AN INTER-TEMPORAL COMPARISON OF INTERNATIONAL POVERTY AS AN ACHIEVED FUNCTIONING DEPRIVATION

PhD Dissertation
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LIST OF ABBREVIATIONS

ARI	Acute respiratory infections
CGER	Combined Gross Enrolment Rate
CPI	Consumer price index
DHS	Demographic and Health Surveys
DOTS	Directly Observed Treatment Short-course
DTP3	Three doses of diphtheria, tetanus toxoid and pertussis in a year
EKS	Eltetö-Köves and Szulc
ELFS	EUROSTAT's European Labor Force Survey
EPI	Expanded Programme on Immunization
FAO	Food and Agriculture Organization
FFS	Fertility and Family Surveys
FPI	Functioning Poverty Index
HDI	Human Development Index
HepB3	Three doses of hepatitis B vaccine in a year
Hib3	Three doses of Haemophilus influenza type B vaccine in a year
HPI	Human Poverty Index
ILO	International Labor Organization
IMR	Infant mortality rate
IPL	International Poverty Line
JMP	WHO/UNICEF Joint Monitoring Programme for Water and Sanitation
LSMS	Living Standard Measurement Surveys
MDGs	Millennium Development Goals
MEDLINE	Medical Literature Analysis and Retrieval System Online
MICS	Multiple Indicator Cluster Surveys
MIMIC	Multiple Indicators Multiple Causes
MIS	Malaria Indicator Surveys
MPI	Multidimensional Poverty Index
NCHS	National Center for Health Statistics
OECD	Organization for Economic Co-operation and Development
ORT	Oral rehydration therapy
PPA	Participatory poverty assessments
PPP	Purchasing power parity
PRA	Participatory rural appraisal
PRSPs	Poverty Reduction Strategy Papers
RBM	Roll Back Malaria
RHS	Reproductive Health Surveys

RSGDs	Reordered subgroup of dimensions
SEM	Structural Equation Model
SGD	Subgroup of dimensions
TGP	Total goiter prevalence
UI	Urinary iodine
UIS	UNESCO's Institute for Statistics
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
VAD	Vitamin A Deficiency
VMNIS	Vitamin and Mineral Nutrition Information System
WB	World Bank
WDI	World Development Indicators
WHO	World Health Organization
WHS	World Heath Surveys

CHAPTER 1

INTRODUCTION

Poverty is a polysemous concept which lends itself to different definitions and interpretations depending on who is defining it and for what purpose it is being defined. Every definition highlights a particular facet of poverty, offers a partial truth and is possibly a value judgment, and for this reason its validity and applicability will always be challenged. From the point of view of policy formulation, it makes a crucial difference if poverty is being defined externally by a 'specialist' or it is the most intimate feeling of a person actually experiencing poverty. Unless policies and actions aimed at combating the problem of poverty are informed by the experiences and perceptions of the poor themselves, they blur the true realities of poverty and present a very distorted view of the priorities of the poor people and what these poor people value most based on their unique understanding of their vulnerabilities (Chambers, 2002). There is an eerie directness in the voice of a poor man from Ghana when he gives expression to his own experience of poverty, "Poverty is like heat; you cannot see it; you can only feel it; so to know poverty you have to go through it" (Narayan, Chambers, Shah, & Petesch, 2000, p. xvii).

Which dimension of well-being is considered and which dimension is left out in any definition of poverty have important ramifications for whatever policy is designed to combat poverty. Consensus has recently been developing in favor of the conceptualization

of poverty as a multidimensional reality. "Fundamentally, poverty is a denial of choices and opportunities, a violation of human dignity. It means lack of basic capacity to participate effectively in society. It means not having enough to feed and clothe a family, not having a school or clinic to go to; not having the land on which to grow one's food or a job to earn one's living, not having access to credit. It means insecurity, powerlessness and exclusion of individuals, households and communities. It means susceptibility to violence, and it often implies living on marginal or fragile environments, without access to clean water or sanitation". [1]

In the absence of an objective definition of poverty, development organizations have resorted to operational definitions of poverty. The World Bank in 1990 adopted a rule-of-thumb measure of US$ 370 per year per person at 1985 prices (the "dollar a day" poverty line) for poor countries. A World Bank study *Poverty and Income Distribution in Latin America. The Story of the 1980s* tacitly admits the scope for potential arbitrariness and bias: "any poverty cut-off will reflect some degree of arbitrariness due to the subjectivity of how poverty is defined" (World Bank, 1993).

Although there is no gainsaying the fact that more objective definitions of poverty will continue to eliminate systematic biases over time which are presently found in the existing poverty measures in varying degree, "diverse bottom-up realities of the powerless" need to be the lynchpin of any policy (Chambers, 2002).

Against the backdrop of controversies surrounding the definition, measurement and possible ways to combat poverty, we conceive poverty as a deprivation of a number of

[1] UN Statement of commitment of the Administrative Committee on Coordination for action to eradicate poverty. UN Doc. E/1998/73, at Para. 3

functionings (actual achievements), considered vital but not equally important for human wellbeing. That different dimensions of wellbeing are not equally important for human wellbeing is a critical assumption of this study. Treating two widely divergent dimensions of wellbeing such as chronic hunger and hunger resulting from a crop failure in some year as similar may lead to misleading conclusions about the wellbeing outcomes

Following Kakwani and Son (2007) we define poverty as a deprivation of a number of functionings (actual achievements), considered vital but not equally important for human wellbeing, caused by an inadequate command over market or nonmarket resources

We estimate poverty in the world based on the dimensions which profoundly affect human wellbeing by combining them into a composite measure to see the state of poverty and deprivation in the world over time. We identify nine basic functionings and corresponding indicators that best reflect these nine basic functionings and develop a functioning poverty index (FPI) to measure relative functioning poverty in 193 economies of the world. We make an inter-temporal comparison of relative poverty between two periods 1990-2000 and 2001-2010.

The Section 2 reviews the existing literature. This section charts the conceptualization of poverty in its historical context and discusses fundamental issues of unidimensional and multidimensional view of poverty with a focus on the recent developments in the multidimensional poverty approaches. In the Section 3, we shall develop the methodology for the measurement of multidimensional poverty. This section also develops a theoretical basis for the justification for the choice of dimensions, their associated indicators and weights. The Section 4 discusses the data issues, especially the workarounds to take care of the missing observations, and standardizing heterodox variables into a consistent deprivation

concept. The Section 5 presents the results including the national and regional distribution of poverty in the world and makes an inter-temporal comparison between two periods 1990-2000 and 2001-2010. We also compare our estimates with a number of existing indices and run a series of robustness tests to see how our proposed model behaves following the change in the assumptions of the model.

CHAPTER 2

LITERATURE REVIEW

In this chapter, we review the roots of economic thought on poverty. Issues of unidimensional approaches to conceptualization and measurement of poverty are also discussed.

2.1 ROOTS OF ECONOMIC THOUGHT ON POVERTY

Thinkers and philosophers have been trying to answer the question as to what constitutes poverty throughout human history. As early as in 4th century BC, Aristotle tried to identify the conditions of best life called eudemonia in his Ethics which is an obvious converse of poverty (Bostock, 2000). In recent times, Booth (1903) discussed the question of poverty in terms of certain living conditions in *Life and Labour of the People in London.* Explaining the living conditions of the people living in London during the years from 1886 to 1903, he introduced the concept of poverty line by classifying the population into "poor" and "very poor" based on certain job types (Booth, 1888). Contrary to the common perception that multidimensional conceptualization of poverty is the product of recent times, Booth's classification of poverty was multidimensional in that it incorporated social dimensions such as "conditions attaining in the home, and the nature and regularity of employment" (Laderchi, Saith, & Stewart, 2003).

General Francis Amasa Walker (1897) explained poverty in deterministic terms compounded partly by the process of industrialization and partly by the objectionable behavior of working classes. Although the role of individual responsibility cannot be easily ignored, the critique on the ethics of the working classes misses an important fact that the formation of ethics is itself a complex process which is directly or indirectly influenced by the lifestyles of the affluent groups of the society. This critique therefore smacks of the political argument often used by the 'high-heeled' to shift the burden of responsibility to the poor themselves. It is worth probing whose interests are being served by the multitudes of unskilled and semi-skilled laborers in the developing world who are ready to provide cheap labor for whatever is on offer in order to eke out a living while permanently remaining in the vicious circle of poverty, disease and illiteracy. What roadblocks and bottlenecks hinder the way of these poor masses in their effort to attain better living standards? Was it the Divine will to bind most part of the humanity in the subhuman or even inhuman conditions? Or poverty is deliberately manufactured to ensure a continuous availability of cheap labor to ensure low manufacturing costs and maximum revenue? Will the reduction in poverty mean a death knell to the culture of consumerism spawned by the producer in the oases of affluence surrounded by the deserts of misery and deprivation? All these questions have to be answered satisfactorily before even thinking of eradicating poverty in the world.

At the turn of 20th century, Dadabhai Naoroji, an Indian politician and thinker, explained poverty against the backdrop of British colonization of India as stemming from 'pitiless drain' of Indian resources to England (Naoroji, 1901). Since Naoroji made no effort to systematically include the internal conditions of India at that time in the poverty analysis,

Naoroji's theory gives only a partial picture of the conditions obtaining at that time and remains unconvincing.

One of the most influential writers on poverty was Benjamin Seebohm Rowntree who divided poverty into primary and secondary categories. In his famous work *Poverty: A Study of Town Life* (1901) Rowntree termed the lack of access to resources sufficient to maintain "physical efficiency" as primary poverty. He defined secondary poverty as the condition in which some individual had an access to resources sufficient to maintain "physical efficiency" but part of these resources was absorbed by some unexpected expenditure either on some useful or wasteful activity.

Rowntree (1901) also introduced the concept of poverty line which reflected the minimum expenditures required to obtain nutritional requirements considered essential by the Local Government Board to maintain physical health.

In his second book *The Human Needs of Labour*, Rowntree (1937) further explained that in order to remain above the poverty line, an individual needed at minimum the food rich in essential nutrients, clothes to save from the extreme weather condition, rent for lodging, fuel and light, and certain belongings for personal and household use.

The monetary approach to the measurement of poverty in recent times inherits certain strands of thought from the consensus of Booth and Rowntree. Both believed that poverty was an objective reality; that poverty can legitimately be assessed externally, not necessarily by the poor themselves, and that the unit of analysis was the individual rather than the social group (Laderchi, Saith, & Stewart, 2003).

The implicit assumption of the equivalence of income and welfare underlying the works of Booth and Rowntree was based on the works of Jevons and Marshall who were the

proponents of the so called "material welfare school." Many empirical, theoretical and methodological improvements in the assessment of poverty that were made subsequent to the works of Booth and Rowntree relied on material welfare school of thought (Laderchi, Saith, & Stewart, 2003) which made a distinction between satisfaction that could be derived from consumption of goods whose basic motive was either 'purely economic', also called 'material' or 'non-economic which is also referred to "non-material". According to Marshall (1920), the goods that satisfied "material needs" were food, clothing, house-room and firing and were considered "necessaries". After one had achieved the necessaries, comforts and luxuries became the next goals to be achieved.

From 1950s onward, criticism of the material welfare school is becoming increasingly vociferous. See Galbraith (1958) for example. At different international forums, serious doubts were expressed regarding the economic growth as the only solution to the problem of poverty. The World Conference of Employment seriously questioned the role of rapid growth in reducing poverty and inequality and creating better opportunities for gainful employment way back in 1976. Such developments were the early attempts to "dethrone" GNP whose rule has proved unexpectedly resilient despite a lot of question marks on its ability to serve the masses.

During the 1970s, doubts also began to be cast on the efficacy of material welfare school approach by the works of empirical sociologists. These sociologists followed the lead of Amartya Sen's seminal work *Poverty: An Ordinal Approach to Measurement* and established the so-called "axiomatic" approach to the measurement of poverty (1976). These empirical sociologists produced a number of sophisticated mathematical models based on income or expenditure. This approach seeks to compress information relating to

various dimensions of poverty like its prevalence and intensity into a single summary statistic.

In the meanwhile, numerous studies of problems of the poor people, their obstacles and opportunities, have led to an understanding of poverty as a complex set of deprivations. Poverty is being increasingly seen as a human condition characterized by multidimensional deprivations. It is no longer seen as lack of income only. Hunger, unemployment, ill heath, malnutrition, social exclusion, political repression and deprivations of many different kinds reinforce human misery (HDR, Human Development Report 2006: Beyond Scarcity: Power, poverty and the global water crisis, 2006). Solution therefore has to be found not only in the GDP growth but in equitable redistribution, expansion of infrastructure, removal of gender discrimination, etc.

Dr. Mahbubul Haq was one of the pioneers in the area of development economics to realize that the conceptualization of poverty in terms of income only, when translated into policy terms, "focuses exclusively on the expansion of only one choice — income" as against the conceptualization of poverty in multidimensional terms with an alternative focus on "enlargement of all human choices — whether economic, social cultural or political" (Haq, 1995, p. 14).

The dissatisfaction with income or expenditure as the only indicator of wellbeing gave birth to new directions of research. Some notable additions to the conceptualization of poverty as a multidimensional human condition was provided by the social exclusion approach of Rene Lenoir in 1947 and Amartya Sen's functionings and capabilities approach and Dr. Mahbubul Haq's human development approach. See Lenoir (1974/1989) and Sen (1985) and Haq (1995) for example.

Haq's human development paradigm of the 1990s sought to bring human beings to the center stage of concern and emphasized the instrumental role of "equity, sustainability, productivity and empowerment" in the debate on human wellbeing. Haq's approach finally culminated in the development of various Human Development Reports and Human Development Indices and Human Poverty Indices (1990, 1997, and 1998). See Bari (2011). The Fuzzy sets approach to the measurement of poverty became popular in Italy. See Cerioli and Zani (1990), Martinetti (2000) and Cheli and Lemmi (1995) for example. In more recent times, inclusion of various social exclusion indicators by the European Union reinforce the impression that poverty should no longer be conceived in any unidimensional space such as income or expenditure (Atkinson, Cantillon, Marlier, & Nolan, 2002). Poverty and deprivation may also be conceived in terms of the sufferings caused by disruptions in the patterns of life. The sacrifice of entire industries to please the inexorable gods of economic efficiency has a cold economic logic behind it. However, the cost of the sufferings of the communities brought in the wake of such disruptions should be brought squarely in the calculus of economic theory.

Despite the growing realization in recent decades that poverty must be conceived in multidimensional framework, ironically the most influential poverty statistic today is one's recent poverty estimates computed in the unidimensional consumption space are based on $1.25-a-day. In the following part of this chapter, we will review the development of various strands in the conceptualization of poverty and measurement techniques with a view to identify the conceptual and methodological gaps which we propose to fill in our research.

2.2 ISSUES OF UNIDIMENSIONAL APPROACHES TO CONCEPTUALIZATION AND MEASUREMENT OF POVERTY

The theory underlying the unidimensional income-based poverty measurement techniques is utilitarianism which is essentially based on the criteria of utility, but practically, monetary variables especially income, consumption or expenditure serve as the proxy for wellbeing. The consumer chooses to maximize her utility. Income, consumption or expenditure is considered to be a measure of the marginal utility that is placed on commodities. Poverty is therefore a shortfall of resources to reach certain predefined level of consumption called a poverty line. Absolute poverty therefore is the lack of income to attain a basket of goods to reach certain predefined threshold. Relative poverty is the lack of certain level of income relative to the median or average income level of society (Förster & Mira D'Ercole, 2005).

Strands of other philosophical traditions have also been employed to buttress the monetary approach to the measurement of poverty. Realizing a theoretical mismatch between income and utility, effort was made to address the role of income in the debate on poverty measurement more squarely by discarding the concept of utility in the minimum rights approach. Certain level of income is considered as a right and a measure of freedom of choice. See Atkinson (1989) and Parijs (1992). But this justification suffers from the same weaknesses as the justification for the utilitarian approach. What amount of income is to be considered a right is obviously an arbitrary choice disregarding the variations in the human characteristics (Laderchi, Saith, & Stewart, 2003). It is also suggested that monetary indicator is not always invoked to measure utility. It is employed as an

appropriate proxy for other dimensions of well-being. In this view, monetary indicators are used as a tool of convenience to identify the people who are not only deprived in the resources but also deprived of more direct dimensions of well-being like adequate nourishment and health, etc.

Income-based poverty measures are also criticized because they gloss over the plurality of the conditions of the poor people. The diversity in the personal characteristics of the people and the differences in their socio-economic needs and conditions are not accounted for in this approach. Given the level of human diversity, this approach will make any legitimate inter-personal comparison impossible. An individual who has to do physical work in extreme weather conditions will obviously require larger amount of food rich in all kinds of nutrients than the one required by an individual who leads a sedentary lifestyle with a minimal level of physical activity.

The arbitrary separation of the poor and the non-poor is also subject of criticism because it is found to be particularly problematic ethically for the population group barely above the poverty line but practically they suffer from the same problems of the people below that poverty line but are not entitled to the benefits reserved for the latter (Cerioli & Zani, 1990).

The freedom of choice is a fundamental constituent of well-being. It is intriguing that there is no explicit reference to the right to choose in the traditional approaches to poverty analysis, one implication of which is that it restricts well-being at a sub-optimal level. An obvious example is the *external* decision regarding what should go in the consumption basket to keep an individual above the poverty line.

Additionally, the alternate conceptualization of poverty in the framework of *multidimensional* poverty which takes a multidimensional view of human conditions gives very different results as compared to the income poverty and points to different policy options to combat poverty. A comparison of Multidimensional Poverty Index (MPI) with the World Bank's income based estimates of global poverty, for example, reveals certain extreme differences where a very high level of multidimensional poverty may correspond with a very low level of income poverty and vice versa (See Figure 1 below).

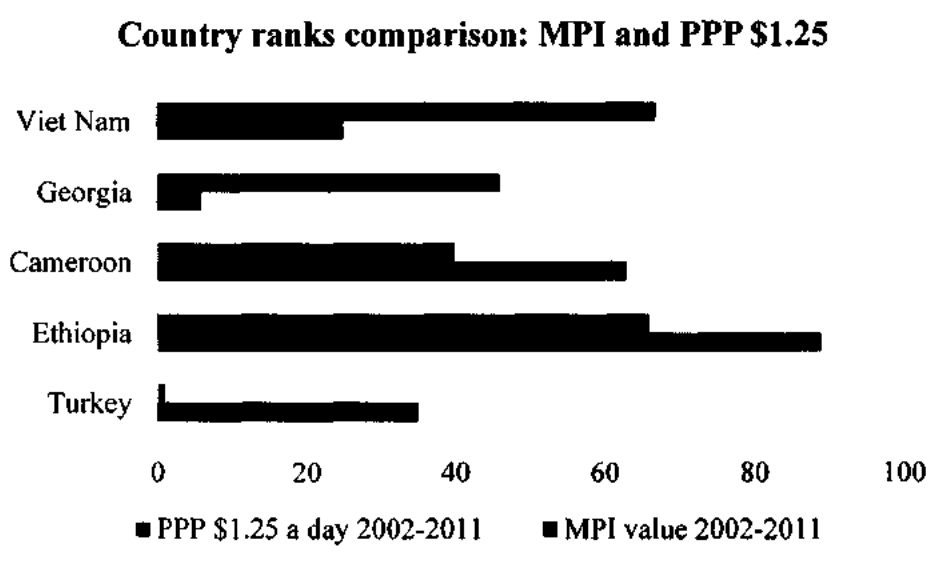

Figure 1: Country ranks: MPI and PPP $1.25 a day

Source: HDR (2013) statistical tables
Note: higher rank represents higher levels of poverty

In the Figure 1, Turkey, Cameroon and Ethiopia have a considerably higher rate of multidimensional poverty as compared to income poverty, while Georgia and Vietnam have much higher income poverty as compared to multidimensional poverty. The scatter diagram below presents a full set of countries for which income poverty and

multidimensional data is available and the differences in the way poverty is estimated by both the measures are too obvious.

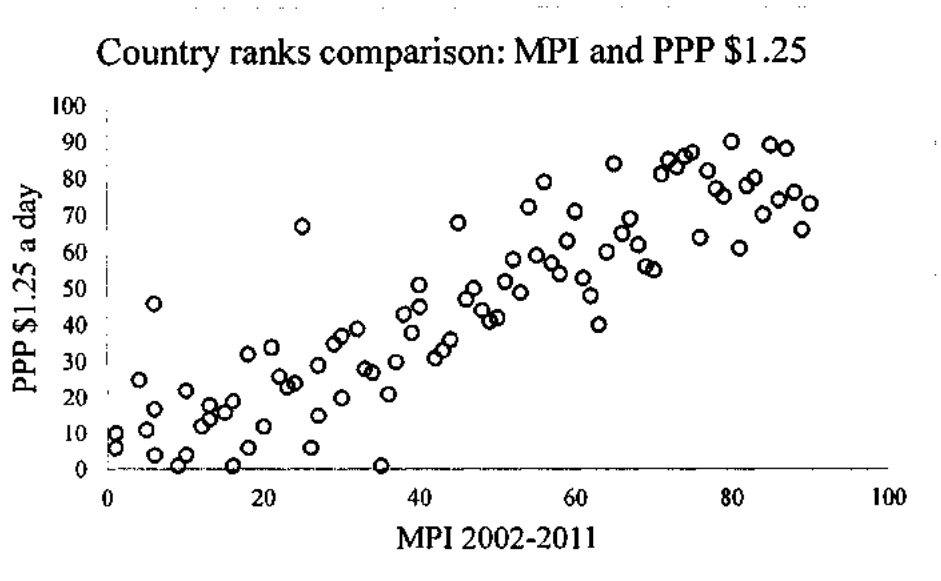

Figure 2: Country ranks comparison: MPI and PPP $1.25 a day

Source: HDR (2013) statistical tables
Note: higher rank represents higher levels of poverty

Even if both the measures seem to be broadly correlated partly because of the important role of money in the measurement of wellbeing, still there are large differences in the country ranks in both the measures. In the Figure 2, Vietnam ranks 25th in terms of multidimensional poverty index while 67th in terms of income poverty. Conversely, Croatia ranks 26th in terms of multidimensional poverty while 6th in terms of income poverty. It is clear that a complete focus on monetary variables as the sole basis of measuring wellbeing ignores the extent of poverty in the world, underscoring the need to develop different tools to estimate poverty.

2.3 POVERTY LINES

2.3.1 Questionable poverty line

The efforts to identify broad differences between the poor and the non-poor based on some behavioral patterns have proved unsatisfactory. The reason may partly be found in the inadequacy of economic theory to address such issues as poverty measurement, although the tools for poverty measurement such as equivalence scale[2] are widely borrowed from the economic theory. The problems in the identification of an objective discontinuity or a poverty line, so to speak, are compounded by the fact that so far no theory has been developed which has the force of a broad consensus (Laderchi, Saith, & Stewart, 2003).

When poverty line is found to be so blunt a tool for even inter-personal comparisons, it is not difficult to guess how much more imprecise it becomes for making an international comparison when different cultures, traditions, mores and habits display a sharper contrast among different countries and regions of the world.

Adam Smith in 1776 observed that the minimum resources needed for some achievement concept depended on the consumption patterns prevalent at that time in different societies. A person who is unable to buy a linen shirt or leather shoes cannot go out without feeling ashamed, but such a deprivation may not mean much in the societies

[2] The needs of the households increase with the addition of a new member but not proportionately due to the economies of scale. However, the needs of the household may be different depending on a number of factors such as the age of family members, their education level and health status etc. The equivalence scale assigns a unique value to a household proportionate to its needs. OECD uses a number of equivalence scales for poverty and inequality studies. (http://www.oecd.org)

where linen shirts or leather shoes are not customarily worn (Smith, 1776). Consequently, the minimum income needed to participate normally in the activities of society could be so widely different across different cultures that any single poverty line becomes meaningless. The desire to fulfill these cultural-specific needs sometimes generates social pressures leading to the transfer of resources sometimes ignoring the more urgent needs like food and healthcare. In developing countries, the women and children seem to bear the brunt when such reallocation is made to meet social obligations. Allocation of resources to fulfill culture specific needs partly explains the existence of undernourishment in the societies where income levels are very high such as United States (Anand & Sen, 1997).

2.3.2 Absolute and Relative Poverty Lines

Absolute poverty lines are generally based on nutritional requirements or efficiency wages. Lewis and Ulph (1998) consider the need for minimum income required to avoid the stigma of poverty a more plausible basis for behavioral discontinuity between the poor and the non-poor. Dasgupta and others have suggested that efficiency wage should be made the basis for the absolute poverty line (Dasgupta, 1993). The concept of efficiency wage is however subjected to criticism because of its ambiguous nature and also because it raises question about whether this can be applied to those who are out of workforce like old and disabled and disproportionately bear the brunt of poverty (Laderchi, Saith, & Stewart, 2003).

Ravallion (1998) subjectively conceptualizes poverty line as "minimum cost of the poverty level of utility" and suggests two methods for deriving such a poverty line. The

first method involves the computation of a basket of food and non-food items containing a certain level of calories called the Food Energy Intake Method and second method involves the computation of the cost of basic needs. The first one starts with the determination of food requirement and adds to it a non-food component and costs it. The second procedure initially determines the list of basic needs and costs them. The nutrition-based poverty line, a fundamental justification of poverty line in the monetary approach though, is subjected to scathing criticism. The search for a single nutrition level becomes difficult in view of the differences in gender, body mass, metabolic rate, geographical location, altitude level, health status and activity level among the people unless the nutrition requirements are qualified with a set of realistic assumptions. The famous 3400 calories threshold also poses problems of a fundamental nature and cannot be taken on its face value. With a certain minimum income it is possible to reach this calorie level but whether the 3400 calories-rich food in really rich enough in the essential micronutrients is a crucial question. The World Health Organization has published an extensive literature on the occurrence of diseases born out of the deficiency in the essential micronutrients. (See WHO, 2004, 2008, 2009).

A serious problem with the nutrition-based poverty lines is that they are drawn at an individual level. The social relations, interactions and dependencies are considered mechanically by "scaling household resources to take into account the diversity in the household structure" (Laderchi, Saith, & Stewart, 2003). In theory, the attainment of the nutritional level of an individual critically depends on the way resources are distributed at the level of household. Banks and Johnson (1993) suggest an equivalence scale to address a fundamental problem posed by the difference in the needs of household with certain

demographic characteristics. The equivalence scale is the ratio of the cost of certain lifestyle and the cost of a "reference" life style. The problem with this approach, however, is that it ignores the differences in the bargaining power of different members in a given household. (Laderchi, Saith, & Stewart, 2003). All these issues in the use of poverty line for the measurement of poverty point to the fact that no unique, objective poverty line is possible which takes care of enormous human diversity.

Unlike income based approaches, the cost of basic needs approach does not depend on income generation but focuses on delivering the basket of basic needs to the intended group through "supply management" and "delivery system" (Srinivasan, 1977). The cost of basic need approach was developed in 1970s by ILO economists but it proved to be short lived and was superseded by monetarist policies (Porter, Allen, & Thompson, 1991). It is also criticized because of the variation in the standards and differences in the social objectives. There is no objective criteria to define the components of the bundles because of sharp differences in climates, cultures, tastes and geographical regions. In theory, basic needs approach is meant for survival but basic needs can correspond with various levels of survivals starting from bare survival to various forms of productive survival. Therefore the society would need different list of basic goods and quantities depending on the society's objectives (Streeten & Burki, 1978). Hunt (1989) said that the cost of basic need approach lacked operational precision, came in conflict with growth promotion policies, and risked locking developing countries into permanent backwardness.

2.3.3 Multiple Poverty Lines

The theoretical inadequacy of a unique poverty line has led some researchers to suggest multiple poverty lines. Should the difference be found in some behavioral discontinuity between the poor and the non-poor instead of the difference between the income, consumption or expenditure? Lipton (1988) does see a behavioral discontinuity between the "poor" and "ultra-poor." But such a behavioral break is not found to have any universal validity (Anand, Harris, & Linton, 1993). Offering arguments and counter-arguments in justifications of a single or multiple poverty lines is not an ordinary, innocuous academic debate because it raises a fundamental question whether poverty has an objective social existence amenable for scientific analysis or it is a "display of the researcher's personal morals on the statistics of deprivation" (Sen, 1981). Sen (1985) believes that "...it is quite unlikely that we get some one measure of interest that is superior to all others and applicable in all contexts". Piachaud is definitely hopeless, "The definition by an individual or by society collectively, of what level represents 'poverty' will always be a value judgment" (Piachaud, 1981). The idea that some things are facts and others are value judgments, and that value judgments are subjective, nebulous unreliable while facts are solid, objective and precise is itself a western misconception.

2.3.4 World Bank's International Comparison of Poverty

As is noted in the previous section, at the core of the criticism of the traditional approach to the measurement of poverty lies distrust of income as a reliable proxy of well-being.

Paradoxically, the same monetary approach is most widely used for the poverty measurement at the national and international levels. The World Bank's international poverty estimate is a unidimensional monetary measure. The World Bank's $1-a-day international poverty line is in fact defined in abstract money units, not anchored in any achievement concept such as basic capabilities like adequate nourishment and therefore cannot be a consistent basis for determining the level of poverty in different years and locations (Reddy & Pogge, 2010).

The World Bank used a three step formula for constructing an international poverty line for the first time in 1990. First, World Bank chose domestic poverty lines of 33 countries during the mid-1980s and rescaled them according to changes in national CPIs to determine their equivalent in 1985 national currency units. Second, it used 1985 PPP conversion factors calculated by Summers and Heston (Summers & Heston, 1988) to convert these rescaled domestic poverty lines into real purchasing power denomination equivalence expressed in local currency units per "international dollar" and chose international poverty line IPL equal to $31 per month. Finally it converted this IPL into national currency units using Penn World Tables (Summers & Heston, 1988). The resulting national poverty lines were again rescaled according to the changes in national CPI and applied to estimates of per capita household consumption to derive the headcount poverty figures.

The Bank constructed another international poverty line in 2000. It converted the domestic poverty lines of thirty three countries into their respective 1993 national currency units and then these domestic poverty lines thus converted were expressed in 1993 international dollars using 1993 general consumption PPPs. The median of the lowest ten

of these converted domestic poverty lines which amounted to $1.08 a day was fixed as new IPL.

In 2008, the World Bank constructed the international poverty for the third time which replaces earlier benchmark $1 a day and $1.08 a day poverty lines. The latest poverty line has been calibrated at $1. 25 a day and has been measured in 2005 prices using new data on purchasing power parities (PPPs) (WDI, 2008).

Conversion of IPL into domestic currency units involves construction of purchasing power parities (PPPs). The PPP measures the relative value of the currencies being compared and estimates the amount of adjustment that needs to be made in the exchange rates so that the purchasing power of a bundle of commodities in equivalent in all the countries being compared. The World Bank used EKS method to compute PPPs for consumption in its headcount poverty estimates.

EKS index was developed independently by Eltetö, Köves and Szulc (Eltetö & Köves, 1964; Szulc, 1964)and is based on the bilateral Fisher index, $F_{i,j}$ which is constructed as the geometric mean of the Paasche and Laspeyres indices: $P_{i,j} = \frac{p_i}{p_i} \cdot \frac{q_i}{q_j}$; $L_{i,j} = \frac{p_j}{p_j} \cdot \frac{q_i}{q_j}$;

$F_{i,j} = \sqrt{P_{i,j} . L_{i,j}}$

Fisher index supposedly eliminates the bias in both Paasche and Laspeyres indices. Paasche index is criticized for understating the true income ratio of the richer country relative to the poorer country while the Laspeyres index is criticized for overstating it. The multilateral EKS index is also expected to be free from the systematic bias found in Paasche and Laspeyres indices (See Ackland, Dowrick, & Freyens, 2006 for example).

$$EKS_{i,j} = \prod_{n=1}^{N} \left(\frac{F_{i,n}}{F_{j,n}}\right)^{1/N}$$

As the relevance of any IPL is dependent on the fact whether it gives or does not give an individual sufficient resources to be able to achieve certain valuable outcomes when converted into local currency units, a crucial question is if $1. 25 when expressed in US currency units is sufficient for an individual to buy basic necessities of life in US in 2005. Realizing that the developed world would find such a low poverty line morally unjustifiable, the Bank's economist called it a frugal line conceding that this estimate should be considered a 'conservative' estimate implying that this was an unreasonably low poverty line (Edward, 2006). The reservation expressed by the Bank itself is in fact a tacit admission that the PPPs used for converting IPL into local currencies are inappropriate.

PPPs derived by the EKS method have also been criticized for not possessing any fixed achievement interpretation (Reddy & Pogge, 2010). Yet another problem that arises as a result of recalibrating the international poverty lines every few years is that it is impossible to say whether a particular IPL is higher or lower than the other IPL in terms of real purchasing power because the PPP dollars from different years are not comparable (Reddy & Pogge, 2010).

2.4 ISSUES OF CONCEPTUALIZATION AND MEASUREMENT OF POVERTY IN THE MULTIDIMENSIONAL FRAMEWORK

Unlike the traditional approach where income was conveniently used as a proxy of well-being, no such simplistic space is readily available in the multidimensional approach to the measurement of poverty. Which aspects of life should be included in the conceptualization of poverty has been a particularly controversial matter. The social, cultural, political dimensions were never denied a role in the traditional approach as a matter of principle, but in practice only income or consumption variables were employed as proxy of wellbeing. The effort to include non-monetary dimensions explicitly in the debate on poverty has given rise to controversy regarding the space in which poverty could be adequately analyzed. Whether the utility space or the capabilities space or the space of rights is the most suitable choice is a question of continuous debate.

If it is argued that poverty is a multidimensional issue, then the need to make the dimensions of poverty explicit can hardly be overemphasized. The first issue is what indicators of well-being should be used to measure the extent of poverty. Second issues relates to the number of indicators that must be used for an empirical assessment of poverty (Alkire, 2002). Regarding the first issue, two possible ways of the choice of indicators are a priori and a posteriori methods. The a priori method of choice of dimensions or indicators is guided by the conventional wisdom. Nussbaum (2000) proposed a list of the dimensions of a fulfilled life (See details in Appendix) following which Sen also gave an indicative list of 'instrumental freedoms' essential for a dignified life and the MDGs are a few examples of *a priori* method used to select appropriate indicators of wellbeing . The second

a posteriori method is guided by the dynamics of data. The principal component analysis and cluster analysis are two frequently used techniques in the context of construction of poverty indices. Schokkaert and Van Ootegem (1990) used factor analysis to identify the functionings of a group of unemployed people in Belgium from their answers to some qualitative questions but they were emphatic in their conclusion that the factor analysis technique did not guarantee an exhaustive list of the functionings nor the relative importance of various functionings generated through this statistical procedure was to be relied on because any change in the characteristics of the data over time and space will render the results questionable (Schokkaert & Ootegem, 1990).

Another issue is the transferability of the indicators of poverty for a country or region to other countries or regions of the world. The incidence of malnourishment of under-5 children and access to safe drinking water may be the problems of the populations of Sub-Saharan Africa and South Asia but in the rich industrial countries of Europe and America these problems are nearly non-existent. So such indicators make comparisons among regions with different characteristics of limited value. Realizing this difficulty, two different indices of human poverty HPI-1 and HPI-2 were developed, the latter being an adjusted index with indicators more suitable for the rich industrialized countries. Though such a division makes sense, it however raises painful questions about the morality of specifying the indicator of the probability to survive up to 40 years in the HPI-1 and up to 60 years in the HPI-2. Secondly, it makes the measurement of poverty level in poor countries relative to the rich industrialized countries impossible.

2.4.1 Absolute vs. Relative poverty

If poverty is to be defined in absolute or relative terms is a relevant question in both monetary and multidimensional approaches to the measurement of poverty. Absolute poverty measures poverty in terms of the amount of money sufficient to meet basic needs such as food, clothing and shelter while ignoring other important dimensions such as an individual's social and cultural needs. This narrow view of poverty led to the concept of relative poverty which defines poverty relative to the economic status of other members of the society. The usual threshold of relative poverty is a certain percentage of the income of the average or median income level of the society.[3] Choice of relative or absolute issue becomes much more complex when we have to compare different countries because we find considerable diversity in the cultures, customs, mores and ideas of good and bad life as well as the differing expectations and behavioral responses to the experiences of poverty in different regions of the world. Even as there is no consensus regarding the choice of relative or absolute conception of poverty in the unidimensional approach where only income or consumption is used as proxy of wellbeing, the number of dimensions like health, literacy, political rights, and nourishment among many possible candidates in the multidimensional approach makes the prospects of any such consensus negligible.

As any relative poverty line (for example, the 60% of median of 'equivalized' income as used in the European Union) is a value judgment and a crude measure of poverty, so is the absolute poverty line. The absolute poverty line is often defined in terms of minimum

[3]http://www.unesco.org/new/en/social-and-human-sciences/themes/international-migration/glossary/poverty/

requirements in some dimension. This absolute poverty line gives rise to a number of problems. For example, before it was scientifically established that the deficiency of vitamin A was associated with night-blindness, certain food baskets could have been chosen as absolutely necessary irrespective of the fact whether they contained sufficient amount of vitamin A or not, but as the new facts about the importance of vitamin A in human food consumption reveal themselves, only the food basket containing sufficient amount of this essential nutrient could be considered balanced. It is thus clear that the absolute standards cannot be defined in isolation and may shift over time relative to the shifts in social standards, change in technology and increase of a general living standard of a society.

The variable nature of absolute poverty is an important part of the famous debate between Amartya Sen and Peter Townsend (Sen, 1983, 1985; Townsend, 1985). Sen (1983) argues that certain conditions such as starvation and hunger constitute an "irreducible absolutist core" of poverty irrespective of the fact how the relative picture of poverty looks like. Townsend (1985) responds that the "absolutist core" is itself relative because nutritional needs vary with the work roles of people in different societies, avoidable disease depends on the available technology, and idea of shelter depends on notions of privacy, highly cultured notions of warmth, humidity and segregation of family members. Sen (1985) argued that absoluteness required neither constancy over time nor invariance between societies; it was just "an approach to judging a person's deprivation in absolute terms" such as certain minimum absolute needs independent of the achievements of others in the society.

Poverty may also be locally defined relative to community norms that may vary across communities. To borrow Smith's (1776) example, a person who is unable to buy a linen shirt or leather shoes cannot go out without feeling ashamed, but such a deprivation may not mean much in the societies where linen shirts or leather shoes are not customarily worn.

Realizing the role of a ubiquitous media in influencing the community norms in present times, the question arises if keeping the poor "ignorant" about lifestyles of the rich may be useful in keeping them from feeling deprived and whether such a policy can be undertaken at national levels. Despite the fact that mere suggestion of such "ignorance" policy may sound a politically incorrect fantasy, a sense of deprivation resulting from the preferences and norms of the affluent sections of the society must not be ignored in the context of debates on poverty.

2.4.2 The unit over which poverty is defined

The unit over which poverty is defined is another important question. In the monetary approach, with a single indicator as a measure of overall wellbeing, the poverty estimation at the level of individual has a straightforward interpretation, for example, 50% of the population is poor. Still a number of theoretical problems surface especially when the individual poverty is inferred from household data using controversial statistical techniques like equivalence scales. However in the multidimensional approach, measuring poverty at the level of individual presents many pitfalls. Fundamentally, here two types of thresholds are involved. First, for individual indicators of well-being, a unique threshold has to be envisaged to distinguish the poor from the non-poor, which is a very challenging task

particularly when an international comparison of poverty is made. Second, threshold is more value loaded and pertains to the number of indicators of well-being. In how many dimensions an individual has to be deprived to be called poor. There is no easy answer to this question and perhaps no consensus is ever possible on the proposed answers to this question. To circumvent this issue, some poverty measurement methods rank geographical areas instead of measuring the headcount or household level poverty directly.

In the geographic ranking methods, a threshold is envisaged for some dimensions of interest (for example, access to potable drinking water, the probability to survive up to 60 years etc.) and then the number of individuals below this threshold is computed for each geographical unit. Two options are available after this. First, each dimension is assessed separately and a list of partial gaps is generated for the whole geographical area. The UNDP's Human Development Reports use this method. Second, all the variables estimated from each geographical unit are compressed into a multivariate index. The resulting poverty or deprivation index is a pure number without an easy interpretation. The index then is used to give ordinal rank to the geographical areas in terms of the incidence of poverty (Boltvinik, 1997).

In view of the controversy surrounding the issue of correct measurement of poverty at the level of individual or household as well as the fact that headcount poverty figure is a blunt tool unable to give reasonable amount of information about the determinants and dimensions of poverty for effective policy formulation, the geographic ranking gives the policymakers a convenient tool to identify spatial distribution of poverty. Once the geographical areas are ranked in terms of the incidence and intensity of poverty, the policymakers may decode the complete information related to different dimensions of

deprivation, for example, the number of people suffering from night-blindness and number of school going age children out of school, in some appropriately formulated composite index, and then surgically target the exact dimension of poverty. Such a prospect is the most promising side of the multidimensional approach to the analysis of poverty.

2.5 AN ANALYSIS OF SOME RECENT MULTIDIMENSIONAL POVERTY APPROACHES

Among the multidimensional approaches to the analysis of poverty, social exclusion, participatory poverty assessments and capability approach have attracted greatest attention in recent years.

2.5.1 Social Exclusion

Social exclusion is defined as a process through which individuals or groups are 'wholly or partially excluded from full participation in the society in which they live' (Foundation, 1995) or 'excluded from ordinary living patterns, customs and activities' (Townsend, 1979).

The concept of social exclusion evolved in industrialized countries to describe the incidence of marginalization experienced by the sections of the society even in the rich industrialized countries. Gradually this concept spread to the developing countries (Clert, 1999). A number of empirical exercises based on different shades of definition of social exclusion were carried out in different developing countries such as India (Appasamy,

Guhan, & Hema, 1996), Venezuela (Cartaya, Magallanes, & Dominiquez, 1997), United Republic of Tanzania (Rodgers, Gore, & Figueiredo, 1995), Tunisia (Bedoui & Gouia, 1995) and Cameroon and Thailand (Rodgers, Gore, & Figueiredo, 1995). From Lisbon Council, European Union has made social exclusion a central plank of it social policy.

The group dynamics are centerpiece of the social exclusion approach. The deprivations of groups related to age, health, ethnicity, religious identity among a possibly large set of indicators are analyzed instead of individual deprivations. Social exclusion approach also fundamentally differs from the competing multidimensional approaches in that it lays emphasis on the processes that engender deprivation. '...a dynamic process, best described as descending levels. some disadvantages lead to some exclusion, which in turn leads to more disadvantages and more exclusion and ends up with persistent multiple (deprivation) disadvantages' (Eurostat, 1998). Social exclusion approach is based on the normative assumption that the situation of the deprived groups cannot be improved without redistribution of the aggregate capital of society. In the agency aspect discussed by Atkinson (1998), the excluders have the responsibility to improve the conditions of the *excludees*.

Social exclusion as a theory to analyze the issue of poverty, deprivation and marginalization defies 'clear definition and measurement' (Micklewright, 2002). The developing and developed worlds reveal diverse characteristics in terms of development level, mode of social interactions, market structures and value systems etc. In view of such diversity, a meaningful international comparison becomes difficult.

2.5.2 Participatory Approach

"What is poverty?" Whose answer to this simple question matters? The answer of a poverty expert, of a researcher, of a politician of developed world or ruler of developing world? Or the answer of the poor himself --- hungry, naked, illiterate, sick and powerless? The Chamber's participatory approach seeks to answer precisely these difficult questions and believes in the voice of the poor as the most authentic account of poverty (See Chambers, 1994, 1997). The thrust on the perspective of the poor in participatory approach distinguishes it from the competing approaches such as monetary approach and capability approach. In the monetary and capability approaches, judgments are externally imposed. In the participatory approach, the focus is instead on the feelings and passions of the poor with which they face poverty.

The participatory poverty assessments (PPA) evolved from participatory rural appraisal (PRA) programs carried out in various parts of the developing world meant 'to enable local people to share, enhance and analyze their knowledge of life and conditions, to plan and to act' (Chambers, 1994). World Bank's *Voices of the Poor*, (2000), a voluminous work aimed at eliciting the responses of the poor to the experience of poverty, was based on this approach. Subsequently, the Poverty Reduction Strategy Papers (PRSPs) have also extensively discussed this method.

The soundness of the theory of participatory approach is however compromised by the contradictions that surface in the process of its application. In theory, the people themselves carry out PPAs but in practice it is almost always the outsiders who conduct the results (Laderchi, Saith, & Stewart, 2003). In view of the heterogeneity in the communities, whose

voice gains precedence is a matter of value judgment and PPA has no theoretical way out of this difficulty. Often the poorest people are systematically excluded from the community and hence are out of the purview of participatory approach which in theory focuses only on community. The amount of information available to the members of community and their social conditioning may not always enable them to make an objective assessment of their condition, a situation Sen (1985) termed 'valuation neglect'. Zaman (2008) also raised an important issue of who should authoritatively voice the concerns of the poor people. The voices of the poor are generally filtered through the agency of the NGO which is reporting these voices. These voices are translated because readers usually do not understand the native dialects. The process of translation may be colored by the agenda of the NGOs and may stifle the true voices of the poor. The true voice of the poor may be different from the construction that is put on that voice. The single minded representation of women in the Third World as the victim of their culture makes it difficult to develop an alternative explanation of their plight, and obscures the degree to which "third world problems" are rooted in modernization and social change (Foucault, 1980). This lack of direct access to the voices of the poor, therefore, makes it difficult to objectively assess their conditions.

2.5.3 Capability Approach

The multidimensional approach that has enjoyed more enduring popularity in recent decades is the capability approach. In the capability approach, attention has shifted away from the utility maximization as the ultimate goal of development towards an emphasis on the expansion of human capabilities. See Sen (1985, 1999) for example. Sen (1985) argues

that "ultimately, the focus has to be on what we can or cannot do, can or cannot be". Thus, wellbeing can be understood in terms of individual achievements rather than the resources that individuals use as means for achieving certain outcomes. Sen has used the terms 'functionings' and 'capabilities' with reference to achievements. The functioning is an actual achievement whereas capability is the substantive freedom to achieve something. Functionings are related with the kind of life that people actually live but capabilities are related with substantive freedoms that individuals have to spend the life they value.

In the capability approach, income as a proxy indicator of utility has been substituted by the indicators of freedom to live a valued life. The monetary indicators are not considered reliable proxies of wellbeing because the resources are transformed into valuable achievement or functionings at differing rates because of diversity in individual characteristics such as age, gender, physical health etc. Additionally, an increase in the level of income does not necessarily enlarge the capabilities set, despite the obvious temptation to infer this relationship from the condition of developed countries with high per capita income levels, where people have generally a higher standard of living than the people in the developing countries. The relationship between income and wellbeing is not as clear as is generally understood. As a result of reduction in the mortality rate in some country for example, there will be more people and hence per capita GDP will decrease. Whether the country is now better off because of lesser mortality rate or worse off because of decrease in the per capita GDP is matter of value judgment (Boltvinik, 1997). Though it is true that income deprivations lead to a set of further deprivations, it is equally true that people may suffer from acute deprivations despite having sufficient amount of wealth. So the level of wellbeing should be the aim of any anti-poverty initiative instead of the level

of income. Because in the capability approach, functionings and capabilities are a measure of wellbeing, poverty has to be seen as a deprivation of basic capabilities, a 'failure to satisfy certain crucially important functionings up to certain minimally adequate levels' (Sen, 1993), rather than merely a lowness of income.

Capability approach is not simply concerned with an inclusion of non-monetary variables in its informational space to analyze the issue of wellbeing and poverty. It is in fact a radically different approach to conceptualize and evaluate wellbeing. The monetary approach in its preoccupation with only monetary indicators as measure of wellbeing ignores the individual characteristics (for example, age, gender and health) as well as the environmental characteristics and the processes of converting the resources into wellbeing in the assessment of poverty, but these concepts are organically integrated in the concepts of functionings and capabilities. The implication of thus enlarging the evaluative space is that the inclusion of social and personal circumstances that limit the capabilities of the individuals to live the life they value becomes necessary in the analysis of poverty.

2.5.4 The matter of choice of indicators of wellbeing in the capability approach

The matter of choice of indicators of wellbeing however leads to certain methodological issues in the capability approach. The first issue relates to the choice of a set of dimensions. Is there a definite set of indicators of wellbeing capable of reflecting the individual and social characteristics as well as the conversion factors across all cultures, or different sets of dimensions are relevant in different contexts? Sen's opinion is that democratic norms

should inform the choice of indicators. However he offers an indicative list. He refers to five 'instrumental freedoms' as essential to a life of dignity, namely economic facilities, social opportunities, political freedom, security and transparency guarantees (UNDP, 2006). There are many other similar lists of basic capabilities, but they are fundamentally concerned with the Western[4] idea of a good life and therefore do not reflect an "overlapping consensus" (Laderchi, Saith, & Stewart, 2003).

A more fundamental issue relates to the very conceptualization of poverty in the capability approach. Can poverty be defined purely in terms of capability deprivation? Can a big, commandeering, illiterate landlord despite suffering from an obvious capability deprivation like illiteracy be justifiably called a poor?

With the realization of this contradiction, poverty is alternatively viewed as capability deprivation arising out of inadequate command over resources needed to generate socially determined basic capabilities (Kakwani & Son, 2007). According to this conceptualization of poverty, poverty is a subset of capability deprivations, so a distinction should be made between capability deprivations in general and poverty arising out of inadequate command over resources needed to generate socially determined basic capabilities (UNDP, 2006).

[4] It may be noted here that the adjective "Western" here suggests only a higher level of material development. In the development discourse, various adjectives such as developed, developing, and under-developed are frequently used to make a distinction among varying levels of material progress along the development continuum. When the poverty levels in the developing countries of Asia and Africa are compared with poverty levels in the developed countries of Europe and Americas, an interchangeable use of adjectives "Western" and "European" as well as the use of Western and "Industrial countries of Europe and America" is not uncommon. See for example (Bauer, 1976; Landes, 1999; Leisering, 2001)

2.6 THE ISSUE OF AGGREGATION IN MULTIDIMENSIONAL VIEW OF POVERTY

The aggregation of the dimensions of poverty in the multidimensional analysis of poverty is perhaps the most difficult question. Though by definition any aggregation is a loss of information, at times it becomes essential to summarize a large amount of data into an easily interpretable form as an input for policy formulation. The Millennium Development Goals have for example 48 indicators to monitor overall progress. The aggregation issue poses a particularly serious problem in the multidimensional concept of poverty. In the monetary approach to the measurement of poverty, any monetary variable like income or consumption is considered to serve as a reliable proxy of various other deprivations. In multidimensional approach to poverty, however, each dimension is considered intrinsically important and introducing a trade-off among different dimensions is at best a value judgment.

The literature on multidimensional poverty makes a distinction between two cases where a person may have to be deprived in one dimension or in all dimensions to be identified as poor. This distinction has been referred to as the union and intersection definitions of poverty (Thorbecke, 2005). There is yet another approach referred to as an intermediate approach to the identification of poverty that considers a person poor if she is deprived in multiple dimensions but not in all the dimensions. This intermediate approach is followed by Multidimensional Poverty Index (MPI)[5] developed by Alkire and Foster (2011). All

[5] Multidimensional Poverty Index (MPI) was developed by Alkire and Santos (2011), in work done for the 2010 HDR. The authors choose 10 components for the MPI; two for health (malnutrition, and child mortality), two for education (years of schooling and school

these approaches have different implications in the context of multidimensional poverty measurement as well as the properties of social welfare function (Atkinson, 2003; Chakravarty, 2003; Tsui, 2002).

The aggregation issue becomes difficult when an international comparison of poverty or deprivation is made since considerable differences in the patterns of deprivation are found across different regions.

A number of methods have been proposed in the literature to track the movement of indicators of development across many dimensions for making comparisons of poverty or deprivation. One way of making comparison with multiple indicators is to use 'development profile'. This shows how various indicators of development vary across dimensions. The good thing about using the 'development profile' is that there is no loss of information. The downside is that unless the values of all the indicators in a country are higher than the values of another country, no clear preference is possible over time and space.

One radical view about this crucial controversy is that 'no synthetic index is possible or desirable' (Boltvinik, 1997). However, as a result of an interest in recent decades in the analysis of poverty and deprivation in terms of their multidimensionality, a considerable

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enrolment), and six aim to capture "living standards" (including both access to services and proxies for household wealth). Poverty is measured separately in each of these 10 dimensions, each with its own weight. In keeping with the HDI, the three main headings-health, education, and living standards-are weighted equally (one-third each) to form the composite index. A household is identified as being poor if it is deprived across at least 30% of the weighted indicators. While the HDI uses aggregate country-level data, the MPI uses household-level data, which is then aggregated to the country level. Alkire and Santos construct their MPI for more than 100 countries (See Alkire & Santos, 2011).

amount of data has piled up which makes the measurement and comparison of poverty an overwhelmingly difficult task unless it is summarized into an easily interpretable statistic. A collection of indicators of social and economic deprivation can however be used as a complementary source of information to fill the gaps left in the process of constructing the index. A simultaneous look at the poverty rates and other socioeconomic indicators gives a fuller picture of the extent of poverty as well as an understanding of how other types of disadvantages overlap with economic deprivation. European Union nations annually report on poverty rates as well as other social indicators like joblessness, literacy and life expectancy at the same time. Similarly, the Human Development Reports also regularly publish social indicators related to disease, malnourishment, mortality and illiteracy besides a number of other indicators to help enrich the understanding of the dynamics of poverty and deprivation.

2.7 WEIGHTING STRATEGIES OF SOME LEADING MULTIDIMENSIONAL INDICES OF WELLBEING/DEPRIVATION

In the following discussion, some major wellbeing/deprivation indices are critically discussed with a view to highlight the weighting strategies employed by them.

2.7.1 Human Development Index (HDI)

If human development is about expanding human capabilities, then it is clear that any attempt at understanding the nature of poverty which does not explicitly address the denial

of choices and opportunities fundamental to human wellbeing will give an incomplete and often distorted picture of the phenomenon of poverty. The monetary approach despite its obvious disregard for the multidimensionality of poverty is paradoxically the most frequently used approach at both national and international levels in present times partly because it can easily circumvent the plethora of value judgments essentially found in the multidimensional conception of poverty. The World Bank's international measurement and comparison of poverty is the most influential statistic in the world today to influence the direction of national and international policies as well as the tone of the discourse on poverty as an international issue. Efforts have been made both conceptually and empirically to present alternative measures of poverty supposedly free from the problems with which World Bank's GDP-centric poverty measurement approach suffers. The UNDP's Human Development Index is the part of these efforts and has proved very 'influential in counteracting the overwhelming influence of GDP as the only indicator of development' (Boltvinik, 1997). The HDI which was developed by a team of development economists at UNDP led by Pakistani economist Dr. Mahbubul Haq is a composite index to rank countries by level of human development. It divides the countries of the world into three categories in terms of the level of their development: developed, developing and underdeveloped.

Before 2011, HDI used to be a weighted average of three indicators of development: the level of education, life expectancy at birth and GDP per capita expressed in international dollars. The old HDI formula for a country *i* in a given year is given below:

$$\boldsymbol{HDI_i = \frac{1}{3}(Life\ Expectancy\ Index) + \frac{1}{3}(Education\ Index) + \frac{1}{3}(GDP\ index)}$$

However, since 2011, new approach is adopted in computing HDI index. The latest version of HDI is a geometric mean of indices constructed from three basic dimensions of wellbeing related to life, education and income.

2.7.1.1 Life expectancy index

Life expectancy index measures a long and healthy life, and uses the average life expectancy at birth as an indicator of long and healthy life. Using the maximum and minimum values fixed as goalposts (See the Table below), Life Expectancy Index (LEI) expresses the achievement of a country by applying this formula which transforms the data within the [0 1] limit:

$$Life\ Expectancy\ Index\ (I_{Life}) = \frac{x_i - \min(x)}{\max(x) - \min(x)}$$

Table 1: Goalposts of Human Development Index

Indicator	Maximum value	Minimum value
Life expectancy at birth (years)	83.57	20
Mean years of schooling	13.3	0
Expected years of schooling	18	0
Combined education index	0.971	0
GDP per capita (PPP US$)	87,478	100

Source: HDR 2013 Technical note

2.7.1.2 Education Index

Education index consists of two components: mean years of schooling and expected years of schooling. The maximum value is the highest observed value in any country included in the sample during the period 1980-2012 while the minimum value in the same period is set at 0. The choice of maximum value from the time series of 1980-2012 departs from older versions of HDI where maximum and minimum values were chosen from the data in a single year.

$$Mean\ years\ of\ schooling\ index\ (MYSI_i) = \frac{x_i - \min(x)}{\max(x) - \min(x)}$$

$$Expected\ years\ of\ schooling\ index\ (EYSI_i) = \frac{x_i - \min(x)}{\max(x) - \min(x)}$$

Once the indices of two sub-components of education index are created, the geometric mean of these two indices is used to create the education index. The education index sets the minimum value at 0 and the highest geometric mean of these two sub-indices from the period 1980-2012 is set as the maximum value.

$$Education\ Index\ (I_{Education}) = \frac{\sqrt{MYSI_i \cdot EYSI_i} - \min(MYSI \cdot EYSI)}{\max(MYSI \cdot EYSI) - \min(MYSI \cdot EYSI)}$$

2.7.1.3 Income Index

The decent standard of living component is measured by GNI per capita (PPP$) instead of GDP per capita (PPP$) to accommodate the international production of a country. The

HDI uses the logarithm of income to reflect the diminishing importance of income with increasing GNI. Once calculated, the scores for the three HDI dimension indices are then aggregated into a composite index using geometric mean.

$$Income\ Index\ (I_{Standard\ of\ Living}) = \frac{ln(x_i) - ln\ (\min(x))}{ln\ (\max(x)) - ln\ (\min(x))}$$

Human Development Index is simply a geometric mean of the scores of these three sub-indices:

$$Human\ Development\ Index = \sqrt[3]{I_{Life} \cdot I_{Education} \cdot I_{Standard\ of\ living}}$$

Ravallion (2012a) finds the trade-offs implicit in the new HDI extremely troubling. He calculates marginal rate of substitution between longevity and income which can be as little as $0.53 per one year life in Zimbabwe but as high as $9000 in the richest countries, an incredibly 17000 times higher than Zimbabwe. The implication of this tradeoff is that there is a steep rise in the value of longevity when there is an increase in the per capita income. The best way of increasing human development in the developed countries is thus to invest in the longevity.

HDI takes only a superficial view of development by limiting its analysis to only three aspects of social development. Many other 'instrumental freedoms' like political rights, economic opportunities, sense of security, sanctity of contract among a large number of other indicators of wellbeing contribute to a dignified life in important ways.

The HDI is also criticized as an imperfect tool to determine the direction of a country's progress over time. It is solely concerned with relative ranking. Because the HDI value for

a country in a given year depends on the values of other countries of that year, and maximum and minimum values keep changing every year, the HDI statistic is not a useful tool for inter-temporal comparison. The fundamental changes in the social and economic conditions of a country over time are thus not reflected in HDI (Hopkins, 1991). Lesotho's average annual HDI growth from 2000 to 2011 was 0.47%. Its rank in 2006 was 159th and by 2011 it could only inch one point higher in HDI's ranking to clinch 160th position (HDR, 2011). This improvement in HDI score takes place despite the fact that in 2000, the life expectancy at birth was 51 years in Lesotho for both sexes but in 2007, it was dramatically reduced to only 45 years. Similarly, in 2000 the adult mortality rate (probability of dying between 15 to 60 years per 1000 population) in Lesotho for both sexes was 520, but in 2007, this adult mortality rate sharply rose to 725 (WHO, 2009).

Ravallion (1997) finds that even if the weights attached to the scaled varies are made explicit, the weights attached to component parts are not explicit which may in fact be implausible. Because income was one of the components of the HDI, Ravallion believes that it is possible to monetize all the dimensions using the tradeoffs implicit in the HDI. He finds out that a low monetary value was attached to poor countries. In the newer version of HDI since 2010, that value has been lowered still further but the weight on income was increased for most of the countries. For example, if Zimbabwe increases national income by $0.52 while its average life expectancy is reduced by one year, it will still "promote" human development (Ravallion, 2012b).

Ravallion (2012b) also criticizes the multidimensional indices in general and suggests some ways to make these indices better. Ravallion believes that the composite indices are unwarranted because the components of the index rather than the composite index itself is

more informative for the policy makers. He comes down heavy over the issue of weighting in the composite indices. He believes that Uncertainty about components and their weights not adequately acknowledged. For non-market goods (for example being able to participate fully in the society), constant weights are assumed for everyone in a given country which is implausible. Conclusion about the country performance over time is not clear when the country specific context of the performance is missing (for example, the initial conditions in a country and how much it has progressed). Actual weights used in lieu of prices are not made explicit, even if prices are regarded as unreliable guides to tradeoffs. Little guidance to robustness of country rankings. Given that the composite indices are the norm rather than the exception now, he suggests that the composite measures should be clear what exactly are they measuring. More attention needs to be given to trade-offs implicitly embodied in the index. They need to be more humble because they often far fewer dimensions of welfare than measures based on consumption at household level. Important aspects of development cannot be captured in a single index must by explicitly recognized (Ravallion, 2012a).

2.7.2 Human Poverty Index (HPI)

Poverty in the human development context can also be understood as a denial of choices and opportunities most fundamental to human wellbeing. Poverty thus is not just the lowness of income; it is the denial of the freedom to live a long, healthy and creative life. To fill this conceptual gap, the Human Development Report 1997 introduced the Human Poverty Index (HPI) 'to bring together in a composite index the different features of

deprivation in the quality of life to arrive at an aggregate judgment on the extent of poverty in a community' (UNDP, 1997).

$$HPI-1=\left[\frac{1}{3}(P_1^{\alpha}+P_2^{\alpha}+P_3^{\alpha})\right]^{\frac{1}{\alpha}}$$

P_1. Probability at birth of not surviving to age 40 (times 100)

P_2. Adult illiteracy rate

P_3. Unweighted average of the percentage of population without sustainable access to an improved water source and children under weight for age

α. = 3

$$HPI-2=\left[\frac{1}{4}(P_1^{\alpha}+P_2^{\alpha}+P_3^{\alpha}+P_4^{\alpha})\right]^{\frac{1}{\alpha}}$$

P_1. Probability at birth of not surviving to age 60 (times 100)

P_2. Percentage of adults lacking functional literacy skills

P_3. Percentage of population below income poverty line (50% of median adjusted household disposable income)

P_4. Rate of long-term unemployment (lasting 12 months or more)

α. = 3

HPI divides the countries of the world into two groups. HPI-1 consists of developing countries and HPI-2 consists of selected high-income OECD countries. To measure poverty, HPI uses set of indicators of deprivation for both groups. the probability of not surviving to ages 40 and 60 for HPI-1 and HPI-2 respectively; adult illiteracy for both HPI-1 and HPI-2; population without access to safe water for HPI-1; children underweight for

their age for HPI-1; population below income poverty line (50% of median household disposable income) for HPI-2 and long term unemployment for HPI-2. [6]

HPI, a converse of HDI, suffers from much of the same problems as HDI does. HPI also takes only a limited view of poverty by limiting its analysis to only three or four aspects of social deprivation. It completely disregards the issues as important as health, provision of public services, social networks among a large number of other indicators of wellbeing which contribute to a dignified life in important ways.

There is however a fundamental difference between HDI and HPI because the latter uses power mean of order three to achieve theoretically consistent imperfect substitutability and supposedly non arbitrary weights. Power mean is justified on the ground that it 'places greater weight on those dimensions in which deprivation is larger.' (Anand & Sen, 1997) This power means approach though seems more objective because weights are assigned to different dimensions of poverty through a statistical technique, it does not make a distinction between the relative importance of two dimensions. If 10% of the population is deprived in the dimension of literacy and 80% of the population is deprived in the dimension of adequate nourishment in country A, it will give the same HPI value as a country B if the 80% of the population here is deprived in dimension of literacy and 10% in dimension of adequate nourishment ceteris paribus. Thus the power mean approach used in HPI also does not make a distinction between the relative importance of various dimensions.

[6] http://hdr.undp.org/en/statistics/indices/hpi/

Human Development Report (2005) may have echoed this concern when it warned. "Losses in human welfare linked to life expectancy, for example, cannot be compensated for by gains in other areas such as income or education" (UNDP, 2005).

It may further be argued that any conceivable procedure for coming up with a single number must, implicitly or explicitly, assign weights to different dimensions of poverty, in order to aggregate them. Procedures which seek to bypass *explicit* assignment of weights do so *implicitly*, and thereby hide the strategy which is being used to compare, evaluate, and aggregate the different dimensions of wellbeing. However, when the numbers are probed to discover what these implicit weights are, we may find that these do not correspond well with our intuitive perceptions regarding the different dimensions of poverty. Therefore it seems preferable to assign explicit weights (which is the approach of this thesis).

2.7.3 Multidimensional Poverty Index (MPI)

In the series of multidimensional indices, a recent index is multidimensional poverty index MPI developed by Alkire and Santos (2011) which brings together three basic dimensions and ten corresponding[7] indicators of wellbeing to take a holistic view of the level of acute poverty in 104 developing countries. A household is considered to be

[7] The indicators related to the dimension of education are *i*) years of schooling, ii) school enrolment; to the dimension of health are *i*) nutrition, ii) child mortality and to the dimension of standard of living are *i*) cooking fuel, ii) sanitation, iii) water, iv) electricity, v) floor and vi) asset ownership. The weight of the indicators representing education and health is equal to 1/6 each and the weight of indicators representing the standard of living is equal to 1/18 each.

multidimensionally poor if it is deprived in *k* out of *n* indicators. The choice of k is a crucial issue in any multidimensional index building and gives rises to a number of issues. The first problem is an individual has to be deprived in how many dimensions to be counted as poor. Suppose we are faced with a situation where we have to choose exactly four out of a total of nine dimensions to term someone as multidimensionally poor, we will find ourselves in a very unsavory situation like this. With nine dimensions there are 2^k-1, that is, 511 possible ways (2^9=512) in which a person can be deprived (there is only one outcome when an individual is deprived in no dimension). There are 126 possible ways in which an individual can be deprived in exactly four out of nine dimensions. So any one combination out of 126 possible combinations that we choose will involve some degree of arbitrariness and will reflect our personal biases.

Table 2: Possible Ways Of Occurrence Of Deprivation In The Number Of Corresponding Dimensions

Deprivation in the number of dimensions	Possible ways of occurrence of deprivation in the number of corresponding dimensions
0	1
1	9
2	36
3	84
4	126
5	126
6	84
7	36
8	9
9	1
Total	**512**

MPI assigns equal weights to three basic dimensions[8] and similarly each indicator within dimensions is equally weighted. (See the table below)

Table 3: Dimensions And Corresponding Indicators Of Multidimensional Poverty Index (MPI)

Dimension	Indicator	Weight
Health	Child Mortality. If any child has died in the family	1/6
	Nutrition. If any adult or child in the family is malnourished	1/6
Education	Years of Schooling If no household member has completed 5 years of schooling	1/6
	Child Enrolment If any school-aged child is out of school in years 1 to 8	1/6
Standard of Living	Electricity If household does not have electricity	1/18
	Drinking water If does not meet MDG definitions, or is more than 30 minutes' walk	1/18
	Sanitation If does not meet MDG definitions, or the toilet is shared	1/18
	Flooring If the floor is dirt, sand, or dung	1/18
	Cooking Fuel If they cook with wood, charcoal, or dung	1/18
	Assets 'If do not own more than one radio, TV, telephone, bike, motorbike or refrigerator and does not own a car or truck.'	1/18

This multidimensional measure again puts weight on various dimensions of wellbeing in a way, which sometimes seems counterintuitive. In MPI, an individual suffers from similar levels of pain caused by child mortality or a school-age child remaining out of school. Similarly, the loss of wellbeing caused by having to bring water from 30 minutes'

[8] The indicators related to the dimension of education are *i*) years of schooling, ii) school enrolment; to the dimension of health are *i*) nutrition, ii) child mortality and to the dimension of standard of living are *i*) cooking fuel, ii) sanitation, iii) water, iv) electricity, v) floor and vi) asset ownership. The weight of the indicators representing education and health is equal to 1/6 each and the weight of indicators representing the standard of living is equal to 1/18 each.

walk is as severe as having no TV and radio. These types of conceptual problems arise primarily because of an assumption at the base of this measure that all indicators are roughly equal in terms of their relative importance. This underscores the need to choose weights that adequately reflect the relative importance of various dimensions of wellbeing.

Alkire and Santos (2001) have used micro data at the level of household in the construction of the MPI so that the index could be used as a tool to target the poorest people or individuals suffering from 'interlocking' deprivations. This is in fact an unrealistic goal because the counts or ranks produced by any index are meaningful to the extent that they give an idea about the prevalence of poverty in a particular region. The policy makers have to dig deeper to decode the determinants of poverty and address the individual problems based on some preferences and available resources. In practice, the policy makers rarely try to target individuals suffering from 'k' number of deprivations and never seek to simultaneously solve all the problems of the individuals found multidimensionally poor but instead formulate a policy to address within the constraints of available resources an individual problem or a combination of problems which may be interlinked with one another at some level.

CHAPTER 3

METHODOLOGY

In this chapter, the selection and justification of various dimensions of wellbeing and their associated indicators, as well as the assigning of weights as values judgments are discussed besides the discussion of the model developed for this study.

3.1 SELECTION AND JUSTIFICATION OF DIMENSIONS

As regards the issue of paternalism that is essentially embedded in any conceivable choice, ranking and weighting of dimensions of wellbeing, it may be argued that the concept of wellbeing may be conceptualized at various levels of generality. Nussbaum's list of valuable capabilities is severely criticized for being paternalistic (See Clark, 2002), and she introduces the concept of plural and local specifications to deal with the problem of paternalism. A high level of generality in the conceptualization of wellbeing corresponds with the plural specification. There are some capabilities such as health and education which are expected to be generally important in almost all cultures of the world. Even if there is a broad consensus among all societies that health and education are desirable in their own right, individual societies might differ with regards to the broad outlines of the education or the best means to ensure health. The concept of local specification specifically accommodates the differences which are culture-specific or are based on some other local

dynamic. Local specification thus "leaves a great deal of latitude for citizens to specify each of the components more concretely, and with much variety, in accordance with local traditions, or individual tastes" (Clark, 2002, p. 94). In our analysis, we chose the dimensions of wellbeing that are quite general in nature and are not much affected by local tastes. There might hardly be any society which does not consider longevity, health and adequate nourishment as important dimensions of human wellbeing. Political freedom, environmental safety and the freedom to do business are also expected to be valuable across all cultures.

Is it possible to define the level of achievement considered essential for leading a valuable life acceptable across different cultures and contexts? This is a very difficult question and is not amenable for a straightforward answer. A number of efforts have been made in the past to draw up a list of prerequisites of a decent life. Controversy however continues as to whether poverty should be defined subjectively or objectively. Rawls, in The Theory of Justice, identifies primary good which 'are in general necessary for the framing and execution of a rational plan of life (Rawls, A theory of justice, 1972). But in the 'Voices of the Poor', it is not some professional drawing a list of the features of a flourishing life with his own mindset; it is the poor themselves who identify the needs for leading a valuable life (Narayan, Chambers, Shah, & Petesch, 2000). Similarly, ESRC Research Group of Wellbeing in Developing Countries consulted the people to identify what makes for a good quality of life in four countries (Camfield, 2005). Sen gives an indicative list of basic capabilities, but stops short of drawing up a specific list nor does he provide any clue regarding a set of capabilities relevant across societies for different persons and cultures. Doyal and Gough (1991) propose a list of Basic Needs which primarily comprised of various dimensions of health and additionally made the safety from

any serious harm the basis of a valued life. Nussbaum (2000) kept on working over the idea of drawing up a list of basic capabilities essential for a valued life on which there is a broad consensus by different societies of the world is possible. Nussbaum argues that even if not all the people agree on what makes a perfect life, we can reach the consensus on what makes a life human (Nussbaum, 1998). The features essential for a full human life, in Nussbaum's view, comprise life of normal length, good health, bodily integrity, cultivation of senses, emotions, practical reason, affiliation, concern for other species, play and control over one's environment (Nussbaum, 2000). (See the list of achievements considered essential for a valued life by Nussbaum and other thinkers over time in the Appendix A)

Ideally a multidimensional analysis of wellbeing should consist of all the relevant dimensions of wellbeing but the absence of an overlapping consensus among all the people of the world as to what constitutes wellbeing makes an agreement on the dimensions next to impossible. "A complete and strictly universal account of the good is unlikely to be attainable" (Braybrooke, 1987). But if no consensus on even the broad contours of wellbeing is likely to surface, does it necessarily mean that any effort to generalize the concept of wellbeing for making cross country comparison is doomed from the beginning? Theory guides to at least three possibilities in this respect: first, what is good for a person depends entirely on that person's preferences (called welfarist theory) (Arneson, 1987); secondly, what is good for a person is an open question and cannot be decided without public reasoning (called deliberative or participatory approach); thirdly, it is possible to know a person's objective preferences independently of that person's subjective preferences (called perfectionist theory) (Van Ootegem & Spillemaeckers, 2010).

The choice of relevant dimensions of wellbeing and their ranking in our analysis is based on the perfectionist theory. Perfectionism, as already explained, essentially addresses the problem of what constitutes human wellbeing independently of the subjective preferences of the individuals. This is not only a pragmatic approach to the conceptualization of human wellbeing, thinkers down the ages have used this approach to find adequate answer to the elusive question of what constitutes the human wellbeing. Writers like Aristotle, Aquinas and Spinoza were perfectionist because they characterized the human good in terms of the development of human nature (Arneson, 1987). In recent times, Nussbaum (1998) has come up with a list of goods essential for a fulfilled life. Aristotelian perfectionist position was that if each human being can endorse some central human capabilities as essential to her life, would it not mean that those capabilities are essential to any good human life, and thus constitute the fundamental basis of any human life? In other words, perfectionism holds that we can know what is objectively good for a person independently of that very person's subjective preferences (even as corrected by full information and considered reasonable judgment).[9]

On the face of it, it seems extremely difficult that such an "overlapping consensus" should ever develop because any list of the prerequisites of a good life will be inevitably subjective and ethnocentric. Sen may have deliberately stopped short of specifying the list of basic capabilities so as to allow the consensus to develop democratically across different societies. Realizing the limitations of data availability and many methodological pitfalls besides a seeming impossibility of a universal consensus on the determinants of a desirable

[9] plato.stanford.edu/entries/perfectionism-moral/

life, we propose a tentative list of nine dimensions of wellbeing, deprivation of which in our view forms the core of multidimensional poverty. We collected data on as many indicators related to these dimensions of wellbeing as possible for 193 countries. We have proposed following nine broad categories of wellbeing:

1. Living a life of normal length
2. Adequate nourishment
3. Healthy living
4. Employment
5. Literacy
6. Clean household energy
7. Economic freedom
8. Political freedom
9. Clean environment[10]

Whenever we specify a 'list' of the dimensions of a desirable life, we readily face the issue of paternalism which is essentially embedded in any conceivable choice, ranking and weighting of dimensions of wellbeing. It may be argued that paternalism is not necessarily incompatible with the theories of wellbeing, and it is in fact shown to be easily reconciled to different concepts like hedonism or objective goods theory of wellbeing (Zamir, 1998). For example, it is possible that a person's happiness may increase as a result of obstruction of his action despite the displeasure that he feels because his preferences are frustrated (Regan, 1983). The reconciliation of paternalism with the theories of wellbeing however

[10] The dimensions and related indicators included in this study have been presented in the Table 16 in the Appendix

depends on the level of generality at which the wellbeing is defined. Nussbaum's list of valuable capabilities, for example, is severely criticized for being paternalistic (See Clark, 2002) which she justifies on the ground that her list allows both plural and local specifications. A high level of generality in the conceptualization of wellbeing corresponds with the plural specification. There are some capabilities such as health and education which are expected to be generally important in almost all cultures of the world. Even if there is a broad consensus among all societies that health and education are desirable in their own right, individual societies might differ with regards to the broad outlines of the education or the best means to ensure health. The concept of local specification specifically accommodates the differences which are culture-specific or are based on some other local dynamic. Local specification thus "leaves a great deal of latitude for citizens to specify each of the components more concretely, and with much variety, in accordance with local traditions, or individual tastes" (Clark, 2002, p. 94). In our analysis, we chose the dimensions of wellbeing that are quite general in nature, are expected to be broadly shared across all cultures, and are not much affected by local tastes. There might hardly be any society which does not consider longevity, health and adequate nourishment as important dimensions of human wellbeing. Political freedom, environmental safety and the freedom to do business are also expected to be valuable across all cultures. It must be stressed that our list of dimensions is not strictly universal or complete, but is broadly universal, incomplete and definitely open to revision.

Additionally, in drawing up a list of only nine dimensions of wellbeing, our objective is to initiate a debate aimed at developing an international consensus on what constitutes the core of poverty and what indicators best reflect these dimensions. We define poverty as a

functioning failure caused by an inadequate command over market or nonmarket resources and then make an inter-temporal comparison of international poverty. We also compare our estimates with the World Bank's monetary measure of international poverty to see how they correlate. Our measure is reductionist like HDI and HPI though in its essence, it aims to present a picture of poverty which is more comprehensive than the one presented by World Bank's unidimensional measure with its focus on mere monetary indicators or the HPI's multidimensional measure with its use of only three basic dimensions of poverty.

We have not explicitly included in our analysis monetary indicators because of the problems associated with their conversion into valuable functionings at different rates because of the difference in individual characteristics. Similarly, we have not included a number of other dimensions of wellbeing which are intrinsically important such as satisfactory social relations and leisure conditions because of the problems of definition and measurement. Sometimes people may be excluded from their social circle because of upward or downward social mobility. It is therefore odd to treat the social exclusion caused by two very dissimilar causes as poverty. Similarly, certain religious traditions may outlaw some leisure activities which are considered quite innocuous in cultures not following the same religious tradition. Likewise, a person may be expected to forgo leisure in favor of some extra hours at workplace without being legitimately called poor. So, there is no escape from defining poverty, at least operationally, as a deprivation of a finite subset of possibly infinite number of capabilities.

Despite best efforts to include maximum possible variables that affect wellbeing, there may still be some unobserved (latent) variables on which the observed variables crucially depend. (Krishnakumar & Nadar 2008)

experienced by individuals. The Freedom in the World survey assigns to each country a numerical rating --- on a scale of 1 to 7 --- for political rights and a similar rating to civil liberties. Each pair of political rights and civil liberties ratings reflects an overall political status of a country. The countries with ratings between 1 and 2.5 are considered 'Free', between 3 and 5 are 'Partly Free' and between 5.5 and 7 are 'Not Free'.

The Freedom in the World 2006 has prepared Checklist Questions and Guidelines to provide guidance regarding what issues are meant to be considered in scoring each numbered checklist question. (See Freedom in the World indicators in Appendix C). We normalized both the indicators using the formula $(x_i/\max[x_{S1}.x_{S2}])$ to ensure inter-temporal comparability of the countries.

Finally, we have four indicators related to the functioning of clean environment: two relate to the percentage of population with access to improved drinking-water source[15] in rural and urban areas and two relate to the percentage of population with access to improved sanitation[16].

WHO / UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation defines an improved sanitation facility as "one that hygienically separates human excreta from human contact" and an improved drinking-water source is defined as "one that, by

[15] Access to an improved water Source: refers to the percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 liters a person a day from a Source: within one kilometre of the dwelling. (WDI, 2006)

[16] Access to improved sanitation facilities refers to the percentage of the population with at least adequate access to excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta. Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection. To be effective, facilities must be correctly constructed and properly maintained. (WDI, 2006)

nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with faecal matter."

We choose improved drinking water as an indicator of environment because the effects of degradation of environment become readily discernable on water for certain reasons. Although industrial wastes and agricultural chemicals "are the main causes of water pollution, in developing nations, more than 95 percent of urban sewage is discharged untreated into rivers and bays, creating a major human health hazard." [17]. On the other hand, the demand for fresh water continues to rise corresponding with the increase in the world population. From 1940 to 1990, there has an increase of 400% in the withdrawals of fresh water from rivers, lakes, reservoirs, and other sources (Encarta, 2008). Viewed against the background of this grim linkage between an increasing discharge of urban sewage into water ways and a rapidly increasing demand for fresh water at the same time, the improved drinking water as a measure of the quality of environment assumes added significance.

Secondly, we have included only two indicators related to the dimension of safe environment despite the fact that there are better choices like CO2 emissions, methane emissions, nitrous oxide emissions, organic water pollutants, water pollution caused by chemical, textile and wood industries is because we are primarily concerned with poverty and deprivation arising out of inadequate command of resources in our research.

[17] Microsoft ® Encarta ® 2008. © 1993-2007 Microsoft Corporation. All rights reserved.

Functioning deprivation arising out of the desire to command more and more resources is beyond the purview of the topic of our research.

Though environment is one of the most important issues in the developed world and strong sentiments about the environment in the developed world are not yet matched in the developing world, there is no gainsaying the fact that it is primarily the developed world that is responsible for posing grave dangers to the environment by pursuing indiscriminate economic expansion. For example, United States' persistent refusal to ratify international protocols requiring a reduction in the emissions is adding to the world environmental problems. So a distinction must be made in the conceptualization of poverty as functioning deprivations arising out of market or nonmarket resources and functioning deprivations in general.

Finally, as can be seen that some of the variables included in the model reflect achievement instead of deprivation such as 'Neonates protected at birth against neonatal tetanus (%)' so we have normalized them by subtracting them from 1 to make them indicators of deprivation.

3.3 WEIGHTS AS VALUE JUDGMENTS

Assigning weights explicitly to different dimensions of wellbeing is the most difficult question as real life does not quite admit of such explicit numerical weighting. Sen however sees the assigning of weight as strength not an embarrassment (Sen, On Economic Inequality, 1997). Weights are assigned all the times without being made explicit. In any

budget, earmarking of funds to achieve certain policy objectives is equivalent to assigning weights. Ultimately, the weights must be chosen to arrive at a decision. The only question is whether this is done implicitly (hiding the value judgments) or explicitly. However, one advantage of making the setting of the weights explicit might trigger a valuable democratic debate. In the monetary measures of poverty, prices are used as value judgments, but in multidimensional indices such as HDI, HPI and MPI, weights are used instead.

Assigning unequal weights explicitly to different dimensions of life is the most difficult question as real life does not quite admit of such explicit numerical weighting. But the purpose of theorizing about the concept of measurement of poverty then is to single out only the most essential factors and relationships so that we can comprehend the problem at hand without entangling ourselves in many complications that exist in real world. As theory is just an abstraction from reality, we have to make some value judgments. Thus assigning explicit numerical weights to different dimensions of real life is although difficult and almost invariably arbitrary; it is inevitable, nonetheless.

In assigning weights to different dimensions of life unequally, some of the factors that were considered are discussed as under.

The first thing we considered in ordering various dimensions is the degree of human interest in various dimensions of wellbeing which may broadly correspond to three distinct categories in the same order of priority: i) the necessities which can be construed as the things on which life depends, ii) the needs, the fulfilment of which provides ease and relief in times of hardship and stress, but life is not disrupted if needs are not fulfilled; iii) embellishments which cater to the higher values of societies such as ethical and moral excellence. The first four dimensions in this study may be seen as corresponding to the

necessities which are crucial for human survival, while literacy and clean household energy may correspond to the needs, and the economic freedom, political freedom and clean environment may correspond to the embellishments which make life beautiful and fulfilling, but deprivation in these dimensions do not disrupt the life as severely as the deprivation in needs and necessities. It must be admitted here that a lot of value judgments are involved in this type of analytic framework, and the dimensions might overlap at various levels but this type of perfectionist approach has its roots in the concept of Maqasid al Shariah (objectives of Shariah) as defined by Al-Ghazali and later by Ash-Shatibi (Ahmad, 2011; Goolam, 2006; Mahmud & Shah, 2010).

Second, we have chosen to assign successively higher weights to the dimensions which are incrementally more important for physical survival. We assigned less weight to literacy relative to adequate nourishment because physical survival critically depends on the latter notwithstanding the fact that literacy is both intrinsically and instrumentally valuable. It may be noted that at some level, all the dimensions of life are mutually interdependent. Healthy living depends on adequate nourishment but adequate nourishment in its turn depends on a number of other functionings such as employment, economic freedom and clean environment among others. One cannot relish even the choicest delicacies, if one does not enjoy good health. Similarly healthy living and literacy depend on other factors. How different dimensions of wellbeing are related with each other in a complex interplay of inter-dependence may be evident in the following figure:

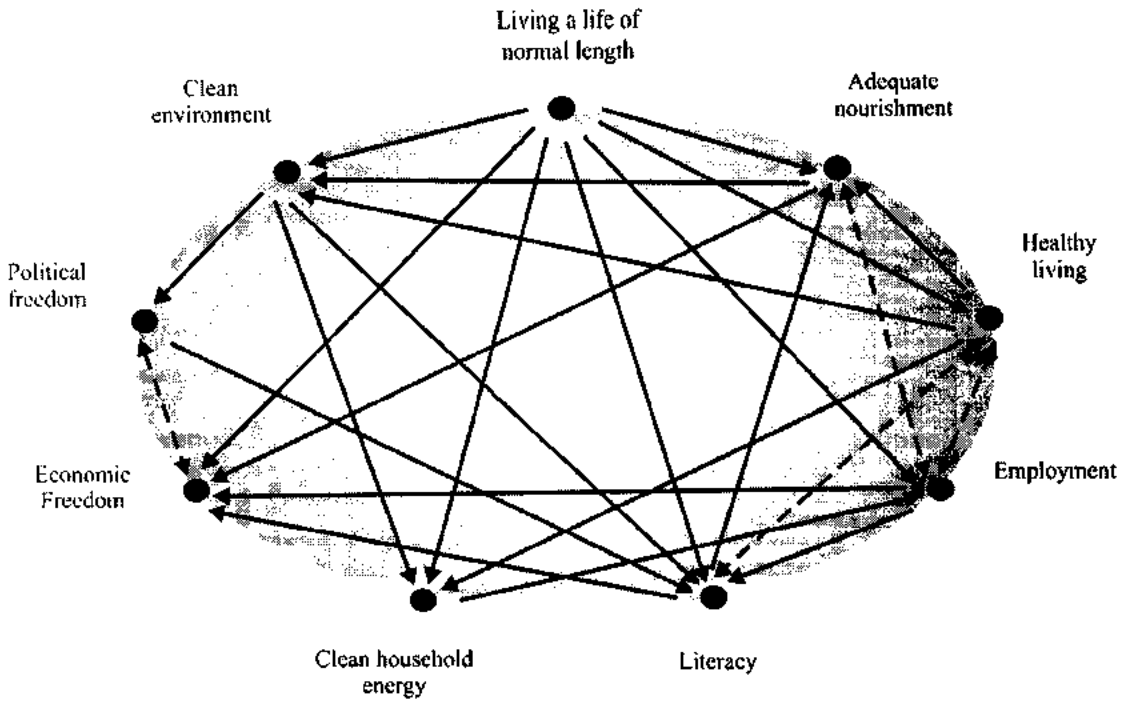

Figure 4: Inter-dependence among various dimensions of wellbeing

Note. Dimension at the initial point of the arrow (e. g. clean environment) depends on the dimension at the terminal point of the arrow (e. g. clean household energy). Dotted arrows indicate mutual interdependence (employment depends on adequate nourishment and adequate nourishment depends on employment).

Third, we assigned immediate needs higher weights relative to distant needs. Political freedom is an important capability of intrinsic value and striving for political rights is valuable in its own right but generally the responsibility of feeding one's children is felt far more acutely than the responsibility of setting the political atmosphere right which generally requires constant efforts spanning often decades.

We have assigned weights to nine dimensions of life in the following order:

1. Living a life of normal length
2. Adequate nourishment
3. Healthy living

4. Employment
5. Literacy
6. Clean household energy
7. Economic freedom
8. Political freedom
9. Clean environment

Before we proceed to discuss the significance of individual functionings, it is important to note that another formulation for the purpose of assigning relative weights to individual functionings may be possible. According to this methodology, we divide the nine functionings into four categories (short-run, medium-run, long-run and hybrid) in terms of the time span required for any policy to expand these functionings.

Table 4: Expected Time in Targeting the Functioning

	Time span	Achieved Functionings
1	Hybrid	Living a life of normal length
2	SR	Adequate nourishment
2	SR	Employment
2	SR	Healthy living
3	MR	Literacy
3	MR	Clean household energy
4	LR	Economic freedom
4	LR	Clean environment
4	LR	Political freedom

After a short detour, we come again to the problem of assigning weights to the achieved functionings. We assign the highest weight to the functioning of living a life of normal length relative to all other dimensions is quite straightforward. The reason for which an

individual can go to great lengths to save the life of his dying child is precisely the reason for which we assigned the highest weight to the functioning of living a life of normal length. Interestingly, this important and all-encompassing dimension of wellbeing shows a strange behavior when correlated with per capita income and shows how imprecise monetary indicators could be in measuring the level of wellbeing. The Preston curve shows that when per capita income exceeds PPP $10000, average life span is not affected by any amount of increase in income level (See Figure 3). However average life span ranging from 40 to 60 years is compatible with when income level is less than PPP $2000. Average life span seems to positively move with per capita income when per capita income ranges from PPP $2000 to PPP $10000 (See Figure below).

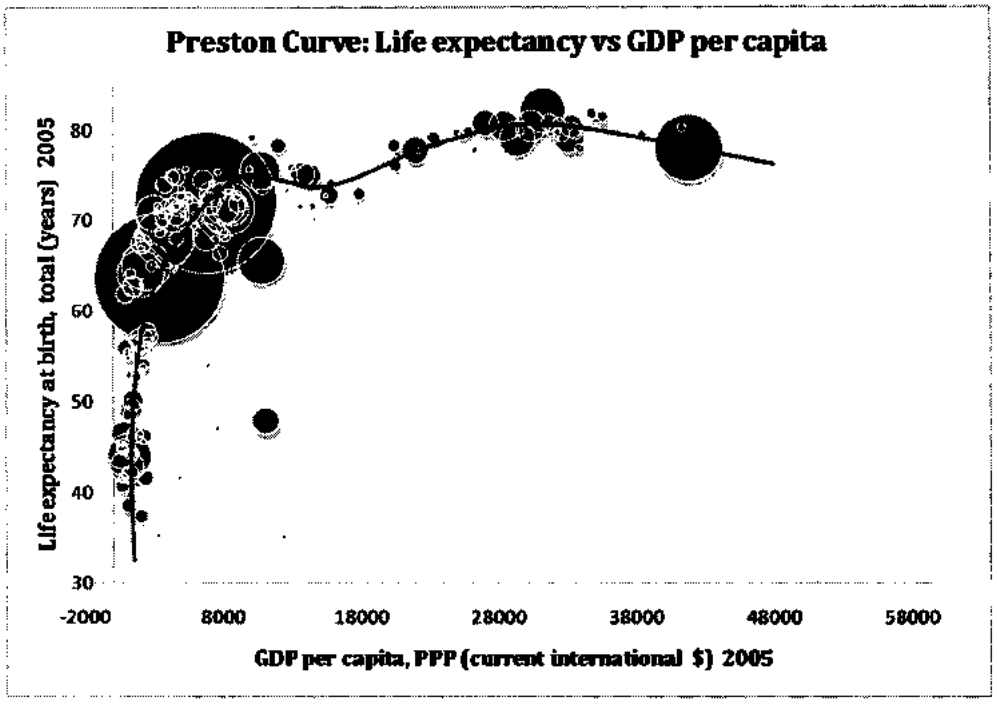

Figure 5: Scatter chart of GDP per capita and life expectancy at birth

Source: WDI 2006. Circles are countries proportional to population.

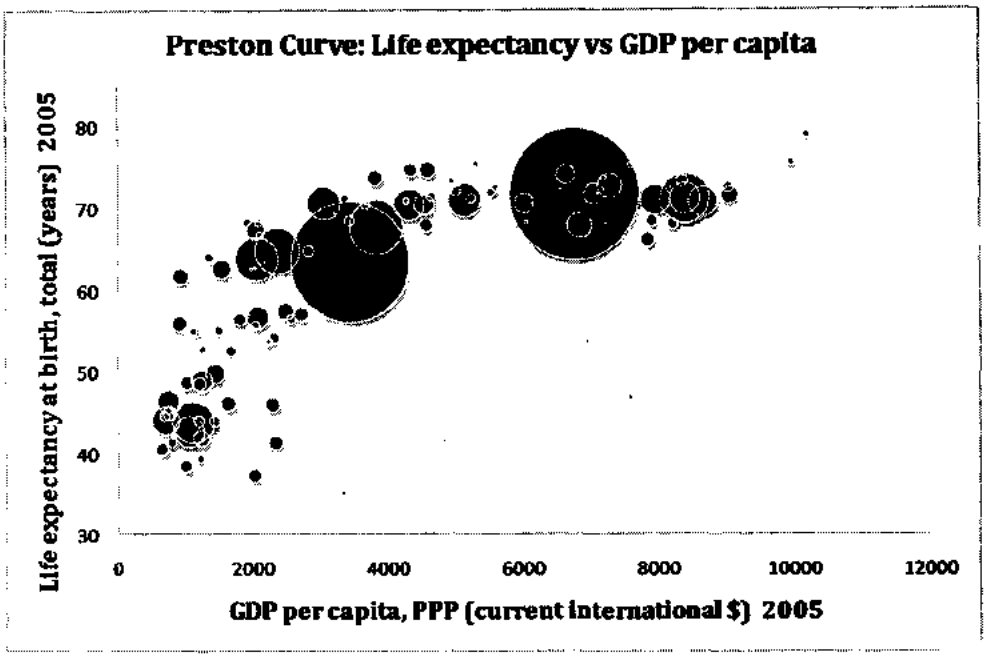

Figure 6: Scatter chart of GDP per capita and life expectancy at birth

Source: WDI 2006. Circles are proportional to population.

Although assigning the highest weight to the functioning of living a life of normal length did not pose any serious problem, giving preference to adequate nourishment relative to healthy living is not as straightforward because healthy living crucially depends on adequate nourishment and by this reasoning healthy living should be assigned greater weight. However, in our conceptualization of poverty, distinction has to be made between functioning deprivation caused by inadequate command over market or nonmarket resources and functioning deprivation in general. The indicators that we chose to measure the functioning of healthy living relate largely to those diseases that arise as a result of inadequate nourishment such as stunting, wasting, underweight and anemia etc. A millionaire suffering from a heart disease should not be called poor notwithstanding the

fact that he is suffering from a serious functioning deprivation. Adequate nourishment thus has a causal relationship with healthy living.

We assigned the fourth highest weight to the functioning of employment because adequate nourishment and healthy living partly depend on gainful employment. Savings, network of social relations or a system of social security system can sustain an unemployed individual for a while but a sick person is not expected to do justice to his profession.

We give the fifth highest weight to the functioning of literacy despite the fact that employment crucially depends on education level. Against the backdrop of a debate on bare survival, employment gets precedence over literacy in the scheme of poor people despite the fact that literacy is an important functioning of intrinsic value. Widespread child labor in the developing world testifies to this preference ordering. Large sections of the population in Sub-Saharan Africa and South Asia engaged in agricultural sector and other informal sectors of economy are illiterate.

The basic idea behind introducing the dimension of clean household energy in our analysis was to estimate the health effects of using unsafe modes of energy at the level of household. The World Health Organization in its report Fuel for Life. Household Energy and Health presents a moving picture of energy poverty,

"Worldwide, more than three billion people depend on solid fuels, including biomass (wood, dung and agricultural residues) and coal, to meet their most basic energy needs: cooking, boiling water and heating. Opening the door to their homes makes for a hazy welcome: thick grey smoke fills the air, making breathing unbearable and bringing tears to the eyes. The inefficient burning of solid fuels on an open fire or traditional stove indoors creates a dangerous cocktail of hundreds of pollutants... Day in day out, and for hours at a

time, women and their small children breathe in amounts of smoke equivalent to consuming two packs of cigarettes per day. " (WHO, Fuel for life: Household energy and health, 2006)

We assign less weight to this functioning because availability of clean household energy depends on employment. A strong 82% correlation between clean household energy dimension and living a life of normal length and 65% correlation between healthy living and clean household energy however will practically identify same countries as poor which are deprived with respect to longevity and energy even if we have given clean household energy dimension less weight.

Whether economic freedom or political freedom should be assigned higher weight is a question not amenable for an easy answer. That economic and political freedoms are interdependent is a foregone conclusion and a 57% correlation between economic and political freedom indicators corroborates this hypothesis. However we can only infer from the experiences of the real people, not philosophers in their ivory towers who have no first-hand experience of poverty, that the force of economic need is more compelling than the desire to control one's political atmosphere. Why after all the denial of the right to own property hurts more than the prospects of a rigged election and why a highly regressive taxation system leaves one more deprived than the denial of a right to organize in different political parties. Why a disenfranchised laborer feels more satisfied in a foreign land where he has sought asylum but where he is given fair wages for his labor than the enfranchised low level public servant back home that is denied wages for months on end because of corruption in government machinery? Thus we assign higher weight to economic freedom.

Our last dimension is clean environment to which we do not assign any explicit weight. But is it justified to assign so much weight to the functioning of living a life of normal length, for example, relative to clean environment that it completely swamps the effect of any positive change in the functioning of clean environment. To answer this question first it has to be stressed that environment has a crucial instrumental role in the determination of life span and a very strong 81% correlation between the functioning of living a life of normal length and the functioning of clean environment partly bears this out. For the sake of argument, given the choice of saving a human life and safeguarding the environment, an expected human behavior is to save a human life even if such hard choices have to be rarely made in practice. We will be making a serious error of judgment in underestimating environment relative to longevity if they were independent of each other. But actually they are closely related. A very strong 81% correlation between these functionings ensures that we will be counting as highly deprived with respect to life span only those countries which are also highly deprived with respect to safe environment. Similarly significant correlations among different dimensions of life point to the fact that poverty is simultaneously associated with diverse forms of deprivations. (See the Figure below)

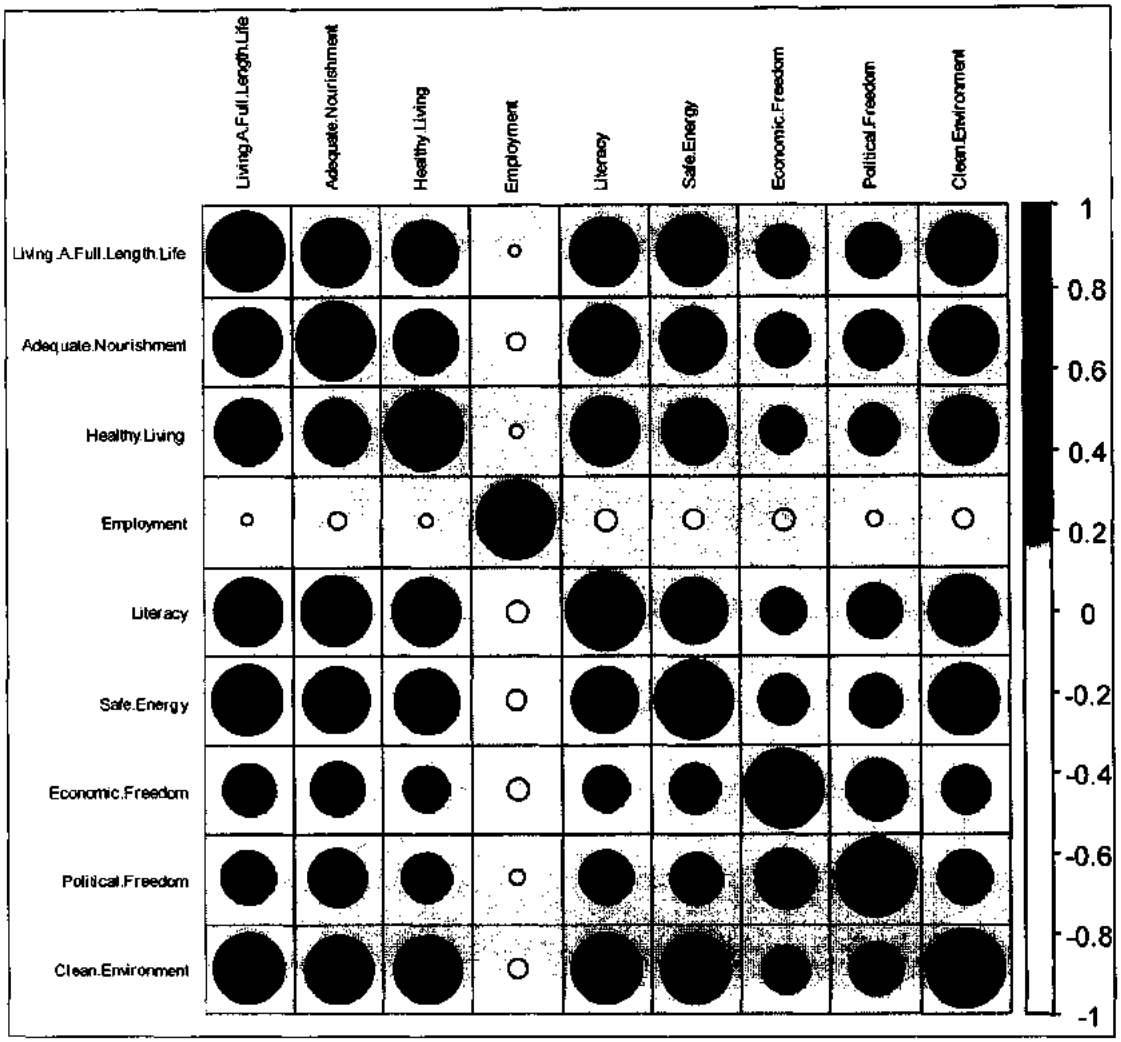

Figure 7: Pearson correlation matrix of dimensions of deprivation in the period 1990-2000

Note: The author has used the idea of Diane J. Cook for this presentation. The correlation plot is created in "corrplot" package written in R language by Taiyun Wei.

As regards the weighting strategy in our analysis, it is fundamentally pragmatic because there is no theory to guide us about the right weights. Sen (1999) says there is no "wonderful formula that would simply give us ready-made weights that are "just right"' (Sen A. K., 1999)". To be constrained in the absence of a theory is not reasonable because weights as a tradeoff are important part of our life and are central to any conceivable comparative decision-making process. Sen suggests that in the absence of a theory to guide us about the right weights, public discussion and scrutiny is expected to give us a weighting strategy that approximates the ideal of "just right". There is a "strong methodological case for emphasizing the need to assign explicitly evaluative weights to different components of quality of life (or of well-being) and then to place the chosen weights for open public discussion and critical scrutiny" (Sen A. K., 1999). In this respect, our weighting strategy is just one among the infinite number of other weighting strategies. Our weighting strategy may also be considered as a the part of exercise to present proposed weights for open discussion, and is therefore open to revision.

3.4 EXTENDING CAPABILITY SPACE FROM INDIVIDUAL TO COUNTRY LEVEL ANALYSIS

Even if Amartya Sen's capability approach is essentially about the freedom of the individual to enjoy the valuable "doings" and "beings", Sen has been instrumental in developing Human Poverty Index which measures the poverty at the national level based on certain indicators of capability deprivation (Alkire, 2005). Similarly Human Development Index which also measures human development at the country level is based on

various capabilities (A. Sen, 2004). How can the capability approach in which the unit of analysis is individual can be extended to the country level analysis has perhaps no clear answer in Sen's writings. However, a few points indirectly explain the transition from individual to country level.

Even if capability approach is concerned about individuals and is a normatively individualistic theory as such, it is not ontologically individualistic in that it does not assume atomistic individuals nor does it assume that functionings and capabilities are independent of the concern for others. As an ontologically non-individualistic theory, it admits the role of social relations and interdependence between community members(Robeyns, 2003). In the Idea of Justice, Sen expands the evaluation space of wellbeing to social groups: "There is indeed no particular analytical reason why group capabilities must be excluded a priori from the discourse on justice and injustice... In valuing a person's ability to take part in the life of society, there is an implicit valuation of the life of the society itself, and that is an important enough aspect of the capability perspective." (A. K. Sen, 2009, p. 246). In this respect, society must be conceived of as the person and the person must be conceived of as the society (Douglas & Ney, 1999).

Sen's work on capability is rooted in his earlier work on social choice theory and inequality and draws heavily on the social choice theory of Arrow (2012) which deals with a procedure to move from a set of preference orderings for individuals in the society to one overall preference ordering for society (See Amartya, 1979). Sen discusses interpersonal

comparisons of welfare in Collective Choice and Social Welfare and On Economic Inequality which are akin to the work of Harsanyi (1976). Harsanyi assumed a "similarity postulate" which held that if the idiosyncratic differences among people were removed, all of us would have the same "extended preferences." (Harsanyi, 1977). Harsanyi (1995) later developed a list of "basic desires" which was similar in important ways to the lists developed by Griffin (1996) and Nussbaum (1995). However Sen himself stopped short of developing his own list because of his concern that such a list might be over-specified (A. Sen & Nussbaum, 1993) The common strand in the lists is that all of them seek to offer a concept of wellbeing which is supposedly shared by all human beings (Qizilbash, 2007). Once a broad consensus has developed over the list of capabilities, it seems reasonable to extend the individual concept to the larger social groups and even countries.

3.5 MODEL

The most important issue in the construction of a composite index relates to the assignment of weights to the individual components in the process of aggregating the information (Scott, 2004). Among the possible weighting strategies, two versions of arithmetic mean (simple non-weighted means and weighted mean) are most often used. The simple non-weighted mean implicitly makes a very strong but theoretically untenable assumption about the perfect substitutability between dimensions for examples as divergent as adequate nourishment and right to protest against a government policy. UNDP's very influential Human Development Index uses this flawed approach. The

weighted mean approach is however theoretically more consistent in assuming that substitutability between different components is not perfect but weights remain arbitrary. A power mean of order greater than one is another weighting strategy which achieves imperfect substitutability by placing 'greater weight on those dimensions in which deprivation is larger' (Anand & Sen, 1997). UNDPs Human Poverty Index uses this approach but it suffers from a fundamental weakness as it places equally greater weights on larger deprivations of two different dimensions without making a distinction in the relative importance of those dimensions. For example, 0% illiteracy and 100% probability of not surviving to age 40 will get equal weight in the computation of HPI as 100% illiteracy and 0% probability of not surviving to age 40.

Realizing the impossibility of the existence of 'some wonderful formula that would simply give us ready-made weights that are "just right"' (Sen, 1999), our problem then becomes one of balancing the risks between choosing an arbitrary but theoretically consistent weighting strategy and theoretically inconsistent and even more arbitrary equal weighting strategy. Sen believes that there is a 'strong methodological case for emphasizing the need to assign explicitly evaluative weights to different components of quality of life (or of well-being) and then to place the chosen weights for open public discussion and critical scrutiny' (Sen, 1999).

In the construction of composite indices, assigning weights has proved the most controversial and a major sticking point especially because no theory exists to guide us about the right weights. Even if all the weights are somewhat arbitrary, does it mean that we should not use the weights. In fact, weights are assigned all the times without being made explicit. In any budget, earmarking of funds to achieve multiple policy objectives is

equivalent to assigning weights. Ultimately, the weights must be chosen to arrive at a decision. In the monetary measures of poverty, prices are used as value judgments, but in multidimensional indices such as HDI, HPI and MPI, weights are used instead. The only question is whether this is done implicitly (hiding the value judgments) or explicitly. However, one advantage of making the setting of the weights explicit might trigger a valuable democratic debate. Sen however sees the assigning of weight as strength not an embarrassment and believes that a "strong methodological case for emphasizing the need to assign explicitly evaluative weights to different components of quality of life (or of well-being) and then to place the chosen weights for open public discussion and critical scrutiny" (Sen A. K., 1999). It has been argued that setting even initially arbitrary weights on deprivations should be viewed as the start of a public debate on what weights are appropriate (Alkire & Foster, 2011). It is hoped that after repeated hits and trials, some such weighting formula might become available on which a broad consensus might develop.

Whether equal weights or unequal weights are more arbitrary is another sticking point. As suggested earlier, any conceivable weighting strategy is arbitrary, but recently a growing body of literature sees equal weights as a particularly arbitrary weighting strategy. See for example (Cahill & Sánchez, 2001; De Muro, Mazziotta, & Pareto, 2011; Duclos, Sahn, & Younger, 2006; Nolan, 2002; Pontines & Siregar, 2008; Ram, 1982; Ravallion, 1998). Human Poverty Index realized the arbitrariness of the equal weights and used the power mean of order three to achieve imperfect substitutability and supposedly non arbitrary weights. Power mean was justified on the ground that it 'places greater weight on those dimensions in which deprivation is larger.' (Anand & Sen, 1997). It is for the

circumventing the unsavory position of assigning unequal arbitrarily to scores of indicators on which no consensus is expected to develop.

As noted in previous section, we have proposed nine broad categories of wellbeing. In drawing up a list of nine dimensions of wellbeing, our objective is to initiate a debate aimed at developing an international consensus on what constitutes the core of poverty and what indicators best reflect them. We collected data for 193 economies of the world and identified certain indicators to measure those broad categories.

We first calculate the arithmetic mean of all dimensions for all countries. The n x m matrix **M** refers to the averages of the indicators $I_{i,j}$ associated with individual dimensions D_n for j countries.

$$\boldsymbol{M} = \begin{bmatrix} \left(\frac{\sum i \in S_1 I_{i,1}^{D_1}}{S_1}\right) & \left(\frac{\sum i \in S_1 I_{i,2}^{D_1}}{S_1}\right) & \cdots & \left(\frac{\sum i \in S_1 I_{i,193}^{D_1}}{S_1}\right) \\ \left(\frac{\sum i \in S_2 I_{i,1}^{D_2}}{S_2}\right) & \left(\frac{\sum i \in S_2 I_{i,2}^{D_2}}{S_2}\right) & \cdots & \left(\frac{\sum i \in S_2 I_{i,193}^{D_2}}{S_2}\right) \\ \vdots & \vdots & \ddots & \vdots \\ \left(\frac{\sum i \in S_9 I_{i,1}^{D_9}}{S_9}\right) & \left(\frac{\sum i \in S_9 I_{i,2}^{D_9}}{S_9}\right) & \cdots & \left(\frac{\sum i \in S_9 I_{i,193}^{D_9}}{S_9}\right) \end{bmatrix}$$

$\frac{\sum i \in S_n I_{i,j}^{Dn}}{S_n}$ is the sum of all the indicators I_i associated with the dimension D_n for the country j, divided by S_n which is the set of the number of indicators associated with dimension n. M can be further simplified as $\mu_{n,j}$ which is the mean of all the indicators of the dimension n for the country j.

$$\mathrm{M} = \begin{bmatrix} \mu_{1,1} & \mu_{1,2} & \cdots & \mu_{1,193} \\ \mu_{2,1} & \mu_{2,2} & \cdots & \mu_{2,193} \\ \vdots & \vdots & \ddots & \vdots \\ \mu_{9,1} & \mu_{9,2} & \cdots & \mu_{9,193} \end{bmatrix}$$

We have used simple average instead of population weighted average because taking an average of percentages and using population weighted average have a difference only in the scale. (See Appendix D for further details)

Additionally, the reliability of the averaging process calls for certain explanations before we move to the stage of assigning explicit weights to the averages of these nine dimensions. We have two kinds of indicators in our analysis. First type is expressed as ratios and the second type includes raw numbers ('relative' indicators) such as economic freedom index scores which we have normalized using the formula $(x_i/\max[x_{S1}.x_{S2}])$ which is in fact the deprivation level of a country on a given indicator relative to the highest deprivation level in the world or conversely the achievement level of a country on some indicator relative to the highest achievement level in the world. The rationale behind simultaneously using apparently two dissimilar types of indicators and implicitly treating them as similar is that we are not measuring headcount poverty. We are developing a composite index to make an inter-temporal comparison of international poverty using indicators related to a wide range of dimensions the deprivation of which has a bearing on human wellbeing. In addition, in the 65 indicators that we included in our analysis, there are only six relative indicators. Any unusual values of these indicators therefore may have only a limited impact on the results.

But what should be the magnitude of the weight is the most crucial question. Theoretically there is one extreme option for assigning weight to the $n\text{-}1^{th}$ dimension relative to the n^{th} dimension. We take the example of two countries j and k which have equal deprivation level in dimension $n\text{-}1$ but unequal deprivation level in dimension n. If so much weight is assigned to $n\text{-}1^{th}$dimension relative to the n^{th} dimension that country j

cannot improve its ranking relative to country k without reducing its deprivation in dimension n-1 relative to k even if it reduces deprivation in dimension n up to zero level. This option should clearly not be acceptable as in this case the inclusion of the n-1^{th}dimension in the analysis will make n^{th} dimension redundant and will reduce a composite measure to a unidimensional one.

However, it is important that the extent of the incidence of deprivation should not be lost sight of while giving a higher weight to a more important dimension. Hunger, as discussed in the previous example, is a far more serious problem than denial of the right to protest against some unpopular political decision. If however the political repression and denial of political rights is rampant in some country which does not suffer from a serious problem of hunger, a drastic curtailment of political rights must be adequately reflected in a proper measurement of wellbeing. That is, weights to a relatively more important dimension should be so assigned that the higher incidence of a deprivation in relatively less important dimension is not swamped. The advantage of relating *severity* of deprivation to the *incidence* of deprivation is that seriousness arising out of higher incidence of a deprivation is reflected in the index despite the fact that the more severe deprivation is given higher weight. Severity of the deprivation refers to the magnitude of the loss of wellbeing caused by the deprivation, while incidence of the deprivation refers to the percentage of the population deprived in some dimension of wellbeing.

So we propose to assign to dimension n-1 just enough weight that its 1^{st} quartile $\theta_1(\mu_i)$ equals the 3^{rd} quartile $\theta_3(\mu_i)$of the i^{th} dimension.

$\mathbf{Q}(\theta_i)$ is a 9 x 1 vector of the ratios of the third and first quartiles of pairs of succeeding dimensions.

$$\mathbf{Q}(\theta_i) = \begin{pmatrix} \theta_1 \\ \theta_2 \\ \vdots \\ \theta_8 \\ \theta_9 \end{pmatrix}$$

where

$$\theta_i = \frac{\theta_3(\mu_{i+1,j})}{\theta_1(\mu_{i,j})} \text{ for all } i = \{1, \dots, n-1\} \text{ and } \theta_n = 1.$$

As we have to make sure that a dimension θ_i gets sufficient weight so that its first quartile equals the third quartile of the dimension θ_{i+1}, we need to attach to the dimension θ_i the weight equal to the product of θ_{i+1}, θ_{i+2} ... θ_n.

$$\omega_i = \prod_{i=i}^{n} \theta_i \textit{ for all } i = \{1, \dots, n\} \textit{ and } \omega_n = 1.$$

Note that we assign no weight to the 9th dimension, $\theta_9 = \omega_9 = 1$. Ω is the 9 x 1 vector of ω_i which takes the product of the quartile ratios to compute the weights. The ω_9 in the following vector represents no weight while the ω_1 represents the highest weight.

$$\boldsymbol{\Omega} = \begin{pmatrix} \omega_1 \\ \omega_2 \\ \vdots \\ \omega_9 \end{pmatrix}$$

The 9 x 1 column vector $\boldsymbol{\Omega}$ thus representsthe weights to be attached to the *9* x *193* matrix **M**. We create a *9* x *9* diagonal matrix **D** from the *9* x *1* column vector ω_i (entries of $\boldsymbol{\Omega}$ are on the main diagonal (↘) and the entries off the main diagonal are all zero) and multiply it with *9* x *193* matrix **M** to get a 9 x 193 matrix $\boldsymbol{\Psi}$. Finally we get 1 x 193 row vector $\boldsymbol{\Gamma}$ by summing the 9 x 193 matrix $\boldsymbol{\Psi}$.

$$\Psi = D \cdot M$$

$$\Gamma = \sum_{i=1}^{9} \Psi_{i,j}$$

It must be noted however that we do not assign different weights to the data for the second period 2001-2010 because thus assigning weights based on data in the succeeding period will make an inter-temporal comparison impossible. If we add the data for the third period, say 2010-2020, and assign it the weights which were computed for the period 1990-2000, what we understand is that we will just have to normalize the computed values for 2010-2020 relative to the minimum and maximum value for the period 1990-2000 without any need to rescaling the composite values.

Realizing the difficulties in measuring poverty absolutely, we choose to measure poverty relatively but the fundamental question is relative to what. There are two extreme choices relative to which poverty can be measured. *i*) a hypothetical situation where there is no deprivation at all (no disease, no hunger, no illiteracy, and no death) and ii) a hypothetical situation where there is complete deprivation (no food, no literacy and no one living!). But as it is obvious that these two extremes are no real life cases we have to choose some realistic benchmark. An obvious choice is to consider the country with the highest deprivation score in the index as 100% poor and the country with the least deprivation score as 0% poor.

Even if the numbers presented here do not have a cardinal meaning especially because we are not measuring the headcount poverty, the numbers here represent the level of poverty conceived as the functioning failure and expressed in relation to two extreme cases. One can consider the HPI methodology which also give values without much cardinal

value, but HPI values are routinely interpreted in the literature as something approximating headcount poverty. See for example (Arimah, 2004; Collicelli & Valerii, 2000; Fukuda-Parr, 1999; Khayum, 2003)

Such a weighting scheme may not make much such sense at the level of an individual but at an aggregate level, this weighting scheme makes a definite sense. An individual may never hold back the resources needed to transport her bleeding child to a nearby health facility for a wholesome meal at lunch. But at an aggregate level, some members of a society may direct resources to adequate nourishment but at the same time allowing some members to starve. Similarly, an individual may not like to starve by channeling her income to dental care, but a society may direct sufficient resources to pay for dental care while allowing some of its members to starve at the same time. So θ is in this respect a coefficient of social empathy. We do not make the pretense here that this is the best way of assigning weights to different dimensions but this is perhaps a better reflection of the real world where individuals do not assign equal weight to different dimensions of wellbeing nor the distinction between different dimensions of wellbeing is blurred to the extent that avoiding illiteracy and hunger becomes an interchangeable preference. We do not deny a possible instrumental role of literacy in ending hunger, but we however stress that the right to go to school will bring no satisfaction to empty stomachs. Individuals in real world have unique preferences but, at the aggregate level, the preferences overlap. We can only make a value judgment based on what most of the individuals in a society are generally expected to behave.

CHAPTER 4

DATA

In this chapter, the sources of data, issues related to missing values, manipulation of data for inter-temporal comparison and standardization of data representing achievement and deprivation concepts to make it amenable for a deprivation measure are discussed.

4.1 SOURCES OF DATA FOR INDICATORS ASSOCIATED WITH DIMENSIONS OF FUNCTIONING POVERTY

Ideally data on all indicators should have been available for the same year for both the periods for a reliable cross-country comparison, but this was impossible because various international bodies undertake surveys according to the time of their own choice. As we are making an inter-temporal analysis of poverty, we reserved the data available in any year for the period between 1990 and 2000 for initial period and data available in any year in the period between 2000 and 2010 was reserved for subsequent period. When data was available for multiple years in a decade, we took a simple average of it rather than taking the most recent data for the simple reason that means are more stable and give a more accurate picture of the performance of a country over a period of a decade.

It may be noted here that ideally the data on various indicators of poverty should have been used from the same year for all the countries for a reliable comparison among all the 183 countries under present study. But practically, the surveys which are available from

different countries may not necessarily be performed in the same year. Even the surveys covering certain aspect of poverty such as iodine deficiency are not conducted in the same year for all the countries.

In what follows, we briefly discuss the sources of information for the dimensions of wellbeing used in our study and their corresponding indicators besides the authoritative definition of the indicator where applicable and caveats regarding the possible problems in the collection, aggregation, interpretation or the comparability of the data.

4.1.1 Living a life of normal length

4.1.1.1 Life expectancy at birth (years)

Life expectancy at birth reflects the overall mortality level of a population consisting of all age groups - children and adolescents, adults and the elderly. WHO computes life expectancy at birth from the period life table. Life table is constructed from age-specific mortality rates extracted from the record of civil registration of the number of deaths in a given year. If the data on age-specific morality rates is not available, under-5 mortality rates and adult mortality rates from household surveys and population censuses are used. It may however be noted that there may be minor differences between the official life tables of the individual member countries and the life tables which WHO constructs by using modified logit system (WHO, 2009).

4.1.1.2 Adult mortality rate (probability of dying between 15 to 60 years per 1000 population)

"Adult mortality rate is the probability of dying between the age of 15 and 60 per 1000 population per year among a hypothetical cohort of 100000 people that would experience the age-specific mortality rate for the reporting years." (WHO, 2009) As the transition in the disease and mortality patterns in the developing countries following an increase in the disease burden from non-communicable diseases is becoming evident, adult mortality rate is becoming more and more precise indicator of the overall mortality patter of the population. Data for this indicator is obtained from the records of civil or sample registration, censuses or surveys which is usually available every 3 or 4 years and a curve is fitted on the available data points to obtain projections for the current years. In view of the limited availability of data in the surveys and censuses, the use of retrospective methods to make projections may lead to considerable measurement errors (WHO, 2009).

4.1.1.3 Infant mortality rate (probability of dying between birth and age 1 per 1000 live births)

"Infant mortality rate is the probability of a child born in a specific year or period dying before reaching the age of one, if subject to age-specific mortality rates of that period." (WHO, 2009) Besides child survival, infant mortality rate also reflects the economic, social and environmental conditions of the children besides the quality of health service being provided to them. WHO computes IMR from the rate of civil registration in the developed countries. For the countries where only survey data is available, WHO derives IMR from

4.1.2 Adequate nourishment

4.1.2.1 Stunting, wasting and underweight

Though under-nutrition can occur in childhood in a variety of ways, the most obvious choice in making an assessment of child's nutrition status is the measurement of height and weight. Height is considered to be a sensitive indicator of acute nutritional deficiencies in a child whereas weight is a sensitive indicator of chronic nutritional deficiencies and infections. Usually three measures care used to measure the adequacy or otherwise of nourishment which are stunting (being too short for one's age), wasting (being too much low weight for one's height) and underweight (having too much low weight for one's age) (WHO, 2009).

The World Health organization (WHO) Global Database on Child Growth and Malnutrition collects data from selected population-based surveys such as DHS, MICS, and other national household surveys to measure the prevalence of stunting, wasting and underweight using z-scores based on reference population as defined by NCHS/WHO. A child is stunted, wasted or underweight if she is less than minus two SDs from the WHO Child Growth Standards median. However there is an alternative finer distinction in case of wasting in which a child is moderately wasted if she is between minus two and minus three SDs from the WHO Child Growth Standards median and severely wasted if she is below minus three SDs from the WHO Child Growth Standards median (WHO, 2009).

Stunting and wasting are different aspects of a complex problem of under nutrition and infections which could hinder child's growth potential even before birth, so both of them,

put together, seem to be a "composite indicator that is difficult to interpret. " Raw data is checked for validity and consistency to ensure comparability but in view of the limited availability of national nutrition surveys and changing international standards to measure prevalence various aspects of under-nutrition, the interpretation and comparability of data over time may be problematic (WHO, 2009).

4.1.2.2 Anaemia prevalence

Data on the prevalence of anaemia among pre-school children (0-4. 99 years), pregnant women (no age range defined) and non-pregnant women (15-49. 99 years) is based on WHO Global Database on Anaemia which is a part of the Vitamin and Mineral Nutrition Information System (VMNIS) and is collected form WHO regional and country offices, UN organizations such as UNICEF, ministries of health, NGOs, academic research findings , Medline regional database, articles in non-indexed medical and professional journals. Only those surveys were used which measure Hb in capillaries, venous or cord blood using quantitative photometric methods or automated cell counters and also reported anemia prevalence or mean Hb concentrations (WHO, 2009).

The fact that data has been collected at different administrative levels besides lack of data availability in the worst affected areas and data availability only once in 13 years from 1993-2005 in most of the countries have made cross-country comparison overtime difficult.

the projection of under-5 mortality rates using Coale-Demeney model life tables. In view of the absence of civil registration in developing countries, DHS and MICS are extensively used but they suffer from 'survivor's selection bias and age truncation (WHO, 2009).

4.1.1.4 Under-5 mortality rate (probability of dying by age 5 per 1000 live births)

"The probability of a child born in a specific year or period dying before reaching the age of five, if subject to age-specific mortality rates of that period. " (WHO, 2009)

In countries where civil registry does not contain data on an annual basis, estimate for current year are based on projections from data points which are usually 3-4 years old. Where civil registration is not complete, nationally representative data from household surveys such as DHS and MICS or censuses are used to estimate the level of under-5 mortality rate. The trend of under-5 mortality is estimated by fitting a curve to the available data points (WHO, 2009).

Estimates from household surveys may be affected by non-sampling errors, survivor selection bias, age truncation and heaping of death at age 12 months (transferring death across one-year boundary may underestimate the infant mortality rates) (WHO, 2009).

4.1.2.3 Low Birth-Weight Babies

The birth of low birth-weight babies is a measure of long-term maternal malnutrition, illness and inadequate health care during pregnancy and may also reflect on mother's socioeconomic status. A baby is defined to be of low birth-weight if she weighs less than 2500 g irrespective of the length of gestational period (WHO, 2009).

The data on the low birth-weight newborns has been collected from a variety of sources including nationally representative international surveys such as DHS, MICS, regional and country WHO offices, national ministries, surveys and censuses (WHO, 2009).

As a significant percentage of newborns are not weighed and their weight is inferred subsequently from mothers' "subjective assessments", the accuracy of the indicator may not be ensured (WHO, 2009).

4.1.2.4 Iodine Insufficiency

Data on the iodine insufficiency, measured by urinary iodine (UI) and total goiter prevalence (TGP), is collected by WHO Global database on Iodine Deficiency from a number sources including WHO regional and country officer, UNO, various NGOs beside a thorough systematic search of MEDLINE and Regional databases (African Index. Medicus, Index Medicus for the WHO Eastern Mediterranean Region, Latin American and Caribbean Center on. Health Sciences Information, Pan American Health Organization Library Institutional Memory Database, Index. Medicus for South-East Asia Region) and

other non-indexed medical and professional journals (Benoist, Andersson, Egli, Takkouche, & Allen, 2004) .

In order to ensure maximum possible comparability, data was obtained from only those surveys which conformed to standard UI and TGP measurement techniques and the surveys which measured TGP by palpation only. In view of the fact that there are no international reference values for thyroid size, data was not collected from a number of surveys of good quality because they used ultrasonography technique to measure TGP (Benoist, Andersson, Egli, Takkouche, & Allen, 2004).

However, despite the best efforts to compile data of good quality, the fact remains that data has been collected from diverse sources and in most of the countries only once in 11 years from 1993 to 2003 which may make cross-country comparability over time difficult. [18]

4.1.2.5 Vitamin A Deficiency

Data on the above variable is available in WHO Global Database on Vitamin A Deficiency which is a part of the Vitamin and Mineral Nutrition Information. System (VMNIS) and is collected by. a number of sources including WHO regional and country officer, UNO, various NGOs beside a thorough systematic search of MEDLINE and Regional databases (African Index. Medicus, Index Medicus for the WHO Eastern Mediterranean Region, Latin American and Caribbean Center on. Health Sciences

[18] Benoist, B. d. , Andersson, M. , Egli, I. , Takkouche, B. , & Allen, H. (2004). *Iodine status worldwide WHO Global Database on Iodine Deficiency.* Department of Nutrition for Health and Development, World Health Organization, Geneva.

Information, Pan American Health Organization Library Institutional Memory Database, Index. Medicus for South-East Asia Region) and other non-indexed medical and professional journals (WHO, Global prevalence of vitamin A deficiency in populations at risk 1995–2005. WHO Global Database on Vitamin A Deficiency, 2009).

Only those surveys were included in the database which measured serum or plasma retinol levels in capillary, venous or umbilical cord blood. The surveys that measured VAD used a number of parameters including "the prevalence of current night blindness (XN), history of maternal night blindness during a previous, pregnancy (pXN), conjunctival xerosis (X1A), Bitot's spot (X1B), corneal xerosis (X2), corneal ulceration/keratomalacia affecting <1/3 of the corneal surface (X3A) or ≥1/3 of the corneal surface (X3B), or corneal scarring (XS)." (WHO, Global prevalence of vitamin A deficiency in populations at risk 1995–2005: WHO Global Database on Vitamin A Deficiency, 2009) [19]

All countries whose GDP is greater than US $ 15000 were considered free from VAD whose degree of seriousness could pose public health problem. Data was included for only pre-school children (less than 5 years of age), pregnant women (all ages and trimesters). (WHO, Global prevalence of vitamin A deficiency in populations at risk 1995–2005: WHO Global Database on Vitamin A Deficiency, 2009)

Limited availability of data and where data was not available, use of regression analysis to derive estimates which could explain only 13–46% of the variation in VAD prevalence among countries with survey data and assorted methodological quality in the available surveys will put to question the issue of accuracy and comparability. Additionally the

[19] (2009). *Global prevalence of vitamin A deficiency in populations at risk 1995–2005. WHO Global Database on Vitamin A Deficiency.* Geneva, World Health Organization.

failure to adjust data on night blindness to day time visual problems may lead to an overestimation of the problem of VAD.

4.1.2.6 Population Undernourishment

As the problem of undernourishment may result from the deprivation of food or malnutrition arising, in turn, out of certain other factors such as infections, the level of health care available or environmental degradation, we have used the population undernourishment indicator estimated by FAO because it takes into account both these factors. FAO considers an individual malnourished if her food is less than minimum level of dietary energy requirements and also estimates the level of undernourishment in the world based on three parameters: average per capita food availability, inequality of access to that food and minimum calories required for average person. FAO measure suffers from certain problems such as uncertain reliability of data, discrepancies between the global and national figures and variability in the definitions used by the national household surveys. (FAO, 2008)

4.1.3 Healthy living

Though most of the indicators associated with the dimension of healthy living are available only for 2000-2007 periods, we have chosen to include the indicators in both the periods. This anomaly is not without reason. Since the overriding concern of our research is the measurement of poverty in country *i* relative to the most deprived nation in the world,

excluding such important indicators will not give us as vivid picture of relative poverty as inclusion of such variables would otherwise do. Given the fact that overall poverty has decreased over the period of a decade, inclusion of the same set of indicators in two periods will overestimate poverty. Given the choice between more precise cross-country comparison and more precise inter-temporal comparison, we choose the former because the main thrust of our argument is a cross-country comparison. Additionally, when more data becomes available for more periods, inclusion of these indicators in different periods will solve this problem.

4.1.3.1 Antenatal Care Coverage

The percentage of women between 15 and 49 years of age with live births who received antenatal care from a. skilled health personnel (doctor, nurse or a midwife) at least once during pregnancy. Antenatal care is expected to ensure interventions vital to the health of pregnant woman and her infant (WHO, 2009).

Household surveys such as DHS, MICS, Fertility and Family Surveys (FFS), Reproductive Health Surveys (RHS) and others contain information regarding the frequency of the checkup of pregnant women by skilled health personnel (WHO, 2009).

Even if WHO is quite specific about the nature of interventions at times of antenatal care visit, there is no guarantee that this important MDG indicator captures all the components of care because household survey does not collect data on the provider of the care in case of at least four antenatal care visits (WHO, 2009).

There are a number of sources which cause bias in the data. Recall error is one such reason for the bias in the data. The lack of a standardized definition of the skilled health personnel may cause a difference in the national and global estimates (WHO, 2009).

4.1.3.2 Births Attended By Skilled Health Personnel

In view of the role of skilled health care during pregnancy and at the time of birth in preventing, detecting and managing complications, assistance by skilled health personnel with proper equipment during the time of birth has been recognized as an important indicator of MDGs (WHO, 2009).

The household surveys such as DHS, MICS, and RHS contain information regarding the nature of assistance reaching the respondent during delivery for a period up to 5 years before the interview (WHO, 2009).

Here again the sources of bias in the data are recall error, lack of standardized definition of skilled health personnel and facility data where no survey is possible which might overestimate the proportion of deliveries attended by skilled professional because the exact number of all the women who deliver outside the facility may not be known (WHO, 2009).

4.1.3.3 Children Aged 5 Years Sleeping Under Insecticide-Treated Nets

This indicator listed as MDG under Goal 6 and also identified by WHO as main intervention to combat malarial disease estimates the percentage of children less than 5

years of age in malaria endemic areas who slept under insecticide-treated nets the previous night (WHO, 2009).

The data is derived from household surveys such as MICS, DHS and MIS and is reviewed in collaboration with Roll Back Malaria (RBM) partnership launched by WHO, UNICEF, WB and UNDP (WHO, 2009).

Seasonal fluctuations in vector and parasite prevalence in endemic areas may not be adequately reflected in the data because the data collection timing may not coincide with the seasonal fluctuations (WHO, 2009).

The effectiveness of insecticide-treated nets is considerably reduced if the nets are washed out but this information is not recorded in standard survey instruments (WHO, 2009).

4.1.3.4 Children Aged 5 Years with ARI Symptoms Taken To Facility

Given that about 20% of all deaths of children less than 5 years of age are attributed to acute respiratory infections (ARI), the proportion of children taken to appropriate health care provider is a key indicator designed to reflect the coverage of intervention and is listed as one of MDG indicator (WHO, 2009).

The information regarding this indicator is contained in DHS and MICS. The recall bias and seasonal fluctuations in the prevalence of ARI may however affect the results and make an international comparison of the data difficult (WHO, 2009).

4.1.3.5 Children Aged 5 Years with Diarrhoea Receiving ORT

This indicator relates to the proportion of children under 5 years of ages who suffered from diarrhea and were administered oral rehydration therapy (ORT). In view of the death of about 1. 8 million children worldwide because of diarrheal diseases, monitoring this cost-effective intervention is crucial for child survival (WHO, 2009).

The child health indictors have been discussed in the UNICEF/WHO Meeting on Child Survival Survey-based Indicators and the treatment interventions have been outlined in the Lancet series. The information regarding children health indictors have been contained in DHS and MICS household surveys (WHO, 2009).

Here again the recall bias and seasonal fluctuation in the prevalence of ARI may however affect the results and make international comparison of the data difficult (WHO, 2009).

4.1.3.6 Children Aged 5 Years with Fever Who Received Treatment with Any Antimalarial Medicine

Treatment of children under 5 years of age suffering from malaria in endemic areas with effective antimalarial drugs is a crucial intervention to contain child mortality. It is also an MDG indicator and is also recognized by WHO, UNICEF and WB as a key intervention to combat the scourge of malaria in Africa (WHO, 2009).

The information regarding this indicator has been extracted from nationally representative household surveys such as DHS, MICS and Malaria Indicator Surveys (MIS) (WHO, 2009).

The accuracy of the data may vary because the indicator reports on all kinds of anti-malarial medicine disregarding the ineffectiveness of certain medicines because of resistance developed against them (WHO, 2009).

4.1.3.7 Children Aged 6-59 Months Who Received Vitamin A Supplementation

In view of the critical role of Vitamin in the survival of children under five years of age, the administration of Vitamin A within last 6 months has become a key indicator of intervention towards child survival in the context of MDGs (WHO, 2009).

The information regarding this indicator has been recorded in nationally representative household surveys such as DHS and MICS. The accuracy of the data however may vary because of recall bias and difference between household surveys data and data collected on National Immunization Days (WHO, 2009).

4.1.3.8 Health Workforce

How much health workforce is just sufficient to satisfy tee healthcare needs of a given population is a question not amenable to any easy answer but low density of health care personnel generally suggests that the healthcare needs of certain segments of a given population remain unmet. Even if there is no right number of health personnel which could be just sufficient to meet the health care needs of a given population, it has been estimated in World Health Report 2006 that for every 10000 individuals, fewer than 23 physicians,

nurses and midwives cannot adequately meet the needs for primary interventions as listed in MDGs (WHO, 2009).

Labor force and employment surveys, population censuses, routine administration information system and health facility assessments are some of the source from which WHO extracts data on the density of healthcare workforce including "dentistry personnel density (per 10000 population)", "nursing and midwifery personnel density (per 10000 population)", "other health service providers density (per 10000 population)" and "physicians density (per 10000 population)" (WHO, 2009).

Some of the probable sources of imprecision in the data may be the inability to distinguish whether health personnel are in private or public sector, double count of health personnel working in different locations and the presence of unregulated individuals in the health workforce (WHO, 2009).

4.1.3.9 Hospital Beds (Per 10000 Population)

The information about the hospital beds is contained in World Development Indicators database. The hospital beds indicator refers to "inpatient beds available in public, private, general, and specialized hospitals and rehabilitation centres. In most cases beds for both acute and chronic care are included" (WHO, 2009).

4.1.3.10 Immunization Coverage

As immunization is an important part in the fight against under-5 mortality, it is considered to be a robust indicator of the performance of health system. In what follows, we will present the definition of the indicators related to immunization coverage which we have included in our study, sources of the data and possible issues in the data collection and interpretation (WHO, 2009).

Immunization coverage among 1-year-olds DTP3 measures the percentage of children aged between 12-23 months who have been administered a combined dose of diphtheria, tetanus toxoid and pertussis three times in a year. Immunization coverage among 1-year-olds HepB3 measures the percentage of one-year-old children who have been given three doses of hepatitis B vaccine in a year. Immunization coverage among 1-year-olds (%) Hib3 measures the percentage of one-year-old children who have been given three doses of Haemophilus influenza type B vaccine in a year. Immunization coverage among 1-year-olds reflects the percentage of one-year-old children who have been immunized against measles. The indicator "neonates protected at birth against neonatal tetanus" estimates the percentage of neonates protected at birth against neonatal tetanus from United Nations Population Division's World Population Prospects but the information is based only on the protection provided through tetanus - toxoid immunization and not on clean deliveries (WHO, 2009).

The principal sources of the data for these indicators are the reports of service providers such as district health centers, vaccination teams, physicians and the household surveys

such as Expanded Programme on Immunization (EPI) 30-cluster survey, the UNICEF MICS and DHS (WHO, 2009).

The subjective nature of estimates arising out of an arbitrary choice of rules, the failure to make uncertainty arising out of a heuristic choice and application of rules explicit and the limitation of data quality and availability and possible recourse to mathematical and econometric modeling make the cross country comparisons over time problematic (WHO, 2009).

4.1.3.11 Tuberculosis Treatment

4.1.3.11.1 Tuberculosis Treatment Success Under DOTS (%)

A successful treatment of infectious cases of TB is a robust measure of the performance of national TB control programmes because the prevention of further spread of the infection is critically dependent of successful treatment (WHO, 2009).

Tuberculosis treatment success under DOTS is an MDG indicator and the Stop TB Partnership, a TB treatment initiative of World Health Assembly of WHO, has set a target of diagnosing at least 70% of people with sputum smear-positive TB under DOTS strategy and cure at least 85% of these (WHO, 2009).

The member countries use WHO's standardized data collection form and report registered cases of TB and the treatment outcomes on an annual basis, the data is internationally comparable (WHO, 2009).

However there is a delay in the assessment of treatment outcomes because the treatment of TB lasts from 6 to 8 months (WHO, 2009).

4.1.3.11.2 Incidence Of Tuberculosis (Per 100000 Population)

The number of TB cases which arise in a given time period. The individuals suffering from both TB and HIV are also included in this category. The incidence of TB is a measure of the burden of TB in a population and can change because of changes in transmission (people getting infected with Mycobacteria tuberculosis) or changes in the rate at which people infected with Mycobacteria tuberculosis develop TB disease. Halting and reversing the "incidence, prevalence and death rates associated with TB" is also an MDG goal (WHO, 2009).

WHO produces estimates of TB which are based on routine surveillance data extracted from annual case notifications, surveys and death registry. However in countries where TB control programs are run with varying degrees of commitment, it becomes difficult to discern changes in the incidence of TB (WHO, 2009).

4.1.3.11.3 Prevalence Of Tuberculosis (Per 100000 Population)

Also called "point prevalence", the prevalence of TB measures the number of cases of all forms of TB including the cases of individuals suffering from both TB and HIV in a population at a given point in time (WHO, 2009).

The distinction between incidence and prevalence from the point of view of policy formulation lies in the fact that the effect of TB control programmes on incidence of TB is less rapid than prevalence because of the likelihood that those people will develop TB who have been infected many years before. The prevalence however responds promptly to an improvement in treatment leading to a reduction in the average duration of disease and a reduction in the probability of dying from diseases (WHO, 2009).

Conducting surveys on the prevalence of disease is costly and logistically complex but the information about bacteriologically confirmed TB cases can also highlight the interaction between the patients and the health systems (WHO, 2009).

4.1.3.11.4 Tuberculosis Detection Rate under DOTS (%)

The percentage of new smear-positive cases of TB detected under DOTS programmes in a given year. The sputum smear-positive cases reflect on the performance of the national TB programs because they are primary source of infection to others and increase the probability of higher rates of morbidity and mortality. WHO estimates the detection rate of new smear-positive cases in a given year based on the reports submitted by the DOTS programs of individual countries (WHO, 2009).

4.1.4 Employment

The information regarding unemployment in our study is drawn exclusively from the unemployment figures of International Labor Organization (ILO) which are based on a

number of sources including LABORSTA (its own statistical database) and its regional and country offices. ILO also collects data from various household or labor force surveys such as EUROSTAT's European Labor Force Survey (ELFS), monthly employment surveys and current employment reports (ILO, 2010).

As the information regarding unemployment is generally collected from national population censuses which are not frequently undertaken because of a number of logistic and economic issues, the information thus collected may not be quite up-to-date. However it may not be a serious problem because we are concerned with average performance of countries in two consecutive decades. The second problem regarding the comparability of data arises out of difference in the definition of unemployment and upper and lower boundaries of age groups being not uniformly demarcated (ILO, 2010).

4.1.5 Literacy

Illiteracy is defined as the "lack of the skills to read and write a simple sentence about everyday life" (UNESCO)[20] and conversely the ability to read and write a simple sentence about everyday life constitutes literacy. The data on the adult, youth and total illiteracy has been collected from UNESCO's Institute for Statistics (UIS) from national population censuses and national household surveys. The data on the percentage of primary school age children out of school is collected by UIS from the records of school register enrolment surveys or censuses in schools, population census or its own estimates. As a variety of

[20] (ILO, 2010)

sources have been used to gather information about illiteracy and population, a lot of variability and imprecision may result and may make cross-country comparison overtime problematic (ILO, 2010).

The ratio of girls to boys in primary and secondary education is an indicator which gives reflects the "progress towards gender parity in education participation and/or learning opportunities available for women in relation to those available to men" besides the level of "woman's empowerment." The data on the ratio of girls to boys in primary and secondary education is extracted from Gender Parity Index (GPI) developed by UIS. The formula used to construct GPI is $GPI_i^t = \frac{F_i^t}{M_i^t}$ where GPI_i^t measures gender parity in year t is and $F_i^t$is the percentage of girls in primary and secondary level in both public and private sector educational institutions in year t and. M_i^t is correspondingly the percentage of boys. A probable weakness in GPI is that it may be influenced by the positive or negative change in the performance of any gender group. [21]

4.1.6 Clean household energy

4.1.6.1 Access to Electricity (%)

This indicator is an estimate of the share of population which has access to electricity (both on-grid and off-grid). International Energy Agency's World Energy Outlook collects data on this indicator (WDI, 2006).

[21] UNESCO Institute of Statistic, Data Centre

4.1.6.2 Energy Use (Kg of Oil Equivalent Per Capita)

This indicator relates to the use of primary energy which can be used as a raw material for other end-use fuels and equals "indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport" (WDI, 2006). Data on this indicator has been collected by International Energy Agency and has been used as a proxy of an indicator

For want of a better indicator which could measure the degree of cleanliness of household energy use, we have used this indicator as a proxy for clean energy consumption by households. The choice of energy use indicator is based on the assumption that higher energy per capita consumption may be positively related with the use of energy sources which do not pose health hazards.

4.1.7 Economic Freedom

In order to make a cross-country comparison of economic freedom in the world over time, we have used the date contained in the Index of Economic Freedom jointly published by the Heritage Foundation and the Wall Street Journal.

Drawing on a comprehensive list of ten aspect of economic freedom including business freedom, trade freedom, fiscal freedom, government spending, monetary freedom, investment freedom, financial freedom, property rights, freedom from corruption and labor freedom, the Index produces an economic freedom score on a scale ranging from 0 to 100 where 0 represents complete business "unfreedom" and 100 representing perfect business

freedom. Each component of economic freedom is similarly graded using an identical scale ranging from 0 to 100 where 0 represent complete lack of freedom and 100 represent total freedom and then all ten components are averaged to get the final score. The Index ranks 183 economies of the world from 1995 to 2010 (Miller, et al., 2010).

The 2010 Index which we have used for the source of data for the subsequent period of our study (2001-2010) is based on data collected from July 2008 to June 2009. As the global financial crisis began to brew in the closing months of 2008, the subsequent phases of the global financial crisis during these years may not be reflected in the data. One result of this partial view is that the effects of the expansionary fiscal and monetary policies which the governments pursued to stimulate growth may take years to manifest themselves. Problems of data availability in some countries such as Afghanistan, Iraq, Liechtenstein, and Sudan and the inconsistency in the data available for crisis years in especially central Asian countries such as Azerbaijan, the Kyrgyz Republic and Uzbekistan and also Papua New Guinea may bias the results (Miller, et al., 2010).

4.1.8 Political freedom

For the dimension of political freedom, we used the finding of the Freedom in the World survey which is a flagship publication of Freedom House which evaluates the level of political freedom in the world on an annual basis. The survey collects information from a variety of sources including news stories, academic research, studies of various NGOs and think tanks, individual contacts and visits to the selects regions (Puddington, 2011).

The survey assigns ratings to political rights and civil rights based on a checklist of 10 political rights questions and 15 civil liberties questions. Each question is assigned a score on a scale ranging from 0 to 4 where 0 represent smallest and 4 highest degree of political freedom and civil liberties. The average score of political freedom and civil liberties gives a comprehensive picture of overall status of a country. A country which scores between 1 and 2. 5 is "Free", between 3 and 5 is "Partly Free" and between 5. 5 and 7, it is "Non-Free" (Puddington, 2011)

Political rights and civil liberties included in the survey are envisaged in the Universal Declaration of Human Rights. The problem with thus ignoring the differences in conceptualization of political rights and civil liberties based on cultural, ethnic and religious preferences is that there may be opposing views about freedom and liberties leading to inconsistency in the interpretation of the survey data.

4.1.9 Clean Environment

The WHO/UNICEF Joint Monitoring Programme for Water and Sanitation (JMP) collects data on drinking water supply and sanitation from national statistics offices, national censuses and a number of international household surveys like DHS, MICS, World Heath Surveys (WHS) and Living Standard Measurement Surveys (LSMS) (WHO, UNICEF, 2008). [22]

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[22] *Joint monitoring programme for water supply and sanitation* [online database]. Geneva, WHO, UNICEF, 2008 (http://www. wssinfo. org/en/welcome. html).

4.2 TREATMENT OF MISSING DATA

Unless otherwise indicated, we developed a rule for missing values. If some value for a country was missing, we took the simple average of the values of the countries grouped in a fine grained classification of WHO Member States of different UN regions and sub-regions (WHO, Iodine status worldwide: WHO Global Database on Iodine Deficiency, 2004) (See the tables of WHO Member States grouped by UN region and sub region as well as the World Bank's groupings of the countries according to the level of income in Appendix E). There were lot of difficulties in finding the data for the regions of Melanesia, Polynesia, Micronesia and Caribbean. When no data was available for some countries in WHO classified member states grouped by UN region and sub-region, we used World Bank categorization of the countries ranked with respect to the level of income (WDI, 2006).

4.3 TREATMENT OF DATA FOR INTER-TEMPORAL COMPARISON

For making an inter-temporal comparison of international poverty over a period of decade, we have chosen two time periods: 1990-2000 and 2001-2010. Our choice is largely constrained by limitations of data availability. Some indicators are available for some single year in a decade whereas other indicators are available for more than one year. Where data was available for multiple years in a decade, we took the simple average of the observations in order to take a long term view of the behavior of the indicators. Data on

some indicators, for example prevalence of night blindness in pregnant women (1995-2005), was collected only once between these two periods. So such indicators have been included in both the periods. Although this inclusion may bias the result against the hypothesis that poverty has reduced over the years, we consider such indicators important to include in our analysis because they provide vital information regarding the distribution of this deprivation across countries and regions.

To normalize a variable, we have abandoned the use of usual transformation function $(x_i - \min(x)/\max(x) - \min(x))$ which is extensively employed to change a raw variable into unit-free variable between 0 and 1 and have instead used the transformation function. $(x_i/\max[x_{S1} . x_{S2}])$ because it ensures inter-temporal comparability. Here x_{S1} denotes the series in the baseline period corresponding to years between 1990 and 2000 and x_{S2} is the same series in subsequent period corresponding to the years between 2001 and 2010. The maximum value of both the periods is the reference point against which a consistent inter-temporal comparison of the progress or regression of a country on some indicator is possible. The implication of keeping x_i as a numerator instead of $x_i - \min(x)$ is that the level of deprivation in a country no matter how small is thus captured. Consequently, deprivations in the developed countries thus become visible in their true perspective instead of being reduced to negligible size relative to the country with zero deprivation. This is not the case with money metric poverty estimates which show only zero level of poverty for developed countries implying no room for further improvement in living standards.

4.4 STANDARDIZING DATA REPRESENTING ACHIEVEMENT OR DEPRIVATION CONCEPTS

We have used two kinds of indicators one of which represents achievement concept such as infants immunized against Hepatitis B and the other represents a deprivation concept such as undernourishment. As the higher values in the final result correspond to higher deprivation level, we have changed achievement indicators into deprivation indicators by simply subtracting the normalized achievement variable from 1.

CHAPTER 5

RESULTS

Realizing the difficulties in measuring poverty absolutely, we choose to measure poverty relatively but the fundamental question is relative to what. There are two extreme choices relative to which poverty can be measured. *i*) a hypothetical situation where there is no deprivation at all (no disease, no hunger, no illiteracy, and no death) and ii) a hypothetical situation where there is complete deprivation (no food, no literacy and no one living!). But as it is obvious that these two extremes are no real life cases we have to choose some realistic benchmark. An obvious choice is to consider the country with the highest deprivation score in the index as 100% poor and the country with the least deprivation score as 0% poor and interpret the poverty level in the intermediate range relative to *both* of these countries. In FPI, the least deprived country in the initial period 1990-2000 is Japan and the most deprived country in the initial period is Sierra Leone. Considering a complete absence of poverty in Japan will not be too unreasonable an assumption but considering Sierra Leone as 100% poor will somehow involve a measure of arbitrariness. But there is, however, a reason in assuming that Sierra Leone is 100% poor. Mali is the poorest country according to IPL estimates with 86. 08% population poor on the average in the period between 1990 and 2000. But in FPI, Mali is the 8th poorest country in the world with 84.

35% functioning poverty in the same period relative to the range where Sierra Leone and Japan represent two ends of the spectrum. So we assume that FPI in Sierra Leone is 100%.

As our measure is a weighted average of different indicators of wellbeing which are very dissimilar in nature, can the FPI values be interpreted in percentage terms when they have no cardinal value? It can be shown that expressing the poverty statistics in percentage terms is not limited to headcount poverty based on the famous $1.25 poverty line. Many composite indices, most notably the HPI, interpret their values in percentage terms when they have no cardinal value. The Human Development Reports make a distinction between the income poverty and human poverty and express human poverty in much the same way as income poverty is interpreted. "[According to the Human Poverty Index for developing countries (HPI-1)] Barbados, Uruguay, Chile, Costa Rica and Cuba rank highest, with human poverty levels of 5% or lower. Burkina Faso, Niger, Mali, Ethiopia and Zimbabwe have the highest human poverty levels of the countries in the index --- all above 50%... For the 17 countries with data, human poverty as measured by HPI-2 varies from 6.5% in Sweden to 15.8% in the United States." (2004, p. 129)

The distinction between monetary poverty and human poverty is well documented in development literature beyond Human Development Reports and sometimes HPI values are directly compared with headcount poverty based on monetary measures. Fukuda-Parr (1999) for example, interprets HPI values in percentage terms in much the same way as the headcount income poverty is interpreted: "[Human poverty] shows interesting contrasts with income poverty: for example, Egypt and Pakistan have reduced income poverty to less than 15 percent by the international measure of $1 a day, but human poverty

remains high, at 34 percent and 36 percent, respectively" (Fukuda-Parr, 1999, p. 101). At times, the HPI statistic is interpreted as the percentage of population "affected by human poverty" (Arimah, 2004, p. 403). Collicelli and Valerii (2000) compare the monetary and human poverty in percentage terms by using HPI values as the relevant statistics. Khayum (2003) also interprets HPI value as the percentage of the population suffering from human poverty. "...Trinidad and Tobago and Cuba have an HPI value of less than 10 percent. This means that these countries have reduced human poverty where it affects less than 10 percent of the population" (Khayum, 2003, p. 86).

As is seen from the previous discussion, various conceptions of poverty are compatible with the interpretation of poverty statistics in percentage terms. We have made it explicit that we are *not* measuring headcount poverty, and measuring only the poverty conceived as the result of a functioning failure, we call the FPI values as functioning poverty and interpret it relative to the two bench mark countries, Sierra Leone and Japan, where functioning poverty is assumed to be 100 percent and zero percent respectively.

Will the poverty level in a country change in the initial period simply because some other countries have replaced Sierra Leone and Japan as the most deprived and least deprived countries in a subsequent period? In fact, the change of limit in the subsequent period will not change any of the value in the initial period because we have rescaled the computed values of FPI in the subsequent period relative to the maximum and minimum values computed for the initial period only. The reason behind rescaling the FPI values in the subsequent period relative to the benchmark values of initial period is that we have assigned same weights that we have computed for the initial period to the dimensions in the subsequent period. Coming to the FPI values, we see that in the initial period (1991-

2000) Japan was least deprived and Sierra Leone was most deprived, while in the subsequent period (2001-2010) Iceland, Switzerland and Japan itself performed better than Japan in the initial period and their calculated FPI values in the subsequent period have changed sign as seen in the Table 5 below. Similarly, in the initial period, Sierra Leone performed worst with normalized FPI value equal to 1, while in the subsequent period Chad even performed worse than Sierra Leone though not worse than Sierra Leone in the initial period. Therefore the rescaled FPI value in the subsequent period is 96.52 for Chad and 90.71 for Sierra Leone. But if Chad had performed worse in the subsequent period than Sierra Leone even in the initial period, the rescaled value of Chad in the subsequent period would have been just greater than 1.

5.1 NATIONAL AND REGIONAL DISTRIBUTION OF POVERTY

We present our results of the incidence of functioning poverty in 193 economies of the world for two periods 1990-2000 and 2001-2010 relative to poverty level in the most deprived country according to our estimates Sierra Leone in the period 1990-2000. See maps of the poverty for both the periods in Appendix F.

Table 5: Relative functioning poverty in two periods 1990-2000 and 2001-2010

	1990-2000		2001-2010		
Country	**FPI. (%)**	**Rank**	**FPI (%)**	**Rank**	**Change (%)**
Sierra Leone	100	1	90. 71	2	9. 29
Chad	94. 73	2	96. 52	1	-1. 79
Afghanistan	91. 02	3	85. 94	4	5. 08
Central African Republic	88. 52	4	87. 41	3	1. 11
Zambia	88. 46	5	79. 73	6	8. 73
Niger	86. 47	6	72. 48	15	13. 99
Rwanda	85. 24	7	65. 33	25	19. 91
Mali	84. 35	8	75. 31	10	9. 05
Burkina Faso	82. 17	9	76. 02	8	6. 15
Democratic Republic of the Congo	81. 74	10	74. 91	11	6. 84
Angola	81. 59	11	71. 58	16	10. 01
Guinea-Bissau	80. 76	12	73. 99	13	6. 77
Mozambique	79. 88	13	80. 93	5	-1. 05
Burundi	79. 47	14	72. 97	14	6. 5
United Republic of Tanzania	77. 56	15	68. 15	20	9. 41
Nigeria	77. 44	16	69. 4	18	8. 04
Uganda	76. 96	17	65. 8	24	11. 16
Guinea	76. 2	18	65. 22	26	10. 98
Malawi	75. 95	19	67. 39	21	8. 57
Zimbabwe	75. 43	20	75. 59	9	-0. 16
Cameroon	73. 4	21	74. 67	12	-1. 27
Lesotho	72. 65	22	77. 61	7	-4. 97
Ethiopia	72. 48	23	66. 94	23	5. 54
Liberia	71. 12	24	58. 54	31	12. 57
Somalia	70. 32	25	67. 26	22	3. 06
Equatorial Guinea	70. 18	26	68. 72	19	1. 46
Congo	68. 73	27	65. 03	27	3. 7
Côte d'Ivoire	67. 02	28	62. 22	29	4. 8
Kenya	66. 36	29	61. 27	30	5. 09
Botswana	66. 14	30	56. 01	33	10. 13
Djibouti	65. 59	31	62. 23	28	3. 36
Swaziland	63. 18	32	70. 28	17	-7. 09
Nepal	61. 95	33	53. 86	38	8. 09
Senegal	60. 34	34	50. 52	44	9. 81
Gambia	60. 16	35	53. 67	39	6. 49
Benin	59. 81	36	51. 86	42	7. 95

Madagascar	58. 61	37	51. 78	43	6. 83
Togo	57. 86	38	52. 06	41	5. 79
Mauritania	57. 71	39	53. 95	37	3. 76
Sudan	56. 42	40	57. 88	32	-1. 46
Cambodia	56. 17	41	50. 14	45	6. 03
Ghana	55. 93	42	53. 61	40	2. 32
Pakistan	55. 19	43	49. 82	49	5. 36
Eritrea	54. 84	44	47. 85	50	6. 99
Yemen	54. 38	45	42. 37	56	12. 01
Haiti	54. 07	46	47. 7	52	6. 37
Gabon	53. 8	47	55. 59	34	-1. 78
Timor-Leste	52. 94	48	47. 74	51	5. 19
Lao People's Democratic Republic	52. 68	49	50. 05	48	2. 63
Marshall Islands	52. 57	50	50. 07	47	2. 5
Bangladesh	51. 19	51	44. 15	53	7. 04
Sao Tome and Principe	50. 84	52	50. 11	46	0. 73
Myanmar	50. 46	53	54. 18	36	-3. 72
South Africa	50. 25	54	54. 2	35	-3. 95
India	49. 56	55	42. 37	56	7. 19
Namibia	48. 94	56	42. 72	54	6. 22
Bhutan	47. 75	57	39. 57	63	8. 18
Comoros	46. 93	58	41. 17	59	5. 76
Nauru	44. 91	59	42. 08	58	2. 83
Guyana	44. 36	60	40. 78	60	3. 58
Papua New Guinea	43. 82	61	40. 53	61	3. 29
Turkmenistan	42. 02	62	39. 31	64	2. 71
Tajikistan	40. 04	63	33. 06	70	6. 98
Mongolia	39. 61	64	42. 7	55	-3. 09
Uzbekistan	38. 62	65	34. 45	66	4. 18
Azerbaijan	38. 33	66	29. 19	80	9. 13
Kiribati	38. 18	67	37. 2	65	0. 99
Kyrgyzstan	36. 54	68	33. 89	68	2. 65
Kazakhstan	36. 28	69	33. 97	67	2. 31
Iraq	36. 21	70	40. 17	62	-3. 96
Solomon Islands	35. 45	71	32. 11	72	3. 34
Cape Verde	35. 17	72	27. 92	84	7. 26
Indonesia	34. 67	73	31. 23	75	3. 44
Lebanon	34. 18	74	24. 33	95	9. 84
Russian Federation	33. 69	75	33. 43	69	0. 26

Bolivia	33.37	76	27	89	6.37
Grenada	33.07	77	26.1	91	6.96
Philippines	33.03	78	28.27	82	4.76
Micronesia (Federated States of)	32.94	79	29.72	79	3.22
Sri Lanka	32.91	80	21.56	106	11.35
Egypt	32.9	81	30.73	77	2.17
Tuvalu	32.84	82	31.31	74	1.53
Maldives	32.53	83	21.75	105	10.78
Vanuatu	32.25	84	28.19	83	4.06
Fiji	30.83	85	28.79	81	2.04
Guatemala	30.43	86	27.19	88	3.24
Algeria	30.04	87	32.32	71	-2.27
Iran (Islamic Republic of)	29.72	88	22.51	103	7.21
Republic of Moldova	29.66	89	22.65	102	7
Democratic People's Republic of Korea	29.65	90	31	76	-1.35
Morocco	28.91	91	27.54	85	1.37
Ukraine	28.82	92	31.57	73	-2.75
Viet Nam	28.7	93	24.21	96	4.49
Georgia	28.34	94	27.32	86	1.03
Seychelles	27.88	95	25.85	92	2.03
Jamaica	27.14	96	26.51	90	0.63
Trinidad and Tobago	27.09	97	23.16	100	3.93
Belarus	27.02	98	23.86	98	3.16
Samoa	26.95	99	25.82	94	1.13
Syrian Arab Republic	26.58	100	20.23	113	6.35
Turkey	26.48	101	17.83	126	8.65
Dominican Republic	26.31	102	25.83	93	0.48
Saint Vincent and the Grenadines	26.05	103	23.99	97	2.06
Belize	25.35	104	27.29	87	-1.94
Latvia	25.34	105	21.86	104	3.48
Honduras	25.04	106	17.64	127	7.4
Thailand	24.59	107	19.55	116	5.04
Palau	24.25	108	21.49	107	2.76
Armenia	23.74	109	30.67	78	-6.93
Saudi Arabia	23.46	110	21.2	108	2.26
Antigua and Barbuda	23.32	111	19	120	4.32
Saint Kitts and Nevis	23.28	112	18.71	122	4.56
Portugal	23.2	113	9.41	158	13.79
Dominica	22.83	114	18.79	121	4.04

Tonga	22. 73	115	21. 19	109	1. 54
Jordan	22. 59	116	18. 23	124	4. 36
Albania	22. 53	117	20. 42	111	2. 11
Estonia	22. 38	118	17. 34	129	5. 04
Romania	22. 18	119	18. 71	122	3. 47
Oman	21. 75	120	19. 1	119	2. 65
Suriname	21. 75	120	19. 65	114	2. 1
Bulgaria	21. 24	122	17. 9	125	3. 34
Libyan Arab Jamahiriya	21. 21	123	23. 41	99	-2. 2
Mauritius	21. 11	124	16. 85	131	4. 26
Cook Islands	20. 95	125	15. 56	136	5. 4
Ecuador	20. 82	126	16. 74	132	4. 08
Bahamas	20. 75	127	17. 35	128	3. 4
Montenegro	19. 92	128	16. 58	133	3. 34
Slovakia	19. 84	129	19. 24	118	0. 61
El Salvador	19. 64	130	15. 4	137	4. 24
The former Yugoslav Republic of Macedonia	19. 6	131	13. 18	144	6. 42
China	19. 53	132	16. 49	135	3. 03
Niue	19. 48	133	20. 42	111	-0. 94
Malta	19. 47	134	8. 68	160	10. 79
Bosnia and Herzegovina	19. 45	135	23. 12	101	-3. 66
Malaysia	18. 91	136	20. 81	110	-1. 9
Barbados	18. 65	137	15. 1	138	3. 55
Peru	18. 62	138	12. 15	147	6. 47
Paraguay	18. 61	139	19. 45	117	-0. 84
Singapore	18. 32	140	6. 74	167	11. 58
Brazil	18. 16	141	14. 62	140	3. 54
Nicaragua	18. 02	142	16. 52	134	1. 5
Poland	17. 87	143	13. 05	145	4. 82
Hungary	17. 68	144	14. 88	139	2. 8
Slovenia	17. 55	145	10. 8	154	6. 76
Colombia	17. 51	146	12. 01	149	5. 5
Venezuela (Bolivarian Republic of)	16. 66	147	14. 2	141	2. 46
Tunisia	16. 43	148	13. 88	143	2. 55
Lithuania	16. 08	149	19. 65	114	-3. 57
United Arab Emirates	15. 82	150	12. 09	148	3. 73
Saint Lucia	15. 62	151	17. 3	130	-1. 68
Croatia	15. 29	152	12. 84	146	2. 44
Brunei Darussalam	14. 8	153	13. 95	142	0. 84

Bahrain	14. 54	154	10. 56	155	3. 98
Cuba	14. 37	155	10. 92	153	3. 45
Uruguay	13. 01	156	11. 33	151	1. 68
Qatar	12. 71	157	8. 57	161	4. 14
Argentina	12. 37	158	11. 98	150	0. 38
Kuwait	12. 34	159	7. 73	163	4. 61
Serbia	11. 63	160	8. 97	159	2. 66
Spain	11. 63	160	6. 83	165	4. 8
Panama	11. 4	162	11. 19	152	0. 2
Mexico	11. 26	163	9. 94	156	1. 31
Andorra	10. 63	164	6. 82	166	3. 81
New Zealand	10. 26	165	4. 78	174	5. 48
Ireland	10. 02	166	3. 56	181	6. 46
Finland	9. 91	167	5. 7	172	4. 21
Czech Republic	9. 45	168	7. 9	162	1. 55
France	9. 25	169	6. 15	170	3. 1
San Marino	9. 03	170	4. 61	175	4. 42
Italy	8. 87	171	4. 28	177	4. 59
Belgium	8. 74	172	6. 56	168	2. 18
Cyprus	8. 67	173	4. 29	176	4. 38
Greece	8. 56	174	7. 24	164	1. 32
Israel	8. 48	175	6. 56	168	1. 91
Australia	8. 33	176	2. 67	185	5. 66
Denmark	7. 91	177	6. 13	171	1. 78
Republic of Korea	7. 26	178	3. 79	178	3. 47
Monaco	6. 99	179	3. 66	180	3. 33
Costa Rica	6. 86	180	4. 8	173	2. 06
Norway	6. 68	181	9. 79	157	-3. 11
Sweden	5. 55	182	1. 87	187	3. 68
Austria	5. 46	183	3. 5	182	1. 96
Chile	5. 21	184	3. 78	179	1. 43
Luxembourg	4. 96	185	3. 04	183	1. 92
Netherlands	4. 22	186	1. 53	188	2. 68
United States of America	4. 07	187	2	186	2. 07
Germany	3. 79	188	2. 85	184	0. 95
United Kingdom	3. 28	189	1. 31	189	1. 98
Canada	2. 85	190	0. 37	190	2. 48
Iceland	1. 01	191	-1. 47	193	2. 49
Switzerland	0. 88	192	-1. 29	192	2. 17

Japan	0	193	-0. 07	191	0. 07
Average	**34. 84**		**31. 09**		**3. 75**

Note. The negative poverty in the three countries including Iceland, Switzerland and Japan in the period 2000-2010 shows that only these countries reduced their deprivation level relative to the deprivation level in Japan in the period 1990-2000.

The MDGs had vowed to half the poverty by 1015, but we see that in the period between 1990-2000 and 2001-2010 only 3. 75% poverty decreased with only 4 years left to reach the goal.[23]

5.1.1 REGIOANL DISTRIBUTION OF POVERTY

How the poverty is distributed among various regions of the world during the periods 1990-2000 and 2001-2010 is presented in the following figure.

[23] I have pointed out to the relevant literature in which human poverty and income poverty is routinely compared, even if the human poverty goes beyond $1.25 definition of poverty and is based on mulitiple indicators of wellbeing. The comparison between unidimensional and multidimensional poverty measures may also provide important insights regarding the identification of the poor, policy formulation and the ways to target the poverty.

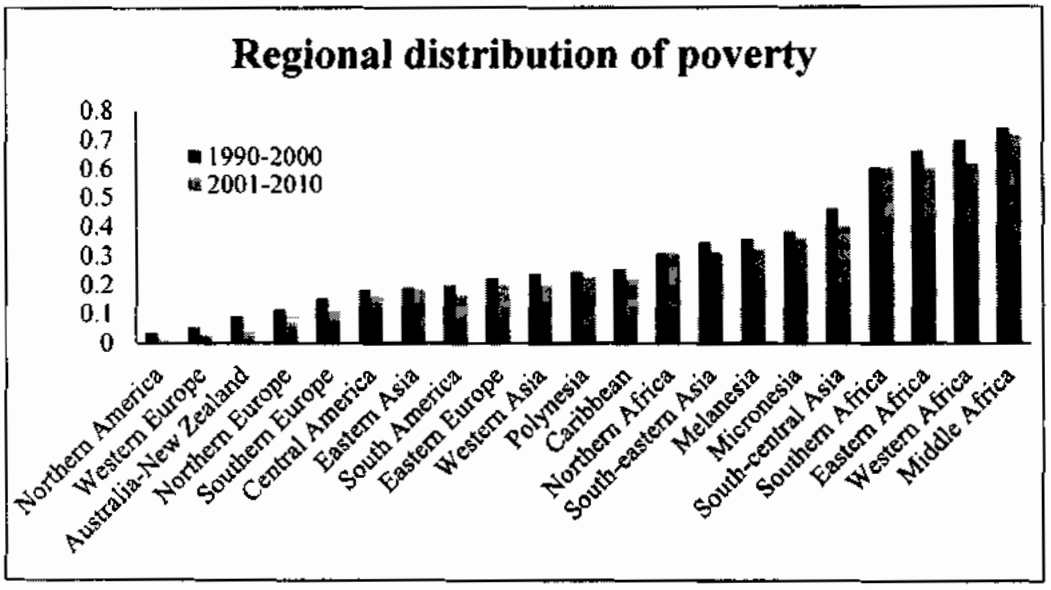


Figure 8: Regional distribution of poverty

As is evident from the above figure, poverty is asymmetrically distributed in the world with Africa bearing the brunt of most of the deprivation. Poverty level is also extremely high in Oceania followed by Asia. Even if there is an overall decrease in poverty in every region of the world, it is still far cry from meeting the goals outlined in MDGs which seek to halve poverty in the world by 2015. (See map of the distribution of poverty in the world in Appendix F)

5.2 CHANGE IN POVERTY OVER THE PERIOD OF A DECADE

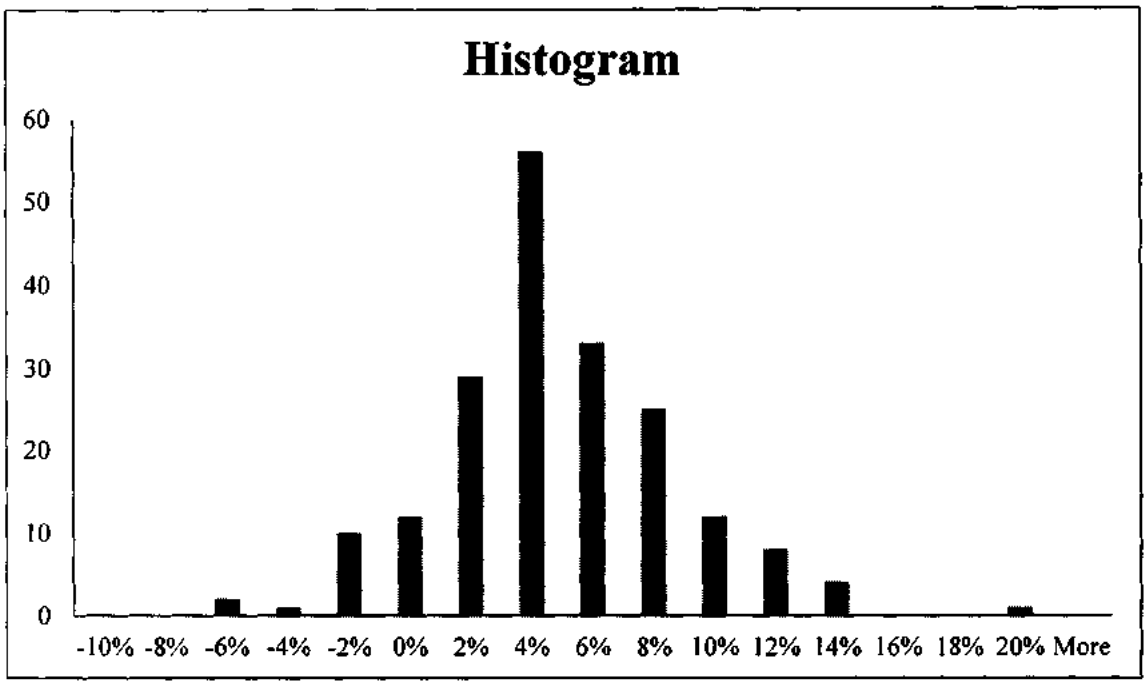


Figure 9: Percentage change in poverty from 1990-2000 to 2001-2010

In the histogram above, we see that in most of the cases poverty has decreased during the period of a decade. However, in nearly 60 countries, there is a reduction of poverty no more than 4% in a decade. About 50 countries register a decrease in poverty from 6% to 8%. The countries which report a decrease in poverty by 10% or more are no more than 20 in number. The present circumstances in which we see large proportion of humanity suffering from extreme forms of deprivation and poverty but moving away from their present state nonetheless albeit slowly offer us reason for both optimism and pessimism.

There are only a few countries which reflect a marked reduction in the level of poverty in two decades. In the following figure, we plot some countries which reflect both increase

and decrease in poverty. (See map of the changes in poverty over a period of decade in Appendix G)

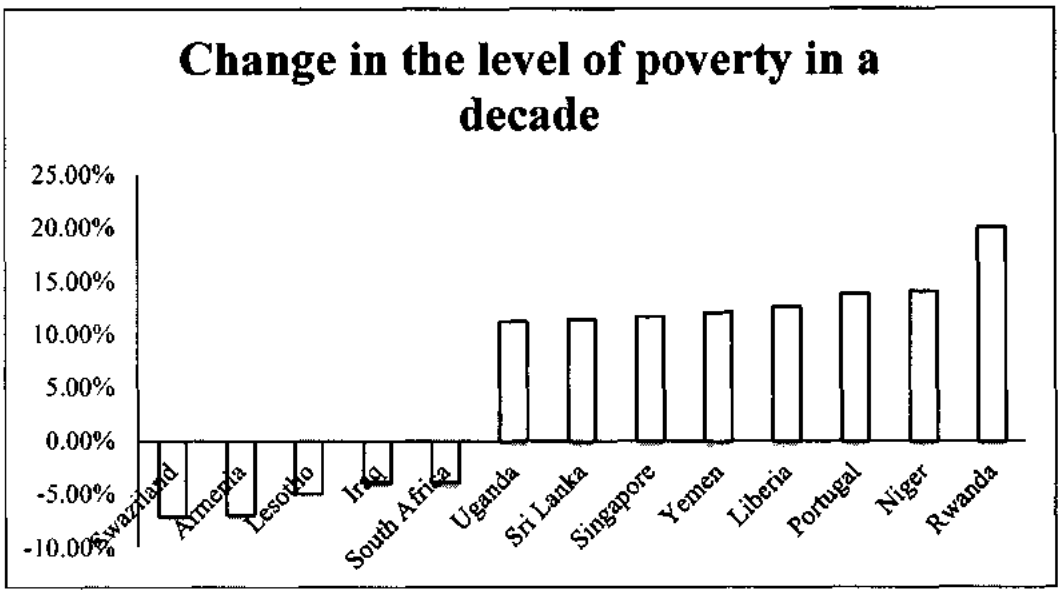


Figure 10: Countries with significant change in the level of poverty in FPI in a decade
Note: The values with minus sign represent an increase in poverty

On a positive note, the decrease in poverty is evident in Africa, Asia and Europe but increase in poverty was predominantly limited to African continent with the exception of Iraq in the above figure reminding us that Africa still lives in a perpetual state of misery and suffering.

In the following figure, we see an overall decrease in the regional distribution of poverty over a period of a decade.

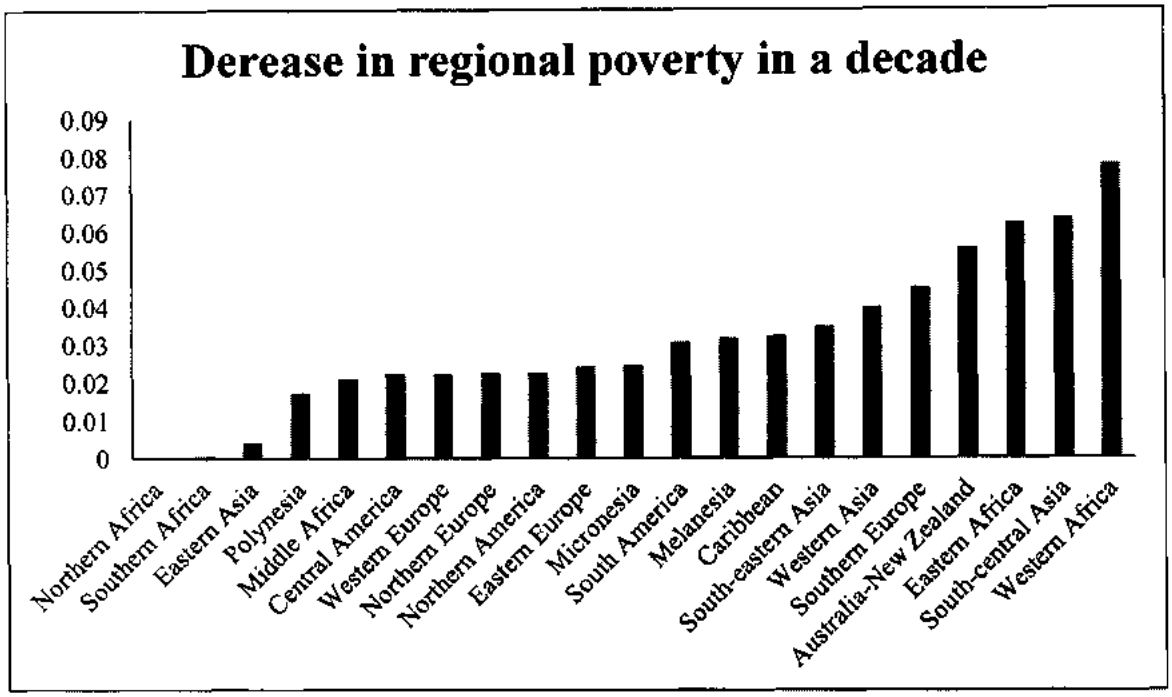


Figure 11: Decrease in regional poverty in a decade

In the above figure, we see moderate decrease in poverty around 5% in Southern Europe, South-central Asia and Western Asia. The poverty decrease in South America and Caribbean is no more than 3%. Northern Europe, Central America and much of Oceana report around 2% decrease in poverty. Situation in Africa however reveals wide disparities with Western and Eastern Africa registering around 6% decrease in poverty and Northern and Southern Africa hardly showing any improvement in their situation even after a decade. An overview of the change in the regional distribution of poverty over time shows that change for the better is not the same everywhere.

5.3 COMPARISON WITH OTHER MEASURES

As pointed out earlier, the objective of this research is to present an alternative conceptualization of poverty, which might offer better insight into the issues of deprivation when juxtaposed with other measures using alternative conceptualizations. With this view, we correlate the FPI with other measures to see the similarities and differences. In the following tables, a correlation of FPI with alternative measures of wellbeing is presented.

We have made a comparison of FPI with other measures in two ways. First, we made a pairwise comparison between FPI and alternative measures using the set of countries jointly available in both the measures. Secondly, we made a pairwise comparison between FPI and alternative measures using only those countries which were jointly available in all the measures.

It may however be noted that Life satisfaction is an achievement measure whereas all other measures represent deprivation. The HDI is so ordered that the least developed country is ranked first.

Table 6: FPI Correlated With Alternative Measures (Different Number Of Countries)

	IPL 1990-2000 (%)	IPL 2001-2007	HDI Rank 2009	HPI-1 2007 (%)	FPI 1990-2000	FPI 2001-2010	Life Satisfaction	MPI (% of Poor)
FPI 1990-2000	0. 84	0. 86	0. 91	0. 89	1	0. 99	-0. 77	0. 89
FPI 2001-2010	0. 82	0. 83	0. 9	0. 87	0. 99	1	-0. 76	0. 84
No. of Countries correlated	**99**	**94**	**179**	**134**	**193**	**193**	**140**	**103**
Mean	**0. 28**	**0. 26**	**90**	**0. 21**	**0. 35**	**0. 31**	**5. 47**	**0. 33**

Note: Pearson correlation method used here.

Table 7: Cross Correlation Of Alternative Measures (Countries Jointly Included In All Measures)

60 countries	IPL 1990-2000 (%)	IPL 2001-2007	HDI Rank 2009	HPI-1 2007 (%)	FPI 1990-2000	FPI 2001-2010	Life Satisfaction	MPI (% of Poor)
IPL 1990-2000 (%)	1	0. 94	0. 8	0. 78	0. 8	0. 78	-0. 45	0. 84
IPL 2001-2007	0. 94	1	0. 82	0. 79	0. 84	0. 81	-0. 42	0. 85
HDI Rank 2009	0. 8	0. 82	1	0. 92	0. 91	0. 89	-0. 54	0. 89
HPI-1 2007 (%)	0. 78	0. 79	0. 92	1	0. 9	0. 86	-0. 53	0. 95
FPI 1990-2000	0. 8	0. 84	0. 91	0. 9	1	0. 99	-0. 59	0. 89
FPI 2001-2010	0. 78	0. 81	0. 89	0. 86	0. 99	1	-0. 58	0. 86
Life Satisfaction	-0. 45	-0. 42	-0. 54	-0. 53	-0. 59	-0. 58	1	-0. 46
MPI (% of Poor)	0. 84	0. 85	0. 89	0. 95	0. 89	0. 86	-0. 46	1
Mean	0. 32	0. 26	117	0. 21	0. 44	0. 39	5. 02	0. 32

Note: Pearson correlation method used here.

It is evident from the tables above that there is a high degree of correlation between countries' ranks in FPI and in other measures up to 91% especially when the maximum of number of countries jointly found in both the measures is considered. However there is relatively small degree of correlation between FPI and Life Satisfaction survey of Gallup pointing to the fact that deprivations and life satisfaction are not the converse of each other. Is it possible to live a satisfied life despite suffering from deprivations of various types and what deprivations reduce human welfare relative to other deprivations requires further research.

5.3.1 Correlation between FPI and individual indicators of deprivation

The degree of correlation between country level poverty estimates and individual indicators of deprivation in those countries may be helpful in checking the robustness of the method used to measure poverty. In the following table, we present an alternative picture of how the individual indicators of wellbeing correlate with IPL poverty estimates for both the periods relative to the poorest country in the initial period 1990-2000, the per capita GNI (PPP current international $) for years 1995 and 2005 and our FPI poverty estimates for two periods 1990-2000 and 2001-2010 relative to the poorest country in the initial period 1990-2000.

Table 8: Correlation between IPL, GNI per capita and FPI and individual indicators of deprivation

Correlation Matrix (%)	IPL (A)	GNI (A)	FPI (A)	IPL (B)	GNI (B)	FPI (B)
Life expectancy at birth (years) Female						
Life expectancy at birth (years) Male	77.65	66.92	96.81	79.31	61.68	96.56
Under-5 mortality rate (probability of dying by age 5 per 1000 live births) Male						
Under-5 mortality rate (probability of dying by age 5 per 1000 live births) Female	85.35	69.63	95.41	85.11	66.26	93.29
Infant mortality rate (probability of dying by age 1 per 1000 live births) Female						

Infant mortality rate (probability of dying between birth and age 1 per 1000 live births) Male	82.1	74.13	94.71	83.14	71.63	93.85
Adult mortality rate [illegible] years per 1000 population) Female	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Country estimates of anaemia prevalence in (%) Preschool-age	76.7	66.87	87.02	78.02	69.18	84.39
Rate of primary school age [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Adult mortality rate (probability of dying between 15 to 60 years per 1000 population) Male	63.07	50.07	83.86	62.78	42.65	82.83
Rate of primary school age [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Access to improved sanitation (%)	80.57	63.61	81.44	77.06	61.82	78.53
Access to Electricity (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rate of Youth Illiteracy. Female	69.76	60.3	78.06	68.86	56.89	76.16
Rate of Youth Illiteracy. Male	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Prevalence of tuberculosis (per 100000 population)	71.09	60.66	77.75	69.43	57.32	77.88
Prevalence of serum retinol <0.70 [illegible] children (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Immunization coverage among 1-year-olds (%) DTP3	69.63	52.49	76.94	64.02	50.34	60.11
Immunization coverage among 1-year-olds (%) Measles	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rate of Adult Illiteracy. Female	67.25	61.94	75.91	70.31	65.15	75.36
Country estimates of anaemia prevalence in (%) Pregnant Women	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Incidence of tuberculosis (per 100000 population)	59.39	52.83	74.11	65.54	54.97	79.13
Rate of Adult Illiteracy. Male	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Immunization coverage among 1-year-olds (%) HepB3	62.82	49.37	72.8	42.33	30.5	42.26
Country estimates of anaemia [illegible] Pregnant Women	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ratio of girls to boys in primary and secondary education (%)	58.1	53.42	72.06	52.93	50.5	64.53
Access to improved drinking-water source (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Births attended by skilled health personnel (%)	64.77	59.2	69.35	77.35	64.9	74.88
Prevalence of night blindness in pregnant women (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Access to improved sanitation (%)	66.99	57.56	66.85	64.85	60.02	66.25
Access to improved drinking water Source (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Children aged 5 years (%) Underweight for age	66.02	55.36	63.45	74.81	55.82	67.74
Health workforce Dentistry personnel [illegible] population)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Prevalence of child malnutrition % of children under 5	56.67	37.35	60.04	57.36	32.82	57.57
Low-birth-weight newborns (%)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Immunization coverage among 1-year-olds (%) Hib3	46.42	46.58	59.82	30.15	35.9	31.43
Health workforce Physicians Density [illegible] population)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Children aged 5 years (%) Wasting (WHO) Moderate & severe	52.49	48.9	58.68	50.65	45.44	54.76
Prevalence of undernourishment [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Antenatal care coverage a (%) At least 4 visits	45.83	53.09	55.31	45.05	47.22	51.45

Children aged 5 years (%) Stunted						
Prevalence of night blindness in preschool age children 1995. (%)	39. 98	39. 67	51. 46	44. 94	36. 47	51. 44
Prevalence of serum retinol <0. 70 μmol/l in preschool women. (%)						
Children aged 5 years With ARI symptoms taken to facility (%)	37. 45	22. 56	44. 72	40. 08	21. 99	44. 81
PR						
Health workforce Other health service providers Density (per 10000 population)	36. 43	32. 56	43. 91	35. 4	22. 4	42. 9
Energy use (kg of oil equivalent per						
Health workforce Nursing and midwifery personnel Density (per 10000 population)	51. 13	39. 84	42. 1	48. 02	53. 01	40. 29
Antenatal care coverage a (%) At least						
Hospital beds (per 10000 population)	50. 35	38. 03	41. 02	51. 09	53. 27	38. 1
Total Goiter Prevalence (%)						
CL	32. 8	53. 08	38. 91	33. 98	55. 9	38. 39
EFI						
Tuberculosis treatment success under DOTS (%)	18. 8	7. 02	34. 81	-19. 57	-23. 1	-3. 36
Population with insufficient Iodine						
Population with insufficient Iodine intake (%) General population	22. 23	22. 36	30. 14	18. 51	7. 61	33. 68
Neonates protected at birth against neonatal						
Children aged 5 years With diarrhoea receiving ORT (%)	5. 73	-6. 39	8. 87	2. 96	-3. 58	7. 77
Rate of Youth Unemployment Male						
Rate of Adult Unemployment MALE	-14. 23	-10. 67	-1. 15	-13. 88	-1. 44	-1. 68
Rate of Youth Unemployment						
Tuberculosis detection rate under DOTS (%)	-11. 59	-10. 03	-14. 4	-48. 93	-39	-61. 03
Rate of Adult Unemployment FEMALE						
Children aged 6-59 months who received vitamin A supplementation (%)	-57. 86	-31. 4	-42. 93	-56. 56	-32. 42	-40. 35
Children aged 5 years Sleeping under						
nets (%)						
Children aged 5 years With fever who received treatment with any antimalarial (%)	-58. 52	-55. 07	-72. 27	-60. 28	-56. 86	-72. 59
Average						

Note: Indicators used in our analysis cover two periods 1990-2000 and 2001-2010. The variables which reflect achievement instead of deprivation such as 'Neonates protected at birth against neonatal tetanus (%)' were normalized to make them indicators of deprivation.

IPL (A): International Poverty Line 1990-2000. (Relative to poorest country in 1990-2000)
IPL (B): International Poverty Line 2001-2010. (Relative to poorest country in 1990-2000)
GNI (A): GNI per capita, PPP (current international $) 1995

GNI (B): GNI per capita, PPP (current international $) 2005
FPI (A): Functioning Poverty Index 1990-2000 (relative to poorest country in 1990-2000)
FPI (B): Functioning Poverty Index 2001-2010 (relative to poorest country in 1990-2000)

In the two periods 1990-2000 and 2001-2010, the relative IPL poverty estimates shows on the average 46% and 44% correlation with individual indicators of deprivation in both periods, whereas per capita GNI (PPP current international $) shows 41. 5% correlation with individual indicators in the initial period and 39. 5% correlation in the subsequent period and FPI poverty estimates for two periods 1990-2000 and 2001-2010 relative to the poorest country in the initial period 1990-2000 show a correlation with individual indicators of deprivation in both the periods 53% and 49% respectively, that is , 7% higher than IPL estimates and 11. 5% higher than GNI per capita in the initial period, 5% higher than IPL estimates and 9. 5% higher than GNI per capita in the subsequent period.

5.3.2 Comparison of Functioning Poverty Index with other measures of wellbeing

In the beginning, it must be stressed that FPI may be considered as a complement to various measures of wellbeing. The following discussion reinforces the idea that, in the context of poverty estimation methods, as more complex dimensions of poverty are analyzed and as assumptions formed in any particular poverty estimation method continue to be based on more sound theoretical and philosophical foundations, a more comprehensive picture of poverty emerges.

In the following section, we will compare a few pairs of countries which have nearly the same level of wellbeing in the alternative measures of wellbeing such as HDI, HPI, MPI, Gallup's Life Satisfaction and World Bank's international poverty line based poverty measure but which widely diverge in terms of the level of achievements or deprivations in the context of FPI. Additionally,

a number of indicators of wellbeing revealing wide disparity between two countries under considerations are presented with a view to highlight the aspects of poverty which are generally left unnoticed in making cross-country comparisons.

5.3.2.1 Comparison of Functioning Poverty Index with World Bank's Poverty estimate (International Poverty Line)

An examination of the scatter diagram of a number of countries, for which data on the World Bank's international poverty line based poverty estimates and the FPI relative to the poorest country in the initial period 1990-2000 was available, reveals that both the measures are broadly correlated with certain differences. In a number of countries, only a small proportion of the population not exceeding 5% is income-poor according to $1. 25 (PPP) but up to 40% of the population in these countries may suffer from functioning deprivation. See the oval in the scatter diagram below.

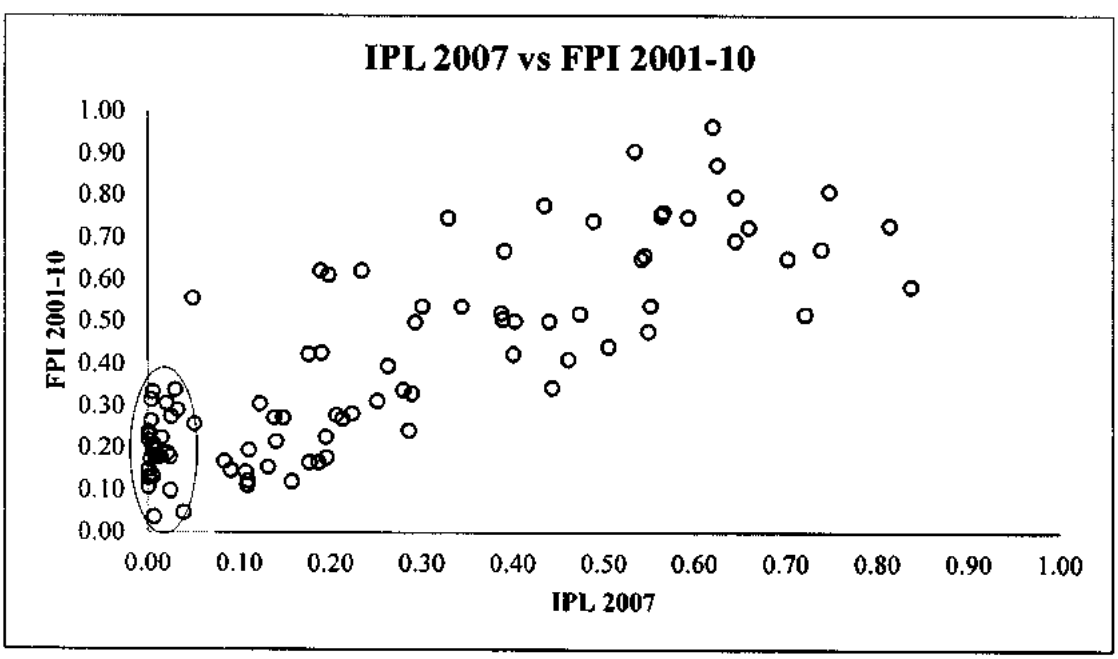


Figure 12: Scatter diagram of IPL 2007 and FPI 2001-2010

In Egypt, around 2% of the population was income poor according to the World Bank's estimates but functioning poverty was found to be no less than 31% in roughly the same period. In Ukraine, less than 1% of the population was poor but functioning poverty was registered around 32% in the same period.

As FPI is not a headcount poverty estimation measure, finding the difference in the respective ranks of countries in both the measures could be more revealing. In the following histogram, sharp differences in the ranks of the countries reveal wide disparities in the level of wellbeing.

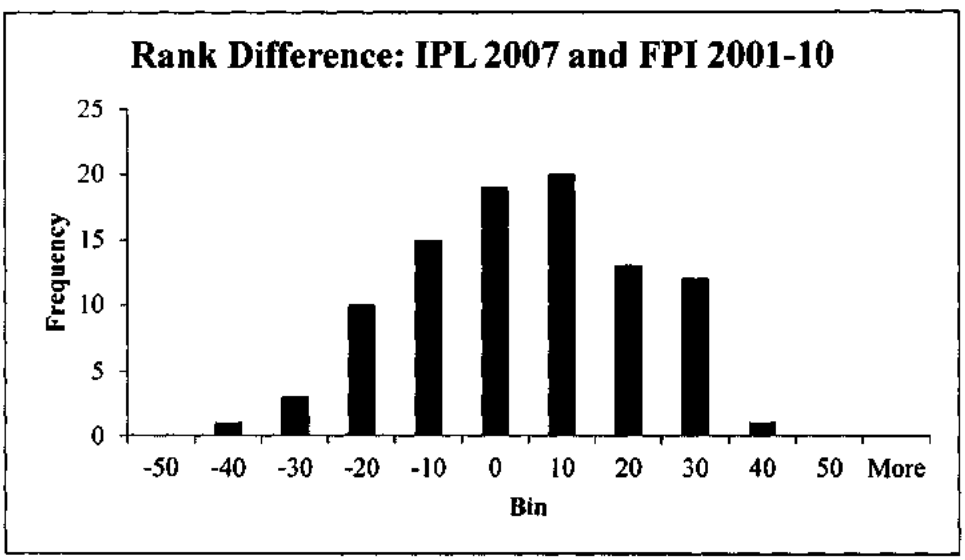


Figure 13: Histogram of rank difference between IPL 2007 and FPI 2001-2010 scores

Here we make a pairwise comparison of Costa Rica and Gabon which suffer from an approximately similar level of income poverty according to the World Bank's $1.25 poverty estimates but widely diverge in the context of functioning poverty.

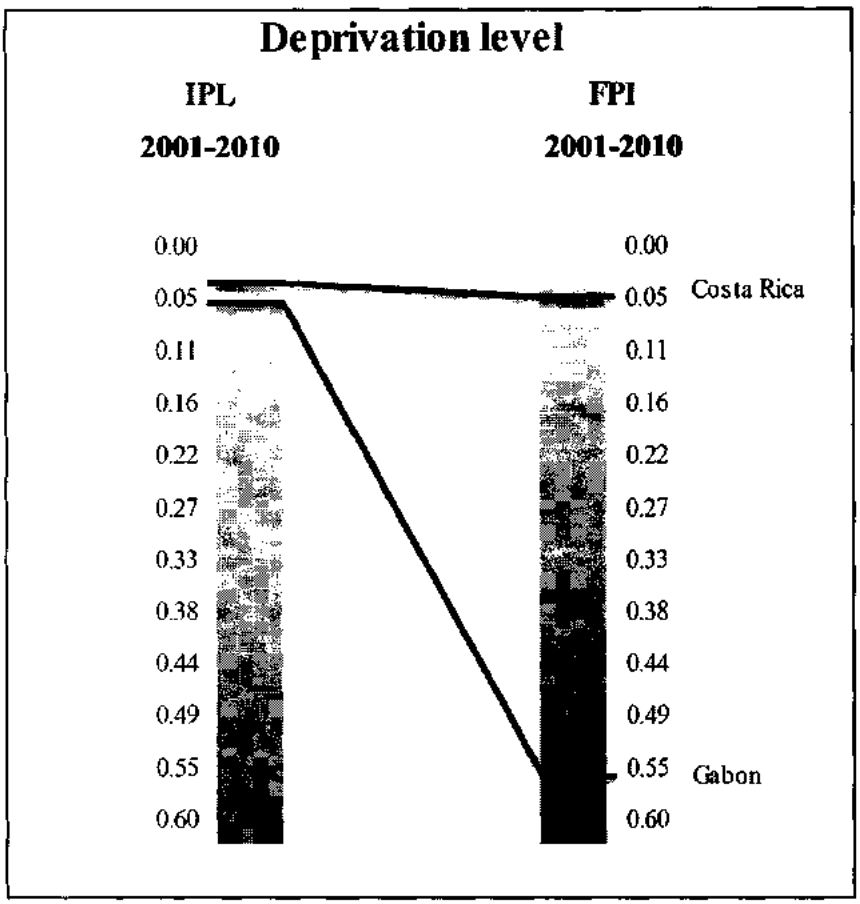


Figure 14: Comparison of level of poverty in two countries in IPL and FPI

Note. Poverty in both the measures is expressed relative to the most deprived country in the respective sample.

According to the World Bank's poverty estimate, there was 4% poverty in Costa Rica during 2001-2007 and 5% poverty in Gabon in the similar period. [24] On the other hand the FPI 2001-2010 estimate suggests that in Costa Rica there was 5% functioning deprivation but in Gabon the functioning deprivation was no less than 56%. In the chart below, a comparison is made between some indicators considered to be crucial for human wellbeing in order to explain so large a

[24] http://data.worldbank.org

discrepancy between the deprivation levels in both of these countries in two alternative measures of deprivation.

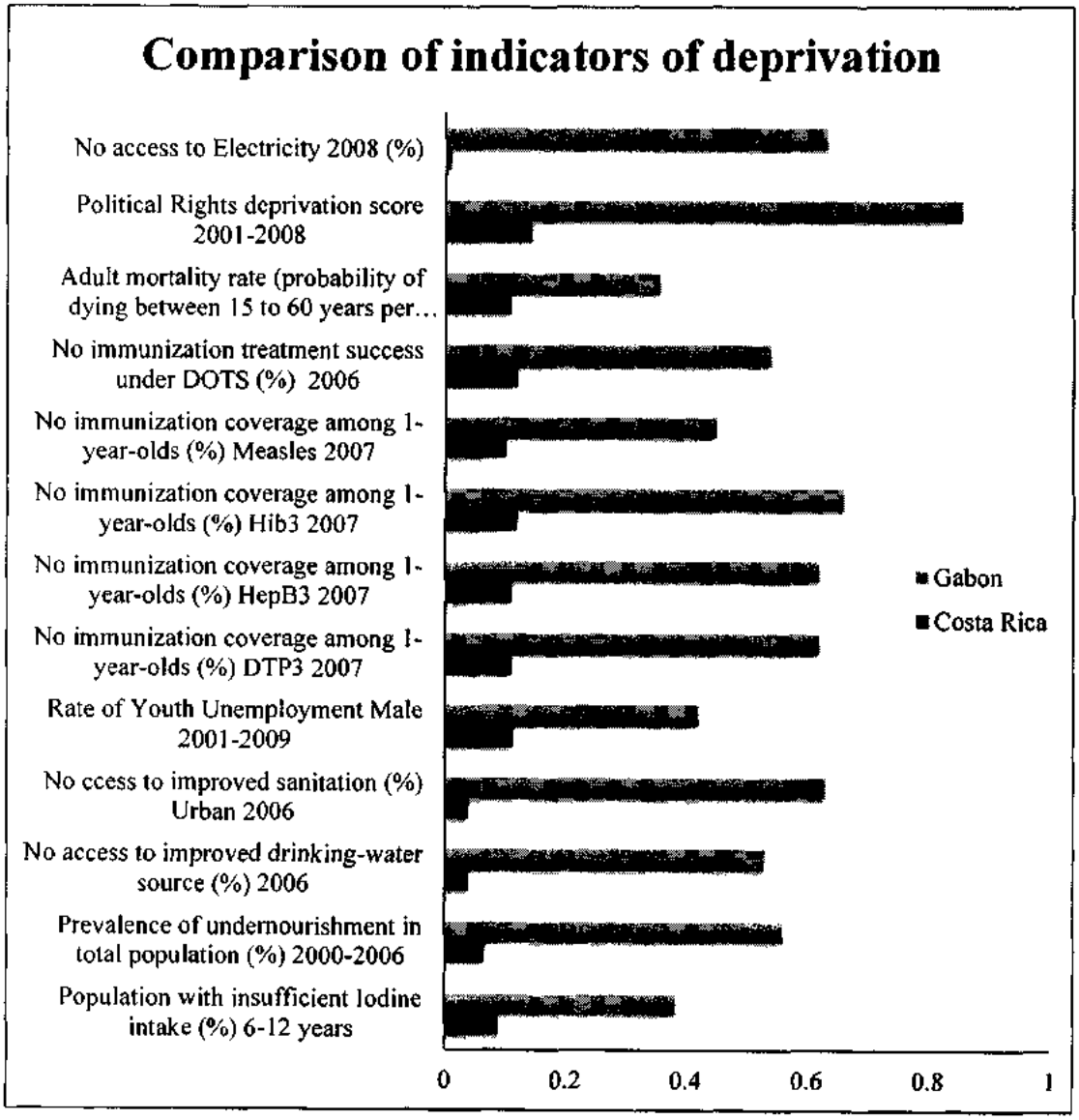


Figure 15: Comparison of indicators of deprivation

In the face of so wide differences in the deprivation level of Gabon and Costa Rica, the fact that World Bank could find difference of only 1% in the poverty level underscores the need to complement alternative conceptualizations of poverty to the presently income-based poverty estimation method.

Secondly, when around 60% of the population of Gabon suffers from undernourishment and has no access to improved drinking water and around 70% of its population has no access to electricity, to insist that only 5% of the population is income poor is to just ignore the issues that warp the lives of poor people.

5.3.2.2 Comparison of Functioning Poverty Index (FPI) with Human Development Index (HDI)

A comparison of the HDI and FPI could be revealing in that both the measures include non-monetary indicators for assessing the level of wellbeing. The scatter plot below comparing the ranks of the countries in both HDI and FPI reveals a significant correlation with some obvious differences.

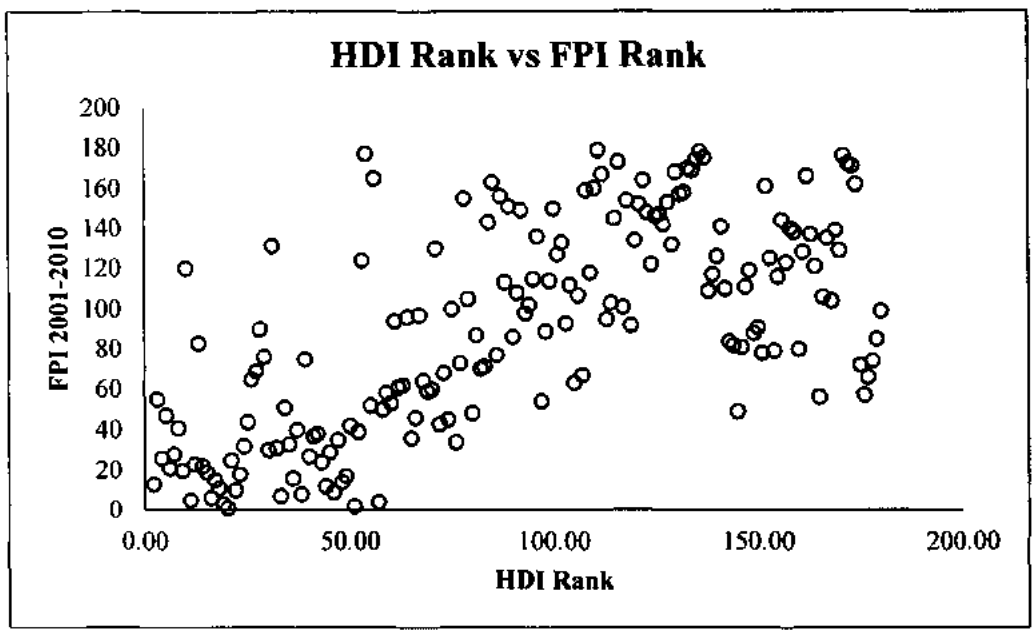


Figure 16: Scatter diagram of HDI and FPI ranks

Note. The FPI was sorted in descending order so that the higher values in the above histogram represent higher achievement level.

Some countries in the above scatter plot register a rank difference which exceeds 50 points. In the following histogram, a comprehensive picture of the rank differences is presented.

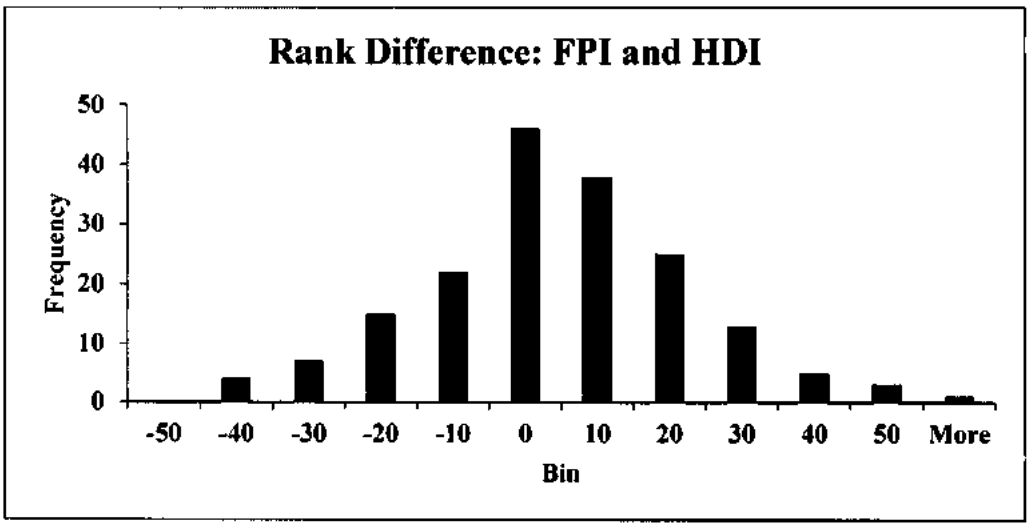


Figure 17: Histogram of rank difference between HDI 2009 and FPI 2001-2010

Now we make a comparison of two countries which have roughly the same development level in HDI but which diverge sharply in FPI.

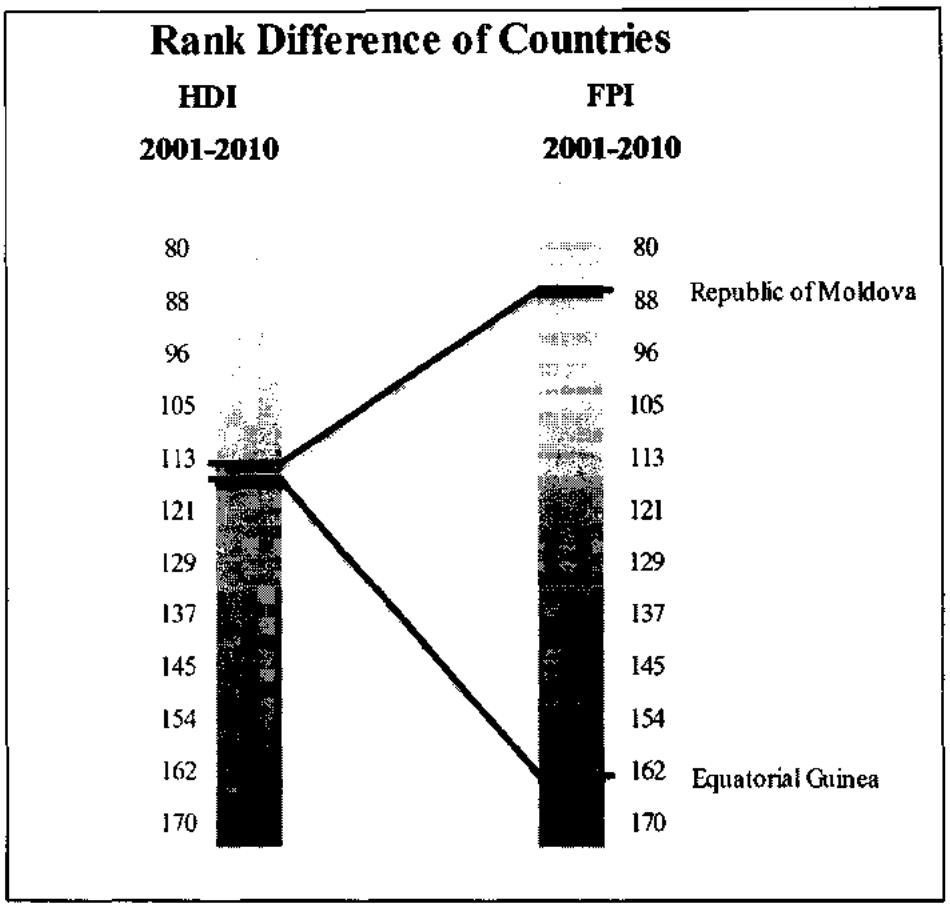


Figure 18: Comparison of level of poverty in two countries in HDI and FPI

Note. In HDI, countries are sorted in the ascending order with respect to development level; in FPI, they are sorted in the ascending order with respect to deprivation level.

In the period between 2001 and 2010, there was a 69% relative functioning deprivation in Equatorial Guinea and 23% relative functioning deprivation in Republic of Moldova, a difference of 46%. However the HDI rank of both of these countries was 114th and 115th respectively[25]. In the following chart, a comparison is made between the sets of various deprivation indicators of these countries.

[25] hdr.undp.org/en/reports/global/hdr2009

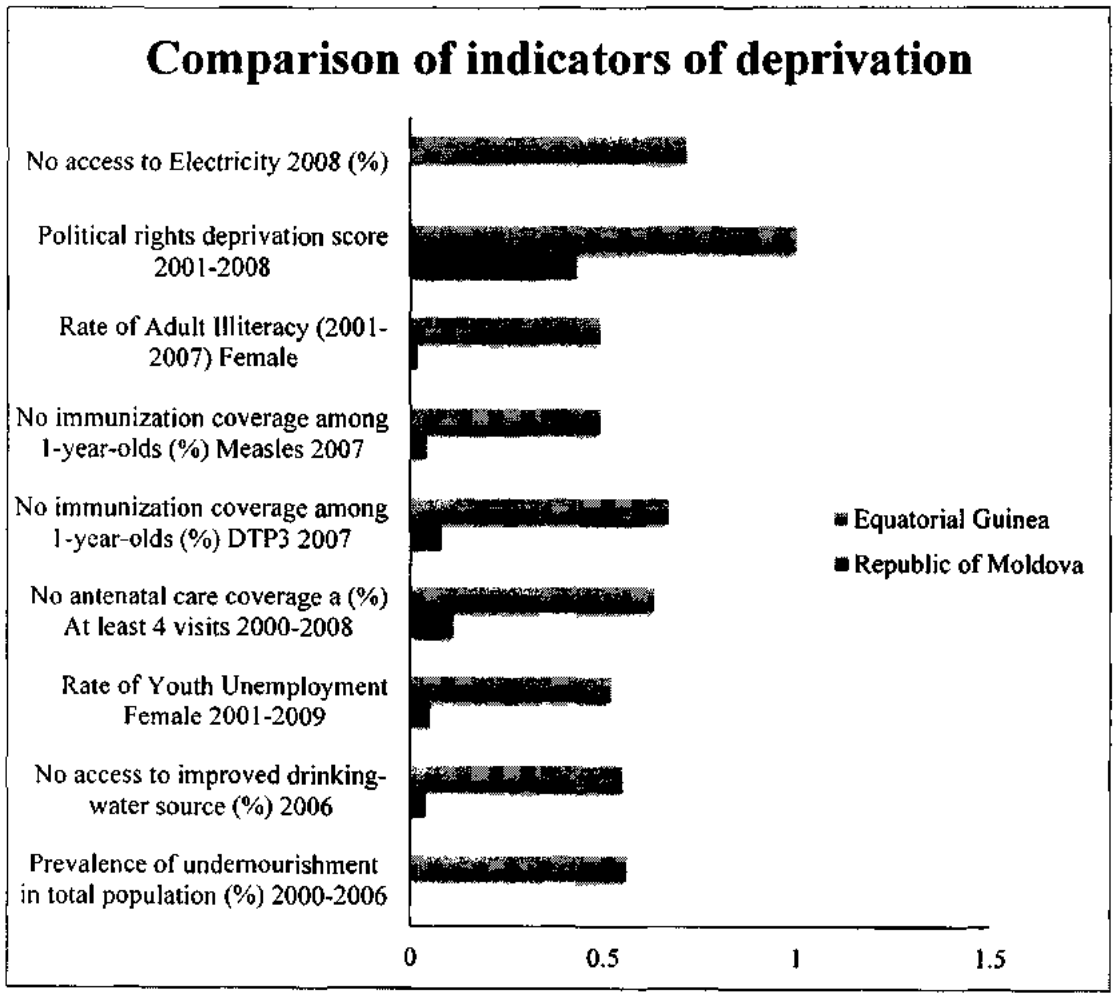


Figure 19: Comparison of indicators of deprivation

Equatorial Guinea and Republic of Moldova despite holding nearly the same rank in HDI reflect wide disparities in the variables which have a direct bearing on the level of human wellbeing. The most glaring difference is in the prevalence of undernourishment. Over 50% of the population of Equatorial Guinea suffers from undernourishment, whereas in the Republic of Moldova nearly no one is malnourished. Similarly, there is a sharp difference in the level of political rights available to the public in both the countries. These factors emphasize the need for inclusion of other indicators of wellbeing in order to have a better insight into the issues of human development.

5.3.2.3 Comparison of Functioning Poverty Index with Human Poverty Index (HPI-1)

The deprivation level of the countries which were available in both the HPI-1 and FPI are compared in the following scatter plot. Although both the measures seem to be strongly correlated, most of the countries seem to be distinctly clustered in two groups.

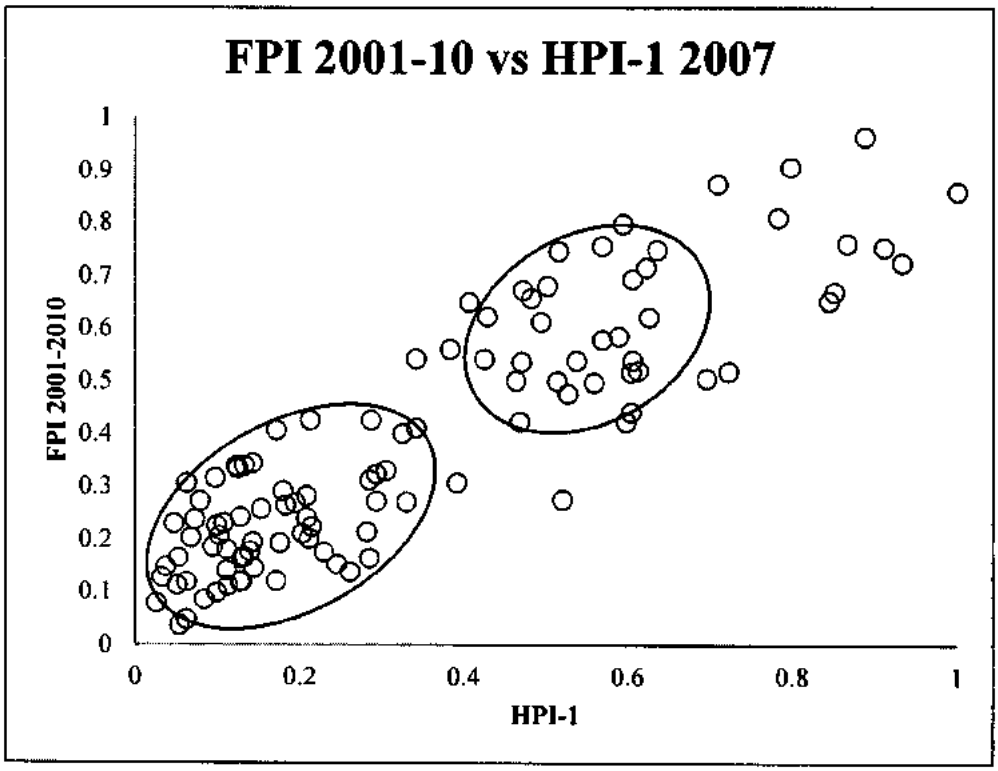


Figure 20: Scatter diagram of HPI-1 2007 and FPI 2001-2010

However a more precise picture about the differences in the ranks of these countries is presented in the following histogram, where some countries differ up to 50 places.

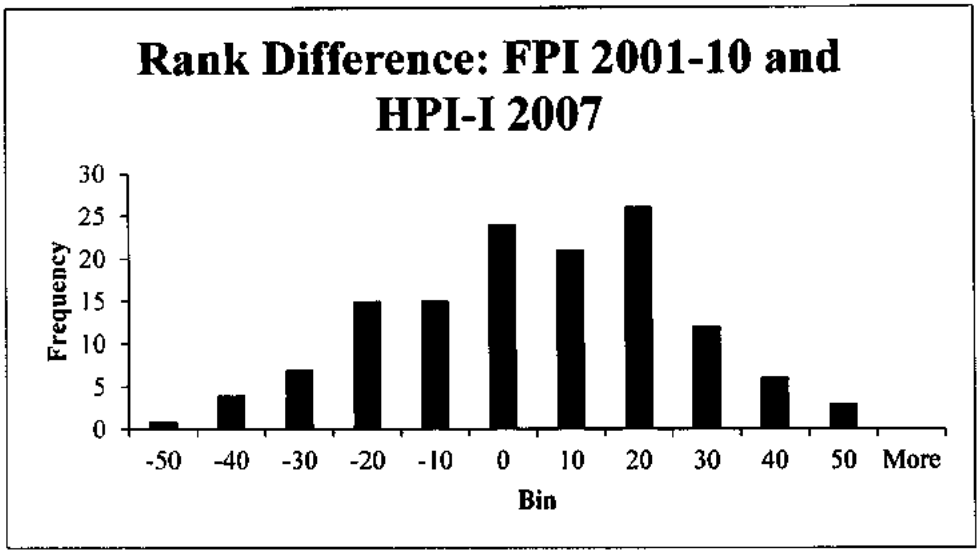


Figure 21: Histogram of rank difference between HPI-1 2007 and FPI 2001-2010 scores

Here we make a pairwise comparison of Morocco and Cameroon which suffer from roughly similar level of poverty according to the HPI-1 poverty estimates but widely diverge in terms of functioning poverty.

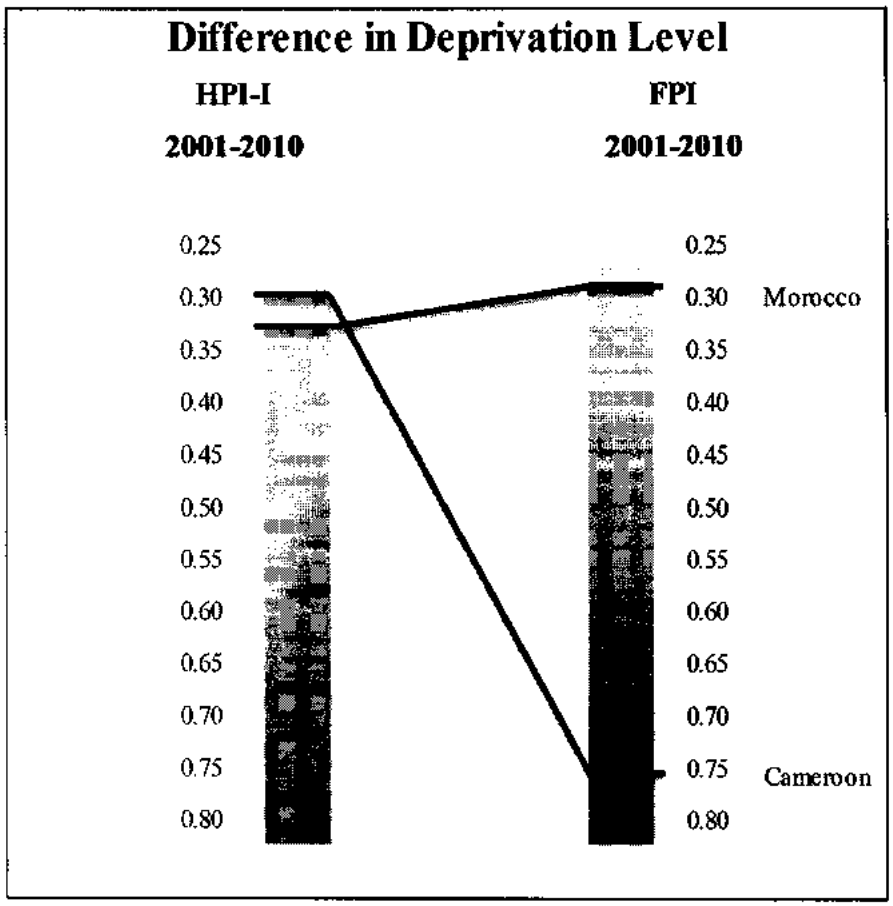


Figure 22: Comparison of level of poverty in two countries in HPI-1 and FPI

There was 30.8% poverty according to the estimates of Human Poverty Index-1 in 2007 in Cameroon and 31. 1% in Morocco. [26] However, in the period between 2001 and 2010, there was 75% relative functioning deprivation (relative to the most deprived country in the index in the initial period) in Cameroon and 28% in Morocco.

In the following chart, a comparison is made between various indicators of deprivation of Morocco and Cameroon to identify the factors that bring about such a significant difference in their respective ranks in these countries in FPI.

[26] http://hdr. undp. org/en/media/HDR_2009_Tables_rev. xls

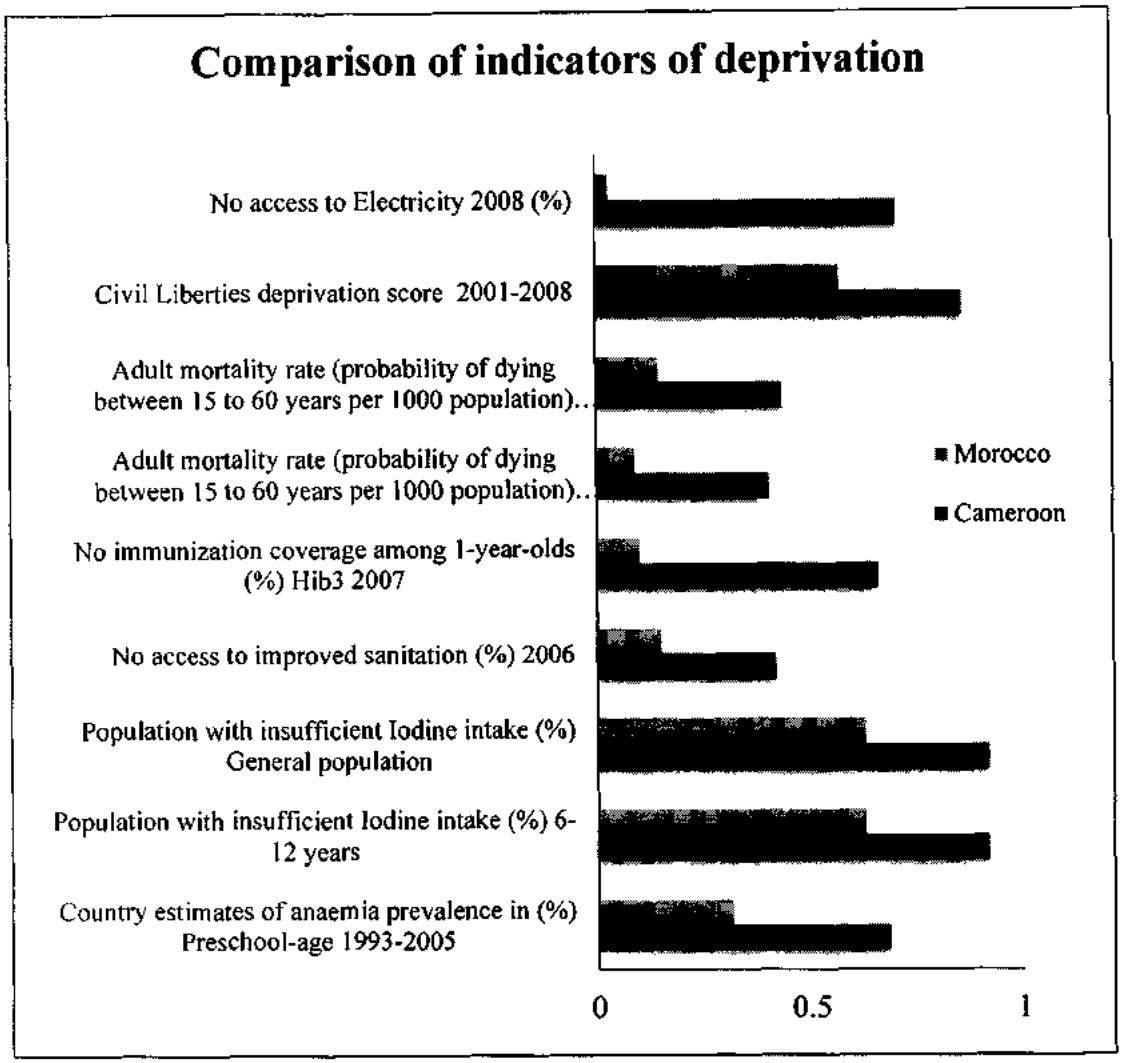


Figure 23: Comparison of indicators of deprivation

Large differences in the mortality rate, access to electricity and sanitation facilities besides glaring disparities in the civil liberties and undernourishment represented by anaemia prevalence in Morocco and Cameroon contribute to a vast disparity in the ranks of these countries in FPI. This underscores the need to initiate a debate aimed at developing a consensus on the relative importance of various dimensions of wellbeing for cross-country comparison and devising a suitable weighting strategy to address such anomalies in the existing measures of wellbeing.

5.3.2.4 Comparison of Functioning Poverty Index with Gallup's Life Satisfaction

A scatter diagram of the countries, for which the data on FPI and Gallup's Life Satisfaction survey was available, reveals interesting patterns. Up to a point there is an inverse relationship between life satisfaction and functioning poverty which is theoretically plausible. However, beyond that, almost similar level of life satisfaction is associated with functioning poverty levels which range from 40% to 90% as is indicated by two ovals. Further research is required to assess the plausibility of assumptions of various measures to come up with a conclusion whether life satisfaction is an obverse side of deprivation or the deprived individuals could still be satisfied or conversely the individuals with not much serious deprivations can still be dissatisfied.

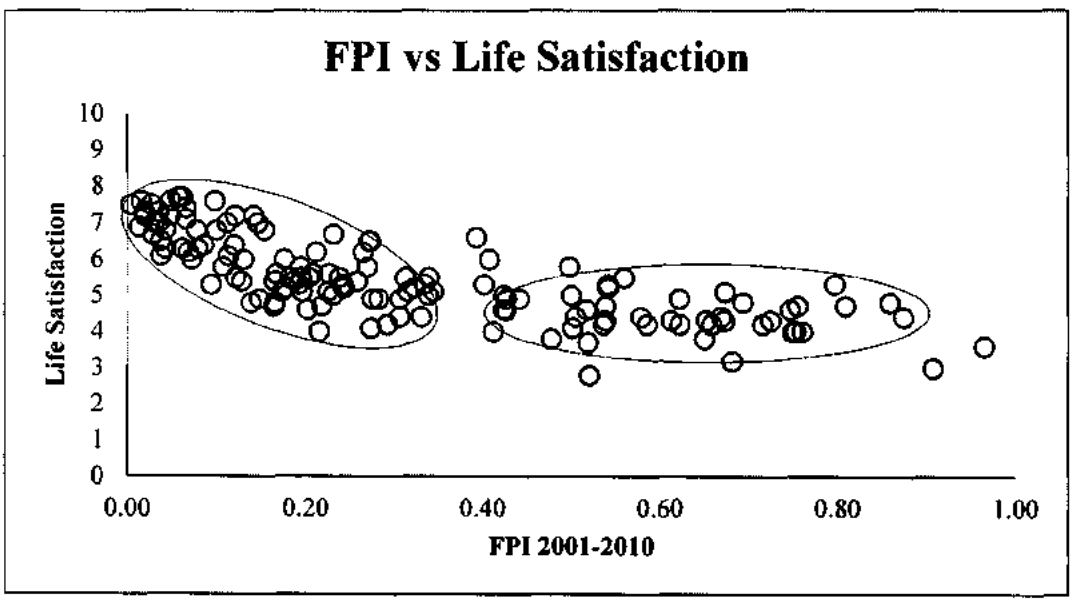


Figure 24: Scatter diagram of Gallup's Life Satisfaction and FPI 2001-2010 scores

Here a relatively little rank difference is observed as compared to FPI's rank differences with other measures such as World Bank's international poverty line based estimates, HDI and HPI-1.

In the following histogram, the rank difference between FPI and Gallup's Life Satisfaction survey [27] is presented. [28]

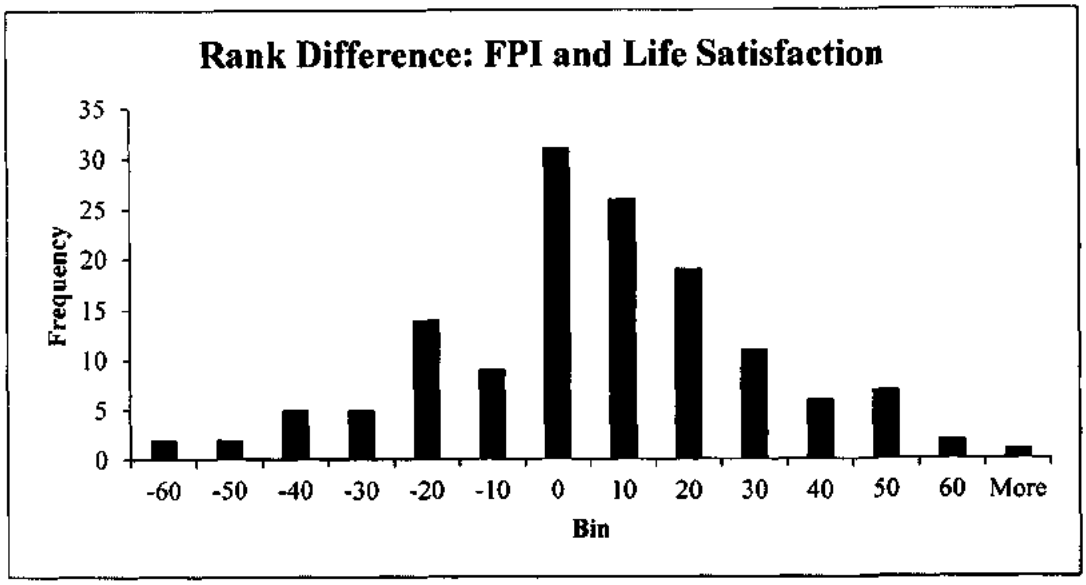


Figure 25: Histogram of rank difference between Gallup's Life Satisfaction and FPI 2001-2010 scores

Coming back to making a pairwise comparison, Armenia and Central African Republic are found to have an exactly equal life satisfaction level but widely diverge in terms of functioning poverty.

[27] https://worldview. gallup. com/world_poll/wellbeing/life_satisfaction

[28] It may be noted that the higher the Life Satisfaction score on the Cantril ladder indicates a greater subjective well-being. However, we assigned the highest rank to country with least life satisfaction for making a comparison with FPI 2001-2010.

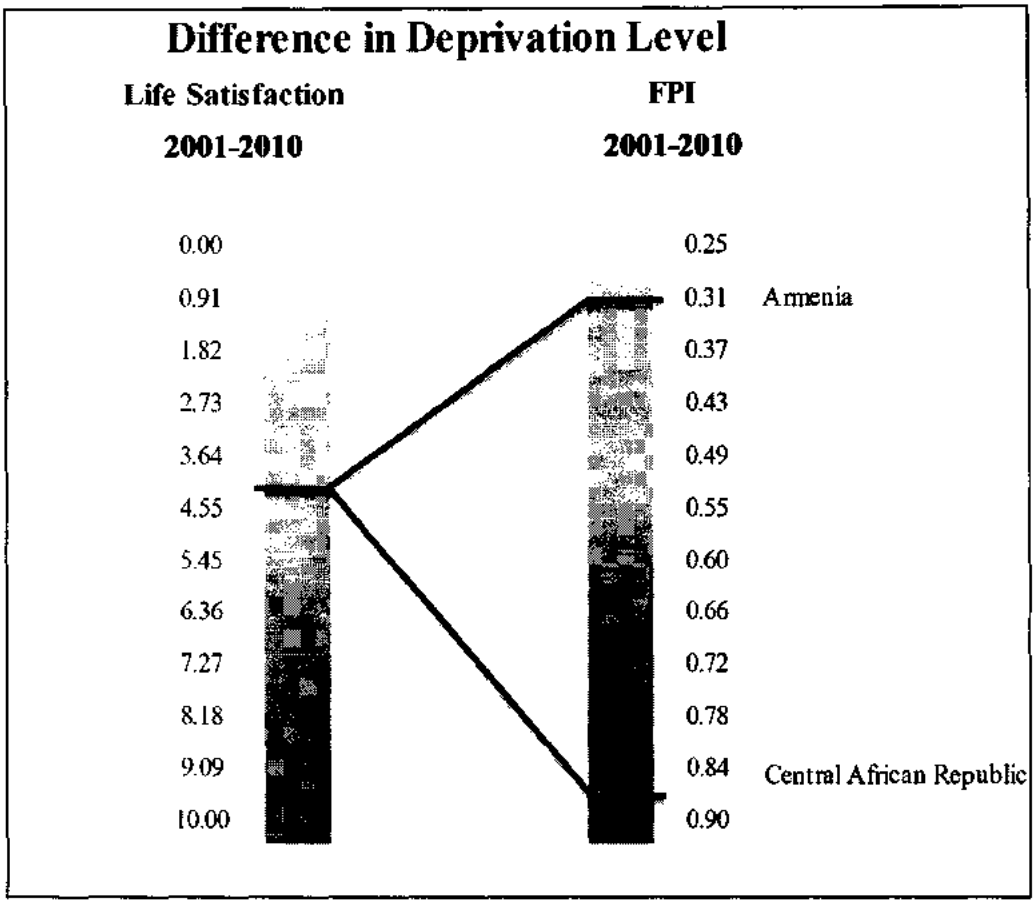


Figure 26: Comparison of level of poverty in two countries in Gallup's Life Satisfaction survey and FPI

Note. A higher Life Satisfaction score on the Cantril ladder indicates a greater subjective wellbeing

There was 24% relative functioning deprivation in Armenia and 89% in Central African Republic in the period between 2001 and 2010. However the Gallup World Poll's Life Satisfaction score for both of these countries was 4. 4. In the chart below, we compare some important indicators for both the countries which have a bearing on human wellbeing.

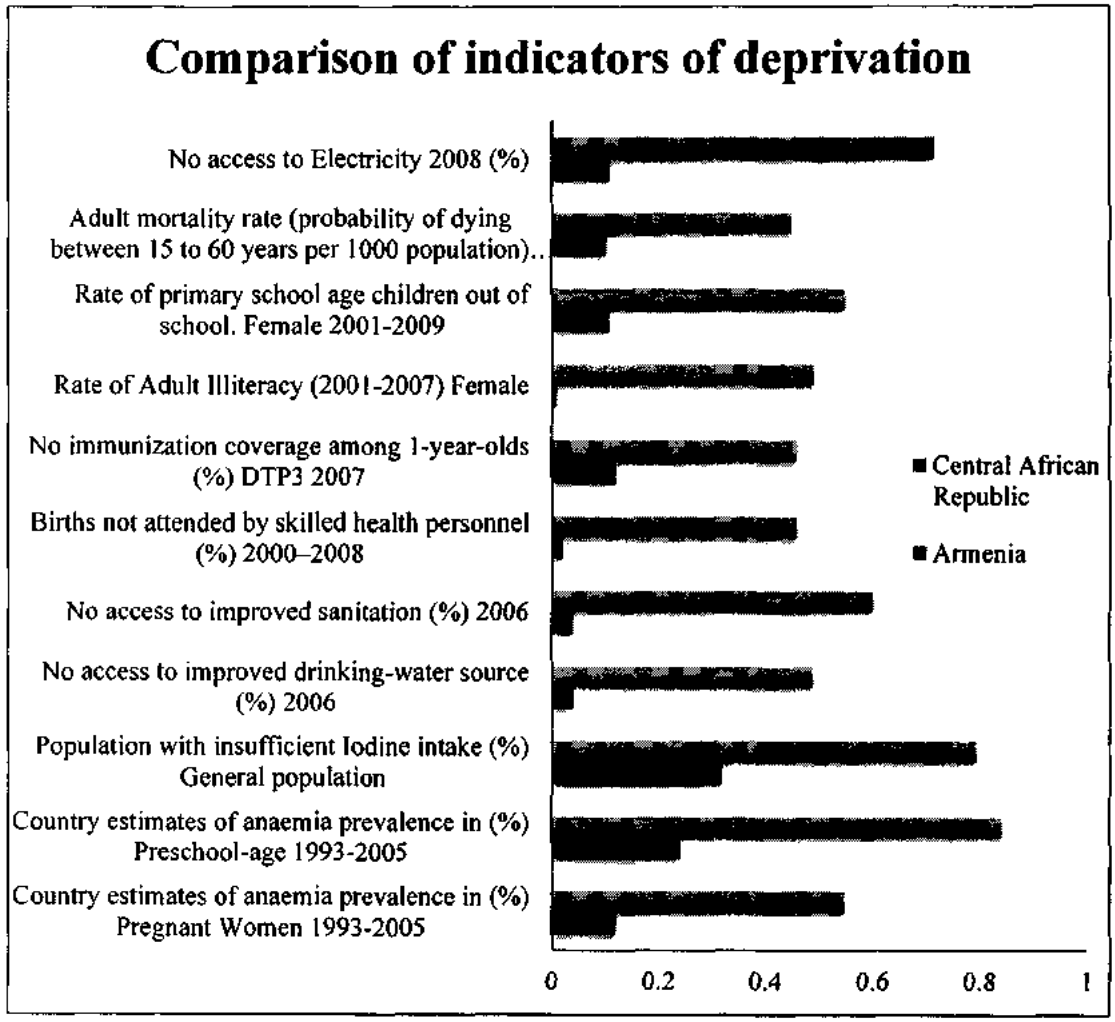


Figure 27: Comparison of indicators of deprivation

In view of the huge differences, which are evident in the chart above, in indicators such as access to electricity, drinking water and improved sanitation besides wide gaps in the literacy level and health care available to women in Armenia and Central African Republic, an exactly similar level of life satisfaction may possibly point towards heterogeneity in the preferences of various cultures in the world. It also emphasizes the need to develop comprehensive wellbeing measurement methods which incorporate richly variegated dimensions of wellbeing, address the differences in the preferences of people belonging to various cultures squarely and are based on

more plausible theoretical foundations. FPI is expected to anticipate development of such wellbeing measurement methods in future.

5.3.2.5 Comparison of Functioning Poverty Index with Multidimensional Poverty Index

Finally, we compare the deprivation level in the world as visualized by MPI and FPI. Again both the measures are broadly correlated. However, a large number of countries in the sample marked by an oval in the scatter plot below demonstrates levels of functioning poverty which reaches up to 35% while showing no or less than 5% multidimensional poverty.

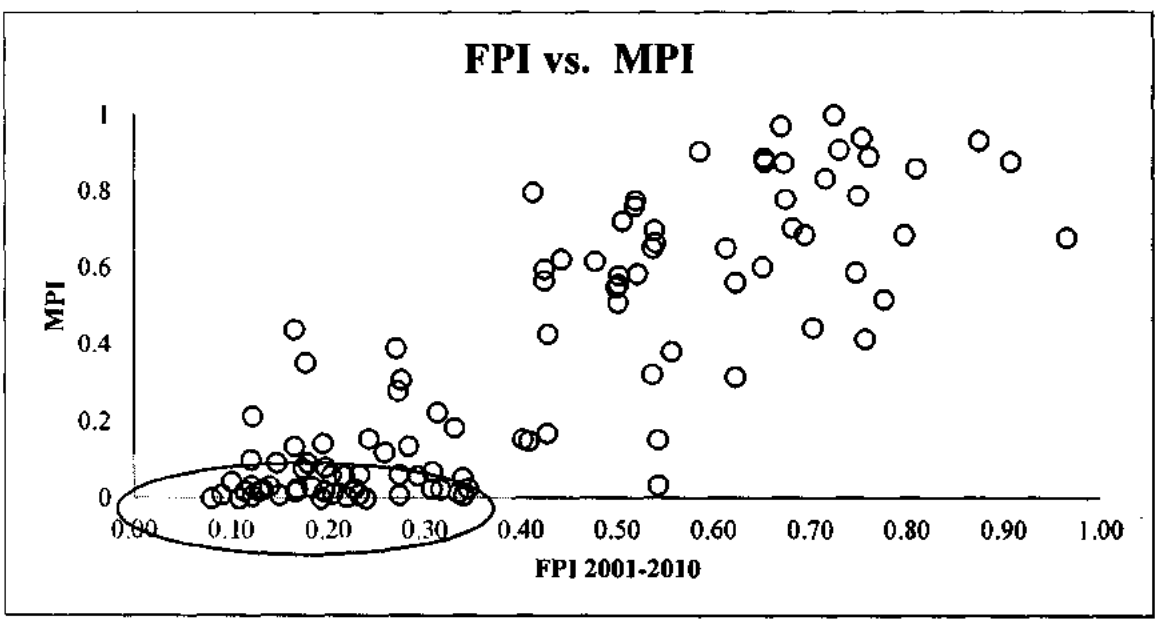


Figure 28: Scatter diagram of MPI 2010 and FPI 2001-2010 scores

As far as the differences in the countries' ranks in both the measures are concerned, the majority of the countries do not shift their positions by more than 10 rank places. However, a few countries

move from each other in terms of their ranks by 40 rank places. What brings them so far from each other is explained with the help of a comparison of two countries which have roughly the same development level in MPI but which diverge sharply in FPI.

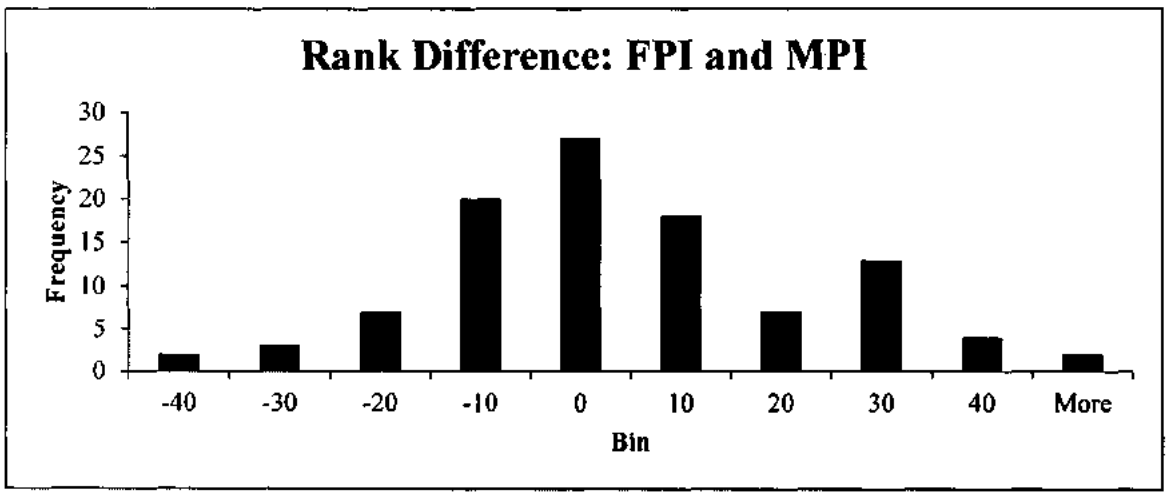


Figure 29: Histogram of rank difference between MPI and FPI 2001-2010 scores

We choose Nicaragua and Swaziland which have exactly a same level of deprivation in MPI measure but very dissimilar deprivation level in the FPI and then we compare them to find what fundamental differences exist between these countries which were identified by FPI but missed by FPI.

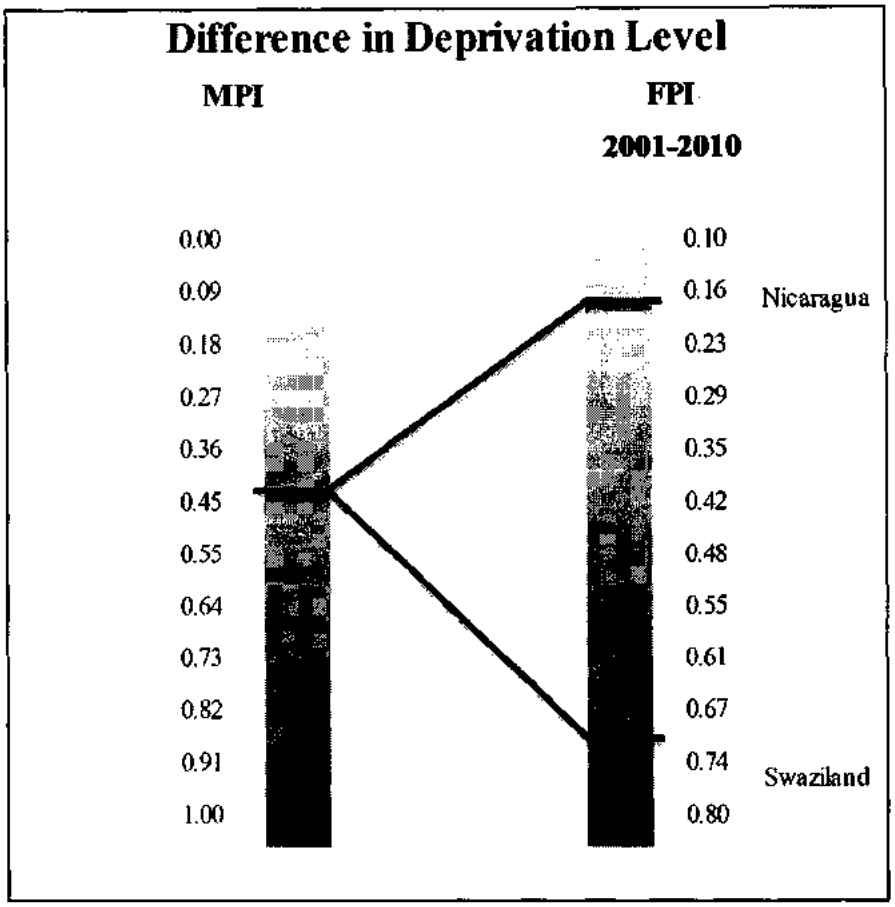


Figure 30: Comparison of level of poverty in two countries in MPI and FPI

In the period between 2001 and 2010, there was 17% relative functioning deprivation (relative to the most deprived country in the initial period) in Nicaragua and 70% in Swaziland. However, there was 44% relative multidimensional headcount poverty (relative to the most deprived country in the index) in both of these countries. [29]

Below we show a bar chart for making pairwise comparison of different indicators of wellbeing.

[29] (Alkire & Santos, Acute Multidimensional Poverty. A New Index for Developing Countries, 2010).

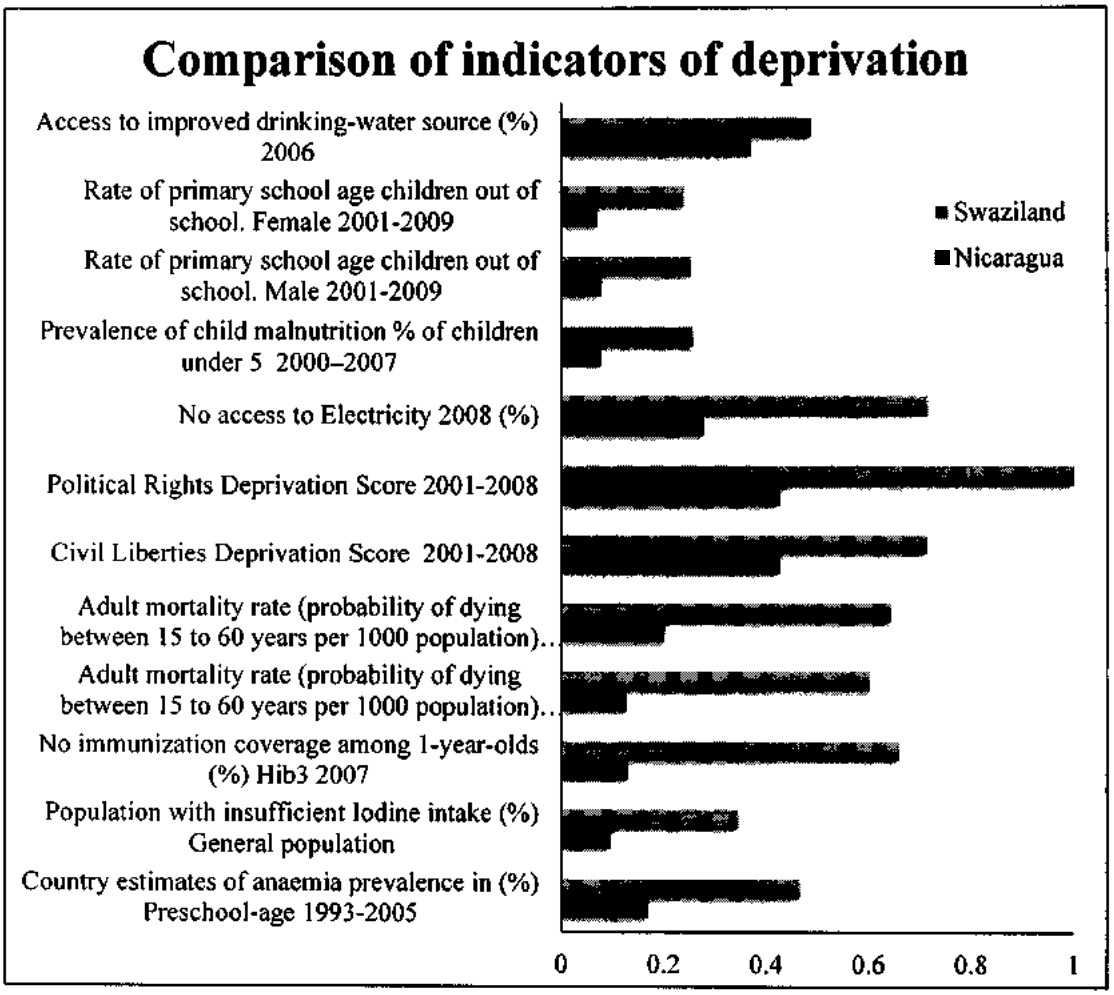


Figure 31: Comparison of indicators of deprivation

Even a cursory inspection of the indicators of deprivation in the bar chart above reveals fundamental differences between these two countries. The most glaring difference and which incidentally matters most in FPI is the adult mortality rate. Similarly, deprivation level in terms of political rights available to the population in both the countries is largely different. Access to electricity, malnutrition both among children and general population besides the ratios of school age children out of school reveal wide gaps.

The discussion above emphasizes the need for including in any measure of wellbeing a rich array of dimensions which are considered important for human wellbeing so that a picture of poverty emerges which is more comprehensive and is relatively free from the problems found in other measures of wellbeing.

5.4 TEST OF ROBUSTNESS

In order to test the robustness of FPI to a change in the assumptions of the model, we followed two approaches. The first approach involves a change in the order of various dimensions using the same weights which were originally used in the present study. The second approach involves using weights which were different from the weights used in the present study. The weights used in the second category are derived in two ways. *i*) by calibrating the theta (using alternative set of coefficients by which to give preference to one dimension of deprivation relative to the other), and using the weights used by other measures of wellbeing and deprivation such as HDI, HPI and MPI.

Two types of methods have been used to assess the stability of ranks with the change in the assumptions of the model. first, Kendall's rank correlation coefficient (Tau-b), Pearson's correlation coefficient and Spearman's rank correlation coefficient for a pairwise correlation and secondly, Kendall's W and Friedman test of rank independence for determining the concordance among all rankings simultaneously. This is summarized in the following diagram:

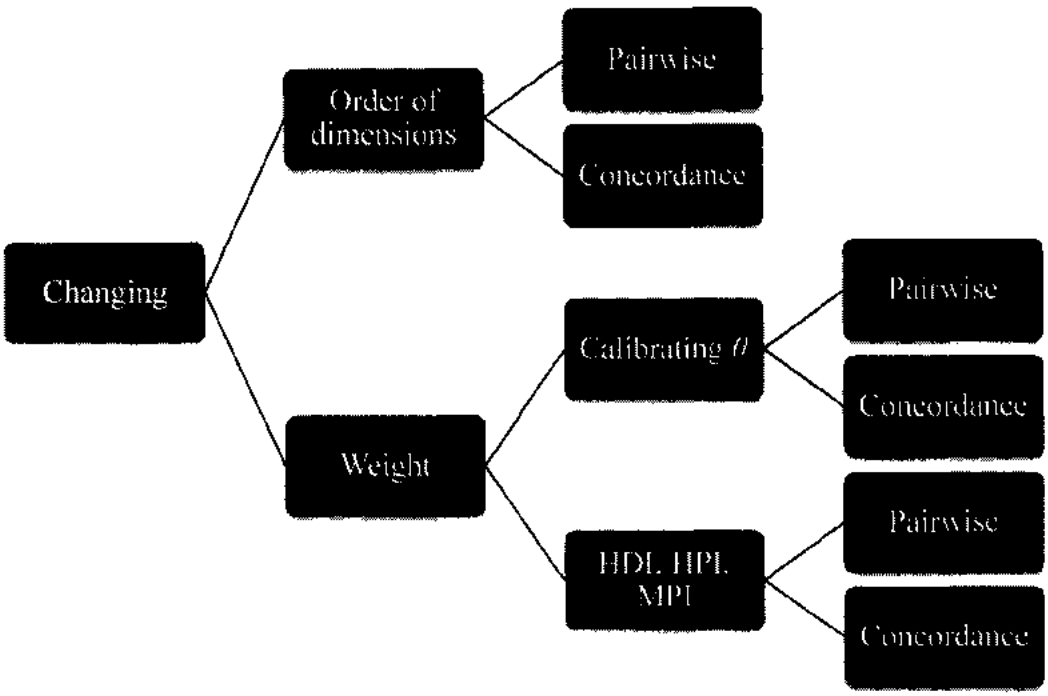


Figure 32: Concordance of alternative scenarios by changing the weight and order of dimensions of ranks

We ran the tests on the whole set of countries which number 193 in the present instance and then repeated the exercise on these countries after they were divided into five subgroups of approximately equal size corresponding to various levels of deprivation.

In the following lines, we will present the estimates and discuss various aspects of robustness issue.

5.4.1 SAME WEIGHTS

First we discuss the approach involving a change in the order of various dimensions using the same weights which were originally used in the present study. As nine dimensions of deprivation with corresponding indicators are considered in this study, one way to determine robustness of

present weighting strategy is to consider the reordering of these nine dimensions in as many ways as are possible. This option is too cumbersome and would be meaningful only if we have some prior information regarding the similarity of the importance of all the dimensions, which in fact is not the case. We therefore divide these dimensions into three subgroups and call it SGD_i (Subgroup of dimensions). The θ_i are the dimensional weights which were originally used in the study.

Table 9: Nine dimensions of wellbeing divided into three subgroups

	Dimensional weight	Dimensions of deprivation
SGD_1	θ_1	Living a life of normal length
	θ_2	Adequate nourishment
	θ_3	Healthy living
SGD_2	θ_4	Employment
	θ_5	Literacy
	θ_6	Clean household energy
SGD_3	θ_7	Economic freedom
	θ_8	Political freedom
	θ_9	Clean environment

Instead of reordering all these nine dimensions in all possible ways, we reorder these three subgroups of dimensions without changing the weights. The resulting combinations are called reordered subgroup of dimensions or RSGDs. When we divide the whole set of countries into only two subgroups, we put the four highest ranking dimensions in the first subgroup and the rest of the dimensions in the second subgroup. |

$RSGD_{1,3,2}$ means that the first set of thetas which are weights attached to the three highest ranking dimensions in the original index are attached to the first subgroup of dimensions, SGD_1, followed by second set of thetas attached to third subgroup of dimensions (SGD_3) and finally the third set of thetas attached to the second subgroup of dimensions (SGD_2). As there are six

possible ways in which these three subgroups of dimensions can be reordered, we write here an exhaustive list of such combinations. $RSGD_{1,2,3}$, $RSGD_{1,3,2}$, $RSGD_{2,1,3}$, $RSGD_{2,3,1}$, $RSGD_{3,1,2}$ and $RSGD_{3,2,1}$. Similarly, $RSGD_{2,1}$ means that the set of thetas attached to the four highest ranking dimensions are attached to the bottom four dimensions.

5.4.1.1 Pairwise correlation

First we report the pairwise correlation among country ranks using three types of correlation coefficients.

Table 10: Pairwise correlation among FPI ranks by changing the order of dimensions while using same weights

		1990-2000						2001-2010					
		RSGD *1, 3, 2*	***RSGD*** *2, 1, 3*	***RSGD*** *2, 3, 1*	***RSGD*** *3, 1, 2*	***RSGD*** *3, 2, 1*	***RSG*** $D_{2,1}$	***RSGD*** *1, 3, 2*	***RSGD*** *2, 1, 3*	***RSGD*** *2, 3, 1*	***RSGD*** *3, 1, 2*	***RSGD*** *3, 2, 1*	***RSG*** $D_{2,1}$
All Countries	Spearman	0. 95	0. 69	0. 72	0. 66	0. 70	0. 85	0. 96	0. 75	0. 74	0. 69	0. 71	0. 87
	Kendall	0. 84	0. 51	0. 54	0. 49	0. 51	0. 66	0. 85	0. 55	0. 56	0. 50	0. 53	0. 68
	Pearson	0. 95	0. 69	0. 72	0. 66	0. 70	0. 85	0. 96	0. 75	0. 74	0. 69	0. 71	0. 87
Top 20% (Extremely poor)	Spearman	0. 92	0. 51	0. 46	0. 47	0. 42	0. 42	0. 93	0. 17	0. 16	0. 04	0. 12	0. 31
	Kendall	0. 75	0. 35	0. 32	0. 34	0. 29	0. 29	0. 76	0. 11	0. 13	0. 03	0. 10	0. 22
	Pearson	0. 91	0. 45	0. 43	0. 41	0. 38	0. 40	0. 89	0. 16	0. 25	0. 08	0. 21	0. 35
Upper Middle 20% (Poor)	Spearman	0. 75	0. 29	0. 34	0. 28	0. 31	0. 69	0. 77	0. 14	0. 00	0. 01	-0. 05	0. 61
	Kendall	0. 59	0. 20	0. 23	0. 18	0. 20	0. 49	0. 59	0. 11	0. 00	0. 00	-0. 04	0. 41
	Pearson	0. 77	0. 32	0. 34	0. 30	0. 32	0. 66	0. 75	0. 18	0. 07	0. 03	0. 02	0. 58
Middle. 20% (Moderately Poor)	Spearman	0. 65	-0. 18	0. 31	-0. 14	0. 29	0. 38	0. 25	0. 35	-0. 09	0. 26	-0. 08	0. 31
	Kendall	0. 44	-0. 13	0. 19	-0. 10	0. 17	0. 25	0. 17	0. 24	-0. 04	0. 18	-0. 03	0. 19
	Pearson	0. 64	-0. 18	0. 30	-0. 13	0. 28	0. 36	0. 28	0. 36	-0. 09	0. 23	-0. 08	0. 31
Lower Middle 20% (Least Poor)	Spearman	0. 28	0. 12	0. 12	0. 08	0. 12	-0. 13	0. 29	0. 32	-0. 01	0. 13	0. 00	0. 14
	Kendall	0. 18	0. 09	0. 10	0. 07	0. 10	-0. 10	0. 20	0. 22	-0. 01	0. 10	-0. 01	0. 10
	Pearson	0. 28	0. 14	0. 09	0. 13	0. 11	-0. 10	0. 19	0. 35	-0. 12	0. 17	-0. 10	0. 15
Bottom 20% (Not Poor)	Spearman	0. 80	0. 63	0. 60	0. 66	0. 62	0. 59	0. 80	0. 69	0. 65	0. 70	0. 66	0. 54
	Kendall	0. 62	0. 46	0. 44	0. 48	0. 46	0. 41	0. 61	0. 52	0. 45	0. 49	0. 45	0. 39
	Pearson	0. 50	0. 55	0. 39	0. 53	0. 42	0. 48	0. 48	0. 64	0. 39	0. 62	0. 42	0. 39

It is evident from the table above that reordering the dimensions while using the same set of weights changes the poverty estimates. When all the countries are considered, the pairwise correlation between the original FPI and alternative changes in the order of subgroup of dimensions are significantly correlated, varying from 66% to 95% using Spearman and Pearson correlation statistics and from 49% to 84% using Kendall's correlation statistic in the initial period from 1990-2000 and reaches up to 96% in the subsequent period in 2001-2010. While the upper level of the correlation range is assuring, the lower bound of relatively small yet significant correlation calls for certain explanations.

Throughout the study we have maintained that it would be implausible to consider various dimensions of wellbeing as equally important, and consequently it would be more realistic to attach different weights to various dimensions. This very fact ensures that a high correlation among alternative changes in the order of dimensions only results from a possibly similar level of deprivation such as 50% of children malnourished and 50% deprivation in terms of political rights relative to the most politically deprived country in the world. An insignificant correlation between the FPI and alternative conceptualization with changed orders of dimensions using same weights partly results from dividing the whole set of countries into five subgroups. Dividing 193 countries into further subgroups is expected to reduce the correlation coefficient further down. Another reason for relatively little correlation is that there is a dissimilar level of deprivation in different dimensions such as a very high level of iodine deficiency close to 60% in the developing world in general and relatively low level of unemployment around 10% on the average, for example.

5.4.1.2 Concordance

The same reasoning applies to the measures of concordance across these ranks summarized in the table below.

Table 11: Coefficients of rank concordance for seven FPI ranks generated by changing the order of dimensions while using same weights

	Kendall	Friedman			Kendall	Friedman		
	W	χ^2	df	p-value	W	χ^2	df	p-value
All countries	0. 767	1031	192	8. 80E-115	0. 813	1093	192	5. 58E-126
Top 20% (Extremely poor)	0. 597	155	37	2. 41E-16	0. 445	115	37	5. 62E-10
Upper Middle 20% (Poor)	0. 509	135	38	7. 62E-13	0. 451	120	38	2. 02E-10
Middle. 20% (Moderately Poor)	0. 397	106	38	2. 72E-08	0. 486	129	38	7. 40E-12
Lower Middle 20% (Least Poor)	0. 351	93. 3	38	1. 48E-06	0. 491	131	38	4. 35E-12
Bottom 20% (Not Poor)	0. 69	179	37	1. 79E-20	0. 73	189	37	2. 74E-22

We can see that the degree of concordance estimated by Kendall's W is quite significant when we consider all the countries for both the periods. Similarly, an extremely small p-value of the Friedman's test of rank independence indicates that the null hypothesis of rank independence can be strongly rejected even at 99% confidence level both for all the countries and all the subgroups. The rejection of null hypothesis of the rank independence suggests that the FPI is broadly correlated with other measures of wellbeing. What is the significance of the null hypothesis of rank independence being rejected? This is important to note that as we said in the outset that our measure is an addition to the ongoing debate on the best composite measure of human being. With a sufficient number of measures of wellbeing converging at some point might mean that, we are inching closer to reaching a consensus on the definition and measurement of wellbeing!

The robustness tests are also meant to address the issue of paternalism which is essentially embedded in any conceivable weighting strategy as well as the choice and ranking of the dimensions of wellbeing. The rejection of the null hypothesis of the rank independence suggests that the present FPI remains broadly correlated with the results achieved by changing the assumptions of the model. It gives us a clue that the indicators of deprivation are broadly correlated: a person suffering in one dimension of wellbeing is more likely to suffer in other dimensions.

It may also be noted that the rank robustness to weight depends also on the correlation among dimensions. If the dimensions for a composite index are highly correlated, then there is more chance of having robustness. However, even when the ranking is highly robust it is normal to have low robustness among subgroups (Foster, McGillivray, & Seth, 2013).

Reiterating the previously made point, a strong pairwise correlation or a high degree of concordance among various rankings, after changing the order while using the same set of weights, is possible only if the level of deprivation across dimensions is roughly similar such as 40% of the population suffering from iodine deficiency and 40% the population being illiterate.

5.4.2 DIFFERENT WEIGHTS

5.4.2.1 DIFFERENT THETAS

A more realistic way to test the robustness of the FPI is, therefore, to change the weights without changing the order of the dimensions. One justification for using this strategy is that a

broad consensus may be possible on the relative order of various dimensions in terms of their importance but a consensus on how much weight is to be attached to individual dimensions of wellbeing or deprivation may not be possible. In the FPI, we gave to n-1 dimension sufficient weight relative to the n^{th} dimension so that its third quartile equalled the first quartile of the n^{th} dimension. In the alternative weighting schemes, we attached n-1 dimension sufficient weight that its 70^{th}, 60^{th} and 50^{th} percentile equalled the 30^{th}, 40^{th} and 50^{th} percentile of the n^{th} dimension respectively and express it as P(70,30), P(60,40) and P(50,50).

5.4.2.1.1 Pairwise correlation

The pairwise correlation coefficients give the following results.

Table 12: Pairwise correlation among FPI ranks by using alternative weights (calibrating θ)

		P(70,30)	P(60,40)	P(50,50)	P(70,30)	P(60,40)	P(50,50)
All Countries	Spearman	1.00	0.98	0.93	1.00	0.99	0.97
	Kendall	0.96	0.87	0.77	0.96	0.92	0.86
	Pearson	1.00	0.98	0.93	1.00	0.99	0.97
Top 20% (Extremely poor)	Spearman	0.98	0.85	0.67	0.97	0.79	0.45
	Kendall	0.90	0.69	0.51	0.87	0.62	0.31
	Pearson	0.98	0.82	0.63	0.97	0.79	0.42
Upper Middle 20% (Poor)	Spearman	0.98	0.89	0.78	0.97	0.86	0.80
	Kendall	0.88	0.71	0.60	0.85	0.69	0.60
	Pearson	0.97	0.87	0.75	0.97	0.86	0.77
Middle. 20% (Moderately Poor)	Spearman	0.92	0.65	0.50	0.89	0.65	0.51
	Kendall	0.76	0.45	0.33	0.71	0.46	0.35
	Pearson	0.91	0.64	0.51	0.89	0.67	0.52
Lower Middle 20% (Least Poor)	Spearman	0.84	0.32	0.01	0.95	0.84	0.74
	Kendall	0.65	0.21	0.00	0.81	0.65	0.55
	Pearson	0.83	0.35	0.03	0.94	0.82	0.73
Bottom 20% (Not Poor)	Spearman	0.97	0.86	0.80	0.99	0.93	0.80
	Kendall	0.86	0.70	0.62	0.92	0.79	0.62
	Pearson	0.97	0.84	0.57	0.98	0.93	0.79

In the table above, we see a very high correlation up to 100% between alternative weighting strategies when all countries are considered. However, in the subgroups, lot of variability in the correlation level is visible which ranges from 0% to 98%. Few points might be noted to understand this huge variability. A distinctly decreasing correlation coefficient value is evident as we move away from the original weighting scheme in the FPI. A 0% correlation between the original FPI and alternative weighting scheme which is P(50,50) in the fourth subgroup of "Least Poor" countries points to the fact that this subgroup is different from other groups. It also underscores the important fact that the assumption of equal importance of various dimensions of wellbeing made in the alternative weighting schemes strongly militates against the assumption of the model that the dimensions of wellbeing are not equally important.

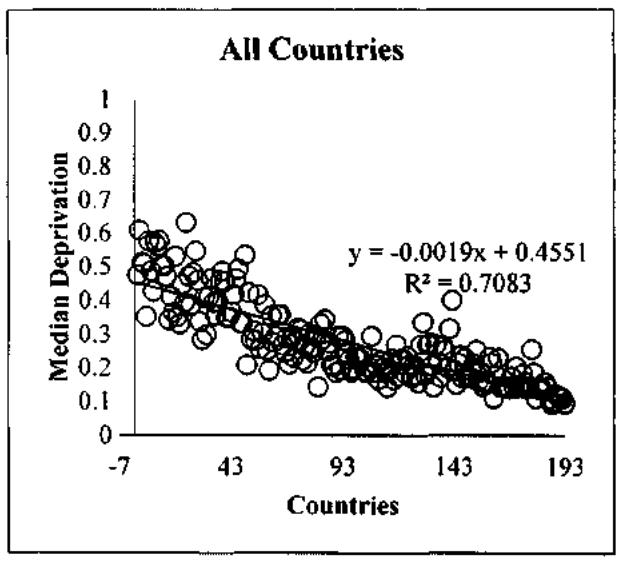
5.4.2.1.2 Concordance

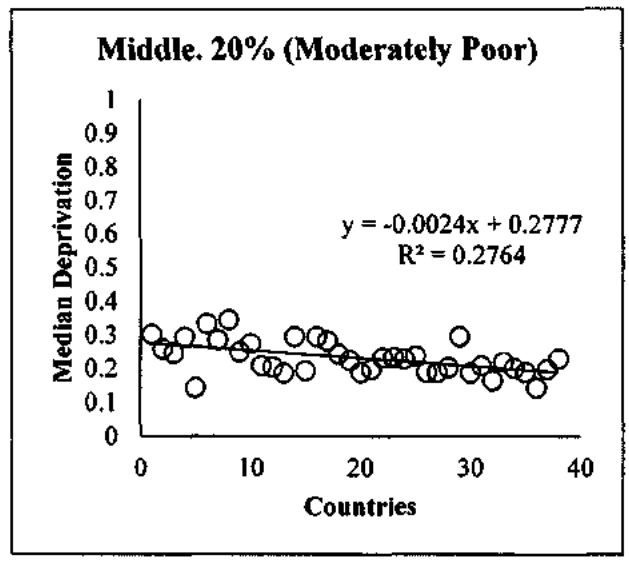
As far as the concordance is concerned, a very high degree of agreement was observed among these ranks through an application of both Kendall's coefficient of concordance (W) and Friedman's test of rank independence. The results are summarized as under:

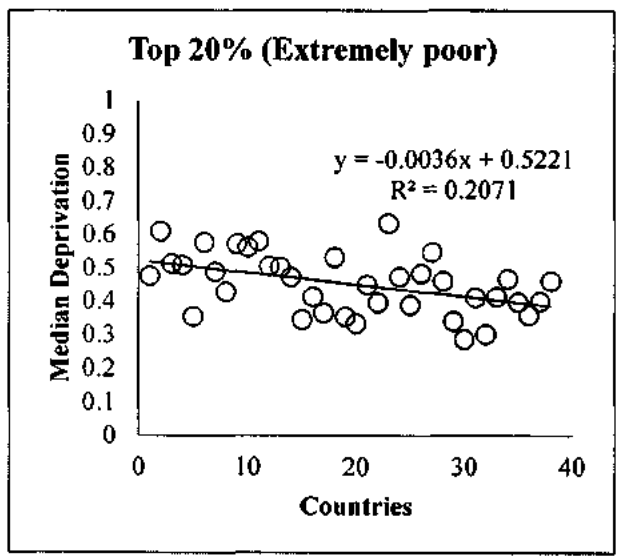
Table 13: Coefficients of rank concordance for four FPI ranks generated using weights produced by using alternative weights (calibrating θ)

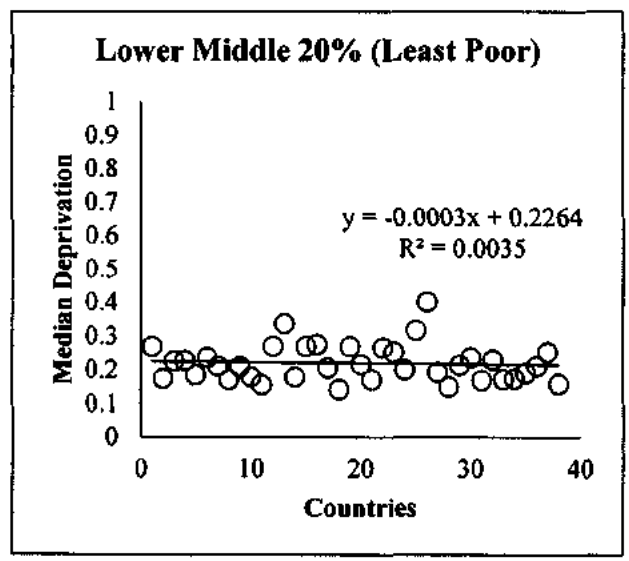
	Kendall	Friedman			Kendall	Friedman		
	W	**χ^2**	**df**	**p-value**	**W**	**χ^2**	**df**	**p-value**
All countries	0. 975	749	192	9. 28E-67	0. 992	762	192	7E-69
Top 20% (Extremely poor)	0. 894	132	37	1. 19E-12	0. 826	122	37	4. 77E-11
Upper Middle 20% (Poor)	0. 923	140	38	1. 24E-13	0. 93	141	38	8. 45E-14
Middle. 20% (Moderately Poor)	0. 823	125	38	3. 28E-11	0. 833	127	38	1. 83E-11
Lower Middle 20% (Least Poor)	0. 619	94	38	1. 18E-06	0. 917	139	38	1. 75E-13
Bottom 20% (Not Poor)	0. 92	136	37	3E-13	0. 934	138	37	1. 31E-13

A degree of concordance among these measures exceeding 99%, when all countries are concerned, reveal the fact that FPI is remarkably robust to a change in weights. However, around 62% concordance in the fourth "Least Poor" subgroup as against around 90% concordance in the rest of subgroups on the average may have something to do with the fact that this subgroup is fundamentally different from other subgroups. The following panel which comprises six diagrams reflecting median deprivation of nine dimensions confirm this assumption.









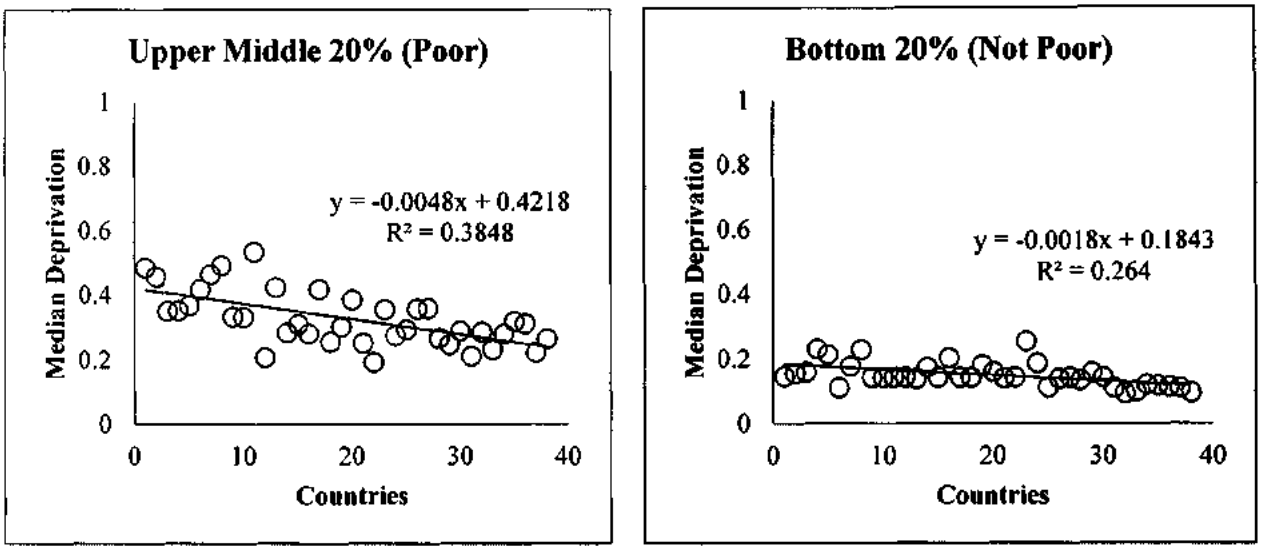


Figure 33: Country level data on stunted and underweight children

A very small R^2 of the fourth subgroup of 20% of countries, termed "Least Poor" in FPI ranking, which by definition is square of the sample correlation coefficient between the outcomes and their predicted values in the context of linear regression when intercept term is included, suggests that a median of various dimensions of deprivation for this group of 39 countries does not show any 'trend' unless some explicit weights are assigned to them. This may be the reason behind a small pairwise correlation coefficient or other measures of concordance for any weighting scheme or any reordering of the dimensions.

In the following diagram, a simple median of the all the dimensions and their corresponding indicators is regressed on the ranks of the country as they actually stand in FPI. An examination of the countries found to be in this subgroup of "Least Poor" countries seems quite plausible when their relative ranks in HDI are concerned.

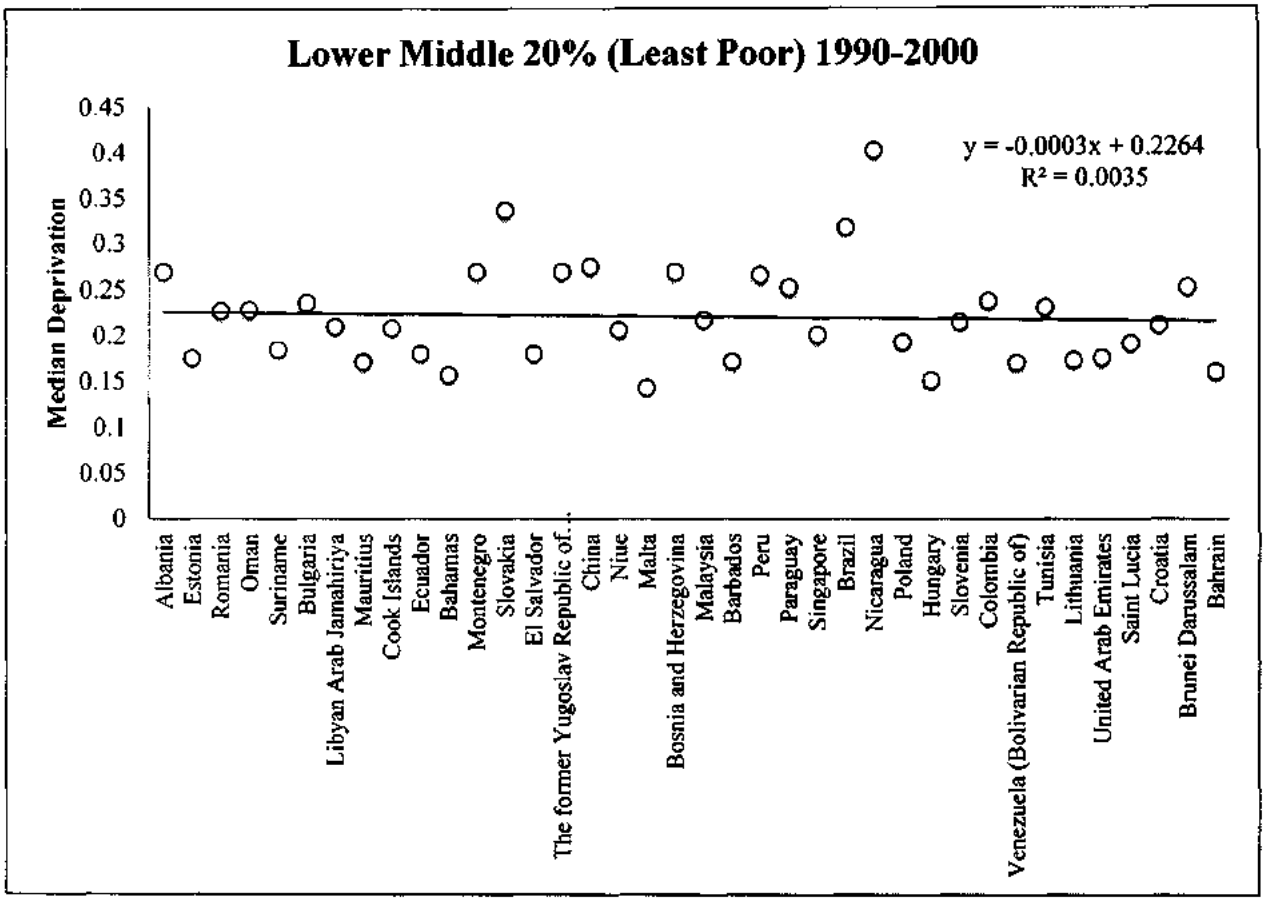


Figure 34: Country level data on stunted and underweight children

Source: WHO

5.4.2.2 HDI, HPI, MPI

We also tested the robustness of FPI by assigning the weights to various dimensions which were used by various other measures of wellbeing such as Human Development Index (HDI), Human Poverty Index (HPI) and Multidimensional Poverty Index (MPI).

5.4.2.2.1 Pairwise correlation

The results of pairwise correlation are summarized as under.

Table 14: Pairwise correlation among FPI ranks by using weights as assigned in HDI, HPI and MPI

		HDI	MPI	HPI	HDI	MPI	HPI
All Countries	Spearman	0. 89	0. 93	0. 83	0. 89	0. 93	0. 72
	Kendall	0. 72	0. 77	0. 66	0. 73	0. 77	0. 53
	Pearson	0. 89	0. 93	0. 83	0. 89	0. 93	0. 72
Top 20% (Extremely poor)	Spearman	0. 59	0. 53	0. 48	0. 35	0. 41	0. 23
	Kendall	0. 43	0. 39	0. 35	0. 24	0. 31	0. 17
	Pearson	0. 57	0. 52	0. 44	0. 37	0. 40	0. 30
Upper Middle 20% (Poor)	Spearman	0. 71	0. 81	0. 70	0. 59	0. 71	0. 31
	Kendall	0. 54	0. 63	0. 53	0. 40	0. 52	0. 21
	Pearson	0. 70	0. 77	0. 56	0. 56	0. 67	0. 22
Middle. 20% (Moderately Poor)	Spearman	0. 46	0. 61	0. 27	0. 29	0. 55	0. 16
	Kendall	0. 28	0. 42	0. 21	0. 20	0. 38	0. 11
	Pearson	0. 48	0. 60	0. 27	0. 31	0. 53	0. 17
Lower Middle 20% (Least Poor)	Spearman	0. 03	0. 11	-0. 08	0. 06	0. 17	0. 07
	Kendall	0. 01	0. 07	-0. 06	0. 05	0. 13	0. 04
	Pearson	0. 01	0. 14	-0. 08	0. 03	0. 19	0. 08
Bottom 20% (Not Poor)	Spearman	0. 76	0. 64	0. 45	0. 76	0. 52	0. 44
	Kendall	0. 57	0. 45	0. 31	0. 58	0. 34	0. 32
	Pearson	0. 49	0. 57	0. 28	0. 46	0. 39	0. 30

Before we discuss the correlation between FPI using original weighting strategy and FPI using alternative weights as proposed in MPI, HDI or HPI, it may be noted that MPI is a measure of headcount multidimensional poverty which involves various assumptions like cut-offs and equal weights across various dimensions. To derive weights for simulating our model, we considered any country where 20% or more of the population suffered from any deprivation as deprived. The 'cut-off' in the present instance is therefore 0. 2.

Around 93% correlation between HPI and MPI is most marked followed by HDI and HPI which equals 89% and 83% respectively when all countries are considered. However in the subgroups, the pictures radically changes. Again in the fourth "Least Poor" subgroup, the correlation is insignificant. Even the sign of correlation coefficient is changed when FPI and HPI are correlated in this subgroup.

The reason for so high correlation between FPI and HDI and MPI respectively may lie in the fact that both MPI and HDI are linear combinations of various dimensions of wellbeing like FPI, whereas in HPI, a power means approach is followed which is essentially a non-linear weighting strategy. (We are not concerned with the updated formula of HDI in this study).

5.4.2.2.2 Concordance

Here we take a look at the concordance between these measures.

Table 15: Coefficients of rank concordance for four FPI ranks generated by using weights as assigned in HDI, HPI and MPI

	Kendall	Friedman			Kendall	Friedman		
	W	χ^2	df	p-value	W	χ^2	df	p-value
All countries	0. 93	714	192	4. 22E-61	0. 888	682	192	4. 42E-56
Top 20% (Extremely poor)	0. 771	114	37	8. 70E-10	0. 679	101	37	8. 80E-08
Upper Middle 20% (Poor)	0. 867	132	38	2. 78E-12	0. 728	111	38	4. 94E-09
Middle. 20% (Moderately Poor)	0. 681	104	38	5. 49E-08	0. 623	94. 7	38	9. 55E-07
Lower Middle 20% (Least Poor)	0. 474	72. 1	38	0. 000696	0. 426	64. 8	38	0. 00436
Bottom 20% (Not Poor)	0. 741	110	37	4. 05E-09	0. 708	105	37	2. 10E-08

A very high Kendall's W coefficient value suggests a high level of concordance among these ranks. Similarly an extremely low p-value in Friedman's test of rank independence strongly rejects the null hypothesis of rank independence.

An analysis of the preceding discussion leads us to the conclusion that FPI is highly robust to a range of weights that were suitably calibrated to include various assumptions about the relative importance of various dimensions of wellbeing. FPI is also significantly robust to a change in the order of dimensions. Both pairwise correlations and overall concordance among ranks for the subgroups, especially the fourth subgroup of "least poor" countries, were at times not significant partly because the countries falling in this subgroup, when ranked according to the FPI estimates, do not show any *trend* whatsoever in terms of the deprivation they face.

CHAPTER 6

CONCLUSION

In this study, we have documented the history of tool developed to analyse the isues of poverty, deprivation and wellbeing right from the 4th century BC. We discussed the unidimensional approaches to the analysis of poverty developed over time as well as the multidimensional approaches and the issues involved with each type of framework and also identified the overlapping strands found in both type of approaches. We more thoroughly discussed relatively more recent multidimensional approaches such as social exclusion approach, participatory approach, human development approach and capability approach which dealt with the complex questions of conceptualization, identification and aggregation of poverty.

It is, however, the human development framework and closely related capability approach and the multidimensional wellbeing/deprivation indices based on these approaches such as Human Development Index (HDI), Human Poverty Index (HPI) and Multidimensional Poverty Index (MPI) which are of more direct relevance to our work and it is with these indices that our work is most closely related to. Some of the important issues in the framework of multidimensional poverty indices relate to the definition of poverty, choice of various dimensions of wellbeing and the magnitude of weights assigned

to various dimensions of wellbeing or deprivation. The issues of assigning explicit weights as value judgments and arbitrariness of these explicit weights have attracted a lot of attention and so far no consensus on these issues seems in sight.

We have based our study on the capability approach developed by Amartya Sen because of its theoretical appeal. In the capability theory, two terms "functionings" and "capabilities" are of central importance. We chose to conceptualize poverty as a deprivation of certain functionings which are related with the kind of life that people actually live. As opposed to functionings, capabilities are related with the substantive freedoms to spend the life that one values. The choice of functionings instead of capabilities may seem like a compromise because defining poverty in the space of capabilities could have offered better theoretical insight to our study. However the choice of functionings instead of capabilities was partly influenced by the lack of empirical tools at present to operationalize the capability theory at the level of capabilities.

If a deprivation of any kind whatsoever in a certain dimension of wellbeing can be legitimately defined as poverty or does a distinction has to be made between poverty in general and poverty arising out of certain predefined deprivations is an important issue in the multidimensional poverty analysis. The importance and the necessity of such a distinction and its implications for policy formulation is well documented in the literature. So following, Kakwani and Son (2007), we chose to make a distinction between two cases of poverty and we defined poverty as a functionings deprivation arising out of inadequate command over market and nonmarket resources.

What dimensions of wellbeing are important for an analysis of poverty and deprivation is also an unsettled question. We chose a relatively larger number of dimensions of

wellbeing (nine dimensions of wellbeing with their associated indicators) to make our study more realistic and plausible because in reality, human wellbeing depends on much more variables than even the best and most sophisticated of our models would allow us to analyse. So we chose nine basic dimensions of deprivation including longevity, adequate nourishment, healthy living, employment, literacy, clean household energy, economic freedom, political freedom and clean environment and related indicators to measure international poverty in 193 countries of the world for two periods 1990-2000 and 2001-2010 and we also make an inter-temporal comparison of poverty as a functioning deprivation.

One significant point of our study is that only non-monetary dimensions of wellbeing go into our model. One of the advantages of including only non-monetary variables in the model is that a comparison of the poverty statistics derived from our model with unidimensional monetary approaches or multidimensional approaches with monetary variables gives us useful insights about the correlation between the monetary and non-monetary dimensions of wellbeing. Instead of using only monetary indicators or a few basic dimensions of deprivation for measuring international poverty, when a large number of dimensions of deprivation and corresponding indicators of the dimensions of these deprivations are synthesized into a composite index for making international comparison of poverty, a more comprehensive picture of poverty emerges and at times dramatic changes in the ordinal rankings of the countries are witnessed.

The real contribution of this study, in our view, is that we explicitly introduced in our model the assumption that the relative weights of various dimensions of wellbeing may be

largely different. This is in sharp contrast with the assumptions underlying other multidimensional indices such as HDI, HPI and MPI etc. that various dimensions of wellbeing are equal or nearly equal. In addition, the scope of this study is much larger with 193 countries of the world included in the study comprise most of the population of the world.

In this study, we measured poverty for both the periods relatively --- relative to the most deprived country of the world in the initial period. One of the advantages of measuring poverty in some country relative to the most deprived country is that it not only makes a direct comparison between the countries under discussion possible but also offers us useful insights about the distance in the level of deprivation between two countries, which, one might argue, pure numbers gained from headcount figures do not necessarily offer.

Coming to the results of this study, in the initial period 1990-2000, the poorest country in the world in terms of functioning deprivation was Sierra Leone and Japan was the least deprived in the same period. Considering these two countries as benchmark and comparing the functioning deprivation in other countries with these two countries, we found that nearly 35% of the world population was poor. In the subsequent period 2001-2010, the poverty level reduced only slightly to 31%. Only a modest reduction of nearly 4% in global poverty during a decade is not something that would allow much optimism with respect to the targets set by MDGs to halve global poverty by 2015. Poverty is also asymmetrically distributed in the world with Africa bearing the brunt of most of the deprivation. Poverty level is also extremely high in Oceania followed by Asia.

Inclusion of only non-monetary variables in the present study gave us a unique opportunity to look how the monetary and non-monetary measures of poverty or wellbeing correlate. When we made binary comparisons between the World Bank's poverty

estimates, the GNI per capita and Functioning Poverty Index with the indicators of wellbeing included in this study for both the periods individually, FPI showed the highest correlation followed by World Bank poverty estimates and GNI per capita.

When we compared the functioning poverty statistics with other multidimensional measures like HDI, HPI, Gallup's Life Satisfaction Survey and MPI, we found that although all these measures were broadly correlated with FPI in both the periods, there were sharp differences in the rank of same country when FPI estimates are[';;;;compared with some other measure.

In order to accommodate the possible reservations that the weights assigned to various dimension of wellbeing in our model may not be plausible or they may be as arbitrary as in any other approach, we ran a series of tests of robustness by changing the assumptions of the model. We changed the order of various dimensions using same weights which were originally used in the study and then changing weights assigned to various dimensions of life. We found that the resulting statistics showed the degree of correlation among the ranks using alternative weighting and ordering strategies which was as high as 95% in certain circumstances but was no less than 66% in the rest of the cases as far as the pairwise correlations are concerned. The concordance of ranks of all the countries in all the measures being compared, as computed by Kendall's W, also suggests that the rankings of the countries remains stable or dependent, technically speaking, even after changing the assumptions of the model.

Despite the fact that the upper level of correlation range when we consider binary correlations is assuring, we must admit that there is no perfect weighting strategy available to make an objective analysis of poverty. After all, this study is undertaken in the spirit of

search for better tools and instruments to analyse and solve the problems of poverty and deprivation.

One implication of our work is that when poverty begins to be understood in terms of deprivation of capabilities and functionings, the focus of poverty reduction policies will be on creating an enabling environment for expanding capabilities and functionings instead of making an unbridled growth in GDP the sole object of public policy with possibly undesirable social and environmental ramifications. At an individual level, the functionings of intrinsic importance like a network of social relations, for example, which are often sacrificed in pursuit of more money will gain their proper perspective. In addition, the dimensions of deprivation which are glossed over by the monetary indicators such as environmental safety will be sharply highlighted and will attract prompt policy response.

In the final analysis, it must be stressed that dimensions of wellbeing are far more varied than the ones customarily employed in the analysis of wellbeing, and deprivation is these dimensions affect human wellbeing in quite different ways. Without sufficiently enlarging our focus to include important dimensions of wellbeing in our analysis and without distinguishing the relative importance of those dimensions, we might miss many aspects of poverty and deprivation which blight human lives in extremely unpleasant ways.

This study has highlighted the issue of paternalism and arbitrariness essentially embedded in the composite indices. One of the future possibility is to develop a database that could address these issues of arbitrariness and paternalism and make the process of choice of dimensions of poverty and assigning weights more objective and transparent.

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APPENDIX A

Table 16: List of Dimensions and Indicators used in Functioning Poverty Index (FPI)

Dimensions	Indicators
Living a life of normal length	Life expectancy at birth (years) Female
	Life expectancy at birth (years) Male
	Adult mortality rate (probability of dying between 15 to 60 years per 1000 population) Femal
	Adult mortality rate (probability of dying between 15 to 60 years per 1000 population) Male
	Infant mortality rate (probability of dying between birth and age 1 per 1000 live births) Femal
	Infant mortality rate (probability of dying between birth and age 1 per 1000 live births) Mal
	Under-5 mortality rate (probability of dying by age 5 per 1000 live births) Female
	Under-5 mortality rate (probability of dying by age 5 per 1000 live births) Male
Adequate nourishment	Children aged < 5 years Stunted for Age
	Children aged 5 years (%) Wasting (WHO) Moderate & severe
	Children aged 5 years (%) underweight for age
	Country estimates of anaemia prevalence in (%) Non-Pregnant Women
	Country estimates of anaemia prevalence in (%) Pregnant Women
	Country estimates of anaemia prevalence in (%) Preschool-age
	Low-birth-weight newborns (%)
	Population with insufficient Iodine intake (%) 6-12 years
	Population with insufficient Iodine intake (%) General population
	Total Goiter Prevalence (%)
	Prevalence of night blindness in pregnant women (%)
	Prevalence of night blindness in preschool–age children (%)
	Prevalence of serum retinol <0.70 in preschool–age children (%)
	Prevalence of serum retinol <0.70 µmol/l in pregnant women (%)
	Prevalence of undernourishment in total population (%)
Healthy living	Immunization coverage among 1-year-olds (%) DTP3
	Immunization coverage among 1-year-olds (%) HepB3
	Immunization coverage among 1-year-olds (%) Hib3
	Immunization coverage among 1-year-olds (%) Measles
	Neonates protected at birth against neonatal tetanus (%)
	Children aged 6-59 months who received vitamin A supplementation (%)
	Children aged 5 years Sleeping under insecticide-treated nets (%)
	Children aged 5 years With ARI symptoms taken to facility (%)
	Children aged 5 years With diarrhoea receiving ORT (%)
	Children aged 5 years With fever who received treatment with any antimalarial (%)

	Antenatal care coverage a (%) At least 1 visit
	Antenatal care coverage a (%) At least 4 visits
	Births attended by skilled health personnel (%)
	Tuberculosis treatment success under DOTS (%)
	Incidence of tuberculosis (per 100000 population)
	Prevalence of tuberculosis (per 100000 population)
	Tuberculosis detection rate under DOTS (%)
	Health workforce Dentistry personnel (per 10000 population)
	Health workforce Nursing and midwifery personnel Density (per 10000 population)
	Health workforce Other health service providers Density (per 10000 population)
	Health workforce Physicians Density (per 10000 population)
	Hospital beds (per 10000 population)
Employment	Rate of Adult Unemployment FEMALE
	Rate of Adult Unemployment MALE
	Rate of Youth Unemployment Female
	Rate of Youth Unemployment Male
Literacy	Rate of Youth Illiteracy Male
	Rate of Youth Illiteracy Female
	Rate of Adult Illiteracy Male
	Rate of Adult Illiteracy Female
	Rate of primary school age children out of school. Male
	Rate of primary school age children out of school. Female
	Ratio of girls to boys in primary and secondary education (%)
Clean household energy	Access to electricity (% of total population)
	Energy use (kg of oil equivalent per capita)
Economic freedom	Index of economic freedom score
Political freedom	Political rights
	Civil liberties
Clean Environment	Access to improved drinking-water source (%) Urban
	Access to improved drinking-water source (%) Rural
	Access to improved sanitation (%) Urban
	Access to improved sanitation (%) Rural

Table 17: Nussbaum's list of features essential to full human life

a. Life: normal length of life
b. Health: good health, adequate nutrition and shelter
c. Bodily integrity: movement; choice in reproduction.
d. Senses: imagination and thought, informed by education.