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A STUDY OF POVERTY AND INEQUALITY: A CRITICAL EXAMINATION OF ISSUES, CONCEPTS AND MEASUREMENTS - A LITERATURE VIEWS

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Abstract

Alleviation of Poverty is a crucial issue in the economic policy of most of the developing countries. But the Understanding of poverty and inequality needs a different aptitude of approaching its issues, concepts and measurement. Accordingly, this article examining the study of nature of issues, concepts and measurements of poverty and inequality which are closely associated with different multivariate phenomenon and magnitudes. This study also emphasized that the poverty and inequality must be approached in a broader view rather than a narrowed one.

Keywords: Examination; Measurements; Literature Views.

1. Introduction

Alleviation of poverty is a crucial issue in the economic policy of most of the developing countries. In India, this alleviation has been one of the prime objectives of the plans after independence. Since the inception of planning in India in 1951, this factor has been given a predominant position in the country's planned development. Though there exists no consensus on whether the proportion of the population living below the line of poverty has declined significantly over the years of planned development, still poverty and its related aspects of deprivation continue to engage the active involvement of the government in their effort to reduce the magnitude of poverty. Poverty alleviation has been an integral part of the strategy in the initial stages of planned development so that the 'trickle-down' mechanism could contribute to the reduction of the level of poverty in the process of economic development. However, it is clear by now that left to itself, the 'trickle-down' would not bring about a significant change in the levels of poverty and an improvement in the standard of living of the weaker sections of society require special attention and direct policy intervention from the government so as to bring about significant improvement in their living standards.

While poverty persists in both rural and urban areas, it is identified to be primarily a rural phenomenon in India. There is no doubt that incidence of poverty and deprivation is higher in rural areas than in the urban centres and the rural poor account for the vast majority of all those found in this poverty ridden condition. But the incidence of urban poverty in India, due to rapid urban growth, is becoming obvious and is linked with the large scale migration of labour from rural areas as is seen in terms of the increasing number of squatters and slum dwellers in cities and towns.

Most of the studies on poverty are exclusively concerned either with urban or rural poverty. One part of the conventional wisdom regards poverty which prevails in rural and urban contexts as analytically equivalent. The present study challenges this view and assumes that rural poverty and urban poverty substantially differ from each other in terms of composition, generation and intensity. The models and assumptions of urban poverty as also rural poverty are an inappropriate guide for understanding the nature of poverty prevailing in both these contexts and the under-estimation of the differences of rural poverty and urban poverty is likely to lead to incorrect conclusions about those factors and policies which are likely to influence the level of living of the poor. The basic objective of this study is to examine the issues, concepts and measurements of poverty & inequality in various dimensions with that of urban and rural nature.

In general, studies on poverty consider socio-demographic and economic structure in rural and urban areas and their variations in food and non food consumption to represent the magnitude of poverty. In India, most of the poverty studies have relied on a single variable approach such as income, calorie intake, year of schooling and other variables, mostly in physical terms. Such an account remains partial and quantitative. But there are views that many diverse elements are involved in the causation of poverty; economic, social, political, demographic, cultural and historical. Here the focus is on the multivariate nature of poverty. To be more precise, poverty cannot be determined by absolute criteria but it has to be understood in terms of relative criteria in the context of society as a whole. Thus, it is necessary to understand the conceptual differences that relate to absolute and relative concepts of poverty and other forms of measure of inequality by with the rural and urban context. This study by literature review examining this conceptual issues measures and methods for the credibility of estimation of level of rural and urban poor.

2. Concept of Poverty

Relevant literature on poverty shows that there is no general consensus of any meaningful definition of poverty. In ancient times, poverty was explained in terms of sin. According to Bandyopadhyaya (1988),[1] the Doctrine of 'Karma' which has been developed in India in the pre-Christian era attributed poverty to the personal misdeeds of the individuals in past lives. Many people, for the present, do not have faith in this and they resort to amass more wealth and income by unscrupulous means. In a way this is also responsible for the persistence of poverty. The original Christianity visualised poverty as a part of general calamity resulting from original sin. Neither a secular explanation of poverty nor any concern for its alleviation can be found in the otherwise spectacular range and depth of ancient Indian thought. But "life has been short and hard in much of the world most of the time. Deprivation of food and other necessities of living has consistently been among the casual antecedents of the brutishness and bravity of human life".[2] As Galbraith points out (1958) "the experience of nations with well-being is exceedingly brief. Nearly all,

throughout all history, have been very poor. The exception ... has been the last few generations in the comparatively small corner of the world populated by Europeans".[3]

In a modern contemporary world, while there is general agreement that there is widespread and abysmal poverty, it is difficult to arrive at a precise definition of poverty. Generally, the human mind reflects on a large and complex set of economic, social and psychological conditions.[4] It may, however, be generally characterized as a state of deprivation, dependence and degradation below physically and socio-culturally acceptable standards.[5] On the face of it 'poverty' is a situational 'Syndrome'.[6] However, defining poverty involves taking from this mosaic, those characteristics that most successfully capture what it means to be poor. When one takes historical definition of the evolution of poverty, changes are needed not only in the technical expertise of the definers, but also in the underlying values and concerns of society.[7]

2.1. Meaning of Poverty

Poverty is defined on the basis of individuals or societies. Seebohwm Rowntree (1901) has defined families whose "total earnings are insufficient to obtain the minimum necessaries for the maintenance of merely physical efficiency".[8] According to him, the biological need is of primary concern. But Hobswarm (1968) has argued that "poverty is always denned according to the convention of the society in which it occurs".[9] However, it is very common to define poverty as a uni-dimensional property. As Wilbur (1973) noted, for practical purposes, it is easy and convenient to use an indicator like income as a criterion and to define poverty in terms of those who are below or above a specific threshold.[10]

Having restricted poverty to those with low incomes, a multiple of correlates, such as housing, education, employment, health, fertility, mortality, etc., are identified. Ramashray Roy (1982)[11] held that it is not clear whether these factors are correlates or consequences of poverty; further, it is also not clear whether these factors should form a part of the definition of poverty or not. Thus poverty is a self-evident phenomenon of every day reality which is hard to grasp in a scientifically manageable way. Poverty is composed of a variety of individuals and cultural experiments, which work the passage of living is even changing in structural significance and features with time.[12] In theory, generally, poverty has been broadly divided into two concepts such as the absolute poverty and the relative poverty. These two concepts are discussed in the following pages.

2.2. Absolute Poverty

The absolute poverty is historical in nature and a global phenomenon. Hence the meaning of poverty changes in the spatio-temporal dimension. The style of being poor in the US or UK is different from being poor in India, Bangladesh or in Pakistan. This concept of poverty is basically derived from that of the concept of poverty of Rowntree which rests on the idea that it is possible to define a minimum standard for physical survival and that the needs of the poor do not change through time.[13] The most important problem in defining absolute poverty lies in identifying 'needs' and quantifying them. In this respect, two criteria are encountered in the existing poverty literature, i.e., subsistence and nutritional criteria.

Subsistence Criterion Approach

This approach to define poverty objectively refers to a condition of acute physical want-starvation, near starvation or a diet conducive to malnutrition and disease, lack of clothing or shelter necessary for protection from inclement elements, absence of minimal medical service, etc. Poverty, thus, is a situation which denies minimum food and shelter necessary to maintain or sustain life. Rowntree perhaps was the first researcher to define poverty in terms of subsistence. He opined, "My primary poverty line represents the minimum sum on which physical efficiency could be maintained. It is a standard of bare subsistence rather than living. In calculating it, utmost economy is practiced - nothing must be bought but that which is absolutely necessary for the maintenance of physical health and what is bought must be the plainest and of most economic description".[14]

The Marxists treat subsistence minimum of being more than that which is physiologically determined. They include both naturals and necessary wants. Marx has stated that" The worker's natural wants such as food, clothing, fuel and housing vary according to the climatic and other physical conditions of his country. On the other hand, the number and extent of his so-called necessary wants... are themselves the product of historical development and depend therefore to a great extent, on the degree of a civilization of country".[15] Marxists argue that the subsistence minimum varies historically, but at any given time and place, it can be identified and approximately measured. Following this line of argument, Baran and Sweezy (1966) define poverty as "the condition in which those members of society live whose incomes are insufficient to cover what is, for that society and at that time, the subsistence minimum."[16] One of the most common elements stressed in the definition of poverty based on subsistence level is that the lack or inadequacy of income.

According to Dandekar (1981), "want of adequate income is denned as poverty."[17]

Some economic philosophers argue that "poverty has to be identified with deficiency in the total level of living which includes not only energy requirements but also a balanced diet needed for health and other basic needs essential for human existence at a tolerable level".[18] The poverty line, in terms of specific income level, varies depending on assumptions as to what constitutes the daily needs of life and the cost of these items. The basic assumption of the poverty line is that there are some absolute criteria to which reference can be made in establishing the 'Vital minimum'. Regardless of where the poverty line is set, it is that which falls below the level of subsistence which is needed to lead a full and fruitful life in society.

The subsistence definition appears to be both easy to explain and administer. But its apparent simplicity throws up some major problems. One difficulty is that which crops up due to the meaning of subsistence. The concept of subsistence implies that some things are necessary for human existence and goods and services beyond this level are treated as luxuries. And this represents value judgements about desirable level of activity and comfort.[19]

Secondly, the cost of basic necessities varies widely. Thirdly, a 'poverty line' definition has failed to distinguish the different minimal needs of families of different sizes, different stages in the life cycle and different geographical locations. Another difficulty in using 'poverty line' is that the line is relative to time. This creates the difficulty in comparing the magnitude of poverty of the day

with that of the past. But the goods or services considered as the necessary minimal are not fixed but increase with the general increase in living standards.[20]

Moreover, this concept, is not helpful to measure the magnitude of poverty and therefore, it is of little operational significance. Difficulties in the estimation of adequacy of non-food items comprising the basket of necessities has further minimised the significance of subsistence concept of poverty. Analysing the definition of poverty, Luck (1946) has opined that "the wants to be considered here are the recognised biological necessities - food and drink. Little will be said about housing. The need for shelter varies according to local and to social custom, it cannot be accurately measured. Fuel is essential for survival in a cold environment, but this too is a regional and variable necessity. A similar consideration applies to clothing. The Conventional biological definition of necessity excludes, except for reproduction, almost everything except food and water".[21] Thus, based on these limitations, the subsistence approach scholars have prepared an alternative approach which has defined poverty based on the nutritional criteria.

Nutritional Criteria of Defining Poverty
A popular method of setting the poverty line, tries to avoid the above problem while still anchoring the poverty line to the most basic consumption need, viz., food energy requirements. This functions as an alternative to the cost of basic needs' method. This method proceeds by fixing the consumption expenditure on income level at which a person's typical food energy intake is sufficient to meet a pre-determined food energy requirement. It is widely used in India.

The food energy intake method faces several problems when it is used for fixing the poverty line. In practice, the normatively fixed calorie intake contradicts with people's requirements when their climatic condition, physical features, age, sex and activities level vary. Sen (1982) has said that "in fact even, for a specific group in a specific region, nutritional requirements are difficult to define precisely".[22] People have been known to survive with incredibly little nutrition and there seems to be a cumulative improvement of life expectation as the dietary limits are raised.[23] It implies that the level of food intake is correlated with health and life expectancy of a person. It also has the positive relation with productivity capacity. In his pioneering work, Leibenstein (1957) has postulated a hypothesis which links work capacity (productivity) of a person with his/her food intake.[24] It also supports through empirical studies by others.[25]

It is often recognised that the income of a person is largely determined by his/her work capacity. Then it would be reasonable to relate income with nutritional components of food. Hence, one can understand the importance of calorie requirements for the betterment of life. There is difficulty in drawing a line somewhere and the so-called minimum nutritional requirements have an inherent arbitrariness that goes well beyond variations between groups and regions.[26]

The next problem with normatively fixed calorie intake method is that there will be inter and intra-individual variation in calorie consumption. Sukhatme (1978) has argued that there is inter and intra individual variation in actual intake of active and healthy adults. He has further said that even for a given individual not only intake but also requirements vary from day to day, week to week and so on.[27]

The other problem with this approach is the intra-family distribution of food intake. Per capita calorie intake is considered to be a yard-stick to measure the calorie deficiency leading to poverty. It neglects the fact that there is discrimination in food allocation for the girl child, children male or female, and women as against the men in the poor households.[28]

In India and Bangladesh, there is a pattern of sex bias against women in the distribution of food pattern which comes through strikingly.[29] There are other problems, which arise with these food habits of these people, such as the availability of a commodity and occupation of the person. These are all neglected issues in the nutritional approach.

Hence, the concept of absolute poverty has a number of conceptual problems and practical difficulties in the identification of the poor. This concept has rested on the assumption that poverty means simply lack of money to meet physical needs. It crumbles under discovery that humans are strongly motivated to also meet their other needs which are more social in nature.[30] Moreover, "people are poor because they are deprived of the opportunities, comforts and self-respect regarded as normal in the community to which they belong".[31] That is why "poverty line cannot be defined in a vacuum but only in relation to a particular society at a particular time. Therefore poverty must be seen not in absolute but in relative terms".[32]

2.3. Relative Poverty

The inadequacies of the absolute poverty concept have contributed to the formulation of an alternative, the concept of relative poverty. From this perspective, the poor are not defined as those who fall below a fixed subsistence level but as those whose incomes are considered too far removed from the rest of the society in which they live. In short, the poor are identified in relation to or as relative to other people.[33]

The concept of relative deprivation which illuminates a very important aspect of welfare, according to Altimir (1982),[34] is central to the consideration of poverty. This has been recognised long time ago. Adam Smith (1776) has said, "by necessaries I understand not only the commodities which are indispensably necessary for the support of life but whatever the customs of the country renders it indecent for creditable people even in the lowest order to be without. The Greeks and Romans lived, I suppose, very comfortably though they had no linen. But in the present time... a creditable day labour would be ashamed to appear in public without a linen shirt, the want of which would be supposed to denote that disgraceful state of poverty".[35]

Hence, relative deprivation, defines poverty as the position of the individuals viz-a-viz a society, primarily in terms of distance between the poor and the average or medium standard of living in the society. Poverty in the relative sense is one aspect of social inequality. It means that part of the population lacks the resources which assumes full social membership in a given society or at least that which would assume living conditions customary to that society.[36]

Townsend (1954),[37] an articulate exponent of this view, has suggested a proper definition of poverty in terms of relative deprivation. He writes, "individuals and families whose resources over time fall seriously short of the resources commanded by the average individuals of family in the community in which they live, whether this community is a local, national or international one are

in poverty". In his recent writings also, he presents a series of ingenious, specific life-rooted indicators "to provide an estimate of objective poverty on the basis of level of deprivation disproportionate to resources".[38] Townsend's indicators show how deprivation affects daily life. For him, poverty infects all of life, the humiliatingly small as well as debilitatingly large. It is different to be poor, misery as poor, as people understand, is degrading.[39]

But within the uniformity of the term 'relative deprivation' there seems to exist some distinct and different notions. Once distinctions were concerned with the contract between the feelings of deprivation and conditions of deprivation, it has been argued that the latter would be a better usage.[40] So that it can be used in an objective sense to describe situations where people possess less of some desired attributes, be it income, favourable employment conditions or in power than the others.[41]

On the other hand, Sen (1982) argues that the choice of' conditions of deprivation' cannot be independent of feelings of deprivation. Material objects cannot be evaluated in this context without reference to how people view them and even if 'feelings' are not brought in explicitly; they must have an implicit role in the selection of attributes.[42] It has been aptly maintained that the importance which should be recognised is that of the " endeavours to define the style of living which is generally shared or approved in each society and it should be found out whether there is a point in the scale of distribution of resources below which families find it increasingly difficult, which would be shown in the customs, activities, and diets comprising that style of living".[43]

It is therefore difficult to isolate 'conditions' from 'feelings' and both of them need an objective understanding. The problem gets accentuated once the choice of 'reference group' for comparison determines the variation of 'feelings of deprivation'. The importance of the reference group with which a particular segment tends to compare itself should not be underplayed. The extent of comparisons cannot be ascertained as the political activity in the community in function, flows and changing perceptions lead to a situation when individual feelings of deprivation is closely related to one's level of expectation as well as one's view regarding the fair share in the communal cake and the individual right to share it.[44]

Definition of poverty in relative terms has thus involved more factors than income adequate for subsistence. They have considered the critical issues to be the result of income distribution in a society. Measure of relative deprivation brings more people under poverty than the official counts. The relative approach of conceptualisation of poverty transcends the economic biases of much of poverty research which are limited only to a gross measure of personal or household income. It introduces the sociological aspects of poverty as indicators of poverty.

The relative deprivation definition of poverty is, however, not free from its shortcomings. First, it underplays the importance of the levels of poverty line for the characteristic of the poor. For it is only the poverty line which tells us how many people are below it, how far below it and how many are near to poverty condition. Thus, the composition issues of poverty remain neglected, if one adheres merely to the relative approach; secondly the relative 17 deprivation approach tries to find out a scientific poverty threshold and forgets that the delineation of poverty is not a 'scientific exercise'. It is, in fact a value based issue.[45]

According to relative deprivation, as far as developing countries are concerned, the poor are those in the lowest four deciles of income distribution. What it implies is that the poor remain the same even though economic development has increased income, irrespective of changes of absolute deprivation. It has been pointed out by Sawhill (1988) that no matter how much income increases in the society "the poor in a relative sense will always be with us".[46] In other words, it may be possible to eradicate absolute poverty; but it is however, never possible to eradicate relative poverty.

Despite this nagging aspect about relative poverty, it should be emphasised that it is perfectly legitimate and as has been suggested that it is consistent with Rawlsian criterion of justice for the government and policy-makers to be concerned with the lower segments of the population in the income scale.[47] Finally, Townsend (1974) has argued that 'poverty' can be defined objectively and applied consistently only in terms of the concept of relative deprivation.[48] Meade (1972) says that poverty is necessarily relative because a person would be regarded poor with reference to the society in which he lives.[49] However, generally in developing countries and particularly in India, absolute poverty is measured on calorie intake criterion for a long time. The concept of relative deprivation has received less attention in the identification of the poor. The following part discusses the various measures are adopted to measure the magnitude of poverty and Inequality.

3. Measures of Poverty and Inequality

There are various measures followed in the literature of poverty and inequality to estimate the level of poverty and intensity of poverty and inequality as well. Among these, the researcher has examined the Head Count Ratio, method, Proportionate Expenditure Gap Method, Sen Index of Poverty and Quality of Life Index Method, to measure the poverty in different dimensions. In inequality measures, all positive measures except the Range, are adopted, and for normative measures are concerned, Atkinson Index is also examined to identity the exactness of inequality. Further discriminant and Logistic functional analysis are also explained to identify the nature of poverty. The concept of each method and its technical details are discussed as follows.

3.1. Poverty Measures

The number of households below poverty line is the most widely used measure of poverty, providing an initial approximate idea of the magnitude of the problem. In this case, the Head Count Ratio is usually a widely used measure in the literature of poverty. It has been appreciated by many economists for the nature of its simplicity and its being easily countable in the measurement of poverty.

Head-Count Ratio (H)
Ever since Charles Booth, the father of scientific social research (1889-1901), conducted a monumental survey with a view to quantifying the extent of poverty in the city of London - the population of people below the poverty line has been used as an index of poverty. The ratio can be defined as if "q" is the number of people who are identified as being poor and "n" is the total number of people in the community, then the head count ratio is q/n.

$$\text{i.e., } H = q/n.$$

It is still the mainstay of poverty statistics on which poverty programmes are based. It has been extensively used recently both for inter-temporal as well as international comparisons.

This measure has some weaknesses in the process of measurement of poverty. It is considered to be a poor measure of poverty as it does not tell how poor the poor are; whether they are close to the poverty line, or below it, or are distributed in some other manner. It would, therefore, not take notice of any change (increace or decreace) in the income of a poor if the change keeps him below the line.[50]

It implies that 'H' takes no account of the intensity of deprivation. Furthermore, a transfer of income from a poor person to one who is richer can never increase the poverty measure 'H' and surely is a perverse feature.[51]

There is vehement criticism from many quarters against the 'H' use. Watts (1968),[52] thinks that poverty is not a discrete condition to make one acquire or shed the affliction associated with the notion of poverty just by crossing a particular income level and wonders what 'H' has but its simplicity to recommend its use. However, there are a number of studies conducted by many scholars who use this in terms of incidence alone.[53]

The Proportionate Expenditure Gap (PEG)
The PEG measure is the shortfall in the average per capita consumer expenditure of the poor from the poverty line. Clearly the greater the hiatus between the poverty line and the average per capita expenditure level of the poor, the greater the 'intensity' of poverty. It is expressed in mathematical form like 'q' being the number of people who are identified as poor, 'g as the total poverty gap of the poor and ℀ is the poverty line, then PEG is

$$PEG = g/\pi$$

This measure does not reflect the change in expenditure of a poor as well as the event of a person leaving on joining the group of the poor. It is clearly insensitive to transfer of income between the person who is poor and continues to be poor even after the transfer. It is also insensitive to the number (incidence) of people sharing the gap.[54]

Thus, neither Head Count Ratio (H) nor Proportionate Expenditure Gap (PEG), taken in isolation, provide a comprehensive picture of poverty: the one, in some sense, is an indicator of the prevalence of poverty and the other of the intensity of poverty. Even when taken together, the two indicators do not exhaust the 'information' content of poverty. In particular, some notion of 'relative' poverty is missed out: in a straightforward way, the greater the extent of inequality in the distribution of expenditure among the poor (measured, say, by the Gini Ratio of Inequality (G) among the poor) the worse may be the nature of poverty - other things remaining the same.[55] H, PEG and G together furnish us with a more complete picture of poverty than any one of these indicators taken individually. A comprehensive measure of poverty which takes this into account is Sen's 'Ps' index.

Sen Index of Poverty (Ps)

Sen's contribution in the field of measurement of poverty is seminal and outstanding. It opens up new vistas. Over time, undoubtedly, the area has been enriched by a number of contributors. Sen (1976)[56] has derived an index using an axiomatic framework based on an ordinal welfare concept. Sen's measure is obviously more informative than a mere Head Count Ratio of the poor. This measure is of interest in the distribution of incomes of the poor.[57]

Sen has noted the desirable properties of a poverty measure, which include the sensitivity of the measure to the number of poor, to the depth of poverty, as well as to the distribution of consumer expenditure in the following two axioms.

- **Monotonicity Axiom:** Other things remaining the same, a reduction in the income of any poor household will increase the poverty measure.
- **Transfer Axiom:** Other things remaining the same, a transfer of income between two poor households - from a poorer household to a richer one - will increase the poverty measure. Simply put, any increase in inequality among the poor, due to one or a series of regressive transfers, must be reflected at a higher level of poverty.

It can be readily seen that 'H' violates both these axioms since 'H' measures only the number of households under the poverty line. A fall in the income of any household leaves the measures unchanged. It thus runs contrary to the monotonicity axiom. Similarly 'H' is unaffected by a transfer of income from any poorer household to any richer household and this violates the transfer axiom.[58]

It can be seen by inspection that the income measure satisfies the monotonicity axiom, but does not satisfy the transfer axiom. A fall in the income of any household under the poverty line will increase the poverty measure. The measure is, however, unaltered by any means preserving transfer of income among households below the poverty line. In addition, "G" is insensitive to any exchange in the number of poor households: if the population below the poverty line is duplicated with the same characteristics, it would leave "G" unchanged.

Sen (1976) has proposed a distributionally sensitive index which combines the properties of 'H' and 'G' in an ingenious way.[59] This index is given by

$$Ps = H [PEG + (1-PEG) G]$$

Ps may be noted, lies in the interval [0 and 1]: the closer it is to 1, the greater the degree of poverty. Various modifications of Ps are possible, for example, depending, on how one chooses to measure inequality in the distribution of expenditure among the poor.[60] If the poverty line is replaced by the average per capita consumer expenditure level, the Head Count Ratio is allowed to go to unity, then Ps will simply collapse to the Gini ratio of inequality G for the distribution of consumer expenditure among the entire population.[61]

Although the Sen index is one of the most well-known of the poverty indices, it suffers from a number of deficiencies when it comes to practical applications. It has been noted that the weights used for the short-fall from the poverty line depend on the rank order that a poor person occupies

among all the poor and this introduces an element of (though within the poverty range) poverty ratio into the measure of absolute poverty.[62] Sen (1976), in defense of this procedure, argues that "the lower a person is in the welfare scale, the greater his sense of poverty"[63] However, many are not persuaded by and accepted of this argument. For example, it has been contended that "the arguments about relative position and ranking are more persuasive for inequality measurement than poverty measurement".[64]

Physical Quality of Life Index (PQLI)
Economists in large number do not rely merely on absolute measure of poverty. They argue that even the absolute criterion is relative and thus, favour relative criterian for measuring poverty. Very little or no effort has been made to measure and identify poverty in India on the basis of relative criterion. Whatever studies are there, they prefer merely physical quality of life index.[65]

The first major alternative to GDP/GNP is suggested by Morris (1979) and has now become, the famous Physical Quality of Life Index which reflects better the 'conditions of the poor.[66] This index is an unweighted simple average of three component indicators, viz., (a) infant mortality rate (IMR), (b) life expectancy at age one (LEI), and (c) the literacy rate (LR) for population aged 15 years and above. For a given country, each indicator takes into account the deviation from the best achievable norm (in the case of LEI) or the worst observed case (in the case of IMR) normalised for the range between the best achievable and the worst observed cases and index or scaled in such a way that the higher value of a given component indicator would reflect social progress. The composite PQLI is taken to measure the physical quality of life which escapes attention in the national accounts based on measures of economic progress.[67]

However, recently this PQLI indicator has been applied at the micro level to enumerate the conditions of the poor.[68] In this measure, more variables have been included to quantify the conditions of the poor with weightage given to each variable according to the positive nature of households.

Thus, the poverty measures described above are ultimately used to quantify the magnitude of poverty in terms of the uni-variate or the multi-variate approaches. However, there are certain aspects of relative deprivation of the poor, which will not be complete, if the inequality measures are not taken into account and it will also not reflect the magnitude of the problem completely, while comparison will take place over time or space. Hence the inequality measure will exhaust the other dimension of relative deprivation to identify the nature of poverty. Inequality measures shall be further analysed in the pages that follow.

3.2. Inequality Measures

The measures of inequality that are proposed in economic literatures fall broadly into two categories. On the one hand, there are measures that try to catch, the extent of inequality in some objective sense, usually employing some statistical measures of relative variation of income. On the other hand, there are indices that try to measure inequality in terms of some normative notions of social welfare so that the higher degree of inequality corresponds to a lower level of social welfare for a given total income.

Both positive and normative approaches have their own merits and demerits in the measure of inequality and also depend on one another for making value judgements. According to Sen (1973), in one way or another, usable measures of inequality must combine factual with normative ones.[69] Positive measures such as range, relative mean deviation variation, co-efficient of variation, standard deviation of logarithms and Gini-coefficient expresses some summary statistics of inequality. In the traditional literature on inequality, applying the above measures has not given any explicit reasons for preferring one measure rather than the another.[70] There are, the normative conclusions which arise from these purely positive measures.[71] Osmani (1982)[72] points out that the positive measures derive their inspiration from the discipline of statistics rather than welfare economics. He further states that the traditional positive measures of inequality define the phenomenon of inequality as the dispersion of frequency distribution. The relative merits of these measures are accordingly discussed from the statistical point of view, viz., how much use is made of the available information, how easily they are estimated, etc., while using them for purely positive purposes. These are no doubts relevant consideration.

Finally, to adopt the normative value judgements on the basis of social welfare function, economists have innovated new measures of inequality which start from explicit specification of value judgements. These are known as the normative measures of inequality such as Dalton's inequality index and Atkinsons's inequality measures.

Thus, the measure of inequality falls into two classes, viz., positive and normative measures. Both are in one way or another significant in identifying the factual features with normative tones. The axioms proposed by Sen (1973) and others and their relations to each of the measures of inequality are explained in the following section.

The Axioms for the Choice of Inequality Measures
To answer the question what measures of inequality will be chosen, Sen (1973), Cowell (1977) and others have proposed certain axioms.[73] The axioms are: I. mean independence, II. population size independence, III. Pigou-Dalton transfer sensitivity and IV. decomposability.[74] The importance of this axioms lies in the drawing up of a short list of inequality measures by eliminating those that are unsuitable.[75]

1) **Mean independence,** i.e., the index remains invariant if every one's income is changed by the same proportion.
2) **Population size independence:** This is satisfied if an equal increase or decrease in the population across all income levels (or other economic variable) does not result in a change in the inequality measure.
3) **Pigou-Dalton transfer sensitivity:** The axiom of Pigou-Dalton transfer sensitivity holds that if an income (or economic variable of intent) transfers from a wealthier person to a poorer one, then that does not make the latter wealthier than the former nor bring about a decrease in the measure of inequality.
4) **Decomposability:** This is a strange condition and is essentially a value judgement. It states that a transfer of the same magnitude should be given different weights at different positions of income scale more specifically a transfer from a poorer to a richer person deserves more weight at the lower and of the income scale than the upper one. Because the loser at the lower end is poorer than the loser at the upper end. although both losers are poorer relative to the respective gainers.

Depending upon the weights this axiom is classified into two principles.

- **Weak principle Transfer** (WPT): The inequality measures satisfy the weak principle of transfers if the following is always true considering any two individuals - one with income Y, the other a richer man with income Y+g where 'g' is positive. Then the transfer, a positive amount of income *Y from the richer to the poorer man, where *Y is less than Y2 g. Inequality should then definitely decrease.
- **Strong principle of Transfer** (SPT): The inequality measures satisfy the principle of transfers in the strong sense, if the amount of reduction inequality depends only on the distance.

3.2.1. Positive Measures of Inequality

In this section the various conventional inequality measures are discussed. Also, their relative merits and demerits are reported.

Range
Range is the simplest measure. It is based on comparing the extreme values of the distribution, i.e., the brightest and the lowest income results.

Range can be defined as the gap between these two levels as a ratio of mean income. Thus defined Range 'E' is given by

$$E = (Max_i \, Y_i - Min_i, \, Y_i) / \mu$$

If income is divided absolutely equally, then clearly E=0. At the other extreme, if one person receives all the income, then E=n. And E lies in general between 0 and n.

The problem with 'range' is obvious. It ignores the distributions in between the extremes. By concentrating on the extreme values only, the range misses important features of the contrast.[76]

Relative Mean Deviation
This measure takes the income level of each person and compares it with mean income and then to sum the absolute values of all differences and looks at that sum as a proportion of total income. This is called the relative mean deviation 'M'.

$$V \quad = \quad \sum_{i-1}^{n} \; | \, \mu - y_i \, | \, / \, n\mu$$

with perfect equality M = 0 and with all income going to one person only, M = 2(n-l) /n. One of the basic features of this is taking the entire distribution. But it is not at all sensitive to transfers from a poorer person to a richer person as long as both lie on the same side of the mean income. It satisfies the pigou-Dalton condition only.

The Variance and the Co-efficient of Variation
To accentuate the differences further away from the mean, the variance squaring the differences and then the proportionate of the absolute sum of the squared differences with the total number of persons variance is called 'V.

$$M = \sum_{i=1}^{n} (y_i-\mu)^2 / n$$

Any transfer from a poorer person to a richer person, other things remaining the same, always increases the variance, and this would appear to be an attractive property for an inequality measure. However, the variance depends on the mean income level, and one distribution may show much greater relative variation than another and still end up having a lower variance, if the mean income level around which the variations take place is smaller than that of the other distribution. But the co-efficient of variation, i.e., a measure which is simply the square root of the variance divided by the mean income level avoids the deficiency the variance is facing.

$$C = V^{½}/\mu$$

It satisfies both mean independence and Pigou-Dalton condition.

Standard Deviation of Logarithms
This measure gives greater importance to income transfers at the lower end. The advantage of the logarithm, in contrast with taking the variance or the standard deviation of actual values, is that it eliminates the arbitrariness of the units and therefore of absolute levels, since a change of units, which takes the form of a multiplication of the absolute values, comes out in the logarithmic form as an addition of a constant, and therefore goes out in the wash when pairwise differences are being taken. It is, therefore, the standard deviation of the logarithm has frequently cropped up as a suggested measure of inequality. As used in the standard statistical literature, the deviation is taken from the geometric mean rather than from the arithmetic mean, but in the income distribution literature using the arithmetic mean seems more common.[77] The standard deviation of logarithms is

$$H = \left[\sum_{i=1}^{n} (log^{\mu} - logy_i)^2/n \right]^{½}$$

This measure has some disadvantage such as it does depend on the arbitrary squaring formula – albeit after a logarithmic transformation – and it shares with V and C the limitation of taking differences only from the mean.

Gini-Coefficient
A measure that has been widely used to represent the extent of inequality is the Gini-Coefficient.[78] One reason for this perhaps, is that it has a very close relationship with the Lorenz curve, which is a particularly expressive diagrammatic representation of income distribution.[79] (The Gini-Coefficient is equal to twice the area between the Lorenz curve and the equal division diagonal).

Another reason may be that it is a measure of inequality by taking note of the differences of each person's income from everyone else's income rather than from the mean, which may be nobody's income, and as such corresponds to a more natural meaning of inequality.[80]

One way of viewing it is in terms of Lorenz Curve due to Lorenz (1905) where by the percentage of the population arranged from the poorest to the richest are represented on the horizontal axis and the percentages of income enjoyed by the bottom X% of the population is shown on the vertical axis.[81]

Obviously 0% of the population enjoys 0% of the income and 100% of the population enjoy all the income. So, Lorenz curve runs from one corner of the unit sequence to the diametrically opposite corner.[82]

Among various scholars who have defined coefficient in different ways, Sen (1973)[83] has formulated the formulae based on Gini's rank-weighting characteristic.

$$G = 1 + (1/k) - (2/k^2) (N/k) \, [IN, + 2N_2 + ... KN_k]$$

The right-hand side of this formula contains three main parts. The first is simply unity plus an average share. The second, a negative element, is the product of the two parametrical expressions. This product is multiplied times the third part, which is each component weighted by its rank. Then the sum is taken.

One criticism of the Gini-Coefficient is that it is relatively complicated to understand and to compute.[84] It does make use of all information about the distribution and is defined for all distributions. However, its interpretability is problematic, because of its discrete data equations which reach its upper bound only in an infinite distribution.[85]

Lorenz Curve
The American statistician, Max Lorenz has devised the most widely used diagrammatic display of distribution[86] called the Lorenz curve which figure is as follows:
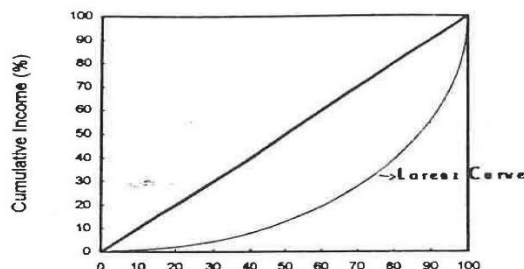

Figure 4.1: Ordinary Lorenz Curve

Cumulative Income Recipients (%)
First the income earning units, individuals or families (sometime classes of individuals or families) must be arrayed in ascending order. The horizontal axis plots the number of income recipients,

from the lowest to the highest income earners, in cumulative percentage terms. As one moves along the horizontal axis to a point twenty, there are the lowest twenty per cent of income earners or income earning families. At point fifty, one comes to fifty per cent of all families, (fifty per cent that earns the least) at one hundred, one has all of them. The vertical axis plots the cumulative percentage share of income going to each percentage share of income earning units (individuals or-families). It also starts at zero and goes to one hundred per cent.

The Lorenz curve gives the relation between the percentage of recipients income and percentage of income they earn. The diagonal represents total equality, in other words, one per cent of the families receives one per cent of the income, five percentage families receives five per cent of income, ten per cent receives ten per cent etc., through all families and all income. The curve traced by a given empirical income distribution, however, will usually say beneath the diagonal. For example the bottom thirty per cent of the families might earn only eight per cent of the income. Similarly the top ten per cent may earn thirty per cent of the income. The greater the gap in the curve below the diagonal the greater the inequality of all individuals or families with equal income, and the curve would coincide with the diagonal. If one individual or family receives all the income, then the curve would coincide with the vertical and horizontal axes.

Lorenz curve provides the theoretical basis for several important inequality indices.[87] It is also used to compare income distributions among two or more countries, in a single country before and after some tax reform, among occupational groups in a single country, etc. If the Lorenz curve of distribution A is everywhere above and nowhere below the Lorenz curve of B (i.e., A is everywhere north west of B), then distribution A is said to 'Lorenz-dominate' distribution B. Two Lorenz curves that intersect, however cannot be ranged with respect to their inequality. Comparing distribution with intersecting Lorenz curves requires use of other distributional characteristics. Nonetheless, the Lorenz curves convey a graphically distinct, geometrically-derived impression of a distribution.

The Lorenz curve measures inequality graphically and area-wise. The area enclosed within the diagonal and the Lorenz curve (area A) represents the actual amount (per cent) of distributional inequality. The maximum amount of inequality that could possibly exist is the total area below the diagonal (area A and area B). Area A is a proportion of areas A+B. The Gini coefficient is at quantitative expression of the ratio of area A to areas A+B. It is a statistical expression of Lorenz's graphical method.

Theil's Entrophy Measure
The other interesting measure of inequality, proposed by Theil (1967)[88] derives from the notion of entropy in information theory and it is, in terms of motivation, rather different from the class of measures which have been discussed. He argues, when x is the probability that a certain event will occur, the information content h(x), of noticing that the event has in fact occurred must be decreasing function of x the more unlikely event. One formula that satisfies this property is the logarithm of the reciprocal of x.

$$h(x) = \log 1/x \qquad \qquad \text{... (1)}$$

When there are 'n' possible events l,....n, we take the respective probabilities xl,...,xn such that xi > 0 and

$$\sum_{i=l}^{n} x_i = 1.$$

The entrophy or the expected information content of the situation can be viewed as the sum of the information content of each event weighted by the respective probabilities

$$H(x) = \sum_{i=l}^{n} x_i h(x_i)$$

$$= \sum_{i=l}^{n} x_i \log\left(\frac{1}{x_i}\right) \qquad \qquad …(2)$$

It is clear that the closer the 'n' probabilities xi are to (1/n), the greater is the entrophy. If xi is interpreted as the share of income going to person i, H(x) looks like a measure of equality. When each xi equals (1/n), H(x) attains its maximum value of log 'n'. If one subtracts the entrophy H(x) of an income distribution from its maximum value of log 'n', one can get an index of inequality. This is Theil's measure.

$$T = \log n - H(x)$$

$$= \sum_{i=l}^{n} \sum x_i \log nxi \qquad \qquad …(3)$$

A shift from a richer to a poorer person lowers "T" i.e., it satisfies the Pigou-Dalton condition.

3.2.2. The Normative Measure of Inequality

Atkinson Index

The equalisation expressing Atkinsons's (1970)[89] index T of Inequality looks complicated at first. It is virtually impossible to express T in any simplified form, that clearly demonstrates its definitional character.[90] However, discussing two concepts, which are most important to the index, the equally distributed equivalent level of income and the inequality aversion parameter (α) in the context of the social welfare function, will help to clarify Atkinsons's inequality formula.

$$I = 1- \left[\sum \left(\frac{Y_i}{\overline{Y}}\right)^{1-\alpha} P_i \right] \qquad \qquad \text{for } \alpha \ne 1$$

$$I = 1- \exp\left[\sum_{i=1}^{n} P_i \log e (y_i/\overline{y}) \right] \qquad \qquad \text{for } \alpha = 1$$

1/1-α

Atkinson began with Dalton's essentially conceptual definition of inequality as the ratio of the actual level of social welfare to that level which would be achieved if the income is equally distributed. He rejected it, however, because it requires measuring both social and individual welfare with a ratio scale that is not invariant with respect to linear transformation. He substituted the idea of equally distributed equivalent' levels of income (YEDE) defined as "the level of income per head which if equally distributed would give the same level of social welfare as the present distribution".[91] Behind the concept of equally distributed income equivalent is the fact that uniform distributions are ranked in the same order by their mean as by their social welfare. The mean income, therefore, can be used as an indicator of the level of welfare. Roughly, then, Atkinson's inequality measure can be defined as 1=1- YEDE/Y or unity minus the ratio of the equally distributed equivalent income level to the mean of the social distribution.

The second important new concept is inequality aversiveness, designated by the parameter 'α' in Atkinson's equation. It adds a normative dimension to the analysis, because it allows the investigator to incorporate into the measurement at specified degree of dislike for inequality. As 'α' increases from zero more weight is attached to transfers at the higher end. As 'α' goes to infinity, only transfers at the bottom are taken into account.[92] The larger the parameter, the greater the aversiveness to inequality.

Setting alpha (α) is a distinctly normative decision and should be based on the investigator's preference about the relative importance of difference portions of the 'Lorenz curve' in an inequality index or on how different types of transfers should affect the index value.[93] Atkinson (1970) has employed three values of the parameter, 1.0, 1.5 and 2.0. Schwartz and Winship (1979) have argued that 'α' should be between -0.5 and 2.5, probably between 0.5 and 0.75, but have recommended that an investigator could use several different values of inequality aversion.[94]

The polarity of Atkinson's index "I" is toward inequality: increasing values of the index indicate increasing inequality. This measure is also

sensitive to concentration because its core is exponentiated.[95] Taagepera (1979) has called it a measure of deprivation because of its sensitivity to poverty when α>l (less than l).[96] It is a relative measure of inequality, because its values are independent of the number of income receivers. It is a population symmetric and it includes any number of all categories. It achieves its minimum value when all persons have equal income and its maximum when one person has all income. The rapidity with which "I" approaches its limits, however, depends on the value assigned to the inequality aversiveness parameter.[97]

Thus, It is noted that the first axiom, viz., mean independence is possessed by the inequality measures with the exception of variance (V), and Pigou-Dalton's measure with parameter zero. In fact, nearly all the inequality measures satisfy the principle of population. The inequality measures such as coefficient of variation, Gini-coefncient, and Atkinson's index satisfy the Pigou-Dalton condition, whereas variance, Theil's entropy index fulfills the Decomposability axiom.

So far the discussion has been about the measures of poverty & Inequality are examined in the present study. It has been understood that there are other two methods such as "Discriminant analysis" and Logistic Regression are need to findout the variation of many variables between rural

and urban groups of poor and causes of probability of being poor respectively. The description and technicality of these two methods has been discussed in the following pages.

4. Discriminant Analysis

Discriminant analysis, first introduced by Sir R.A. Fisher (1936) is a statistical technique. It is used to distinguishes several mutually exclusive groups. Based on a collection of variables the discriminant analysis can be performed for two or more groups. The concept underlying discriminant analysis is fairly simple. Linear combinations of the independent, sometimes called predictor variables are formed and serve as the basis for classifying cases into one of the groups. Thus, the goal of discriminant analysis is to classify cases into one of several mutually exclusive groups based on their values for a given set of predictor variables.

The first step in discriminant analysis is to select cases to be included in the computations. A case is excluded from the analysis if it contains missing information for the variable that defines the groups or for any of the predictor variables. Next step that it analysing group differences related with variables. Although, the variables are interrelated and it will need to employ statistical techniques that incorporate these dependencies, it is often helpful to begin analysing two differences between groups by examining univariate statistics. Further, since interdependencies among the variables affect most multivariate analyses, it is worth examining the correlation matrix of the predictor variables. In such a case, a pooled within groups correlation matrix is obtained by averaging the separate covariance matrices for all groups and then computing the correlation matrix. A total correlation matrix is obtained when all cases are treated as if they are from a single sample.

Discriminant Function
Descriptive statistics and univariate tests of significance provide basic information about the distributions of the variables in the groups and help to identify some differences among the groups. However, in discriminant analysis and other multivariate statistical procedures, the emphasis is on analysing the variables together, not one at a time. By considering the variables simultaneously one can able to incorporate information about their relationship.

In discriminant analysis, a linear combination of the independent variables is formed and serves as the basis for assigning cases to groups. Thus, information contained in multiple independent variables is summarised in a single index. In discriminant analysis, the weights are estimated so that they result in the 'best' separation between the groups.

The linear discriminant equation is

$$D = B_o + B_1 X_1 + B_2 X_2 + \dots + B_p X_p \qquad \dots (1)$$

is similar to the multiple linear regression equation. The X's are the values of the independent variables and the B's are coefficients estimated from the data. If a linear discriminant function is to distinguish some group 1 to group 2, the two groups must differ in their 'D' values.

Therefore, the B's are chosen so that the values of the discriminant function differ as much as possible between the groups or that for the discriminant scores the ratio,

$$\frac{\text{between - groups sum of squares}}{\text{within - groups sum of squares}}$$

is a maximum. Any other linear combination of the variables will have a smaller ratio. Based on the coefficients, it is possible to calculate the discriminant score for each case. The discriminant score for case 1 is obtained by multiplying the unstandardised coefficients by the values of the variables summing these products, and adding the constant. The mean score for all cases combined is 0 and the pooled-within groups variance is 1. This is always true for discriminant scores calculated by SPSS/PC+. Using the discriminant score, it is possible to obtain a rule for classifying cases into one of the two groups. The technique used in SPSS/PC+ DISCRIMINANT is based on Bayes' rule. The probability that a case with a discriminant score of D belongs to group is estimated by

$$P(G_i/D) \quad = \quad \frac{P(D/G_i)\,P(G_i)}{\sum\limits_{i=1}^{g} P(D/G_i)\,P(G_i)} \qquad \qquad \dots(2)$$

The classification output is an excerpt from the SPSSPC+ output that lists classification information for each case for a group of cases whose membership known. However, the summary of this classification output for more detailed information on the results of the classification phase can be presented in the form of classification results table. For each group, classification output shows the numbers of correct and incorrect classifications correctly classified cases appear on the diagonal of the table since the predicted and actual group are the same.

Finally, in different ways the variables coefficients are interpreting in the discriminant analysis. The first way is the standardized and unstandardized discriminant function coefficients. The unstandardized coefficients are the multipliers of the variables when they are expressed in the original units. As in multiple regression, the standardized coefficient are used when the variables are standardized to a mean of 0 and a standard deviation of 1. The interpretation of the coefficients is also similar to that in multiple regression.

Another way to assess the contribution of a variable to the discriminant function is to examine the correlations between the values of the function and the values of the variables. The computation of the coefficients is straight forward. For each case the value of the discriminant function is computed, and the Pearson's correlation coefficients between it and the original variables are obtained. Separate correlation matrices can be calculated for each group and the results combined to obtain a pooled within-groups correlation matrix. The total correlation coefficients are larger than the corresponding within-groups correlations. However, the relative magnitudes will be similar.

Another set of coefficients, sometimes called Fishers linear discriminant function coefficients or classification coefficients, can be used directly for classification. A set of coefficients is obtained for each group and a case is assigned to the group for which it has the largest discriminant score. The classification results are identical for both methods if all canonical discriminant functions are used.

5. The Logistic Regression Model

This article has also an object to identify the characteristics which quantify the probability of being poor based on a qualitative response model, i.e., the logit model in measurement of poverty and inequality. The selection of this model may be justified on the following grounds.
  1) The logit model directly yields an estimate of the probability of a households being poor. These probabilities can be interpreted as measures of the risk of poverty that have direct relevance for anti poverty policies.
  2) Within the class of qualitative response models another candidate is the probit model. The logit model is based on the cumulative logistic probability function while the probit model is based on the cumulative normal probability function. The cumulative logistic and normal function are quiet similar except that the former has slightly fatter tails. Besides, the logit model is easier to use from a computational point of view.

Algebraic Description of the Logit Model
Let Y_i (i = 1....N) represent a dichotomous random variable which takes the value 1 if a specified event occurs (in this case the event is that the ith household is poor) and 0 if the event does not occur (i.e., the ith household is not poor). The classification of sampled household into two categories, viz., poor and not poor, is carried'out on a per capita consumer total expenditure criterion. Specifically, if the per capita consumes total expenditure of the ith household falls below a given cutoff point, then the household is classified as poor. The household is not poor if the per capita consumer total expenditure of its household exceeds the cutoff point.

Let the probability of the ith household's being poor $P_i = P(Y_i=1)$ depends on a set of explanatory variables, $X_{i1},...X_{ik}$. An appropriate functional form between the dependent variable, $P_i = (Y_i=l)$ and the explanatory variables, $X_{i1},...X_{ik}$, must satisfy two requirements. One requirement is that it translates the values of the explanatory variables, $X_{i1},...X_{ik}$, which range over the entire real line, to a probability that ranges in value from 0 to 1. Another requirement is to maintain the property that increases in any of the variables, $X_i,...X_k$ are associated with increases (or decreases) in the probability in question. These requirements are satisfied by a cumulative' probability function. The resulting probability distribution is represented as

$$P_i = P(Y_{i=}1) = F(ß_o + ß_i X_{i1} + ... + ß_k X_{ik}) \qquad ... (1)$$

where F is a cumulative probability function. A special form of F is the cumulative logistic probability function. The logit model is based on this probability function and is specified as :

$$P_i = P(Y_{i=}l) = F(ß_o + ß_1 X_{i1} + ... + ß_k X_{ik})$$

$$= \frac{1}{1 + e^{-(ß_o + ß_1 X_{i1} + \cdots + \beta_K X_{iK})}} \qquad ...(2)$$

where F is a cumulative logistic function and 'e' represents the base of natural logarithms. It is easy to show that this specification leads to the following form:

$$\log \left(\frac{\frac{P_i}{1-P_i}}{Y} \right) = \beta_0 + \beta_1 X_{i1} + \ldots + \beta_k X_{ik} \qquad \ldots(3)$$

The dependent variable in this regression equation is the logarithm of the odds that the ith household is poor. One feature of the logit model is that it transforms the problem of predicting probabilities within a (0,1) interval to the odds of an event's occurring (the event in this case is that the ith household is poor) within the range of the entire real line. Differentiating equation (3) with respect to an explanatory variable, one can obtain

$$\frac{\partial \log \left(\frac{\frac{P_i}{1-P_i}}{Y} \right)}{\partial X_{ik}} = \beta_k$$

β_k measures the change in the logarithm of the odds that the ith household is poor as a result of a unit change in X_{ik}. A positive value of the coefficient in question thus implies a positive effect on the dependent variable while a negative value implies a negative effect. The slope of the cumulative logistic distribution is maximum at $P=\frac{1}{2}$ In terms of the regression model, this implies that changes in explanatory variables will have their maximum impact on the probability in question at the midpoint of the distribution.

A suitable technique for estimating equation (3) with individual observations is maximum likelihood. A skatch of this procedure is given below.

Individual Pi are not observed: instead one can know for each observation whether the household is poor or not poor. Thus, the measured dependent variable, $Y_i=1$ if the household is poor and 0 if the household is not poor. Here the objective is to find parameter estimators for $\beta_0, \beta_1, \ldots \beta_k$ that make it most likely that the sample of poor and not poor households would have occurred.

If n_1 households are poor and the remaining n_2 are not poor ($n_1+n_2=N$), and ordering the observations such that the first n_1 observation represent the poor households, the likelihood function has the form

$$L = \text{Prob} (Y_1, \ldots, Y_N) = \text{Prob} (Y_1) \ldots \text{Prob}(Y_N)$$

it is assumed that each of the individual observations is independent of each other observation. Now, by taking into account the fact that the probability of not being poor is equal to 1 minus the probability of being poor, the likelihood function reduces to

$$L = \prod_{i=1}^{n_1} P_i \prod_{i=n_{i+1}}^{N} (1 = P_i) = \prod_{i=1}^{N} P_i^{Y_i} (1 - P_i)^{1-Y_i} \qquad \ldots (4)$$

The last expression follows because $Y_t = 1$ for the first n_1 observations, and 0 for the last n_2 observations. The logarithm of L than takes the form

$$\log L \;=\; \sum_{i=1}^{n_1} \log P_i \;+\; \sum_{i=n_{i+1}}^{N} \log(1 - P_i) \qquad\qquad \ldots (5)$$

where the P_i represent the probabilities associated with the cumulative logistic probability function.

To maximise log L, one can differentiate (5) with respect to $\beta_o, \beta_1, \ldots \beta_k$, set the result equal to zero, and solve :

$$\frac{\partial(\log L)}{\partial \beta_o} \;=\; \sum_{i=1}^{n_1} \frac{\partial P_i/\partial \beta_o}{P_i} \;-\; \sum_{i=n_{i+1}}^{N} \frac{\partial P_i/\partial \beta_o}{1 - P_i} \;=\; 0 \qquad \ldots (6)$$

$$\frac{\partial(\log L)}{\partial \beta_1} \;=\; \sum_{i=1}^{n_1} \frac{\partial P_i/\partial \beta_1}{P_i} \;-\; \sum_{i=n_{i+1}}^{N} \frac{\partial P_i/\partial \beta_1}{1 - P_i} \;=\; 0 \qquad \ldots (7)$$

$$\frac{\partial(\log L)}{\partial \beta_k} \;=\; \sum_{i=1}^{n_1} \frac{\partial P_i/\partial \beta_k}{P_i} \;-\; \sum_{i=n_{i+1}}^{N} \frac{\partial P_i/\partial \beta_k}{1 - P_i} \;=\; 0 \qquad \ldots (8)$$

for estimators of $\beta_o, \beta_1, \ldots \beta_k$, Note that since (6), (7) and (8) are nonlinear, the solution are obtained with the help of an iterative procedure.

The maximum likelihood estimation procedure has a number of desirable properties. Under general conditions maximum likelihood estimators are consistent, (asymptotically) normal and efficient. An analogue of the regression t-test can be applied to the estimated coefficient to its standard error follows a normal distribution. For testing the significance of all or a subset of the coefficients in the logit model when maximum likelihood is used, or generalised likelihood ratio test can be used. The likelihood ratio is given by

$$\lambda = \max L(\omega) \,/\, \text{Max } L(\Omega) \qquad\qquad \ldots (9)$$

where λ is the likelihood ratio, max $L(\omega)$ is the maximum of the likelihood function where M elements of the parameter space have been constrained by the null-hypothesis (e.g., if testing for the significance of a set of β_s in the logit model, the maximum of L with these β_s set equal to zero), and maximum $L(Q)$ is the unconstrained maximum of the likelihood function. The appropriate test follows from the fact that $-2 \log \lambda$, is approximately distributed like chi-square with M decreases of freedom.

The discussion presented in this above section on poverty and inequality measurements, discriminant analysis and logistic regression function based on different indices and models, have been discussed in detail. The next section leads for conclusion.

6. Conclusion

Thus, dimension of poverty and inequality and its number of issues, concepts and measurement are critically examined here. It has been understood that poverty and inequality is a multivariate phenomena and its magnitude must be approached in a broader view. The problem and characteristics of poverty and inequality are studied in this article emphasized its relative nature not with absolute one. Any policy programme approached for its alleviation on poverty and inequality in this views gives more light for eradication.

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