods and consumer durables since the Maldives has only one shopping centre for these goods – Male'. Furthermore, the three most important items that are actually homogenous and available and consumed throughout the country – wheat flour, rice and sugar – are imported and sold throughout the country at a fixed price. Therefore, the poverty analysis of the VPAs and the TIA was based on nominal prices, unadjusted for price differences over time and across regions.

Table 3.2 presents the headcount indices for the Maldives, Male' and the Atolls for the years 1997, 2004 and 2005 for four poverty lines – the three mentioned above and a poverty line of Rf. 21 per person per day being the atoll median in 2004. It shows that income poverty is declining rapidly both in Male' and in the atolls.

Table 3.2: Headcount indices according to various poverty lines, Maldives, Male', Atolls, 1997–2005

Poverty line	Maldives			Male'			Atolls		
	1997	2004	2005	1997	2004	2005	1997	2004	2005
Rf. 7.5	21%	12%	6%	10%	10%	*	25%	13%	8%
Rf. 10	26%	17%	8%	12%	11%	*	31%	20%	11%
Rf. 15	40%	28%	16%	18%	15%	7%	50%	34%	20%
Rf. 21	55%	41%	26%	27%	20%	13%	64%	50%	32%

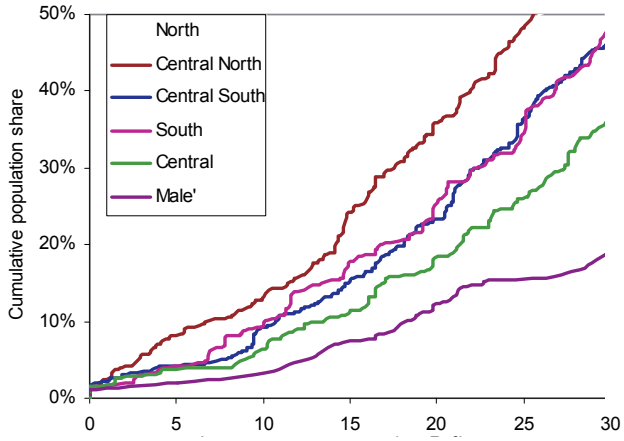
* = too few observations.

Source: Tsunami Impact Assessment 2005

As the cumulative frequency distributions for the years 1997, 2004 and 2005 for, respectively, the Maldives, Male' and the atolls do not intersect, it implies that poverty is declining according to the first-order, second order and third-order poverty dominance criteria both in Male' and in the atolls. In other words, Figures 3.8 and 3.9 do not only imply a decline in the incidence of poverty, but the depth of the poverty as measured by the poverty gap index or the squared poverty gap index has also declined over time for all reasonable poverty lines.

Figure 3.10 presents the cumulative frequency distributions for the relevant income interval Rf. 0–30 per person per day for the development regions.

Figure 3.10: Cumulative population ranked from poor to rich, Regions, 2005



Source: Tsunami Impact Assessment 2005

These regions and their constituent atolls are:
- North: Haa Alifu, Haa Dhaalu, Shaviyani (47,000 inhabitants on 47 islands)
- Central North: Noonu, Raa, Baa, Lhaviyani (47,000 inhabitants on 46 islands)
- Central: Kaafu, Alif Alifu, Alifu Dhaalu, Vaavu (25,000 inhabitants on 32 islands)
- Central South: Meemu, Faafu, Dhaalu, Thaa, Laamu (37,000 inhabitants on 47 islands)
- South: Gaafu Alifu, Gaafu Dhaalu, Gnaviyani, Seenu (49,000 inhabitants on 27 islands)

In 2005, according to all reasonable poverty lines, poverty incidence is highest in the two northern regions: North and Central North and lowest in Male' and in the Central Region.

Over time, especially the South Region has made considerable progress in poverty reduction as can be seen in Table 3.3 While in 1997, the headcount indices in the South were practically the same as in the North for various poverty lines, in 2004 and 2005 the headcount indices in the South are significantly lower than those in the North. The Central South Region has made much progress in 2005, probably due to fisheries, and is now catching up with the South Region.

Table 3.3: Headcount indices according to various poverty lines by region, 1997–2005

Poverty line	North			Central North			Central			Central South			South		
	1997	2004	2005	1997	2004	2005	1997	2004	2005	1997	2004	2005	1997	2004	2005
Rf. 7.5	30%	19%	11%	25%	13%	10%	12%	12%	4%	20%	15%	5%	29%	8%	7%
Rf. 10	39%	28%	14%	33%	20%	14%	15%	15%	7%	26%	21%	9%	35%	13%	10%
Rf. 15	52%	44%	25%	53%	35%	24%	30%	28%	11%	44%	33%	15%	51%	27%	18%
Rf. 21	67%	58%	40%	67%	50%	37%	51%	42%	19%	60%	52%	27%	70%	44%	28%

Source: Own calculations based on primary data from VPA-1, VPA-2 and TIA

So far, the poverty dominance approach has been applied to income as being the living standard indicator. The next chapter applies the poverty dominance approach to many non-income living standard indicators and shows how these various dimensions of poverty can be combined to make up a multidimensional poverty index for the Maldives.

3.6 POVERTY DETERMINANTS

There is voluminous literature on the question: "Why are the poor poor and the rich rich?". In a macro-framework the most important poverty determinants are

institutions, geography and trade.[21] This section focuses on the micro-economics of households in developing countries *given* their macro-economic environment of institutions and geography.

Household size and labour force participation

Larger households are more likely to be poor, as measured by per capita household consumption, than smaller households.

Per capita household consumption $\frac{C}{N}$ can be decomposed into:

$$\frac{C}{N} = \frac{C}{Y}\frac{Y}{Y_L}\frac{Y_L}{N_L}\frac{N_L}{N_A}\frac{N_A}{N}$$

where: C is household consumption
N is the household size
Y is household income
Y_L is household income from labour including self-employment
N_L is the number of earners in the household
N_A is the number of adults in the household.

For the poor, the first term $\frac{C}{Y}$, the propensity to consume, is close to 1. With the absence of physical capital in poor households, household income is generated by wage labour and self-employment so the second term $\frac{Y}{Y_L}$ is also close to 1. Labour income per worker, the average wage rate (including income from self-employment) $\frac{Y_L}{N_L}$ is determined at macro-level and therefore exogenous for the household. What can be influenced by the household itself are the last two terms, $\frac{N_L}{N_A}$, the labour force participation rate of adults in the household and $\frac{N_A}{N}$, the share of adults in the household.[22]

Poverty in the household declines when $\frac{C}{N}$ increases. When the adult labour force participation rate in the household $\frac{N_L}{N_A}$ increases $\frac{C}{N}$ increases and poverty declines. The presence of children not only decreases $\frac{N_A}{N}$ directly, making poverty more likely,

21. See e.g. Rodrik et all (2004).

22. See e.g. Musgrove (1980).

but it may also reduce $\frac{N_L}{N_A}$ by requiring at least one adult to partly stay home to look after the children.

Musgrove (1980) found empirically that poverty was associated more strongly with household size and low labour force participation rates in the household than with low wage rates.

The relationship between per capita household consumption and household size discussed so far is quite obvious. The larger the family, the lower per capita household consumption and the lower the household adult labour force participation rate. They are poorer *because* they are larger.

A more interesting question is: Why do poor families *choose* to be larger. To answer this question, we need to consider life-cycle models such as the two-period consumption model of Hammer where parents maximize:

$$U = U(C_1, C_2)$$

where C_1 and C_2 are the parent's first and second period consumption, respectively.[23] The parents earn income in the first period but none in the second. In the absence of a social security system and pensions, they receive income in the second period from first period savings (if any) and from children raised in the first period. Consequently,

$$C_1 = Y - C(K; X) - S$$

and

$$C_2 = R(K; Z) + S(1 + r)$$

where Y is income, K is the number of surviving children, X and Z are vectors of exogenous variables, S is savings, $C(K;X)$ is the costs per surviving child, $R(K;Z)$ is the pension received from surviving children, and r is the interest rate. The variables under control of the family are the number of children born in period one and the amount of savings. As the poor can not save much, they are likelier to need future financial support in old age from their children. Consequently, the poor need more children as a source of pension.

23. See Hammer (1986).

Further, as child mortality rates are higher in poorer households, they require more births to achieve a desired household size. If parents wish K surviving children, the number of births B needs to be:

$$B = \frac{K}{1 - m}$$

where m is the child mortality rate in the household. By taking the derivate, we get:

$$\frac{\partial B}{\partial m} = \frac{K}{(1 - m)^2} > K$$

implying a greater than proportional response to child mortality in the household. There is some empirical evidence that child deaths stimulate excess replacement births in the household to insure against high risk of further child death.[24]

Other Poverty Determinants

1. Static OLS

A basic model identifying poverty determinants uses per capita household consumption as dependent variable in a regression with exogenous household characteristics as explanatory variables. Such model is a reduced-form equation of the various structural equations which express the income earning and consumption behaviour of the household.[25]

$$\ln\left(\frac{C}{N}\right) = \alpha + \beta_1' X_j + \beta_2' E_j + \beta_3' Z_j + \varepsilon_j$$

where $\beta'_{1,2,3}$ are vectors of unknown parameters, X_j is a vector of household characteristics including N and N_A (among others), E_j is a vector of employment characteristics including N_L (among others), Z_j is a vector of geographic characteristics and ε_j is a random error term. Assuming a normally distributed error term, this equation can be estimated by OLS.

24. See Lipton and Ravallion, 1995.

25. See Grootaert and Braithwaite, 1998.

2. Poverty Dynamics, Logit regressions

Household panel data enable to analyze the characteristics of households who escaped from poverty (poor in year $t=0$ and non-poor in year $t=1$) and the characteristics of households who fell into poverty (non-poor in year $t=0$ and poor in year $t=1$). The 'escape' and 'fall' regressions can be estimated using the binominal Logit model where the dependent variable y takes a value of 1 if the poverty situation of a household in year $t=1$ is different from that of year $t=0$ and a value of 0 if no change in the poverty situation has occurred. The logistic function can be written as:

$$\Pr(y=1) = P(X) = \frac{\exp(\alpha+\beta X)}{1+\exp(\alpha+\beta X)}$$

$$\Pr(y=0) = Q(X) = 1 - P(X) = \frac{1}{1+\exp(\alpha+\beta X)}$$

where X is a vector of explanatory variables.

Chapter 4

Weighting Dimensions of Poverty Based on People's Priorities

Constructing a Multidimensional Poverty Index for the Maldives*

* This chapter is based on "Weighting Dimensions of Poverty based on People's Priorities" by Hans de Kruijk and Martine Rutten (2007a).

4.1. 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 per capita income or consumption) and non-monetary (including health, education, and so on).[26]

Defining poverty as a multidimensional concept subsequently raises the question of how to measure overall poverty and how to weigh the different dimensions. Like Bourguignon and Chakravarty (2003) we specify a poverty line for *each* dimension and quantify the extent of poverty for each dimension by means of the poverty gap index. As for the aggregation problem, several solutions 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.[27] 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.[28] 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.[29] 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.

26. World Bank (2001), Duclos et al. (2006) and Alkire and Foster (2008).

27. UNDP (2004), Technical Note 1, World Bank (2001), Chapter 1, Box 1.6.

28. Bibi (2005), Collicelli and Valerii (2000).

29. Booysen (2002), Ferro Luzzi et al. (2006) and Ram (1982).

In this chapter we present a new index, the Multidimensional Poverty Index (MPI), which does not suffer from these deficiencies. The MPI uses a weighting structure which is derived directly from population preferences, so that it can be tailored to country-specific circumstances.[30] 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 MPI.

The MPI is subsequently derived for the Maldives, using data from the Vulnerability and Poverty Assessments carried out in 1997/98 and 2004.[31] 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).[32] Furthermore, in this chapter poverty is defined as deprivation according to relevant living standard dimensions *at a certain point in time*. Modelling what is usually called vulnerability, i.e. the risk that a household or individual will experience an episode of poverty over time will be the topic of the next two chapters.

The remainder of this chapter is organised as follows. Section 2 develops the Multidimensional Poverty 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.

30. In this respect it bears close similarity with the literature on measuring happiness. See for example Clark and Oswald (2002).

31. Republic of Maldives (1999, 2005).

32. See also Coudouel et al. (2002), Chapter 1, Box 1.1.

4.2. METHODOLOGY: CONSTRUCTING THE MULTIDIMENSIONAL POVERTY INDEX

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)[33] and the Human Development Index (HDI), the Gender Development Index (GDI) and the Human Poverty Indices (HPI) of the UNDP.[34] 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.[35] 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.[36]

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.[37]

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33. Morris (1979).

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

35. See for example World Bank (2001), Chapter 1, Box 1.6.

36. 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.

37. 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).

We present 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 Principal Components Analysis (PCA), which is a variant of the more general method of factor analysis.[38] 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.[39] Subsequently, the poor can be identified using cluster analysis.[40] 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 which is also less laborious, less complex and more transparent, and easy to derive.

The Multidimensional Poverty Index

Let $n_d \geq 1$ be the number of dimensions d of living standards or poverty which can be observed in a country and let PG_d be the poverty gap index for dimension d.

We subsequently rank the living standard dimensions according to the priorities of the population.[41] 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:

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

39. 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.

40. 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.

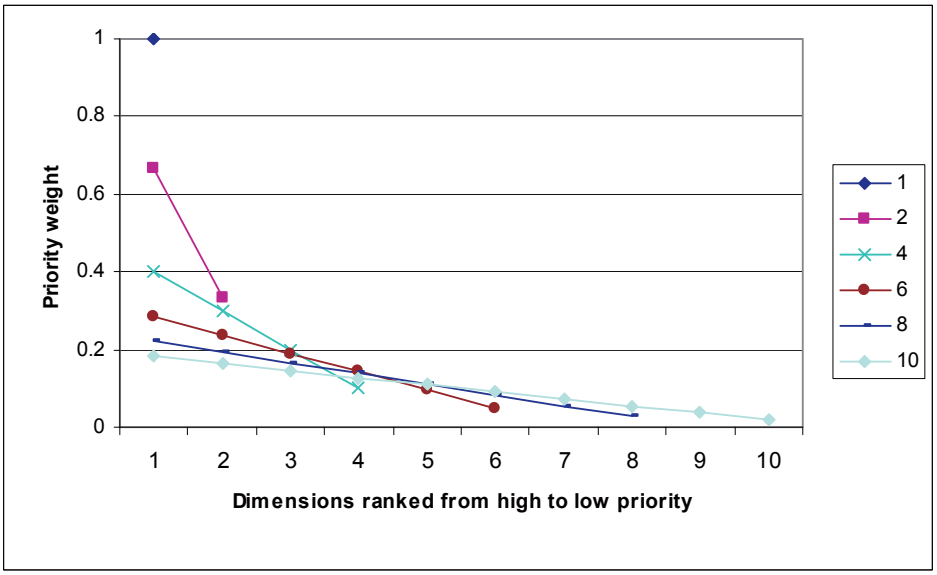
41. Obtained from carrying out a household survey. See next section for an application to the Maldives.

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

where $0 < w_d < 1$ is the priority weight attached to dimension d. Equation (1) 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 4.1 shows how the weighting structure varies with the number of dimensions.

Figure 4.1: Priority weights for one, two, four, six, eight and ten dimensions



The Multidimensional Poverty Index can now be constructed as a weighted average of the poverty gap indices, PG_d, with weights w_d:

$$MPI = \sum_{d=1}^{n_d} (w_d . PG_d) \tag{2}$$

If the population is poor on all fronts, i.e. $PG_d = 1$ for all d, MPI will take on the value of 1. At the other extreme, if the population is not poor on any of the dimensions, i.e. $PG_d = 0$ for all d, MPI will take on the value of 0. The next section illustrates the MPI for the Maldives.

4.3. APPLICATION TO THE MALDIVES

Before applying the MPI 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.

4.3.1 Dimensions of Poverty in the Maldives

We construct the MPI for the Maldives using the data from the Vulnerability and Poverty Assessment studies carried out in the Maldives in 1997/8 (VPA-1) and 2004 (VPA-2). The assessment presents a MPI 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 4.1 presents the set of living standards dimensions and their indicators relevant for the 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. These quantitative indicators provide the means to construct the MPI for the Maldives in aggregate and at regional level.

4.3.2 Poverty Gap Indices 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.[42] 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 PG for all dimensions by multiplying the headcount index by the average shortfall.

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

Table 4.1: 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

Table 4.2 presents the PG for each living standard dimension for the island population for the years 1997 and 2004. A high score corresponds to poor performance.

Table 4.2: PG by dimension for the Atolls, Maldives, 1997 and 2004

PG	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%

Sources: VPA-1 and VPA-2

Differences between the individual PGs and changes in the PGs 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 4.2 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 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 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 4.2 further shows that no progress has been made in the field of employment, transport and environment (indeed the first two living standard dimensions show 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 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 PG 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, are 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.

4.3.3 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.[43] 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 4.3 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.

Table 4.3: Female and male priority rankings for the Atolls, Maldives, 1997 and 2004

	1997			2004		
Ranking (r_d)	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

* 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.
Sources: VPA-1 and VPA-2.

43. 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.

It is remarkable that women and men gave practically identical overall rankings.[44] 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 PG 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 4.3 and using equation (1), the reader can verify that the female and male priority weights for each dimension for 1997 and 2004 are as shown in Table 4.4.

The priority weights displayed in Table 4.4 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 MPI for the Maldives to differ from a MPI constructed using equal weights.

Table 4.4: 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

44. 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 MPI 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).

4.3.4 Multidimensional Poverty Index for the Maldives

Applying equation (2) and using the data contained in the previous subsections we can calculate the MPI for the atolls of the Maldives.[45] Table 4.5 displays the MPI for the years 1997 and 2004 at regional level, at atoll level, and – combining the MPI for all atolls with that of Male' – for the Maldives as a whole. For illustrative purposes the table also displays the MPI when it is constructed using equal weights.

Table 4.5 shows that the MPI is generally lower with priority weights than with equal weights. This implies that there is relatively less poverty for high priority living stan-

Table 4.5: Multidimensional Poverty Index (MPI) 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%

Sources: VPA-1 and VPA-2

45. Small differences may occur due to rounding errors.

dard 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 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.

As for regional differences, Table 4.5 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 MPI 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.[46] An HDI of 0.74 implies a shortfall of 0.26. This figure is remarkably close to the MPI using priority weights. Nevertheless, the MPI – 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.

4.4. CONCLUSIONS

This chapter 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 Multidimensional Poverty Index (MPI) 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 MPI 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.

46. UNDP (2006).

An application of the MPI 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-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 indices) 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 MPI at regional, atoll and aggregate level is remarkably similar to an MPI constructed with equal weights. In general, however, the MPI 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 MPI 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 MPI 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 MPI – 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.

The next two chapters include, respectively, 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.

Chapter 5

Poverty Dynamics in the Maldives Before the Tsunami*

* This chapter is based on "Poverty Dynamics in the Maldives before the Tsunami" by Hans de Kruijk and Martine Rutten (2007b).

5.1. INTRODUCTION

The Maldives witnessed rapid economic growth over the recent period, averaging eight percent per year over the last decade. The country has also achieved many of the Millennium Development Goals (MDGs). However, despite high economic growth and social progress, the Maldives continues to face major developmental challenges. These include the vulnerability of the island population for experiencing an episode of poverty over time and the wide disparities in income and access to social services and infrastructure, particularly between the capital Male' and the outer atolls.

This chapter analyses the vulnerability of the island population of the Maldives over the period 1997 to 2004. It draws upon the Vulnerability and Poverty Assessment surveys that have been carried out for the Maldives in 1997 and 2004 (VPA-1 and VPA-2, respectively).

The previous chapter examined the extent of poverty in the Maldives for the years 1997 and 2004 by constructing a composite poverty index based on people's priorities. Since VPA-2 was carried out approximately half a year before the tsunami of December 26 2004 hit the Maldives, its effects on development are not taken into account in the present chapter. The next chapter will cover this issue. Nonetheless, this chapter provides information on the vulnerability and poverty situation of the island population just before the tsunami, which is needed to assess the impact of the tsunami.

Vulnerability is defined here as the probability that a household will experience an episode of poverty over time. It is measured in terms of changes in income poverty of households, with some households remaining poor (non-poor) and some households that were previously poor (non-poor) escaping from (falling into) poverty. We subsequently use Logit regression analysis to determine the factors behind these observed changes. It enables us to identify not only possible household coping strategies, but also appropriate and targeted government policies that may help households to escape from or remain out of poverty.

Our approach fits well within the general class of literature on the measurement and analysis of vulnerability.[47] It is similar to that of Jalan and Ravallion's (1998, 2000)

47. See for example Alayande and Alayande (2004) for a study on vulnerability in Nigeria, Chaudhuri et al. (2002), Pritchett et al. (2000) and Suryahadi and Sumarto (2003) on vulnerability in Indonesia, Dercon and Krishnan (2000) for an analysis of vulnerability in Ethiopia, Gaiha and Imai (2006) on vulnerability in rural

study on rural China, McCulloch and Baulch's (1999, 2002) analysis for rural Pakistan and Lawson et al.'s (2006) study on Uganda in that it applies regression analysis to a model of a discrete dependent variable measuring the dynamic poverty status on a set of independent variables in order to explain the probabilities of entering and exiting poverty observed over a certain time period.[48]

This chapter is organized as follows. Section 2 shortly describes the geographic and socio-economic context in the Maldives that sets the scene for the remainder of the chapter. Section 3 examines the vulnerability of the island population over the period 1997 to 2004 in terms of changes in household income poverty. Section 4 identifies the factors that are likely to have caused the observed changes in income poverty. The final section concludes.

5.2. THE MALDIVES CONTEXT

The island universe in the Maldives is particularly varied and diverse. The 1,190 islands that make up the Republic are grouped into 26 natural atolls that together form a chain 820 km in length and 130 km at its widest point, set in an area of more than 90,000 square km of the Indian Ocean. Nearly 200 islands are inhabited. All are very small. Only 33 inhabited islands have a land area of more than one square km and no fewer than 75 islands – more than one-third of the total – have less than 500 inhabitants, while 100 islands – 50 percent of the total – have less than 1,000 inhabitants. This gives the Maldives a geography that is extreme, even by the exceptional standards of small archipelagic states.

The small size of the inhabited islands, in terms of both land area and population, and the large distances between them, especially when measured in travel times by the common means of transport, the dhoni, implies severe diseconomies of scale. These are hardest felt when delivering health and education services (even at basic levels) and providing infrastructure: nearly all materials need to be imported so construction costs are many times higher than in continental developing countries. Development potential is further constrained by the lack of mineral resources, the lack of rivers and

India, Glewwe and Hall's (1998) study on vulnerability in Peru, Kamanou and Morduch (2004) for an analysis of Cote d'Ivoire, Kurosaki (2006a,b,c) for a study on vulnerability in Pakistan, Ligon and Schechter (2002, 2003) on vulnerability in Bulgaria and Sen's (2003) analysis of vulnerability in rural Bangladesh.

48. For an overview of the literature, see e.g. Baulch and Hoddinott (2000), Cafiero and Vakis (2006), Calvo and Dercon (2005), Coudouel et al. (2002), Dercon (2001), Hoddinott and Quisumbing (2003), Kamanou and Morduch (2004), Kurosaki (2006c) and Ligon and Schechter (2002, 2004).

streams, poor soils that are ill-suited for agriculture, and the dependence on rainfall for agriculture and for affordable potable water. Many people also find it difficult or expensive to reach social services, since even when these are available on nearby islands, people do not have the options common in continental countries of using a bicycle or simply going by foot.

Despite these constraints, the Maldives has made significant progress and has recently graduated from least developed country status – a feat no other country has ever managed. Economic growth has been impressive, with an annual growth rate of growth of about ten percent during the 1980s and early 1990s, and about seven percent per annum between 1997/98 and the middle of 2004, the two measuring points of the VPA surveys. Population growth has also declined – from three percent per year in the late 1970s to below two percent currently. As a result, growth in GDP per capita has also been high – at around five per cent per year. In 1995 prices, per capita GDP increased from around $400 in 1977 to nearly $1,700 in 1997 – and to more than $2,400 in 2004.

Rapid economic growth has largely been due to the success of the tourism industry. Between 1997 and 2004 the number of resorts increased from 73 to 86 and the number of annual tourist arrivals from 366,000 to more than 600,000. The other activity of importance outside tourism, especially in terms of employment and income on the islands, is fisheries and its related processing – between 1977 and 2004, exports of marine products increased from 18,000 to 75,000 tons. Including all supporting activities in tourism such as parts of manufacturing, construction, trade, transport and other services, tourism represents well over half of the economy and the share of fisheries including fish processing accounts for about 12 percent.

The Maldives is on track to achieve most of the Millennium Development Goals (MDGs) by 2015. Many characteristics of poverty found in other parts of South Asia and in Africa are not present in the Maldives. There is no starvation, although there are serious nutritional problems, and there is no link between income and nutrition status. Primary education is already practically universal, implying no gender disparities in enrolments and literacy rates are close to 100 percent for the age-group 15–24 years. Child mortality rates and maternal mortality rates are declining rapidly both in Male' and in the atolls. The incidence of HIV/AIDS is very low and malaria has been eradicated. There is no urban begging, even though incomes of many people are low. And while many houses in the capital Male' are getting more and more overcrowded due to continuous and increasing rural-urban migration, there are no slum dwellers.

However, despite rapid economic growth and social progress, the Maldives continues to face major developmental challenges. These include the vulnerability of the island population for experiencing an episode of poverty over time and the wide disparities in income and access to social services and infrastructure, particularly between the capital Male' and the outer atolls.

The coming sections aim to identify not only who is poor and at what times, but also the underlying factors causing households either to fall into or escape from poverty. Such analysis will be indicative of appropriate government policies for sustainable development, as well as household coping strategies.

5.3. VULNERABILITY IN THE MALDIVES: INCOME POVERTY DYNAMICS

Unit of measurement and analysis

The VPA surveys include 12 living standard indicators, all of which impinge upon vulnerability, that is the risk of experiencing an episode of poverty. The most relevant indicator, however, is income since individuals or households with sufficient income can – to some extent – 'buy themselves' out of poverty along the other living standard dimensions and so become less vulnerable overall. We therefore use income as the indicator with which to track changes in the poverty situation.[49]

The unit of analysis is the household. Moving from the household to the individual level simply means dividing the household income by the number of household members. This approach neglects economies of scale within the household and intra-household income inequality, proper diagnosing of which was beyond the scope of the VPA surveys.

Household income itself is a complex concept and difficult to measure in a developing country where a large part of the labor force is either self-employed or of the own-account worker type. Like most poverty studies we therefore use per capita household expenditures as a proxy for per capita household income. Per capita household expenditures are calculated as the sum of per capita household cash expenditures, the value of own-produced consumption (based on local market prices), the value

49. We are well aware that changes in income do not fully capture all aspects of vulnerability, but in fact no single indicator will. For example, a household may be part of a broader network, which is able to provide resources in case a negative event occurs. See for example World Bank (2001) Chapter 1, Box 1.3 and Coudouel et al. (2002) for more on the measurement of vulnerability.

of salaries in kind, and actual housing rent paid. They exclude gifts received (since donors will report these items in their own consumption expenditures) and the imputed rent of owner-occupied housing (since there is no housing market on the islands).

Panel data

We use a panel of 1,169 households, almost half of the households of the VPA-2 survey sample which also had been interviewed for VPA-1 to analyze vulnerability in the Maldives. The panel is limited to the island population – the capital Male' is excluded – since people on the islands move less frequently compared to Male' and even if they do so it is generally known where they went to. Practically all panel households could be located and non-response was negligible. The geographical dispersion of the panel households is wide, ensuring that the results apply to all atolls and regions. Table 5.1 summarizes the characteristics of the surveys and the panel used to assess the vulnerability of the island population.

Table 5.1: Summary information on the sample and panel dataset

Sample\Panel	Atoll sample VPA-1	Panel sample VPA-1	Atoll sample VPA-2	Panel sample VPA-2
Number of households in the sample	2,286	1,169	2,421	1,169
Total number of persons in the sample	14,203	7,616	14,603	7,180
Average household size (persons)	6.2	6.5	6.0	6.1
Percentage of women in the household	52	52	53	53
Average age of the sample population	21	21	25	25
Average expenditures per person per day	19	19	26	25

Source: VPA-2

The full dataset and the panel subset for both periods are alike, indicating that the panel offers a good representation of the entire population. There were, however, changes between 1997 and 2004. The average household size decreased, and both per capita expenditures and average levels of education increased.

Income poverty dynamics

The panel data provide valuable insights into the dynamics of poverty. They not only show to what extent poverty has changed from 1997 to 2004, but also reveal more about those who are currently poor, showing what proportion was previously also poor and what proportion has fallen into poverty from higher levels of income. Tables 5.2 and 5.3 present the panel households by income class in absolute numbers and percentage distribution, respectively. These so-called transition tables distinguish

five income classes based on three poverty lines of 7.5, 10 and 15 Rufiyaa per person per day, plus the international poverty line used for the Millennium Development Goals (MDGs), Rf. 4.34, which is the Rufiyaa equivalent of one dollar per person per day in terms of purchasing power parity.

Table 5.2: Number of panel households by income class, 1997 and 2004

1997 \ 2004	<4.3	4.3–7.5	7.5–10	10–15	>15	
<4.3	0	3	8	16	22	49
4.3–7.5	4	6	13	26	78	127
7.5–10	0	6	9	34	85	134
10–15	4	12	16	47	186	265
>15	10	17	21	66	480	594
	18	44	67	189	851	1169

Source: VPA-2

Table 5.3: Percentage distribution of households by income class, 1997 and 2004

1997 \ 2004	<4.3	4.3–7.5	7.5–10	10–15	>15	
<4.3	0%	0%	1%	1%	2%	4%
4.3–7.5	0%	1%	1%	2%	7%	11%
7.5–10	0%	1%	1%	3%	7%	11%
10–15	0%	1%	1%	4%	16%	23%
>15	1%	1%	2%	6%	41%	51%
	2%	4%	6%	16%	73%	100%

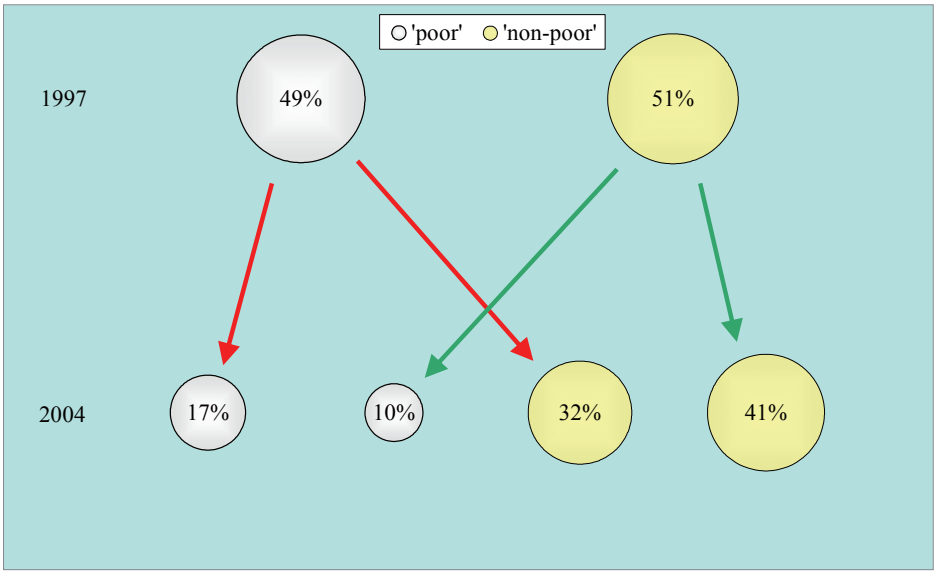
Source: VPA-2

The transition tables confirm that between 1997 and 2004 income poverty fell considerably for all poverty lines. For instance, between 1997 and 2004, the proportion of households with less than Rf.15 per person per day fell from approximately 49 to 27 per cent. The diagonal elements show which households were in the same income class both in 1997 and in 2004. Only 47 per cent of the households remained in the same income class, showing just how dynamic the poverty situation in the Maldives is. Of the 53 per cent of households that changed income class, around 40 per cent graduated to a higher class (above diagonal elements) and around 13 per cent fell into a lower class (below diagonal elements).

The final row of Table 5.3 shows that in 2004, 73 per cent of households had incomes greater than Rf. 15 per person per day; the remaining 27 per cent can be considered poor. Of this figure 17 per cent can be classified as chronic poor since their income was also below Rf.15 in 1997; the other 10 per cent had been non-poor seven years earlier but had fallen into poverty. These can be classified as vulnerable. The final column of Table 5.3 shows that in 1997 51 per cent of the population had incomes greater than Rf. 15 per day. The remaining 49 per cent were poor but of these households 32 per cent managed to escape poverty during the period and were non-poor by 2004. This flow in and out of poverty is depicted graphically in Figure 5.1.

Figure 5.1 shows that, during the seven-year period, three out of five of those poor households in 1997 managed to escape from income poverty. On the other hand, one in five of the non-poor households fell into poverty. In order to determine whether

Figure 5.1: Income poverty dynamics for the island population of the Maldives, 1997–2004, Rf.15 poverty line



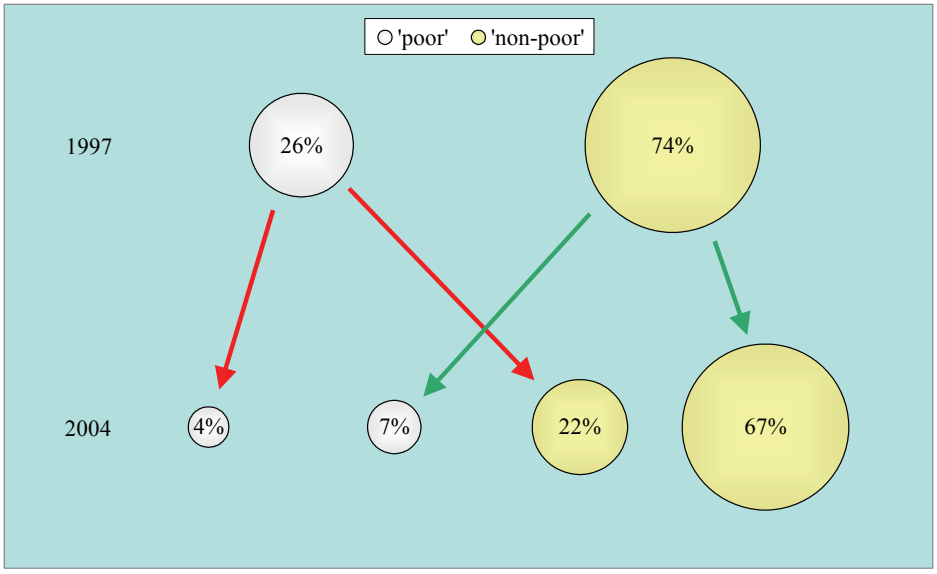
Source: VPA-2

these findings are robust and insensitive to the choice of the poverty line, the poverty dynamics analysis has been repeated using a poverty line of Rf.10 per person per day. The results are displayed in Figure 5.2.

The figures indeed confirm that the pattern of movement in and out of income poverty for the two poverty lines is similar. In both cases, the majority of those who were income poor in 1997 had escaped from poverty. Those who were income poor in 2004 belonged to one of two groups: those who had also been poor in 1997 and a large group of those who had been non-poor in 1997 but had subsequently fallen into poverty.

These large movements between income groups clearly indicate that the income poverty situation is quite dynamic. It implies that anti-poverty programs should be designed not just to lift the poor out of poverty, but also to prevent the non-poor from falling into poverty.

Figure 5.2: Income poverty dynamics for the island population of the Maldives, 1997–2004, Rf.10 poverty line



Source: VPA-2

5.4. DETERMINANTS OF ENTRY INTO AND EXIT OUT OF POVERTY IN THE MALDIVES: ECONOMETRIC ANALYSIS

In order to understand the factors associated with the observed poverty transitions, we apply a multivariate econometric analysis which models a discrete dependent variable measuring dynamic poverty status.

We consider two important sub-groups within the panel: those who escaped from poverty between 1997 and 2004 and those who fell into poverty over the same period. For the former we carry out a so-called 'escape' regression, which is applied to all households that were poor in 1997. For the latter we carry out a so-called 'fall' regression, which is applied to all households that were non-poor in 1997. The escape and fall regressions have been estimated using the binomial Logit estimation method, where the dependent variable takes a value of one if the poverty situation of a household in 2004 is different from that of 1997 and a value of zero if no change in the poverty situation has occurred.[50]

50. The binomial Logit estimation method was preferred over a binomial Probit estimation since it obtained a better fit with the data.

We distinguish the poor from the non-poor using a poverty line of Rf. 15 per person per day. This is of such a level – the highest of all poverty lines considered in Section 5.3 – that transitions across this poverty line are substantive and meaningful. This is to counteract some of the criticism of Ravallion (1996) on the discrete dependent variable approach to modelling poverty transitions, mainly with respect to its loss of information compared to an approach of modelling directly the underlying variable measuring the standard of living.

The explanatory variables included in the regressions have been chosen using an iterative procedure.[51] Table 5.4 displays the results in terms of the marginal effects of each variable, together with the z-value and significance of the coefficient associated with each of the explanatory variables.

Using the poverty escape regression, 71 per cent of the cases are predicted correctly using this model. Together with a Pseudo R-squared of 0.18 this indicates a moderate to weak fit of the model. Similarly, for the falling into poverty regression, 83 per cent of the cases were predicted correctly and the Pseudo R-squared equals 0.19. The remainders of the results are discussed below, focusing on the results that are significant at the 10 per cent level at least.

Determinants at household level – Human capital

In line with prior expectations, the estimation results suggest that a high initial level of and positive change in the number of household members keeps households in poverty and pushes households below the poverty line. Moreover, escape seems to be hampered less than fall is being promoted by a large initial household or an increase in household size.

The base level and change in proportion of adults employed have a strong positive effect on the odds of escaping poverty, but do not significantly affect the probability of falling into poverty. Industry of employment matters as well. Being employed in the agricultural sector negatively affects the probability of escaping poverty whilst having no noticeable effect on the probability of falling into poverty. In contrast, being employed in the trade and transport, government and tourism sectors makes it less likely for individuals to fall into poverty. Of these variables, the proportion of household members employed in the government sector has an ambiguous influence; it both (insignificantly) hampers escape from poverty and it significantly and

51. See Appendix for more detail.

Table 5.4: Binomial Logit regressions of escaping from and falling into income poverty, Maldives (excluding the capital Male'), 1997-2004, Rf.15 per person per day poverty line.

	Escape		Fall	
Number of Observations	560		563	
Observed probability	0.64		0.20	
Independent variables (X)	Marginal effect	z-statistic	Marginal Effect	z-statistic
Fixed Term	-0.1159	-0.85	-0.4156	-4.9***
Determinants that can be influenced by the household				
Human capital				
Initial number of household members	-0.0112	-1.9*	0.0157	2.5**
Change in number of household members	-0.0208	-3.5***	0.0265	4.5***
Initial number of young household members	0.1242	1.3	0.1303	1.4
Change in number of young household members	-0.1039	-1.2	0.0729	0.9
Initial proportion of adults employed	0.1334	2.1**		
Change in proportion of adults employed	0.1592	3.2***		
Proportion employed in trade and transport VPA-2	0.1006	1.2	-0.1298	-1.8*
Proportion employed in (semi) government VPA-2	-0.0376	-0.6	-0.2904	-3.7***
Proportion employed in the tourism sector VPA-2	0.0945	1.0	-0.3352	-2.0**
Proportion employed in the agriculture sector VPA-2	-0.1467	-1.8*	-0.0204	-0.3
Proportion employed in the fishing sector VPA-2	-0.0188	-0.3	-0.0180	-0.3
Proportion employed in manufacturing sector VPA-2	0.0072	0.1	-0.0205	-0.4
Initial proportion employed working as employee			0.1016	1.6
Change in proportion of working as employee			0.0785	1.5
Initial proportion of working as own account worker	-0.0608	-1.1		
Change in proportion of own account workers	-0.0728	-1.6		
Dummy for receiving remittances	0.0988	3.1***	-0.0547	-1.5
Initial average level of education	0.1983	3.1***		
Change in average level of education	0.0956	2.0**		
Other capital				
Dummy for taking a loan to invest VPA-2	0.0936	1.7*	-0.1346	-1.9*
Dummy for investing without taking a loan VPA-2	0.0569	0.8		
Initial proportion of members voluntary participating in community activities	0.1894	2.0**	-0.0901	-1.0
Change in proportion of members voluntary participating in community activities	0.0892	1.3	-0.1070	-1.5
External determinants				
Household-specific				
Proportion of female household members VPA-2	-0.1531	-2.0**		
Dummy for female-headed household VPA-2	-0.0179	-0.6		
Proportion of members not working due to bad health VPA-2	-0.2941	-2.9***	0.1740	1.8*
Regions				
Dummy for Northern region	-0.1598	-3.4***	0.2649	5.0***
Dummy for Northern Central region	-0.1756	-3.7***	0.2040	3.6***
Dummy for Central region	-0.0772	-1.3	0.1567	2.6***
Dummy for Southern Central region	-0.0472	-1.0	0.0704	1.1
Pseudo R-squared (McFadden)	0.18		0.19	
Proportion of correct predictions	0.71		0.83	
Predicted probability at mean of X	0.68		0.14	

* Significant at 10% level ** Significant at 5% level *** Significant at 1% level

Empty cells indicate that the variables are not included in the regression to avoid multicollinearity.

strongly prohibits a fall into poverty, as being employed in the government sector is relatively secure and salaries are more or less fixed. The proportion of household members employed in tourism has the strongest effect on preventing from falling into poverty of all variables included in the poverty fall regression.

Receiving remittances from household members employed elsewhere has the expected positive effect on the odds of escaping poverty and the expected negative effect on the odds to fall into poverty. The initial average level of and change in the average level of education of a household are also positively related to escape. Although no apparent relationship exists with the poverty fall dummy, the coefficient for the level of education present in a family is the largest in the poverty escape regression.

Determinants at household level – Other capital

When a household takes a loan to invest, it increases the chance that the household will escape poverty or it decreases the chance that the household will fall into poverty. The results show that the impact of taking out a loan to invest is largest on the odds of falling into poverty.

A clear positive relation exists between the initial proportion of household members voluntarily active in community activities and the probability that a household escapes poverty.

External household-specific determinants

The proportion of women in a household significantly impedes escaping from poverty, but does not influence falling into poverty. The proportion of family members unable to work due to bad health decreases the chances of escaping poverty and has the largest negative coefficient of all variables in the poverty escape regression. It also significantly increases the likelihood that a family will wind up in poverty.

Regional determinants

The results on the influence of the region in which households live on the odds of escaping or falling into poverty provide some interesting patterns. All dummies included in the regressions decreased the odds of escaping poverty and increased the probability of falling into poverty with significant results for the more Northern regions. This means that living in the omitted region, the Southern region in this case, was best for households. In contrast, households living in the North Central and Northern region are more likely to remain in poverty or to fall into poverty, with

the latter having the biggest positive impact on the odds of falling into poverty of all variables included in the poverty fall regression.

5.5. CONCLUSIONS

Despite rapid economic and social development of the Maldives and being on track on achieving most of the MDGs, the vulnerability of the island population in terms of poverty dynamics is quit high. Household panel data for the period 1997/98 – 2004 show that, although the majority of the poor manages to escape from poverty, a substantial part of the non-poor falls back into poverty at the same time. We have used Logit regression analysis to determine the factors behind these observed changes during the period 1997/98 – 2004 with panel data. This allows us to identify not only possible household coping strategies, but also appropriate and targeted government policies that may help households to escape from or remain out of poverty.

It appears that the most influential determinants helping households to escape from poverty are: (i) the initial level of education, (ii) the proportion of members voluntarily participating in community activities and (iii) the change in (and level of) the proportion of adults employed. The three factors that have the largest impact on impeding an escape from poverty are: (i) the proportion of household members not working due to bad health, (ii) living in the two Northern regions and (iii) the proportion of female household members.

The factors most important with respect to falling into poverty are: (i) living in the Northern regions, (ii) the proportion of household members not working due to bad health and (iii) the number of young household members, whereas (i) working in the tourism sector, (ii) in the public sector or (iii) taking out a loan to invest are the most important helpful determinants that prevent households from falling into poverty.

Policy implications of these results are not only relevant at government level but also at household level. The government may consider, as important elements of their poverty reduction strategy, to pay more attention to the development of the Northern regions, further stimulate access to good quality education and health care for the island population, and further stimulate the development of (private sector) tourism across the country. With regard to poverty reduction strategies of the households themselves, they involve: (i) education, (ii) increasing the household labor force participation rate (especially in tourism and the public sector) and (iii) family planning.

APPENDIX: METHODOLOGY OF THE LOGIT REGRESSION ANALYSIS

The analysis was an iterative procedure. First, a broad impression of poverty dynamics was obtained and as knowledge of the topic was being accumulated the results were fine-tuned. At the start, a model was formulated using theoretical determinants. This model was then translated into an empirical one for testing. At the same time, the survey data from the panel households were converted into variables suitable for the model and then further adapted to satisfy multicollinearity conditions. Some theoretical determinants could not be inserted due to lack of information.

The prepared data were then imported into the statistical analysis program E-views to carry out an initial assessment of the relationships between the dependent variable and the theoretical determinants. Then a systematic procedure was used to select the indicators that from the model results appeared to have a significant relation to the dependent variables. Logit regressions were run with as dependent variables the four possible poverty states of the households in the two surveys: *always poor, escaped, fallen back into poverty and never poor*.

Determinants without significant regression coefficients were omitted from the regression one by one to see how coefficients of the other explanatory variables and their z-values reacted. In this way, the most significant and stable regression specifications were chosen. It should be noted however that for comparison reasons some insignificant variables have been retained in the models. The presence of such redundant variables is not harmful as long as there are sufficient observations in the dataset. This step also included general statistical tests on the validity of the model. Corrections were consequently made to satisfy heteroskedasticity conditions.

The knowledge obtained through the initial assessment on which variables are correlated and how was subsequently used to adapt the underlying model for poverty dynamics. These modified assumptions then made it necessary to change some variables as well as the way they were included. The regressions were then run again and various statistical tests applied to validate the results. This iterative process was repeated until there were no further improvements in the determination coefficients of the regressions.

Chapter 6

Tsunami Impact on Poverty Dynamics in the Maldives*

* This chapter is based on "Tsunami Impact on Poverty Dynamics in the Maldives" by Hans de Kruijk and Martine Rutten (2008).

6.1. INTRODUCTION

The Maldives witnessed rapid economic growth over the recent period, averaging eight percent per year over the last decade. The country has also achieved many of the Millennium Development Goals (MDGs). However, despite high economic growth and social progress the Maldives continues to face major developmental challenges such as vulnerability, large income and non-income disparities between the capital Male' and the atolls, increasing youth unemployment throughout the country and environmental challenges due to the insular nature of the country and the lack of land resources for its growing population (being 300,000 in 2006). Beach erosion is increasing vulnerability in practically all islands. This and the anticipated sea level rise present unprecedented challenges, as witnessed by the Indian Ocean tsunami of 26 December 2004.

This chapter analyses the impact of the tsunami on household poverty and vulnerability in the Maldives. It uses the database of the Vulnerability and Poverty Assessment surveys that have been carried out for the Maldives in 1997 and 2004, before the tsunami hit the Maldives (VPA-1 and VPA-2, respectively) and the Tsunami Impact Analysis that has been carried out in 2005 (TIA). The analyses carried out in this chapter build on the previous chapter, which focused on the vulnerability of the island population over the period 1997 to 2004.

Vulnerability is defined here as the probability that a household will experience an episode of poverty over time. It is measured in terms of changes in income poverty of households, with some households remaining poor (non-poor) and some households that were previously poor (non-poor) escaping from (falling into) poverty. We use Logit regression analysis to determine the factors behind these observed changes – and simple OLS to determine the factors causing poverty in a given period – and subsequently compare the pre-tsunami period with the post-tsunami period to discern the impact of the tsunami.

Since the Indian Ocean tsunami hit the coasts of Indonesia, Malaysia, Thailand, Burma, Bangladesh, India, the Maldives, Sri Lanka, Seychelles, Somalia and Yemen several studies have appeared which attempt to estimate the short-term economic impact of the tsunami. These have usually been carried out at the macro level (estimating economic the impact of the tsunami on economic growth and national welfare)[52]

52. See Israngkura's (2005) analysis for Thailand and Bandara and Naranpanawa's (2007) study of the economic impact of the Tsunami and reconstruction aid package using a Computable General Equilibrium model for Sri Lanka.

or sectoral level (estimating the impact of the tsunami on for example the tourism sector).[53] Also, some are multi-country and include or focus on lessons for policy and program design.[54] Our study contributes to this body of literature by examining the impact of the tsunami at the household level by observing changes in income poverty and the factors behind it before and after the tsunami hit the Maldives. It is the only tsunami impact study based on detailed household survey data, carried out in all villages of the country before and after the tsunami comprising a wealth of information on the channels via which a natural disaster such as the tsunami impacts upon household welfare.

This chapter is organised as follows. Section 2 shortly describes the economic developments in the Maldives over the past twenty-five years and the macroeconomic effects of the tsunami that set the scene for the remainder of the chapter. Section 3 examines poverty and vulnerability of the island population over the period 1997 to 2005, and compares the pre-tsunami period 1997–2004 to the period 2004–2005 to discern the impact of the tsunami. Section 4 identifies the factors determining poverty and the factors that are likely to have caused the observed changes in income poverty (i.e. vulnerability), using static OLS and dynamic Logit regression analyses respectively, and distinguishing the pre- and post tsunami period. The final section concludes.

6.2. BACKGROUND

Rapid economic development

Thirty years ago the Maldives was very different from the country today. Most Maldivians lived on islands that were worlds unto themselves. There were no means of communication and there was no electricity. For the vast majority of Maldivians there was no alternative to a life of subsistence fishing and agriculture. The lives of many people on the remotest and least accessible islands had probably more in common with the lives of those who had lived 500 years earlier than with the lives today.

Over the past 25 years the economy of the Maldives has grown rapidly, with an annual rate of growth of more than 8 percent. Per capita GDP increased on average by about 5.5 percent annually. The main driver for rapid economic development has been

53. See Birkland et al. 's (2006) analysis for Thailand's tourism sector.

54. See Athukorala and Resosudarmo's (2005) analysis for Indonesia and Sri Lanka and Telford and Cosgrave's (2006)'s evaluation of the international response to the Indian Ocean Tsunami.

tourism. Including other activities that in practice are devoted exclusively to tourism, such as parts of manufacturing, construction, trade, transport and other services, tourism presently accounts for more than 50 per cent of GDP. By the expansion of tourism to more than 600,000 tourist arrivals in 2004, the country has witnessed nothing short of an economic revolution accompanied with tremendous economic and social change. The Maldives transformed from a closed economy to a very open economy within one generation.

There is no abject poverty in the Maldives. Many characteristics of poverty found in other parts of South Asia and in Africa are not present in the Maldives. While there are serious nutritional problems, there is no observable link between income and nutrition status and there is no starvation. There are no slum dwellers, although many houses in Male' are getting more and more overcrowded due to continuous and increasing rural-urban migration and on the islands, most of the 12,000 people that were made homeless by the tsunami are still living in temporary shelters.

Macroeconomic effects of the tsunami[55]

The 26 December 2004 Indian Ocean tsunami was the greatest natural disaster in living memory in the Maldives. It inundated the land on some islands and on a few destroyed anything standing. However, it had scarcely any effect on other islands such as the capital Male', and in the atolls in the extreme north and south there was only limited physical damage. The tsunami caused the relocation of 17 percent of the atoll population. Most of them returned to their own houses after a short time and by mid-2005 only about four percent of the islanders were still living in temporary accommodation.

The tsunami brought many economic activities to a sudden halt. Even so, the slowdown was briefer than might have been expected. Tourism recovered quite quickly. The tsunami hit during the peak period and largely wiped out the rest of the season. Nevertheless, by the middle of 2005 many resorts that had closed were back in business and tourist flows also started to revert to normal levels: during the first four months of 2006 tourist arrivals were nearly double those of the first four months of 2005 and bed-nights were only about 8 percent below the record levels of 2004.

The speed of recovery from the tsunami has been impressive. In 2005 fishing communities enjoyed the highest catch on record. The construction sector too continued

55. This subsection is based on TIA.

to boom. The extra activity generated in the aftermath of the floods, including the relocation of people and the provision of accommodation, and refurbishment of damaged resorts and infrastructure on many islands, stimulated additional opportunities.

Overall, the tsunami's macro-economic effects were quite small and mostly short term. This is largely because it did little damage to the economic infrastructure, and negative impacts were offset by favourable circumstances such as large fishing catches. As a result, although the GDP declined in 2005, it staged a remarkable recovery in 2006, so that average annual growth for the two years was between 7 and 8 percent, thus continuing the trend evident from 2002 onwards.

This is not to underestimate the suffering of those directly affected by the tsunami, but the population was also able to benefit from many opportunities provided by the economy's excellent performance. The impact of the tsunami on poverty and vulnerability of the island population will be examined in the next section.

6.3. POVERTY INCIDENCE AND POVERTY DYNAMICS BEFORE AND AFTER THE TSUNAMI

Unit of measurement and analysis

The VPA and TIA surveys consider twelve living standard dimensions: education, health, housing, employment, income, environment, drinking water, electricity, transport, communication, food security, and consumer goods, all of which impinge upon vulnerability, defined as the risk of experiencing an episode of poverty. The most relevant indicator, however, is income since individuals or households with sufficient income can – to some extent – 'buy themselves' out of poverty (and defend themselves against vulnerability) along the other living standard dimensions and so become less vulnerable overall. We therefore use income as the indicator with which to track changes in the poverty situation, i.e. to measure vulnerability.

The unit of analysis is the household. Moving from the household to the individual level simply means dividing the household income by the number of household members. This approach neglects economies of scale within the household and intra-household income inequality, proper diagnosing of which was beyond the scope of the VPA and TIA surveys.

Income is calculated as the sum of wage income, business profits, property income, own produced consumer goods and miscellaneous income (such as pensions and alimony) and excludes gifts, post-tsunami aid received and, for owner-occupiers, imputed housing rent.

Panel data

VPA-1, VPA-2, and the TIA roughly used the same questions and over time followed a large number of the same households – permitting a 'panel analysis'. Of the 2,336 participating households in the TIA in 2005, 1,797 households had also been included in the 2004 survey while 1,019 households are included in all three studies.

The panel is limited to the island population, i.e. the capital Male' is excluded, since people on the islands move less frequently compared to Male' and, even if they do so, it is generally known where they went. Practically all panel households could be located and non-response was negligible.

Developments over time measured in a series of surveys consist of both real changes and sampling errors. With independently pooled samples it is nearly impossible to separate these two effects. As we want to measure real changes and not changes in sampling errors, panel data where the same households are followed over time are very useful. They do not display changes in sampling errors but only measure developments over time of that particular part of the population.

Although sampling errors of a panel do not change over time, there are sampling errors of the original panel, like in all samples. To see whether the developments of the original panel over time are close to developments of the overall population, they are compared with developments of the full samples of the surveys in Table 6.1.

Table 6.1: Summary information on the sample and panel dataset

Sample\Panel	VPA-1		VPA-2		TIA	
	Atoll sample	Panel sample	Atoll sample	Panel sample	Atoll sample	Panel sample
Number of households in the sample	2,286	1,019	2,421	1,019	2,181	1,019
Average household income per person per day (Rf.)	25	25	31	28	37	37
Wage share in household income	48%	48%	49%	49%	46%	44%
% of households with less than Rf. 15 per person per day	45%	44%	33%	34%	20%	20%

Source: Authors' calculations based on the VPA-1-2-TIA database.

Table 6.1 shows that, over the years, important income characteristics of the panel remain quite close to those of the much larger atoll samples, which allows us to carry out our income poverty dynamics analysis with panel data.

Income poverty dynamics

Tables 6.2 and 6.3 report on the poverty dynamics of the 1,019 panel households that were interviewed in both 2004, six months before the tsunami, and 2005, six months after the tsunami. The tables present the panel households by income class in absolute numbers and percentage distribution, respectively. These so-called transition tables distinguish four income classes based on three poverty lines of 7.5, 10 and 15 Rufiyaa per person per day. The 7.5 Rufiyaa per person per day poverty line approximates the line of one dollar per person per day in purchasing power parity used as the international Millennium Development Goals (MDGs) poverty line.[56]

The information for this panel shows that income poverty has declined for all possible poverty lines – the share of the population below the various poverty lines is consistently lower in 2005 than in 2004. One can look, for example, at the Rf. 7.5 per day line. In 2004, 15 percent of the population was below this while one year later the proportion had fallen to 9 percent. Over the same period, the proportion of the island population with an income higher than Rf. 15 per person per day increased from 66 to 80 percent.

Table 6.2: Number of panel households by income class in Rufyaas per person per day, 2004 and 2005

2004 \ 2005	<7.5	7.5-10	10-15	>15	Total
<7.5	29	10	22	93	154
7.5-10	14	4	9	33	60
10-15	17	5	16	93	131
>15	32	8	35	599	674
Total	92	27	82	818	1019

Source: Authors' calculations based on the VPA-1-2-TIA database.

Table 6.3: Percentage distribution of panel households by income class, 2004 and 2005.

2004 \ 2005	<7.5	7.5-10	10-15	>15	Total
<7.5	3%	1%	2%	9%	15%
7.5-10	1%	0%	1%	3%	6%
10-15	2%	0%	2%	9%	13%
>15	3%	1%	3%	59%	66%
Total	9%	3%	8%	80%	100%

Source: Authors' calculations based on the VPA-1-2-TIA database.

This progress is a continuation of the progress made during the period 1997–2004 as shown in Tables 6.4 and 6.5, but the progress made after the tsunami (Tables 6.2 and 6.3) is even larger than in the pre-tsunami period (Tables 6.4 and 6.5).

56. For the purchasing power parity (PPP) conversion factor see the *UN Statistics* of the United Nations Statistical Division of the Department of Economic and Social Affairs (DESA) at: http://data.un.org/Data.aspx?q=PPP+maldives&d=MDG&f=seriesRowID%3a699%3bcountryID%3a462.

Table 6.4: Number of panel households by income class in Rufyaas per person per day, 1997 and 2004.

1997 \ 2004	<7.5	7.5-10	10-15	>15	Total
<7.5	45	13	40	139	237
7.5-10	9	6	10	40	65
10-15	23	11	26	81	141
>15	77	30	55	414	576
Total	154	60	131	674	1019

Source: Authors' calculations based on the VPA-1-2-TIA database.

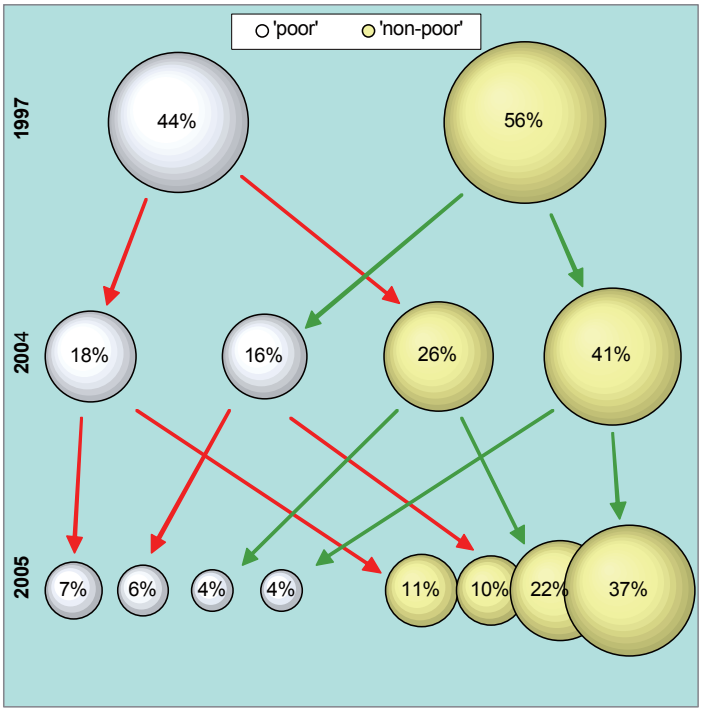
Table 6.5: Percentage distribution of panel households by income class, 1997 and 2004.

1997 \ 2004	<7.5	7.5-10	10-15	>15	Total
<7.5	4%	1%	4%	14%	23%
7.5-10	1%	1%	1%	4%	6%
10-15	2%	1%	3%	8%	14%
>15	8%	3%	5%	41%	57%
Total	15%	6%	13%	66%	100%

Source: Authors' calculations based on the VPA-1-2-TIA database.

One of the more disturbing findings of the sequence of surveys from 1997 onwards is that the population seems to be much more vulnerable than has been assumed. This has been depicted in Figure 6.1 which shows movements between the richer and poorer income groups. In 1997, using the Rf. 15 poverty line, 44 percent of the population was poor and the remaining 56 percent non-poor. This 44 percent then splits into two groups: 18 percent remained poor while 26 percent became non-poor in 2004. However, examining the poor in 2004 shows them to consist of two groups:

Figure 6.1: Income poverty dynamics 1997–2005, atoll population, Rf.15 poverty line



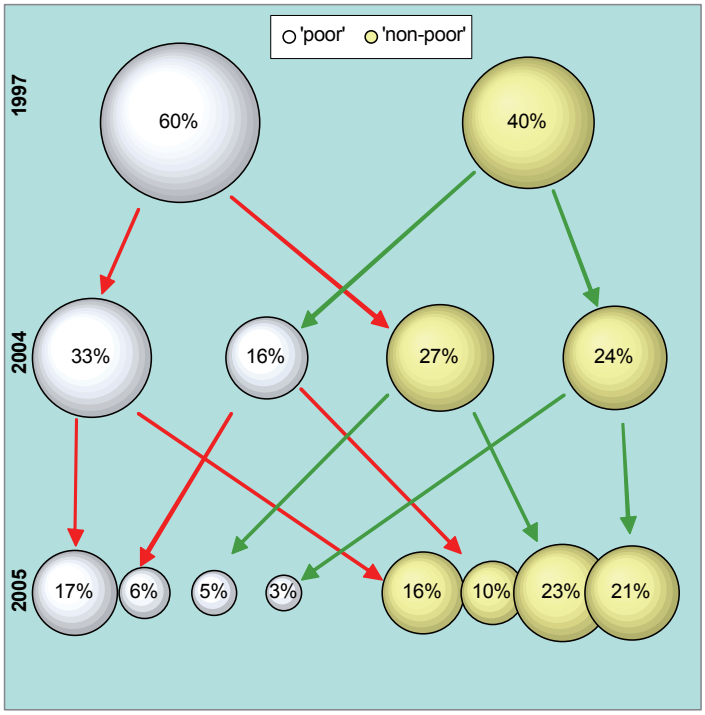
Source: TIA

the 18 percent who had also been poor in 1997, and the 16 percent who had been non-poor in 1997. Similarly, there was a substantial movement between 2004 and 2005.

Over the period of the three surveys, only 7 out of the original 44 percent poor remained so throughout. In 2005, they made up about one-third of all the poor, with the others moving in and out of poverty, and sometimes back again. Only two out of three non-poor in 1997 remained so throughout. Taken together, this means that during this period more than half of the island population moved in or out poverty at least once.

To determine whether this high level of vulnerability is sensitive to the choice of the poverty line, the same poverty dynamics analysis has been repeated using a poverty line of Rf. 21 per person per day (Figure 6.2). Using this higher poverty line, a lower percentage of the poor manages to escape from poverty and a higher percentage of the non-poor falls back into poverty. Also in this case poverty dynamics is substan-

Figure 6.2: Income poverty dynamics 1997–2005, atoll population, Rf. 21 poverty line



Source: TIA

tial. Only a quarter of the original poor in 1997 is still poor in 2005 and only half of the originally non-poor in 1997 remained so in 2005.

Comparing the degree of poverty dynamics and vulnerability between the periods 1997–2004 and 2004–2005 on the basis of Figures 6.1 and 6.2 is not straightforward as the first period covers seven years – without annual information – whereas the second period is one year only.

Nevertheless, considering that 28 percent of the non-poor – defined as having more than Rf.15 per person per day – (16/56) fell into income poverty during the 7-year period 1997–2004 compared to 12 percent ((4+4)/(41+26)) in the 1-year period 2004–2005, and considering that about 60 percent of the poor managed to escape from poverty both during the 7-year period 1997–2004 (26/44) and 62 percent in the 1-year period 2004–2005 ((11+10)/(18+16)), it seems that poverty dynamics, already being high during the pre-tsunami period 1997–2004, was indeed higher during the tsunami period 2004–2005.

Using static OLS and dynamic Logit regressions, respectively, the next section describes the poverty profiles of the households before and after the tsunami and the characteristics of households that, respectively, managed to escape from or fell into income poverty during 2004–2005.

6.4. DETERMINANTS OF POVERTY AND VULNERABILITY BEFORE AND AFTER THE TSUNAMI: ECONOMETRIC ANALYSIS

The analysis of the characteristics of the poor before and after the tsunami is based on 746 households. This subgroup filled all questionnaire forms. To find the main determinants of household incomes before and after the tsunami, this section first presents the results of two OLS regressions, one for 2004 and one for 2005. Then it presents the results of two binomial Logit regressions that identify the main characteristics of households which, following the tsunami, respectively escaped from, or fell into, income poverty. In both analyses, we draw differences and parallels between the pre- and post tsunami analyses to discern the impact of the tsunami.

6.4.1 Determinants of Household Income Before and After the Tsunami

To get a picture of the static determinants of household income before and after the tsunami, we performed two simple OLS regressions at the logarithm of per capita in-

come per day plus one, correcting for the fact that the logarithm of numbers smaller than 1 are negative, whereas we presume that the utility of income is never negative. Furthermore, the variables are weighted for household size to correct for economies of scale related to increasing household size.

Table 6.6 gives an overview of the impact and significance of the selected independent variables on per capita household income before and after the tsunami. These variables are classified in household characteristics, employment characteristics and a geographical variable. As the tsunami struck islands scattered over the entire country, no variables for the regional location of the households are added here, but a Population Vulnerability Index (value 0 for the largest island population, value 1 for the smallest island population) is used.[57]

Parallels before and after the tsunami

Obviously, parallels in both years 2004 and 2005 are the significant positive impact on household income of, respectively, the proportion of adults within the household who are employed, households that are receiving remittances and households that are taking a loan to invest, while the occurrence of a food crisis has a significant negative relationship with household income in both years.

Further, Table 6.6 shows that there is no major difference before and after the tsunami of the significance of the various economic sectors to work in. Working in the sectors fishing, construction, government, trade and transport, and tourism was lucrative before the tsunami and remained so thereafter. The fishing sector recovered quickly with an extraordinary fish catch in 2005. The construction sector boomed after the tsunami; about 8,600 houses that were damaged or completely destroyed needed repair or reconstruction.[58] As the bulk of the building materials had to imported and transported, the trade and transport sector expanded as well. Working in the government sector is safe and sound, and tourism recovered quite quickly. Although, apart from tourism, the sectors agriculture and manufacturing were hit most by the tsunami, the variables measuring the proportion of household members employed in the agricultural sector or in manufacturing are both not significant before and after the tsunami.

57. In the dynamic analysis in section 6,4.2 we have chosen to add dummy variables indicating the displacement level situation of the households after the Tsunami.

58. See Republic of Maldives, Department of National Planning, Ministry of Finance and Treasury, (2009), "Maldives- 4 Years after the tsunami".

Table 6.6: Determinants of household income before and after the tsunami: OLS regressions 2004 and 2005.

Year	2004		2005	
Number of observations	746		745	
Mean of dependent variable	3.063		3.340	
Weighting factor	Household members 2004		Household members 2005	
Method of regression	OLS		OLS	
Independent Variables	Coefficient	t- Statistic	Coefficient	t- Statistic
Fixed Term	2.280	7.40	1.390	5.04
Household characteristics				
Number of household members	–0.031	–2.51**	0.018	2.72***
Proportion of young household members	–0.050	–0.21	0.359	1.91*
Proportion of old household members	–0.338	–0.81	0.178	0.51
Proportion of female household members	–0.448	–2.34**	–0.055	–0.33
Dummy for female-headed household members	–0.149	–1.84*	–0.021	–0.38
Average level of education[a]	–0.063	–0.65	0.164	1.86*
Dummy for occurrence of a food crisis	–0.253	–1.98**	–0.163	–2.59***
Dummy for taking a loan to invest	0.278	1.94*	0.266	3.15***
Proportion of household not working due to bad health	–0.391	–0.91	–0.008	–0.04
Employment				
Proportion of adults employed	2.354	8.74***	3.155	13.86***
Proportion employed in the trade and transport sector	0.615	2.21***	0.251	1.67*
Proportion employed in the (semi) government sector	0.539	3.04***	0.267	1.84*
Proportion employed in the tourism sector	0.712	3.29***	0.336	1.81*
Proportion employed in the agriculture sector	0.048	0.24	–0.174	–0.77
Proportion employed in the fishing sector	0.625	3.91***	0.642	5.08***
Proportion employed in the manufacturing sector	0.232	1.40	0.119	0.76
Proportion employed in the construction sector	0.843	3.08***	0.731	5.28***
Proportion of household working as employer	1.342	2.12**	0.455	1.98**
Proportion of household working as employee	0.724	5.73***	0.315	4.10***
Proportion of household working as own-account worker	0.153	1.59	–0.096	–1.06
Proportion of household voluntary participating in community activities	–0.094	–0.59	–0.031	–0.44
Dummy for receiving remittances	0.725	8.19***	0.342	3.15***
Geography				
Population vulnerability index[b]	–0.260	–1.72*	–0.116	–1.17
Adjusted R-Squared	81%		88%	
Durbin-Watson statistic	1.931		1.950	

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level

(a) 1=low, 2=middle, 3=high

(b) 0=largest population, 1=smallest population

As for employment status, Table 6.6 shows that working as an employee or employer remains a stable and positive source of income generation, whereas the variable measuring the proportion of the household working as an own-account worker is not statistically significant in both years.

Differences before and after the tsunami

The most remarkable difference between the 2004 and the 2005 regression is the impact of household size on per capita income. As expected theoretically, there is a significant negative relationship between household size and income per capita in a regular year such as 2004. However, after the tsunami we see a significant positive relationship between household size and income per capita. A possible explanation for this noteworthy result could be that larger households are less vulnerable to disasters because their income sources are more diversified.

Another remarkable difference between the pre-tsunami situation in 2004 and the post-tsunami situation in 2005 is the role of women. In 2004, the proportion of female household members and the dummy variable for female-headed households have an expected significant negative impact on income, but in 2005 these variables are not significant any more. This may be due to tsunami relief efforts and tsunami recovery and reconstruction programmes including working capital grants and loans for fish processing (mostly done by women) and livelihood restoration programmes for women's income generation activities such as sewing and home gardening.[59]

6.4.2 Determinants of Poverty Dynamics Before and After the Tsunami

To understand the factors associated with the observed poverty transitions, we apply a multivariate econometric analysis which models a discrete dependent variable measuring dynamic poverty status. We consider two important sub-groups within the panel: those who escaped from poverty between 2004 and 2005 and those who fell into poverty over the same period. For the former we carry out a so-called 'escape' regression, which is applied to all households that were poor in 2004. For the latter we carry out a so-called 'fall' regression, which is applied to all households that were non-poor in 2004. The escape and fall regressions have been estimated using the binomial Logit estimation method, where the dependent variable takes a value of 1 if

59. See Republic of Maldives, Department of National Planning, Ministry of Finance and Treasury, (2009), "Maldives- 4 Years after the tsunami".

the poverty situation of a household in 2005 is different from that of 2004 and a value of 0 if no change in the poverty situation has occurred.[60]

We distinguish the poor from the non-poor by using two poverty lines of respectively Rf. 15 and Rf. 21 per person per day. This is of such a level that transitions across this poverty line are substantive and meaningful.[61] Table 6.7 displays the results in terms of the marginal effects of each variable, together with the z-value and significance of the coefficient associated with each of the explanatory variables. Empty cells indicate that the variables are not included in the regression to avoid multicollinearity.

Using the poverty escape regression, 82% of the cases are predicted correctly. Together with a Pseudo R-squared of 34% this indicates a moderate fit of the model. Similarly, for the falling into poverty regression, 89% of the cases were predicted correctly with a Pseudo R-squared of 36%. The remainder of the results are discussed below, focussing on the results that are significant at the 10% level at least.

Table 6.7 shows that – for both poverty lines – the probability to escape from poverty is significantly higher and the probability to fall into poverty is significantly lower for larger households and for households where relatively more adults are working. This is in line with the results of the static analysis in 2005 after the tsunami (see Table 6.6). Larger households and households with more income earners appear to be less vulnerable for a disaster as they can spread their income sources. This prevents them from falling into poverty and gives them a better chance of escaping it.

Other important characteristics of households that prevented them from falling into income poverty after the tsunami include (i) a higher level of education; (ii) receiving remittances from family members working in resorts or in Male'; (iii) having a high percentage of employees in the household; (iv) residing on host islands. After the tsunami, the former inhabitants of islands that were completely destroyed had been relocated to various host islands.[62] The total population of the ten most important

60. The binomial Logit estimation method was preferred over a binomial Probit estimation since it obtained a better fit with the data.

61. This counteracts some of the criticism of Ravallion (1996) on the discrete dependent variable approach to modelling poverty transitions, mainly with respect to its loss of information compared to an approach of modelling directly the underlying variable measuring the standard of living.

62. The tsunami displacement classification consists of four groups: first, those who were relocated to other islands, 'people displaced externally' (PDEs); second, those who were accommodated in temporary housing on their own islands, 'people displaced internally' (PDIs); third, the original population living on islands that

Table 6.7: Binomial Logit of escape and fall regressions 2004–05 with two poverty lines.

Poverty line	Rf. 15		Rf. 15		Rf. 21		Rf. 21	
Regression	Escape		Fall		Escape		Fall	
Number of observations	222		522		331		414	
Observed probability	0.66		0.13		0.51		0.18	
Predicted probability at mean of X	0.79		0.04		0.51		0.06	
Independent variables (X)	Marginal effect	Z-statistic	Marginal effect	Z-statistic	Marginal effect	Z-statistic	Marginal effect	Z-statistic
C	−0.51	−2.66***	0.02	0.47	−0.42	−2.32**	0.18	1.84*
Initial number of household members	0.04	2.66***	−0.01	−2.83***	0.03	2.25**	−0.01	−2.54**
Change number of household members	0.02	1.29	0.00	0.40	0.01	0.69	0.00	0.48
Proportion of young household members							0.13	1.57
Initial proportion of old household members	0.22	1.03	0.07	1.40	−0.52	−1.88*	0.03	0.44
Change in proportion of old household members	0.00	0.01	0.07	1.09	−0.74	−2.45**		
Proportion of female household members	0.04	0.17	0.05	1.16	−0.34	−1.63		
Change in proportion of female household members	−0.15	−0.62	0.01	0.11	−0.53	−1.77*	−0.14	−2.11**
Initial level of average education*			−0.01	−0.57			−0.11	−2.67***
Change in average level of education*			−0.04	−2.20**	0.14	1.80*	−0.14	−3.77***
Dummy for taking a loan to invest	0.15	1.09						
Dummy for occurrence of a food crisis	−0.08	−1.02	0.04	2.43**	−0.12	−1.44	0.07	2.90***
Initial proportion of adults employed	1.03	2.92***	−0.22	−4.77***	1.09	4.33***	−0.37	−4.90***
Change in proportion of adults employed	0.87	3.30***	−0.26	−5.29***	1.10	4.21***	−0.49	−6.45***
Initial proportion employed in trade and transport sector	0.47	0.95			0.68	3.57***	−0.08	−1.30
Change in proportion employed in trade and transport sector	0.77	2.64***	0.06	1.88*				
Initial proportion employed in the (semi) government	−0.49	−2.71***	0.00	−0.06				
Change in proportion employed in the (semi) government	−0.23	−1.65*	0.05	1.74*	0.29	2.20**	0.07	1.40
Initial proportion employed in the tourism sector					0.36	1.32	−0.13	−1.46
Change in proportion employed in the tourism sector					0.35	1.61	−0.15	−1.62
Initial proportion employed in the agriculture sector	−0.38	−1.30	0.14	2.51**			0.28	2.02**
Change in proportion employed in the agriculture sector	−0.45	−1.91*	0.05	0.62			0.15	1.31
Initial proportion employed in the fishing sector	0.24	1.83*	−0.01	−0.23	0.36	2.94***		
Change in proportion employed in the fishing sector					0.30	2.66***	−0.07	−2.00**
Initial proportion employed in the manufacturing sector	−0.21	−1.25	0.04	1.61				

Change in proportion employed in the manufacturing sector	–0.24	–1.95*	0.05	2.24**				
Initial proportion employed in the construction sector	0.14	0.69	–0.11	–2.00**	0.48	1.84*	–0.04	–0.64
Change in proportion employed in the construction sector	0.16	1.02	–0.10	–2.17**	0.26	1.94*	–0.06	–1.44
Initial proportion of household working as employee	0.14	0.92	–0.06	–2.36**				
Change in proportion of household working as employee	0.22	1.86*	–0.07	–3.53***	0.13	1.51	–0.10	–3.65***
Initial proportion of household working as own-account worker	–0.09	–0.62			–0.28	–2.56**	0.08	2.59***
Change in proportion of household working as own-account worker	–0.04	–0.38			–0.26	–2.79***	0.07	2.60***
Initial proportion of household voluntary participating in community activities	0.42	2.15**			0.41	2.31**	0.00	–0.02
Change in proportion of household voluntary participating in community activities	0.20	2.17**						
Dummy for receiving remittances			–0.07	–2.02**	0.24	1.79*	–0.12	–2.23**
Proportion of the household injured due to the tsunami	–0.06	–0.26	0.06	1.58			0.06	1.27
Dummy work lost due to the tsunami	–0.14	–1.52	0.03	1.50	–0.20	–2.07**	0.01	0.36
Dummy livelihood lost due to the tsunami			–0.04	–2.11**				
Dummy Externally Displaced Islands	0.13	0.80	0.05	1.59	–0.02	–0.18	0.11	2.42**
Dummy Internally Displaced Islands	0.03	0.28	0.04	2.14**	–0.06	–0.57	–0.02	–0.63
Dummy Host Islands	0.02	0.17	–0.07	–2.05**	0.12	0.75	–0.09	–2.20**
Pseudo R-squared (McFadden)	0.34		0.36		0.25		0.39	
LR statistic	96		146		115		152	

host islands increased by about two-thirds – from about 16,000 to roughly 27,000 – which helped the original population to double their business profits.

Households that fell into income poverty after the tsunami generally had a higher percentage of household members working in the agricultural sector. Although the sectors tourism, manufacturing and agriculture were hit most by the tsunami, tourism recovered quite quickly. Many resorts that had to close immediately after the tsunami were back in business again in mid-2005. The revitalization of agriculture requires much more time as many agricultural fields were completely destroyed and became salty. Table 6.7 further shows the significant relationship between the occurrence of a food crisis and the probability of falling into poverty.

hosted the majority of the PDEs; and fourth the inhabitants of all other islands. Dummies are used for the first three categories.

Own-account workers are more likely to fall into poverty and less likely to escape from it when referring to the higher poverty line of Rf. 21 per person per day. This confirms the results of the static analyses of Table 6.6 that working as an employee or an employer is more stable and safer than being an own-account worker.

Chapter 5 analyzed poverty dynamics in the Maldives in the pre-tsunami period 1997–2004 using a poverty line of Rf. 15 per person per day.[63] In the pre-tsunami period, the most influential determinants of escaping poverty are education, receiving remittances and community and labour force participation. Important factors impeding escaping poverty are not working due to bad health or living in the North. These factors, in addition to household size, are also most influential on the odds of falling into poverty, whereas working in tourism or in the trade and transport sector or in the public sector or taking a loan to invest prevent households from falling into poverty.

The most important parallel of poverty dynamics before and after the tsunami is the impact of participation in the labour force and in community activities. In both periods 1997–2004 and 2004–2005 the proportion of adults employed is a significant determinant of escaping poverty and of preventing households from falling into poverty, while voluntary participating in community activities also helps households to escape from poverty.

The biggest difference of poverty dynamics in the two periods is the impact of household size. In a 'normal' period larger households are less likely to escape from poverty and more likely to fall into poverty, whereas in the period before and after the tsunami larger households appear to be less vulnerable as they are able to diversify their income sources which prevents them from falling into poverty and gives them a better chance of escaping it.

6.5. CONCLUSIONS

The Maldives witnessed rapid economic and social development during the last decades and then came the Indian Ocean tsunami of 26 December 2004. While the macro-economic effects of the tsunami were quite small in the Maldives, poverty dynamics were quite high. Many households that were non-poor before the tsunami fell into income poverty and other households that were poor before the tsunami

63. See Table 5.4.

escaped from poverty. However, household panel data show that a high transition rate in and out poverty is not unusual in the Maldives. Poverty dynamics was also high in the pre-tsunami period 1997–2004.

We use simple OLS to identify the determinants of household income in the pre-tsunami and post-tsunami periods and Logit regressions to analyze the characteristics of two types of households: those who fell into poverty after the tsunami and those who escaped from poverty in the same period. These characteristics are compared with the results of a similar exercise for the pre-tsunami period 1997–2004 to discern the impact of the tsunami on poverty dynamics in the Maldives.

Parallels between the 2004 and 2005 static OLS regressions are the significant positive impact on household income of, respectively, the proportion of adults employed, receiving remittances and taking a loan to invest, while the occurrence of a food crisis has a significant negative relationship with household income in both years.

Dynamic Logit regression analysis reveals that six month after the tsunami, important characteristics of households escaping poverty are similar as in the pre-tsunami period, being participation in the labour force and in community activities, whereas characteristics preventing households from falling into poverty are different from usual. After the tsunami, households with the following characteristics are less vulnerable and less likely to fall into poverty: (i) a higher level of education; (ii) receiving remittances from family members working in resorts, in Male or abroad'; (iii) having a high percentage of employees in the household; (iv) residing on host islands; (v) having a relatively large household size.

The most remarkable difference between the two periods, both static and dynamic, is the impact of household size. As expected theoretically, in a regular period such as 1997–2004 there is a significant negative relationship between household size and income per capita, and larger households are also less likely to escape from poverty and more likely to fall into poverty, whereas in the period 2004 – 2005 before and after the tsunami larger households appear to be less vulnerable for a disaster as they are able to diversify their income sources which prevents them from falling into poverty and gives them a better chance of escaping it.

Chapter 7

Summary of Conclusions

Poverty dynamics research leads to a better understanding of poverty than point-in-time studies. In cooperation with the Government of the Maldives, the United Nations Development Programme (UNDP) and the World Bank, we have executed a comprehensive longitudinal poverty study based on three large-scale household surveys carried out on all 200 inhabited islands in the Maldives. The first wave was conducted in 1997 with follow-ups in 2004 and 2005. We have followed more than 1,000 of the same households over time, permitting a 'panel analysis' to get insight in poverty dynamics and in the characteristics of households that managed to escape from poverty and of households that fell back to poverty. This thesis presents the results and introduces some conceptual and methodological innovations that might be interesting for the academic world.

Poverty has been defined in many different ways during the last century: absolute versus relative poverty, objective versus subjective poverty and one-dimensional versus multidimensional poverty. We consider poverty as more than low income. It includes also vulnerability and lack of access to, for instance, good education and health, especially in a country like the Maldives where the majority of the population lives on 200 very small remote islands. Therefore, we have developed a new poverty indicator, the Multidimensional Poverty Index (MPI), with 12 dimensions: income, health, education, employment, housing, transport, electricity, communication, food security, environmental security, availability of drinking water, and consumer goods.

A multidimensional concept of poverty raises the questions of how to quantify the various dimensions of poverty and how to weigh these dimensions to measure overall poverty. The choice of a single poverty line, no matter how it is constructed, is always arbitrary and based on value judgments. We solve this problem by applying the poverty dominance approach that enables poverty comparisons across regions and over time without knowing the level of the poverty line. Instead of trying to establish a single poverty, we consider a set of all reasonable poverty lines and analyze whether the results of various poverty lines are robust regarding the development of poverty over time (increased or declined) and over regions (is there more poverty in the north than in the south?) irrespective of the selection of the poverty line. The poverty dominance approach has been applied to all 12 dimensions of poverty, thereby showing in which dimension and where in the country the biggest progress has been achieved and which dimensions of poverty need more attention and where.

As for the aggregation problem, existing attempts to solve the 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. We solve the aggregation problem by using a weighting structure that is derived directly from population preferences on the ranking of living standard dimensions as obtained from the household surveys. These ranking are transformed into *priority weights* for each dimension so as to obtain the composite MPI index. The weights are recognised and appealing, and its derivation is transparent and simple.

The application of the MPI to 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, and being able to show cross-regional differences and changes over time. The individual scores of 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.

Many households that were non-poor before the tsunami fell into income poverty and other households that were poor before the tsunami escaped from poverty. However, household panel data show that a high transition rate in and out poverty is not unusual in the Maldives. Poverty dynamics was also high in the pre-tsunami period 1997–2004. With panel data, we use simple OLS to identify the determinants of household income in the pre-tsunami and post-tsunami periods and dynamic Logit regressions to analyze the characteristics of two types of households: those who fell into poverty and those who escaped from poverty.

During the pre-tsunami period 1997–2004, the most influential determinants helping households to escape from poverty appear to be: (i) the initial level of education, (ii) the proportion of members voluntarily participating in community activities and (iii) the change in (and level of) the proportion of adults employed. The three factors that have the largest impact on impeding an escape from poverty are: (i) the proportion of household members not working due to bad health, (ii) living in the two Northern regions and (iii) the proportion of female household members. The factors most important with respect to falling into poverty are: (i) living in the Northern regions, (ii) the proportion of household members not working due to bad health and (iii) the number of young household members, whereas (i) working in the tourism sector, (ii) in the government sector or (iii) taking out a loan to invest are the most important helpful determinants that prevent households from falling into poverty.

Parallels between the pre-tsunami year 2004 and the post-tsunami year 2005 using static OLS regressions are the significant positive impact on household income of,

respectively, the proportion of adults employed, receiving remittances and taking a loan to invest, while the occurrence of a food crisis has a significant negative relationship with household income in both years.

Dynamic Logit regression analysis reveals that six months after the tsunami, important characteristics of households escaping poverty are similar as in the pre-tsunami period: participation in the labour force and in community activities, whereas characteristics preventing households from falling into poverty are different. After the tsunami, households with the following characteristics are less vulnerable and less likely to fall into poverty: (i) a higher level of education; (ii) receiving remittances from family members working in resorts, in Male or abroad'; (iii) having a high percentage of employees in the household; (iv) residing on host islands; (v) having a relatively large household size.

The most remarkable difference between the two periods, both static and dynamic, is the impact of household size. As expected theoretically, in a regular period such as 1997–2004 there is a significant negative relationship between household size and income per capita, and larger households are also less likely to escape from poverty and more likely to fall into poverty, whereas in the period 2004 – 2005 before and after the tsunami larger households appear to be less vulnerable to a disaster as they are able to diversify their income sources which prevents them from falling into poverty and gives them a better chance of escaping it.

Policy implications of our results are not only relevant at government level but also at household level. Poverty reduction strategies of the government should be designed not just to lift the poor out of poverty, but also to prevent the non-poor from falling into poverty. In the case of the Maldives, the government may consider paying more attention to the development of the Northern regions, further stimulating access to good quality education and health care for the island population, and further stimulating the development of (private sector) tourism across the country. As for poverty reduction strategies of the households themselves, our results point to more education, taking a loan to invest, and increasing the household labour force participation rate, especially in the public sector and in the tourism sector.

Samenvatting
(Summary in Dutch)

In 1997 werd ik door de coördinator van de Verenigde Naties in de Malediven gevraagd om als teamleider, samen met Willem van den Andel, een groot armoedeonderzoek op te zetten en uit te voeren op alle 200 bewoonde eilanden. Ik was vereerd en nam de uitnodiging graag aan, niet wetende dat dit de start zou zijn van een meer dan tienjarige betrokkenheid bij de Malediven. In die periode hebben we drie uitgebreide longitudinale armoedeonderzoeken opgezet en uitgevoerd waarin we meer dan duizend dezelfde gezinnen over de tijd hebben gevolgd, telkens aangevuld met een controlegroep van ongeveer 1500 wisselende gezinnen.

Armoedestudies waarin dezelfde gezinnen over de tijd worden gevolgd maken het mogelijk karakteristieken te identificeren van succesvolle gezinnen die uit armoede weten te ontsnappen en van gezinnen die tot armoede vervallen. Dit leidt tot een beter begrip van armoede dan momentopnames. Deze dissertatie beschrijft de manier waarop de gegevens van de drie longitudinale armoedestudies zijn verzameld en verwerkt, welke onderzoeksmethoden vervolgens zijn toegepast bij de analyse en wat de onderzoeksresultaten zijn, en beoogt hiermee een bijdrage te leveren aan de armoedeliteratuur. Verder hebben we enkele conceptuele en methodologische vernieuwingen geïntroduceerd en toegepast die wellicht interessant zouden kunnen zijn voor de wetenschap.

Armoede is op verschillende manieren gedefinieerd gedurende de afgelopen eeuw: absolute versus relatieve armoede, objectieve versus subjectieve armoede, en ééndimensionale versus multidimensionale armoede. Wij beschouwen armoede als meer dan een laag inkomen alleen. Het omvat ook kwetsbaarheid en beperkte mogelijkheden en toegang tot bijvoorbeeld gezondheidszorg en onderwijs, met name in een land als de Malediven waar de meerderheid van de bevolking verspreid woont op 200 piepkleine geïsoleerde eilandjes. Daarom introduceren wij een nieuwe armoedeindicator, de Multidimensionale Armoede Index (MPI), met 12 dimensies: inkomen, gezondheidszorg, onderwijs, werkgelegenheid, huisvesting, transport, elektriciteit, communicatie, voedselzekerheid, milieuzekerheid, beschikbaarheid van drinkwater, en consumptiegoederen.

Elke dimensie krijgt meerdere armoedelijnen. Immers, de keuze van één enkele armoedelijn is altijd arbitrair en gebaseerd op waardeoordelen. Wij lossen dit probleem op door het toepassen van de "armoede dominantie benadering" die het vergelijken van armoede tussen regio's en over de tijd mogelijk maakt zonder te weten waar de armoedelijn zich bevindt. In plaats van één arbitraire armoedelijn beschouwen we de complete set van alle armoedelijnen die redelijkerwijs mogelijk zijn. Vervolgens analyseren we of de resultaten op basis van de verschillende armoedelijnen robuust zijn

in de zin dat er een eenduidige uitspraak gedaan kan worden over het verloop van armoede in de tijd (toegenomen of afgenomen) en over regio's (is er meer armoede in het noorden dan in het zuiden?) ongeacht de keuze van de armoedelijn. Deze benadering is toegepast op alle 12 dimensies van armoede, zodat zichtbaar wordt in welke dimensies en waar in het land de grootste vooruitgang is geboekt en welke dimensies van armoede meer aandacht behoeven en waar.

Een multidimensionale armoede index van 12 dimensies roept de vraag op welke gewichten de verschillende dimensies zouden moeten krijgen in de totale index. De meest gebruikte methoden zijn gelijke gewichten, zoals bijvoorbeeld in de Human Development Index, of gewichten die tot stand komen middels factor analyse. Beide methoden zijn echter niet acceptabel. Het gebruik van gelijke gewichten is arbitrair en het gebruik van gewichten middels factor analyse is artificieel en deze gewichten kunnen substantieel verschillen met de prioriteiten van de bevolking. Deze dissertatie presenteert een nieuwe methode waarbij de gewichten worden bepaald door de prioriteiten van de bevolking. Deze gewichten zijn aantrekkelijk omdat ze worden (h)erkend, transparant zijn en eenvoudig te berekenen.

Voor de resultaten beschouwen we twee periodes: de reguliere periode 1997–2004, en de periode 2004–2005 zijnde zes maanden voor en zes maanden na de tsunami van 26 december 2004. In de reguliere periode is de meeste vooruitgang geboekt op het gebied van communicatie, gezondheidszorg, onderwijs en elektriciteit, terwijl de armoededimensies werkgelegenheid en transport zijn verslechterd. In beide perioden wist een groot deel van de armen in de Malediven uit inkomensarmoede te ontsnappen, maar tevens verviel een aanzienlijk deel van de niet-armen tot armoede. We hebben geprobeerd de karakteristieken van de succesvolle gezinnen die uit inkomensarmoede wisten te ontsnappen en de karakteristieken van de gezinnen die tot inkomensarmoede vervielen te ontdekken en te beschrijven. Deze kennis is niet alleen van belang voor overheidsbeleid, maar zou ook een rol kunnen spelen voor strategieën van de gezinnen zelf.

De belangrijkste karakteristieken van de gezinnen die in de reguliere periode 1997–2004 uit armoede wisten te ontsnappen zijn: een relatief hoog onderwijsniveau, een relatief grote deelname aan vrijwilligerswerk en een relatief grote en toenemende arbeidsparticipatie. De drie meest invloedrijke factoren die het ontsnappen uit armoede verhinderden zijn: een relatief groot percentage gezinsleden dat niet kan werken vanwege slechte gezondheid, wonen in de twee noordelijke regio's en een relatief groot percentage vrouwelijke gezinsleden. De belangrijkste karakteristieken van de gezinnen die tot armoede vervielen zijn: wonen in de twee noordelijke regio's, een

relatief groot percentage gezinsleden dat niet kan werken vanwege slechte gezondheid en een relatief groot aantal jonge gezinsleden, terwijl werken in de toeristensector, in de overheidssector of een lening nemen om te investeren de belangrijkste factoren blijken te zijn die verhoedden dat gezinnen tot armoede vervielen.

Overeenkomsten tussen momentopnames zes maanden voor en zes maanden na de tsunami, gebruik makend van statische OLS regressies, zijn de significant positieve invloed op het gezinsinkomen van respectievelijk: arbeidsparticipatie, het ontvangen van gelden van gezinsleden die elders (niet op het eigen eiland) werken en het aangaan van een lening om te investeren, terwijl het optreden van een voedselcrisis een significant negatieve relatie heeft met het gezinsinkomen in beide jaren.

Dynamische Logit regressieanalyse laat zien dat belangrijke karakteristieken van gezinnen die uit armoede weten te ontsnappen in beide periodes, de reguliere periode 1997–2004 en de periode rondom de tsunami 2004–2005, dezelfde zijn, met name arbeidsparticipatie en vrijwilligerswerk, terwijl karakteristieken die voorkómen dat gezinnen tot armoede te vervallen verschillend zijn. Het blijkt dat gezinnen minder kwetsbaar zijn voor een ramp als de tsunami en minder terugvallen tot armoede als zij één of meer van de volgende eigenschappen hebben: een hoger onderwijsniveau, geld ontvangen van gezinsleden die buiten het eigen eiland werken, een relatief hoge arbeidsparticipatie, wonen op een gasteiland, of een relatief groot gezin hebben.

Het meest opmerkelijke verschil tussen de twee periodes, zowel statisch als dynamisch, is de invloed van de gezinsgrootte. In een reguliere periode zoals 1997–2004 is er een negatief verband tussen gezinsgrootte en gezinsinkomen per hoofd, zoals theoretisch verwacht. Grotere gezinnen hebben bovendien een kleinere kans uit armoede te ontsnappen en een grotere kans om tot armoede te vervallen. Echter, in de periode 2004–2005 voor en na de tsunami blijken grotere gezinnen minder kwetsbaar te zijn voor een ramp omdat zij beter in staat zijn hun inkomensbronnen te spreiden zodat zij minder snel tot armoede vervallen en een grotere kans hebben uit armoede te ontsnappen.

Beleidsimplicaties van onze resultaten zijn niet alleen relevant voor de overheid, maar ook voor de gezinnen zelf. Overheidsbeleid om armoede te verminderen moet niet alleen strategieën bevatten die armen uit armoede kunnen halen, maar ook strategieën die voorkómen dat niet-armen tot armoede vervallen. In het geval van de Malediven, zou de overheid kunnen overwegen meer aandacht te besteden aan de ontwikkeling van de twee noordelijke regio's, het verder stimuleren van toegang tot onderwijs en gezondheidszorg voor de eilandbevolking en het verder stimuleren van

de ontwikkeling van de particuliere toeristensector in het hele land. Wat strategieën voor armoedevermindering van de gezinnen zelf betreft, onze resultaten wijzen op meer onderwijs, het aangaan van een lening om te investeren, een grotere arbeidsparticipatie ook buiten het eigen eiland, met name in de overheidssector en in de toeristensector.

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