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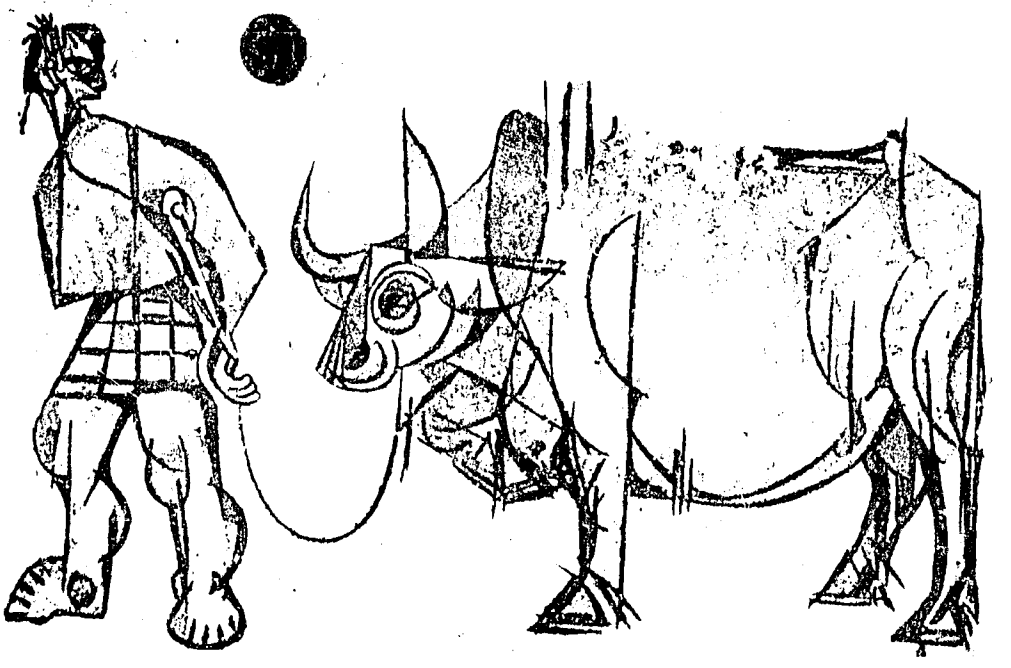

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by Susan M. Randolph

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MEASURES OF ABSOLUTE POVERTY AND THEIR APPLICATIONS IN PROGRAM PLANNING AND EVALUATION FOR INCREASING THE PARTICIPATION OF THE POOR

Susan M. Randolph

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FOREWORD

The commitment of development agencies and LDC governments to direct their resources toward assisting the poorer sectors has progressed a great deal in the last ten years. At least minimally, the poor are to be the prime beneficiaries of most development efforts, though programs that truly assist them have not been so readily devised. In the past decade there has been an explosion of research and writing within the economics discipline on how to measure the number of poor and how to assess the impact of policies upon their economic status. Formalistically the work has proceeded with ever greater precision and sophistication. Still, few are satisfied with the measures or conclusions relating to efforts to improve the lot of the poor.

The failure of programs to assist the poor in an effective and sustained manner is not usually due to the shortcomings of economic analysis. Many more shortcomings lie in the political and administrative realms. But when the conceptualization and measurement of "poor" groups is too gross, or too complex, and not really connected to the functional design and implementation of development efforts, some responsibility lies with the economic approach to the problem. Good analysis is no substitute for the mobilization of political support to assist the poor or for supportive administrative structures and routines. But it is an important contributing factor to putting together the pieces of strategy to counter the effects and persistence of poverty.

This state-of-the-art paper undertakes a critical review of measures for identifying what are known in the literature, and in policy pronouncements, as "target groups," though one may well prefer a less top-down designation. The usual methodologies, like the terminology of "target group," are usually themselves non-participatory. It should be possible to approach the issue in terms of how to make measures of poverty themselves more "participatory," but that would be the subject for another, more extended paper. The main concern here is to assess the measures now commonly proposed, and sometimes used.

When assessing them, we want to show some of the implications they have for "participatory" development. In particular, we are concerned with what distortions each measure might introduce. This raises a classical problem, described in statistical terms as a "two-tail" problem — whom does the methodology leave out who should be included, and whom does it include who should be excluded? The first is of greatest concern, though naturally the latter is a concern to the extent program resources are scarce.

We are particularly concerned with how the methodologies may exclude members of groups such as women and children, the geographically remote, ethnic minorities, and others who are all too commonly overlooked in census or survey data as well as in government program efforts. By looking at methodologies already in use or advocated, we can consider how they may be made more realistic for identifying intended beneficiaries, whose participation should also be sought in decision-making and implementation, as well as evaluation.

We recognize that it is usually difficult to get data and measures dealing with the poor when designing and carrying out projects, and that often shortcuts or compromises are necessary. The point of view here is not a purist or perfectionist one. But it should be clear that any one methodology contains certain biases or vulnerabilities, and we want to make clear the implications of these for poverty-oriented efforts.

To some extent the perspective taken here, reflecting the measures dominant in the field, is a static one, or at best a comparative one involving pictures of poverty at different points in time. There is evolving a more dynamic mode of analysis, drawing more on anthropology than economics, which deals with the "survival strategies" of the poor. This is very interesting and promising, but still in its early stages. Work is being done along these lines with the USAID mission in the Philipines by Dr. David Korten, and it complements the analysis and suggestions offered here.

The treatment here of poverty analyses is a starting point for moving beyond conventional appproaches to increasing the participation of the poor in development. At a minimum, persons and agencies working with such measures should be cognizant of the alternatives available, and of the limitations of each. To move more directly into analysis which is linked to anti-poverty action, the "survival strategy" approach is appropriate. In fact, the effort made here to assess multiple sources of income, seasonality of poverty risks and the role of access to assets, particularly land and other natural resources, converges on the approach which Dr. Korten is working on.

Dr. Randolph is well-placed to undertake the analysis offered here. She was a member of the original working group (and the only economist) when our Rural Development Committee began to analyze "rural development participation" back in 1976. That work resulted in a monograph setting forth the dimensions of participation relevant to development projects.[1] Subsequently, during 1978, Dr. Randolph worked

---

[1] See John M. Cohen and Norman Uphoff, Rural Development Participation: Concepts and Measures for Project Design, Implementation and Evaluation, (Ithaca: Cornell University, Rural Development Committee, 1976); also "Participation's Place in Rural Development: Seeking Clarity through Specificity," World Development, 8:3, March 1980, pp. 213-235.

with an interdisciplinary team composed jointly by the Cornell Rural Development Committee and the International Islamic Centre for Population Studies and Research of Al Azhar University in Cairo. This group produced an analysis of poverty in rural Egypt with special attention to some of the issues addressed in this monograph.[2] Upon completing this work, she turned to writing her doctoral dissertation, The Determinants of Earnings Mobility in Malaysia, dealing with income distribution and poverty issues.

Given her concern with issues of participation and poverty that went beyond conventionally economic formulations, and her experience in working through the analysis of poverty in Egypt and Malaysia, the Rural Development Participation Project, with which she had been affiliated, asked her to write this paper. It is one of the methodological outputs of the Project, undertaken under a cooperative agreement between the Rural Development Committee and the Bureau for Science and Technology, USAID.

Norman Uphoff
Director, Rural Development
Participation Project

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[2]See Distribution of Land, Employment and Income in Rural Egypt by Iliya Harik and Susan Randolph, Ithaca: Cornell University, Rural Development Committee, 1979. Previous to coming to Cornell, Dr. Randolph worked with the Development Foundation of Turkey in Ankara and in rural areas of Turkey between 1972 and 1976, dealing with the planning and evaluation of development projects.

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S.M.R.

Introduction

THE CONCEPT OF POVERTY

The poor have always been among us, but there is increasing conviction that this should not be accepted passively. The poor have become a growing focus of concern in the past decade and a half. Development agencies and the governmnents of less developed countries have increasingly singled out the poor as prime beneficiaries of development efforts. This is apparent from the explicit inclusion of anti-poverty policies and goals in official actions and statements of both national governments and international agencies. Increasing amounts of hard resources are backing soft commitments toward the poor.

Despite, or perhaps because of, the growing volume of literature in the economics discipline on the subject, no consensus has been reached on the best measure of poverty or on the most appropriate method of gauging its elimination. The concept of poverty used in the literature is varied, illuminating the different faces of poverty, but this shifting concept of poverty has precluded consensus on its appropriate measurement.[1]

At the most basic level, the phenomenon of poverty is ubiquitous. There is something universal in the concept of poverty as Amartya Sen has written of it: "In its most raw form, poverty is universally recognized; it is for all to see, hear and smell" (Ibid., p. 13). At the same time, any definition of poverty is cultural. As Eric Hobsbawm says, poverty "is always defined according to the conventions of the society in which it occurs."[2] Poverty involves inescapably some individual value judgment,

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[1]Two useful reviews on the concepts of poverty are contained in Gary S. Fields, Poverty, Inequality and Development, Cambridge: Cambridge University Press, 1980, Chapter 2; and Amartya Sen, "Three Notes on the Concept of Poverty," World Employment Programme Research Working Paper, Geneva: International Labour Office, January 1978, Note 1.

[2]E. J. Hobsbawm, "Poverty," International Encyclopaedia of the Social Sciences, New York: Macmillan, 1968, p. 398.

defined according to one's own position in society. "Poverty, like beauty, lies in the eye of the beholder," writes Mollie Orshansky.[3]

Three broad approaches to the definition of poverty are found in the literature: the relative inequality approach, the relative poverty approach, and the absolute poverty approach.

The Relative Inequality Approach focuses on individuals' perceptions of poverty, and is in essence a psychological concept of poverty. So long as someone is poorer than others in a society, poverty exists. The poorer person, regardless of actual income level, will feel deprived. If someone else has two million dollars, it is the rare fellow who will not suffer psychological deprivation in spite of the fact that he has a million dollars. By this concept of poverty, the elimination of poverty requires the equalization of incomes, and the magnitude of poverty is best assessed by measuring the extent of inequality in the income distribution.

Research along this line of poverty measurement was pioneered by Simon Kuznets over two decades ago.[4] Kuznets examined the income shares of individuals falling within the various fractiles (quartiles, deciles, etc.) of the income distribution. Since then, many measures of the extent of inequality based on or related to the Lorenz Curve have been proposed and evaluated, in particular the Gini Index.[5] The Lorenz Curve concept is widely accepted as the best method of making intertemporal poverty comparisons. However, the Lorenz Curve for one period (or country) seldom completely

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[3]M. Orshansky, "Measuring Poverty -- A Debate," Public Welfare, 36:2, Spring 1978, p. 46.

[4]See Simon Kuznets, "Economic Growth and Income Inequality," American Economic Review, March 1955, pp. 1-28; "Quantitative Aspects of the Economic Growth of Nations: VIII, Distribution of Income by Size," Economic Development and Cultural Change, January 1963, pt. 2, pp. 1-80; and Modern Economic Growth, New Haven: Yale University Press, 1966.

[5]Other measures include the Coefficient of Variation, the Atkinson Index, the Theil Index and the Variance of Log Income.

dominates (that is, lies wholely inside) that for another period, and in such cases another of the measures must be relied upon to assess directional changes in poverty. These other inequality-based poverty measures, however, all implicitly make some value judgment about the desirability of income accruing to individuals occupying various positions in the income distribution. This reality has precluded any widespread agreement on what is the "best" inequality measure.[6]

The Relative Poverty approach focuses concern on the lower tail of the income distribution, and is akin in spirit to the Rawlsian criterion of justice.[7] The poor are defined with respect to their position in the income distribution rather than with regard to any absolute standard of poverty. In this view, as in the inequality approach, poverty involves psychological or relative deprivation. Here, however, an individual is thought to experience a sense of deprivation not simply because there is someone with a higher income, but rather because his income is inadequate to share fully in the diet, activities and style of living that are the cultural norm.[8] The cultural norm, in turn, is set by the income level received by the bulk of the population.

The relative poverty measure proposed by the World Bank encompasses the poorest 40% of the population. Increases (or decreases) in the real income of the poorest 40% will indicate in these terms some achievement (or lack) of poverty eradication. One obvious problem with this measure is that poverty can never be

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[6]Three good reviews on the value judgments implicitly made by the different inequality measures can be found in F. A. Cowell, Measuring Inequality, Oxford: Bocardo and Church Army Press, 1977; Paul D. Allison, "Measures of Inequality," American Sociological Review, 43:6, December 1978, pp. 866-870; and Nanak Kakwani, Income Inequality and Poverty: Methods of Estimation and Policy Applications, Oxford: Oxford University Press, 1980, especially pp. 9-126.

[7]John Rawls, A Theory of Justice, Cambridge: Belknap Press of Harvard University Press, 1971.

[8]For an elaboration of the Relative Deprivation concept of poverty, see S. M. Miller and P. Roby, "Poverty: Changing Social Stratification," in Peter Townsend, The Concept of Poverty, London: Heinemann, 1971; and W. G. Runciman, Relative Deprivation and Social Justice, London: Routledge, 1966.

eliminated. There will always be a poorest 40%, though it is conceivable that an income distribution could tighten sufficiently around its median that many if not all of the bottom 40% received incomes sufficient to fully share in the style of life that is the cultural norm. The solution to relative poverty is thus much the same as the solution to relative inequality discussed above -- equalization of incomes.

Another relative poverty measure which avoids this inconsistency was proposed by Victor Fuchs in 1967.[9] Fuchs' measure counts the proportion of individuals with income less than half of the median income. Changes in this proportion indicates progress (or absence of it) in moving toward poverty eradication.

A number of other poverty measures originally proposed to respond simultaneously to absolute and relative approaches to poverty can be transformed into purely relative poverty measures by substituting for the poverty line either the median income, one-half the median income, or some other relative income level choosen to conform with the level of income necessary to support the cultural norm's standard of living. When this is done, however, it should be recognized that measured changes in poverty are in part due to changes in the absolute income levels of the poor, and in part due to the changing cultural norm. This group of measures, the best known of which is the Sen Index, will be discussed in Chapter II, pages 62 to 76.

The Absolute Poverty approach ignores individuals' relative positions within the income distribution and their subjective "feelings" of deprivation. Instead, the absolute poverty approach views poverty as an objective condition of deprivation and identifies the poor by comparing individuals' well-being against some absolute standard of well-being, the poverty line. Just where that absolute standard should be set is the subject of considerable contention. Three perspectives compete for dominance in the literature

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[9] Victor Fuchs, "Redefining Poverty and Redistributing Income," Public Interest, Summer 1967, pp. 88-95.

-- the public policy perspective, the cultural decency perspective, and the biological necessities perspective.

The public policy perspective relies upon political consensus to set the income or consumption level below which persons are defined as poor and below which public assistance is deemed necessary.[10] In effect, the level of income fixed by political consensus as the poverty line will reflect a balancing of community capabilities, desires and power relations. The poverty line set by political consensus will evolve and shift over time according to the political center of gravity and economic conditions. The adoption of the public policy perspective to fix the poverty line leads to problems in gauging the success of poverty programs or a nation's progress towards eliminating poverty over the medium- or long-term since measured changes in poverty will reflect the changing poverty line as well as any actual changes in the well-being of the poor in the population. Furthermore, cross-national comparisons of poverty become meaningless given the vastly different specifications of poverty emanating from the different political and economic climates.

The cultural decency perspective is similar to the relative deprivation approach in that cultural norms are tied into the definition of poverty. The difference is that the cultural decency perspective emphasizes concrete conditions of deprivation instead of feelings of deprivation. The cultural decency perspective first identifies the concrete consumption requirements for a "decent" life and then identifies as poor those who cannot consume this level of goods and services. Alternatively, it calculates the cost of consumption goods required for a decent life and identifies as poor those whose incomes are inadequate to purchase this minimum consumption basket.

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[10] For a further elaboration of the Public Policy approach to defining poverty, see Report of the United States President's Commission on Income Maintenance, Washington, 1969, especially p. 8.

This approach to defining an absolute poverty line has captivated a large number of poverty researchers.[11] It is not, however, without its ambiguities and problems. Because this definition of poverty is tied to cultural norms, it is not as universal, objective and time-invariant as it first appears. Standards of decency can never be fully divorced from either the subjective feelings of deprivation, a country's aggregate economic position, the level of inequality, or the power relations within a country, since all of these factors influence the cultural norm.

The biological necessities perspective emphasizes the rawest form of poverty: biological deprivation. Children with swollen bellies supported by toothpick limbs epitomize this picture book representation of poverty. Such poverty is universally recognized and such conditions of deprivation differentiate the poor from the non-poor in the biological necessities perspective. More precisely, the biological perspective defines the poor as those who do not consume or who do not receive income sufficient to purchase those commodities which are indispensably necessary for the support of biological life.

Not surprisingly, this concept of poverty guided the first well known study of poverty by Seebohm Rowntree in 1901.[12] Although few controversial judgments or assumptions would seem to be needed to define a biological poverty line, our medical understanding of basic biological needs is far from adequate. Furthermore, biological needs differ by physical age and sex characteristics, climatic conditions and energy expenditures.

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[11]This concept of poverty was enunciated long ago by Adam Smith in his discussion of necessities. See Adam Smith, Wealth of Nations, 1776, pp. 351-352. This notion of poverty is couched in modern terms in several of the articles, notably the Townsend article, in D. Wedderburn, Poverty, Inequality and Class Structure, Cambridge: Cambridge University Press, 1974. Amartya Sen, and many of his followers include this aspect of poverty in their definition of poverty. See Amartya Sen, "Three Notes on the Concept of Poverty," op. cit.

[12]S. Rowntree, Poverty: A Study of Town Life, London: Macmillan, 1901.

When the poor are identified on an income basis, further inaccuracies enter into the identification of the biologically deprived. The cost of purchasing biological necessities differs by micro economy, and, given available data, it is seldom feasible to adjust adequately for these differences. Even if the minimum income necessary for given individuals to meet their biological needs could be precisely specified, there is no assurance that individuals with this level of means will in fact meet their biological needs. People have psychological as well as biological needs. Most will feel compelled to satisfy some minimum level of psychological needs before fully satisfying their biological needs. As George Orwell puts it, ". . . when you are underfed, harassed, bored and miserable, you don't want to eat dull wholesome food. You want something a little bit 'tasty'."[13] The needs of the soul guarantee that many who in some statistical sense need not suffer biological deprivation will in fact suffer biological deprivation. If a poverty line is to be drawn which at least approximately divides those who are biologically deprived from those who are not, the definition of a biologically based poverty line can never be fully divorced from a specification of cultural norms and attendant psychological needs.

None of the approaches to measuring poverty escape valid conceptual and operational criticism.[14] Ultimately, their usefulness must be judged on their ability to evoke the political and social will to remedy poverty, to illuminate the complex factors

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[13] George Orwell, The Road to Wigan Pier, Victor Gollancz, London, 1937; as quoted by Wolf Scott in Concepts and Measurement of Poverty, UNRISD, Report No. 81.1, Geneva, 1981, p. 7.

[14] Wolf Scott points out and discusses many of the operational difficulties inherent in the use of the absolute concept of poverty and provides illuminating examples of some of the paradoxes which arise when interpreting the statistics. See his study, Concepts and Measurement of Poverty, UNRISD, Report No. 81.1, Geneva, 1981. Another report published by the United Nations Research Institute for Social Development examines the data bases typically available for computing measures of inequality and the international comparability of statistics on income distribution. See Donald McGranahan, International Comparability of Statistics on Income Distribution, UNRISD, Report No. 79.6, Geneva, 1979.

generating poverty, to assist in the design of programs leading to the eradication of poverty, and to gauge the success of programs intended to remedy poverty. All of the approaches to poverty measurement have merit to these ends and deserve continued attention. Each concentrates on a different face of poverty.

This paper focuses on poverty measures assessing and addressing the face of poverty generally conceded to be the most severe and compelling — objective biological deprivation. The absolute poverty approach can be focused directly on biological deprivation and accordingly is adopted in this paper. When trying to define an absolute poverty line, the public policy solution may be most appropriate from a particular administration's point of view. However, it does not guarantee a close monitoring of the magnitude of biological deprivation. Depending upon the political and economic circumstances of a country, the poverty line defined through public consensus may indicate an absence of poverty even when there is mass biological deprivation, or it may report the persistence of poverty despite the elimination of outright biological deprivation. Accordingly, in this paper, the biological necessities perspective dominates when defining poverty lines, although it is often influenced by the cultural decency perspective. The methodologies discussed for identifying the poor range from those designed to identify individuals who conceivably cannot avoid biological deprivation to those designed to identify all individuals who suffer biological deprivation even though many of these individuals possess the resources to avoid biological deprivation in some technical sense.

The discussion on poverty measurement is divided here into three chapters. The first chapter is concerned with the definition of a poverty line in a manner consistent with the biological necessities perspective. Four separate procedures are discussed: identification through direct medical observation; specification of the commodities necessary to support life and identification of poverty through assessment of individuals' consumption adequacy; identification according to a monetary poverty line

which would ensure meeting biological needs; and identification through correlates of poverty. The strengths and weaknesses of each procedure are emphasized from a conceptual and practical standpoint.

The subsequent chapter is concerned with the problem of aggregating across individuals identified as poor to obtain a summary poverty measure. The full range of poverty measures suggested by researchers which emphasize absolute poverty are discussed. These measures can be classified as headcount measures, poverty gap measures, and weighted poverty gap measures. The final section of the chapter suggests characteristics of an absolute poverty measure which would make it consistent with the notion of poverty as the absolute magnitude of biological deprivation. Each poverty measure is then evaluated against these criteria. Throughout the discussion, an eye is kept on the biases, vulnerabilities and practicality of each measure with regard to the different purposes and contexts of poverty measurement.

The last chapter focuses on applications of poverty measurement for policy formulation, and program design, monitoring and evaluation. The first two procedures discussed — decomposition analysis and poverty profiling — provide the necessary information to direct funding to those subgroups in the population where the need is greatest and where the probability of program leakages is the smallest. In addition, these two procedures illuminate the contexts in which poverty flourishes and in doing so suggest promising program approaches for the remedy of poverty. Next, the use of poverty measures in cost-effectiveness analysis is discussed as it relates to choosing among possible alternative poverty programs. Finally, some issues in longitudinal poverty comparisons are discussed as they apply to the monitoring and evaluation of poverty programs, and the attainment of policy objectives.

Chapter I
IDENTIFYING THE POOR

Having taken as the core dimension of poverty the magnitude of absolute biological deprivation, and considering as poor those individuals enduring biological deprivation, we can set about the task of identifying the poor — the basis for any subsequent anti-poverty efforts. Because biological deprivation is the most raw and obvious form of poverty, the identification process might appear simple. It is not. The dividing line between biological sufficiency and biological deficiency is difficult to fix operationally even from a medical perspective. Any decision on where to draw a poverty line is inherently arbitrary. The number of arbitrary decisions required to identify the poor multiplies as one moves from direct medical observation to indirect indications of biological deficiency based on consumption or income level. The problem is serious enough that some have suggested that any procedure adopted to identify the biologically deprived is untenable.[1]

Such an extreme posture is unwarranted. Although the exact dividing line between biological sufficiency and deficiency is open to dispute, there is unquestionably some range, if not a precise line, below which those with conscience and credentials will agree that biological deficiency exists and above which biological sufficiency is ensured. Challenges to the necessarily arbitrary choices of definition and procedure can be anticipated and put to rest through the employment of sensitivity analysis. What is essential in comparative poverty analyses is that the definitions and procedures be held constant. The study of poverty in terms of biological deprivation is too important to allow it to be swept aside by definitional and procedural quibbles.

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[1] An attack on the biological definition of poverty is put forward by many of the contributors to P. Townsend, ed., The Concept of Poverty, London: Heinemann, 1971.

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Amartya Sen puts the issue well, "...the dismissal of the whole approach seems to be a robust example of misplaced sophistication."[2]

This chapter examines four general methods of identifying the poor in a manner consistent with the definition of poverty as the magnitude of absolute biological deprivation. The methods examined include:

1) identification of the poor through direct medical observation;
2) specification of the commodities necessary to support life, and identification of the poor through assessment of individuals' consumption;
3) identification through a monetary poverty line set at a level ensuring the consumption of biological necessities;
4) identification by ascertaining correlates of poverty.

The first method is the most direct and accordingly the least arbitrary. The other methods have cost-saving advantages by using generally existing data bases. Even when no data are available, the cost of collecting the data necessary to implement these less direct methods is lower than the cost of medical observation. The third method is particularly suited to gauging the relative intensity of poverty between poor individuals, and accordingly has served as the basis for most summary poverty measures. The last method is the crudest. It also demands the least data once correlates of poverty have been ascertained. This chapter explains the methods commonly used to identify the poor. In addition, it points out the strengths and weaknesses of each method from a conceptual and practical standpoint.

Physical Assessment of Nutritional Status

Physical assessment of nutritional status by medical or other trained personnel can provide evidence of nutritional insufficiency, which may be taken as the most direct indicator of biological deprivation. Because there is a strong interaction

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[2]Amartya Sen, "Three Notes on the Concept of Poverty," op. cit., p. 6.

between the adequacy of water, shelter, fuel, sanitary facilities and clothing on the one hand, and nutritional requirements on the other, the assessment of nutritional status indirectly assesses the adequacy of non-food biological needs. Increased energy requirements resulting from inadequate shelter, and long treks for water will subtract from the nutritional benefit of a given caloric intake. High levels of crowding and poor ventilation, or contaminated water supplies and poor sanitation contribute to the increased frequency of infection, which at an otherwise adequate caloric intake will result in poor nutrition.

These factors make the physical assessment of nutritional status a better substantive indicator of biological deprivation than methods comparing the adequacy of caloric intake to standardized needs given assumed levels of activity, shelter and hygiene. Three different types of data may be used for the physical assessment of nutritional status — anthropometric measurements, biochemical analyses, and clinical examinations. Each method provides somewhat different information, and ideally would be undertaken jointly.

The most commonly used measures of nutritional status are anthropometric measurements, including height, weight, skin-fold thickness and upper arm circumference. These measurements can be made with inexpensive equipment, by relatively untrained technicians, and are easily and quickly analyzed. Furthermore, the necessary measurements can be made in a short period of time and require little cooperation on the part of the people being assessed. Height at a given age, weight at a given age, and weight in relation to height are the measures most commonly used for such assessment. For example, normal height but low weight suggests acute malnutrition, whereas low height <u>and</u> low weight (but a "normal" ratio of height-to-weight) suggests chronic malnutrition.

Children are more vulnerable to inadequate nutrition, and the effects of undernutrition on their measurements are more obvious and more dramatic than the

effects on adults. Furthermore, because there is little difference in anthropometric measurements among healthy well-nourished populations of children up to about age 6 (regardless of race or nationality), well accepted international standards are available which can be used to evaluate measurements for children.

Two practical problems are apt to lessen the accuracy of the physical assessment of nutritional status for children. First, getting accurate height and weight or skin thickness data is not easy. Second, a precise determination of age is required, and age is not precisely known in many developing countries.

Anthropometric data are not as easily interpreted for persons above the age of six since there are considerable "normal" differences between populations above this age in various countries. As a result of this fact, there is disagreement over the appropriateness of international standards for populations above age six. One option is to generalize the nutritional status of children to represent the entire household. However, it is not necessarily true that the parents of malnourished children will also be malnourished. Furthermore, many households do not include a child under the age of six, and as a result, their nutritional status would remain undetermined.

In summary, some of the problems of using anthropometric data are: (1) the difficulty of getting accurate height and weight or skin thickness data (especially for children); (2) the problem of determining exact age of each person examined; and (3) the lack of accepted standards for assessing the nutritional status of the adult population.

The second source of data for evaluating nutritional status, biochemical data, involves a variety of chemical analyses done on blood samples and occasionally on urine, stool or hair samples. Some of the analyses that may be done on blood include measurement of hemoglobin or hematocrit, serum iron, serum proteins, some mineral and some vitamin levels. These measurements reflect relatively long-term nutritional adequacy rather than acute malnutrition. They require expensive equipment and highly skilled technicians to perform the assessments. They also require a high degree of

cooperation from the people being assessed, and there can even be cultural taboos which impede obtaining samples.[3]

There is an appearance of precision in such measures, but interpreting levels remains an issue of some debate. The primary problem is setting standards of what constitutes deficiency. A secondary problem is the possibility that illness or a recent change in diet will affect the measured levels. The expense of collecting biochemical data, coupled with the lack of agreement over standards against which to interpret findings, make the biochemical assessment of nutritional status a less practical method of poverty identification.

A final source of data for the physical assessment of nutritional status is data from physical (clinical) examinations. Specific findings, such as body configuration, skin texture and lesions, hair quality, keratoconjunctivitis, bony deformities or tenderness are indicative of general or specific nutritional deficiencies. The collection of such data is time consuming, requires highly trained personnel and a large degree of cooperation on the part of the individuals being assessed. As a result, this sort of data is seldom used for mass screenings.

The most accurate classification of individuals between nutritional sufficiency and deficiency results from combining information from the different anthropometric, biochemical and clinical data bases. Individuals who show nutritional deficiency on the basis of any indicator can be suitably classified as poor.

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[3]Several studies of nutritional status done in Kenya and India by researchers associated with Cornell's International Nutrition Program have found more ready cooperation from children, workers and farmers than usually assumed for these countries, so perhaps this consideration has been overstressed in the literature. Reports of these studies include: Lani S. Stephenson, Michael C. Latham and Martin L. Odouri, "Costs, Prevalence and Approaches for Control of Ascaris Infection in Kenya," Journal of Tropical Pediatrics, 26, December 1980, pp. 246-263; June C. Wolgemuth, Michael C. Latham and Andrew Chesher, "Worker Productivity and the Nutritional Status of Kenyan Road Construction Laborers," American Journal of Clinical Nutrition, 36, July 1982, pp. 68-78; and P.D. Bidinger, D. W. T. Crompton and Susan Arnold, "Aspects of Intestinal Parasitism in Villages from Rural Peninsular India," Parasitology, 83, 1981, pp. 373-380.

A problem arises, however, when trying to assess the intensity of deprivation rather than simply the fact of deprivation for each individual. Most poverty researchers contend that a simple counting up of the number of poor individuals provides an incomplete assessment of the magnitude of poverty. They argue that the same percentage of poor individuals can represent quite different magnitudes of poverty if the average extent (or intensity) of deprivation among the poor differs between populations.

When several indicators, based on different units of measurement, are used to assess the existence of deprivation, it is all the more difficult to develop an index of the intensity of deprivation. How does one compare the intensity of nutritional deprivation between two individuals when one person is underweight and the other has a vitamin A deficiency? How can one aggregate the total intensity of deprivation suffered by an individual who has deficiencies apparent on the basis of several indicators? This indexing problem makes more reasonable the adoption of a single general indicator of nutritional adequacy, such as hematocrit level or muscle circumference. This means, of course, somewhat lower accuracy in discriminating between the poor and the non-poor.

In summary, basing identification of poor individuals on a physical assessment of nutritional status appears ideal at first glance. However, it is open to criticism on several grounds. First, the easiest and cheapest data to collect, anthropometric data, are only universally recognized as accurate for children under six years of age. Second, the most accurate assessment of nutritional status results when evidence from biochemical, anthropometric and clinical analyses are jointly used to evaluate nutritional status. However, the use of joint test results confounds specification of the intensity of poverty—an aspect of individuals' poverty status that many researchers feel is essential to gauge adequately the magnitude of absolute poverty in a country.

The most serious impediment to the use of such physical methods of poverty identification is the requirement for special surveys. The cost of gathering even anthropometric data — the cheapest type of medical evidence to gather — is quite high. This fact, perhaps more than any other fact, has led to the development of alternative methods of poverty identification which rely either on routinely collected data or on data which have applications beyond the study of poverty.

Direct Assessment of Consumption Adequacy

An alternative method of identifying the poor relies on the specification of a commodity based poverty line. This method is commonly referred to as the Basic Needs approach to poverty identification, and owes much of its operational refinement to the efforts of researchers at the International Labour Organization. The poor are differentiated from the non-poor according to whether they consume a bundle of commodities meeting the biological necessities of life. The primary data base used to assess consumption adequacy is the household consumption survey. Household consumption surveys are routinely undertaken in many developing countries and have applications beyond the study of poverty. Because no special surveys are required when this method is used to identify the poor, it offers considerable cost savings over physical assessments methods.

The general procedure involves three basic steps. First, a general list of basic needs is defined--food, clothing, shelter, etc. Second, minimum requirements are specified separately for each basic need either in terms of commodities, commodity mixes, or commodity characteristics. Third, individuals' consumption levels for each basic need are compared to the minimum requirement for each basic need. Those individuals whose consumption level is below minimum requirements with respect to <u>any</u> basic need are identified as poor.[4] The reliability of this method of poverty

[4]The methodology assumes that there are no interactions between consumption levels of one basic need and minimum requirements of another basic need. Some researchers have argued that a deficiency in the consumption of one basic need may be

identification depends upon the accuracy with which each individual's consumption of goods and services can be measured, and the accuracy and consistency with which all the various market baskets of goods and services which different individuals consume can be evaluated for their biological adequacy. In practice, individuals' consumption levels can only be imperfectly measured, and a whole range of conceptual and practical problems prevent a fully accurate evaluation of biological adequacy of different market baskets.

Researchers unanimously agree that food is the most important basic need. All household consumption surveys contain information on the consumption of a reasonably detailed list of food items. Because many alternative food baskets will meet the nutritional requirements of a given individual, the preferred practice is to assess food adequacy on the basis of food characteristics—calories, protein, vitamins and minerals.

The preferred procedure first establishes nutritional requirements in terms of food characteristics for different classes of individuals; the classes defined on the basis of all the personal characteristics influencing nutritional needs—age, sex, body structure, metabolic rate, activity level, lactation and pregnancy status, climatic environment, etc. Next the nutritional value of each individual's actual food consumption is computed in terms of calories, protein, vitamins and minerals. Finally, individuals are classed according to their nutritional requirements, and the nutritional value of their diet is compared to their nutritional requirements. Although the above procedure is preferred, it is seldom feasible given the usually available data base and the realistic limitations on collecting consumption information.

Information on personal characteristics is generally limited in household consumption surveys. Normally, only data on the age (or age bracket) and sex of

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offset by consuming more than the minimum requirements of another basic need. To the extent that this is true, some individuals will be incorrectly identified as poor and poverty estimates will be biased upwards. There are, unfortunately, no estimates of the probable extent of the error. Although the argument is compelling conceptually, the magnitude of error involved is likely to be small, and certainly not large enough to counsel the abandonment of this general approach to poverty identification.

household members and the regional location of households is available. Sometimes information on the race of households is available and can be used as a proxy for body structure. Information on metabolic rate, activity level, and lactation and pregnancy status of household members is never included in household consumption surveys, and these variables greatly influence nutritional requirements.

The implication, of course, is that the nutritional requirements of individuals can only be very roughly established. It would certainly be feasible to piggy-back onto the standard household survey questions concerning the pregnancy and lactation status of females. However, it is unlikely that information on metabolic rates or activity levels could be reliably and routinely collected in household consumption surveys. Thus, even when considering improvements in household consumption surveys to facilitate the study of poverty, inaccuracies in the identification of the nutritionally deprived must be accepted.

A second factor that restricts use of preferred procedures for identification of the nutritionally deprived is that household consumption surveys adopt the household as the unit of observation. Doing this makes it difficult if not impossible to extract information on the actual food consumption of individual household members. Furthermore, it is unlikely that any large-scale survey would be able to collect information reliably on the food consumption of individuals. Households do not as a matter of course measure out the food given to each individual, and some food is eaten from a common bowl. The most that can be expected is that households record reliably those quantities of food purchased or brought into the household.

The standard solution to this problem is to assess the adequacy of household nutrition. The nutritional requirements of each individual in a given household are summed, and the sufficiency of measured household consumption is compared with the aggregated household needs. Should actual household consumption be less than aggregate household needs, all individuals in the household are defined as poor.

One obvious drawback to this approach is its implicit assumption that food is distributed within the household on the basis of household members' nutritional needs. There is considerable concern within the literature that this may not be the case, and in particular that many cultures' household allocation practices favor males. Thus, some members of a household classified as poor may in fact be well-nourished. Similarly, in households classified as non-poor, household allocation practices may leave some household members nutritionally deprived.

The typical magnitude of error resulting from the assumption of household allocation based on need is not clear at present, and is certain to vary between cultures. Small-scale studies comparing individuals' poverty classification based on medical evidence or individual consumption levels with that based on household consumption levels would improve our understanding of the magnitude of error likely to result when poverty identification is based on household consumption adequacy. Furthermore, such comparative studies would assist in specification of adjustment techniques, improving the reliability of poverty estimates based upon household consumption surveys.

One final issue remains concerning the estimation of nutritional requirements, and concerns the nutritional standards used. Individuals have been known to elude death by starvation on amazingly small quantities of nutrients. On the other hand, life expectancies increase concurrently with nutritional intake over a wide range of nutritional intake levels. As a result, nutritional standards are difficult to define precisely and any standards adopted will be somewhat arbitrary. The normal practice is to adopt separate standards for numerous age, sex and, when possible, ethnic or race cross-classifications, each sufficiently generous to ensure reasonable longevity and to account for individual variations in activity level and metabolic rate among most normal persons subjected to usual environmental stresses within the classification.

Despite the many sources of error involved in practice when estimating nutritional adequacy through the intermediary of food consumption, the accuracy of

this method's assessments is judged acceptable by most researchers. It should be emphasized, however, that the nutritional standards are set to meet the needs of individuals exposed to usual environmental stresses--that is, individuals who are adequately sheltered and clothed, possess the means to prepare their food in a manner that permits utilization of the food's nutrients, and have access to adequate quantities of potable water and sanitary facilities. This means that the accuracy of the judgment on nutritional adequacy depends upon the adequate consumption of non-food basic needs.

Determining the adequacy of non-food consumption is problematic. As pointed out earlier, there is considerable disagreement even at the most general level on what is appropriately included as a non-food basic need. Second, for non-food items, minimum requirements are not easy to specify. Finally, household consumption surveys do not always contain the necessary information to determine the adequacy of non-food basic needs consumption.

The debate concerning what constitutes non-food basic needs can largely be resolved by examining the items in common between listings and by noting the concept of poverty underlying the different listings. Clothing, shelter, fuel for heat and cooking, potable water, rudimentary sanitary facilities and health care are included in almost all listings of basic needs. Other items commonly added to the list include transportation, education, electricity, household furnishings, employment, and various culture specific items.

Most items in the second list are essential to the satisfaction of cultural and psychological needs, but few researchers argue that they are essential to physical survival. Researchers who include various of the items in the second list either implicitly or explicitly adopt a cultural definition of poverty. The first list, then, can be viewed as the list of basic non-food requirements for physical survival, and accordingly, the list most appropriate to the biological notion of poverty.

Minimum consumption requirements for non-food items are difficult to specify on several accounts. First, as with food, many different commodities can meet a particular basic need. Shelter can be provided by many different types of housing—from an umbrella or tent to a gold-leafed palace. Setting minimum needs requirements involves defining the specific commodity characteristics which are essential to survival. In the case of housing, these would be such characteristics as the number of dimensions enclosed, the materials used to make the enclosures, and the floor space of the enclosure. The relevant characteristics are themselves difficult to define in practice.

Second, there is little scientific knowledge that can be invoked to set the minimum levels of a particular characteristic required for physical survival. Science cannot give us a clear-cut answer on the amount of floor space essential to the survival of a particular person in a particular environment. Finally, the non-food requirements of a person depend upon his personal characteristics, his situation, and his environmental surroundings. The age of a person has a bearing on housing space requirements. There are household economies of scale, and a person living alone requires more floor space than does a family on a per capita basis. Persons living in cold climates require more completely enclosed housing and more space per person than do those living in warm climates where much of their time can be spent out of doors.

It is not possible to provide a universally applicable set of minimum requirements for non-food basic needs. In practice, several sets of non-food basic needs requirements must be drawn up to account for differences in climate, household composition, and settlement density. Within a particular context, it is possible to come up with a <u>reasonable</u> specification of minimum non-food requirements against which individual or household consumption can be compared.

As in the case of establishing nutritional adequacy, individuals are defined as poor whenever their actual consumption level is below their individual minimum requirements, and all members of a household are defined as poor when a household's

consumption level is less than that household's total consumption requirements. In the final analysis, any requirements defined are inherently arbitrary and are strongly influenced by the researcher's own common sense notions of what is necessary for physical survival. Because of this, there is an inherent arbitrariness in the identification of the poor through assessment of consumption adequacy.

One final fact all too frequently confounds assessment of non-food consumption adequacy. Much of the consumption information needed may not be collected in the available household consumption surveys. Although information on rent, household maintenance and repair expenditures is commonly collected, information on the characteristics of housing is not always collected. Nor is adequate information on sanitary facilities, water consumption or health care commonly collected.

In summary, the consumption adequacy method of identifying the poor is decidedly superior to the medical method when cost is the criterion. When accuracy is the criterion, the medical method is superior, but less so, if an ideal data base exists upon which to determine consumption adequacy.

The errors in the establishment of consumption adequacy arise from two sources: one theoretical and the other practical. The theoretical errors arise from difficulties in establishing minimum requirements for non-food basic needs. The practical errors are more numerous and stem from data base inadequacies. Because households are the unit of analysis in the typical household consumption survey, the assumption of household allocation based on need must be invoked to assess individuals' consumption adequacy. Many researchers feel that this assumption leads to an underestimate of the number of poor females and an overestimate of the number of poor males of substantive significance.

Error in estimation of the consumption adequacy of non-food basic needs is likely to be particularly great given the generally scant data base from which to make estimates. There is substantial room for improvement here and the costs need not be

high. The marginal cost of collecting the necessary information on housing, sanitary facilities and water as a regular part of household consumption surveys would be negligible. Adequate information on health care would be more problematic to collect. Consumption information on health care suggests little about the adequacy of health care since needs are largely determined by chance factors. It would, however, be possible to include at little extra cost questions on the adequacy of health care consumption as perceived by the household itself.

Like the medical method of poverty identification, the consumption adequacy method is unsuited for assessing individuals' intensity of deprivation as opposed to the fact of their deprivation. Because several indicators of poverty—food adequacy, shelter adequacy, etc.—are used to assess an individual's poverty status, and because each indicator is based on a different unit of measurement, it is extremely difficult to develop a composite index that adequately measures the overall intensity of individuals' poverty. A solution to the index problem is to translate deficiencies in consumption of the different basic needs into a common unit of measurement. Such a translation is the basis of the monetary method of poverty identification.

Monetary Poverty Lines

Poverty identification based on a monetary poverty line is not as accurate as identification based on either medical or actual consumption evaluations. However, three strong arguments recommend the use of a monetary poverty line for poverty identification. First, monetary poverty lines permit quantification of the intensity of individuals' deprivation as well as the fact of their deprivation. The intensity dimension of poverty is extremely difficult to capture when either of the methods of poverty identification already discussed are employed. Second, so far most of the summary indices of poverty base their poverty identification on a monetary poverty line. Third, additional data demands for this method are less stringent. Any data base which

contains information on three key variables--household income, composition and location--can be used to identify the poor.

In broad outline, identification of the poor via a monetary poverty line involves the following steps. First, the minimum amount of income required to purchase the where-with-all to meet the biological needs of a standard consumer unit (an individual of a particularly age and sex or a household with a particular age, sex and size composition) living in a particular region is estimated. This threshhold income level is commonly referred to as the poverty line, although it is less ambiguously denoted as the poverty line for a standard consumer unit.

Next, all households' nominal incomes are converted to their real value with respect to the price level prevailing in the standard region. Household-specific poverty lines are then computed on the basis of the number of consumer units in each particular household. All members of households whose real incomes are below their specific household poverty line are identified as poor. A household's income shortfall per consumer unit from the poverty line per consumer unit is a standard measure of the degree of deprivation suffered by the household's members--the greater the shortfall, the greater their deprivation.

This basic procedure glosses over three crucial issues. Precisely how is the poverty line per consumer unit to be estimated? Precisely how should one account for regional price variations? How does one determine the number of consumer units in a particular household? There is no single answer to any of these questions, and in fact many techniques have been employed, some with a greater demand for data than others. The more commonly used techniques are discussed below.

Techniques for Estimating the Reference Poverty Line

The reference poverty line (the poverty line per standard consumption unit) is generally estimated by combining two components--the income required to meet

nutritional needs, Y_f, and the income required to meet other basic needs, Y_o. A variety of methods have been used to estimate each component of the poverty line, but by whatever means the two separate components of the poverty line are estimated, the reference poverty line, Y^*, is simply the sum of Y_f and Y_o.

To facilitate discussion, let us arbitrarily choose as the standard consumption unit a 35-year-old adult male living in a single person household in some particular region who is fully integrated into the money economy (that is all goods and services consumed are purchased from the market place, and all income received is received in cash). It does not matter, in principle, what sort of individual, or set of individuals is chosen as the standard consumption unit. What matters is that the characteristics of the chosen individual which influence basic needs requirements and the price structure faced be made explicit.

Estimating the food component: The strategies commonly employed to establish the food component of the poverty line differ in the role they accord behavioral norms and personal preferences in determining feasible diets. At one extreme any and all diets are considered feasible and establishing the food component of the poverty line amounts simply to identifying the cheapest diet meeting nutritional requirements. To establish the least cost diet, information on the cost of all food items available in the region of concern is gathered along with information on the nutritional value of each food item (in terms of calories, proteins, etc.).

Next, the nutritional needs of the standard consumption unit (in our case a 35-year-old man) are specified in terms of calories, proteins, etc. Then, from the list of foods available in the region, all conceivable diets meeting nutritional needs are costed. From among the list of conceivable diets, the cheapest one is chosen, and the cost of this diet is specified as Y_f, the food component of the poverty line. Because the number of conceivable diets meeting nutritional needs is extremely large, linear

programming techniques are generally employed and the exercise is assisted by a computer.

Theoretically speaking, nobody with a food budget in the amount of Y_f per consumer unit or greater need suffer nutritional deprivation. Practically speaking, however, most people who spend Y_f per consumer unit on food will be nutritionally deprived, for the simple reason that few would conceive of the computer's chosen diet and fewer still would possess the courage to eat such a diet. The diets resulting from this cost minimization exercise are almost always culturally unacceptable.

A second method of establishing the food component of the poverty line is identical to the least-cost diet method just discussed except that cultural norms are taken into account when drawing up the list of feasible diets. In the linear programming context, this entails excluding from the list of available food items those items which are culturally repugnent (such as pork in Muslim countries) and imposing constraints on the programming routine to ensure that certain amounts of culturally preferred foods are included in all diets costed. From among this constrained list of feasible diets, the cheapest diet is choosen and its cost specified as the food component of the poverty line, Y_f.

The probability that people spending at least Y_f per consumer unit on food will in fact be nutritionally deprived is much lower when Y_f is specified by this method than when it is specified through an unconstrained cost minimization exercise. This constrained cost minimization exercise is not entirely satisfactory, however, since choosing the most appropriate set of constraints requires a degree of cultural intimacy that few researchers possess. An inappropriate constraint set can lead to a Y_f specification bearing little relation to a culturally acceptable minimum-cost diet.

A third method of establishing the food component of the poverty line resembles the approach just described, but boasts little in the way of cultural intimacy. This method simply sets as the food component of the poverty line, Y_f, the cost of

purchasing enough of the culturally preferred basic staple (corn, wheat, millet, or whatever it may be) to meet the caloric needs of the standard consumption unit (in our case a 35-year-old man). This method offers some distinct advantages. Identification of a community's basic staple demands little in the way of cultural familiarity. The method is restrained in its appetite for data; one only needs to learn the price of the basic staple and its caloric value. No computer or elaborate algorithm is needed for computations; a pencil and paper will suffice. This method's glaring drawback is that it only crudely approximates the minimum cost of a culturally acceptable diet. Its acceptability rests on the validity of two assumptions: 1) people behave as though the basic staple were the cheapest source of calories, and 2) the cheapest acceptable foods providing nutrients missing from the basic staple cost, on average, no more or less per calorie than the basic staple.

The final method commonly used to establish the food component of the poverty line adopts an entirely different strategy than the other methods. Rather than attempt to specify some "minimum cost diet," this method bases its specification of the food component of the poverty line on actual consumption patterns. In doing so, it takes fuller account of behavioral norms and personal preferences. The procedure followed is straightforward, but data intensive. First, household consumption survey data, information on the nutritional characteristics of all food commodities, and a set of nutritional standards are used to evaluate the nutritional adequacy of all households exhibiting the characteristics of the standard consumption unit (in our case, households comprised of a single prime aged male).[5] Next, the average (or some other measure of central tendency) household expenditure on food of all those households which come within some small range (say five percent) of exactly fulfilling all of their nutritional requirements is computed. This average food expenditure is specified as Y_f, the

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[5]The detailed steps involved in assessing the nutritional adequacy of any household are more fully specified as a part of the discussion on the Direct Assessment of Consumption Adequacy. See pp. 17-24.

food component of the poverty line. This method provides a more accurate estimate of the minimum food budget that households require to ensure that they do in fact fully satisfy their nutritional needs than any other method discussed. One laments the method's gluttony for data.

Estimating the Non-Food Component: The strategies commonly employed to establish the non-food component of the poverty line, with one exception, parallel those employed to establish the food component of the poverty line. First, one can estimate the theoretically minimum non-food cost of subsistence. This method's counterpart is the least-cost diet, and estimation procedures are analogous. First, obtain information on the cost of all commodities or sets of commodities which could theoretically satisfy each of the different non-food basic needs of the standard consumption unit (in our case a 35-year-old man living alone in a specified region). Next, cost each conceivable bundle of commodities satisfying all non-food basic needs of the standard consumption unit. From among these bundles, the cheapest bundle is selected and its cost is specified as the non-food component of the poverty line.

The costing exercise is somewhat complicated by the fact that many items fulfilling non-food basic needs are consumer durables. For those commodities which are consumer durables, the appropriate price to use is not the purchase price, but rather the commodity's rental price or use cost.[6] The primary criticism of this method is identical to the primary criticism of the theoretical minimum-cost diet: Few households whose non-food budget is equivalent to the theoretically mimimum non-food cost of subsistence will fully satisfy their non-food basic needs in practice. The problem is not one of knowledge. People in direst poverty still spend money needed for biological subsistence to satisfy psychic needs for cultural acceptance and for certain luxuries.

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[6] A commodity's use cost is determined by dividing the purchase price of the commodity by the commodity's expected useful life. For example, if the commodity's expected life is ten years, and the poverty line is to represent the cost of susbistence for a single year, then the commodity's use cost is one-tenth of its purchase price.

Behavioral norms can be accounted for in the cost-minimization exercise by removing from the list of consumption bundles conceivably satisfying basic needs those bundles that households would never purchase in practice, and by including in the budget the minimum cost of meeting those cultural needs that households actually will fulfill before fully satisfying their biological basic needs. Both of these refinements demand the exercise of considerable cultural expertise.

Cultural expertise is not needed to accord behavioral norms and personal preferences their rightful role. One can apply the general strategy of averaging the actual expenditures of those households which come within some small range of exactly fulfilling their basic needs. This strategy was described earlier in relation to estimating the food component of the poverty line. The procedural steps in this application are identical to those specified earlier; only the focus shifts from nutritional basic needs to non-food basic needs for assessing consumption adequacy and necessary expenditure.

The appropriateness of all three methods of estimating the non-food component of the poverty line described so far has been insistently and repeatedly challenged in the literature. The substance of the challenge centers on the tremendous arbitrariness inherent in any specification of exactly what levels of what specific commodities adequately fulfill a particular non-food basic need. Only one method of specifying the non-food component of the poverty line, the Engel's Proportion method, circumvents this problem. In light of the persistant attack levied against other methods, it is not surprising that this method is the most widely used.

The Engel's proportion method requires data on total expenditures and food expenditures for a sample of households exhibiting the characteristics of the standard consumption unit. Statistical methods are used to estimate the precise functional relationship between total expenditures and food expenditures. This information is then used to estimate the Engel's Proportion (the average proportion of total expenditures on food) for households exhibiting the characteristics of the standard consumption unit and

spending exactly Y_f (the dollar value of the food component of the poverty line) on food.[7] The reference poverty line, Y^*, and the non-food component of the poverty line, Y_o, are then specified on the basis of this Engel's Proportion and Y_f as (Y_f/Engel's Proportion) and ($Y^* - Y_f$) respectively.

Although this method circumvents the problem of determining subsistence standards for the consumption of non-food commodities, it does so by side-stepping the whole issue of non-food basic needs. When the Engel's Proportion method is used to specify Y_o, the extent to which non-food basic needs are or can potentially be met by households spending exactly Y_o per consumption unit on non-food basic needs is unknown. It cannot be determined without confronting the very issue this method sought to avoid.

The non-food component of the poverty line, as specified by the Engel's Proportion method, is not the minimum or typical non-food budget required to meet non-food basic needs. Rather it is the non-food budget which by inference is required to induce households to spend Y_f on food. Accordingly, when the poverty line, Y^*, is derived using the Engel's Proportion method, it represents the income level at which households have the potential (or at which typical households will be induced) to meet their <u>nutritional</u> needs.[8]

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[7] The appropriate Engel's curve can be estimated by plotting the expenditure on food of each household exhibiting the characteristics of the standard consumption unit against the households' respective incomes and statistically fitting the best curve to this plot. The Engel's Coefficient of concern is found by dividing Y_f by the income level which the estimated Engel's Curve associates with a food expenditure equal to Y_f.

[8] A rough approximation of the Engle's Proportion method is often used to set the poverty line. The food component of the poverty line, Y_f, can be set by any of the methods described earlier, and the non-food component of the poverty line, Y_o is computed as some percentage of Y_f, that is, $Y^* = Y_f + pY_f$ where p is the percentage. The percentage adopted generally is set on the basis of the Engle's Proportion estimated for countries or regions that are culturally similar to the study area. Specifically, p is set equal to (1 -E)/E where E is the borrowed Engle's Proportion.

Techniques to Adjust for Regional Price Variations and for Differences in Households' Participation in the Monetary Economy

The cash income required to meet biological needs varies between households of identical size and composition for two reasons. First, prices differ between regions. Second, households differ in the degree to which they are integrated into the monetary economy; many households receive income in kind and can rely on home production to fill many of their needs. For these reasons, either numerous poverty lines must be defined for households differing in their geographical location and their degree of participation in the monetary economy, or household incomes must be adjusted to reflect their real value.

Two techniques are commonly employed to account for regional price variation. The simplest technique uses a general regional price index to convert cash incomes to a common real value. The accuracy of this method depends upon how the price index was constructed. If the market basket used to construct the regional price index contained predominantly subsistence commodities, then the method is acceptably accurate. A more accurate, but considerably more cumbersome technique defines separate poverty lines for each region and then either uses these directly in the poverty identification comparison, or creates an index from them and adjusts incomes. The index can be made by taking the ratio of the poverty line in the standard region to the poverty line in the particular region of concern. Incomes are then adjusted by multiplying incomes in a particular region by their corresponding index value.

Several adjustment techniques are available to account for differences in households' degree of participation in the monetary economy. In practice, the technique of choice depends upon data availability. When households' incomes are to be computed from household consumption data, no adjustments are required to account for differences in households' degree of participation in the monetary economy — one needs only compute the market value of all goods consumed. When information is available on

households' cash income receipts and on the amounts of particular kind receipts and commodities produced by the household, then the procedure generally followed is to compute the market value of kind receipts and home production and add this to the household's cash income to arrive at the household's total cash equivalent income.

When information is available only on households' cash income receipts, which is usually the situation, techniques available to adjust for the value of kind receipts and home production are less than satisfactory. One option is to determine from separate studies of rural households the average ratio of cash income to total cash equivalent income. This information can then be used to adjust rural incomes upwards. A more accurate adjustment can be made if the primary survey contains information on the occupation of rural household heads (such as small farmer, medium farmer, large farmer, and agricultral laborer) and there are available also studies identifying the average degree of rural households' labor market participation by occupation of household head.

When the primary survey does not contain information on households' income in kind and home production, whether adjustment procedures are feasible will depend upon the availability of secondary data sources and studies of households' degrees of labor market participation. Clearly, if the analyst is able to choose among methods, the procedure which makes the <u>least</u> sweeping averaging assumptions will be the most accurate. No technique is likely to permit truly accurate adjustments, however, since households facing the greatest poverty risk will be those which receive less than the average amounts of in-kind income and produce fewer commodities for home consumption than the typical household does. It is precisely these households whose cash equivalent incomes will be over-estimated by these techniques.

Consumer Unit Scales: Techniques to Adjust for Differences in Households' Size and Composition

Clearly, the income required to meet a household's biological needs will depend upon the size and composition of the household. Despite romantic claims to the contrary, when it comes to reckoning the cost of a subsistence existence, two cannot live as cheaply as one. Furthermore, a four-member household comprised of four adults cannot live as cheaply as a four-member household comprised of one adult and three children. So far we have avoided confronting this issue directly by limiting our discussion to some reference household (specifically, a household comprised of one thirty-five-year-old male) or by talking about a household's povery line per standard consumption unit.

But how many standard consumption unit equivalents are in households of various sizes and compositions? In fact, several techniques are commonly employed to specify consumer unit equivalency scales for households of varying sizes and compositions. Each technique strives to approximate the costs of meeting the biological needs of households of varying size and composition relative to those of the standard consumption unit.

The simplest approach is based on caloric requirements. Here, a single prime-aged male is generally taken as the standard consumption unit. An adult male equivalency scale is established by computing the ratio of caloric requirements for each different age/sex combination to the caloric requirements of the standard consumption unit. The number of consumer units in a given household is then determined by adding up the number of adult male equivalents in the household.

For example, in Table 1.1, the first two columns show the recommended daily caloric allowances for Americans by age and sex. Using an adult male aged 23-50 as the standard consumption unit, the equivalency scale is computed in the third column. The number of consumer units in a household comprised of a prime-aged male, a prime-

aged female, a child aged 5 and a male aged 12 would be 3.45 based on this scale. The criticism of this technique centers around its crudeness. Subsistence requires more than calories, and the relative cost of meeting other nutritional and non-food needs for individuals of varying characteristics will not be identical to the relative caloric requirements. Furthermore, household economies of scale, especially with regard to non-food consumption, are not taken into account by this method.

Table 1.1: Calorie-Based Consumer Unit Scale

Age/Sex Classification		Caloric Requirements*	Prime Aged Male Equivalency Weight
Infants:	0 - .5	936	936/2700 = 0.35
	.5 - 1	1188	1188/2700 = 0.44
Children:	1 - 3	1300	1300/2700 = 0.48
	4 - 6	1800	1800/2700 = 0.67
	7 - 10	2400	2400/2700 = 0.89
Males:	11 - 14	2800	2800/2700 = 1.04
	15 - 22	3000	3000/2700 = 1.11
	23 - 50	2700	2700/2700 = 1.00
	51+	2400	2400/2700 = 0.89
Females:	11 - 14	2400	2400/2700 = 0.89
	15 - 22	2100	2100/2700 = 0.78
	23 - 50	2000	2000/2700 = 0.74
	51+	1800	1800/2700 = 0.67

*Caloric Requirements are those published by the Food and Nutrition Board of the National Academy of Sciences (National Research Council Recommended Daily Allowances, revised in 1973). They appeared in Food & Nutrition News, Vol. 45, No. 2, Dec. - Jan. 1973-1974, p. 1.

A second approach bases equivalency scales on personal views concerning the costs of supporting a given standard of living. This approach and the survey base underlying it have been most fully developed by Theo Goedhart, Victor Halberstadt, Arie Kapteyn and Bernard Van Praag.[9] In essence, households of differing compositions

[9]See T. Goedhart, V. Halberstadt, A. Kapteyn and B. Van Praag, "The Poverty Line: Concept and Measurement," Journal of Human Resources, Vol. XII, No. 4 (Fall 1977), pp. 503-520.

are asked to evaluate the costs of supporting various standards of living for a household equal in size and composition to their own. After accounting for distortions in cost estimates due to the fact that a household's income is in great excess of the standard of living they are asked to cost, the different cost estimates are averaged over households with a common size and composition.

The equivalency scale is then determined by taking the ratio of the average costs estimated by households of each different size and composition group to the average cost estimated by households whose size and composition is chosen as the standard. One example of an equivalency scale specified by this method is given in Table 1.2 below. The equivalent poverty line incomes for households of different sizes and compositions were determined on the basis of the methods described briefly above using survey data for Dutch families.[10] Table 1.2 takes as the standard consumption unit a household with two members.

The primary drawback to using this method to approximate an Equivalency Scale is the requirement for a special survey to determine personal views on the matter. It is unlikely that scales based on surveys of one country adequately reflect the views of individuals in another country, particularly given the entirely different set of price relations faced by families in different countries.

Table 1.2: Equivalency Scale Based on Personal Views of Families

Family Size	Equivalency Scale
1	0.81
2	1.00
3	1.13
4	1.24
5	1.32
6	1.40
7	1.47

[10]The equivalency scale was computed from the equivalent poverty line incomes specified by Goedhart et. al. on the basis of their survey of 2,885 Dutch households. It should be noted that the poverty line was also determined on the basis of personal views. See Ibid., p. 515.

The inspiration underlying the third commonly used approach for determining equivalency scales, the equal proportions approach, must be attributed to E. Engel, who as early as the late 19th Century argued that a reasonable measure of the standard of living of households was the proportion of income spent on food. Specifically, Engel argued that the standard of living of households of the same size and composition could be ranked according to the proportion of expenditures on food (the smaller the proportion, the better off the household). Further, he held that the standard of living was equal between households differing in size and composition if they spent the same proportion of their income on food. Accordingly, the equivalency scale can be specified by taking the ratio of "equivalent incomes" of households of varying sizes and compositions to the income of some household chosen as the standard consumption unit.

Since Engel's early work, several other bases have been used to specify equivalent incomes including the proportion of income spent on necessities other than food, the proportion of income spent on luxuries, and the proportion of income saved. In each case, when the proportion of income spent on the expenditure category of concern is equal between households differing in size and composition, their standards of living are deemed equal, and accordingly, their incomes are considered equivalent. The equivalency scales are then derived on the basis of the equivalent incomes as explained earlier. The flaw in this approach is that it fails to take account of economies of scale, and differences in needs between children and adults.

The bias resulting from economies of scale can be illuminated by looking at the case of a single member household transformed into a two member household through the institution of marriage. If the same standard of living is to be maintained, expenditures on food items must approximately double. However, the same standard of living can be maintained without doubling expenditure on many non-food items. For example, only one cooking area and set of cooking utensils is required whether the household has one or two members. Only a small amount of additional fuel suffices to

cook a stew for two instead of one. The floor space of a house need not be doubled to commodiously accommodate two individuals instead of one.

These economies of scale imply that two-member households can attain the same standard of living as one-member households while spending a higher proportion of their income on food than the one-member household. Accordingly, equivalency scales based on the proportion of income spent on food or on necessities other than food overstate the subsistence income requirements of households larger than the standard consumption unit and understate the subsistence income requirements of households smaller than the standard consumption unit.

The bias caused by differences in needs between children and adults can be understood by looking at the case of a two-member household transformed into a three-member household through the birth of a child. The same standard of living can be maintained without increasing expenditures on luxury items consumed exclusively by adults, such as alcohol and tobacco. If our three member household were spending the same proportion of its income on alcohol and tobacco, it would actually be experiencing a higher standard of living than the childless household. Accordingly, equivalency scales based on the proportion of income spent on alcohol and tobacco (or any set of luxury items consumed predominantly by adults) overstate the equivalent income requirements of households with proportionately more children than the standard consumption unit, and understate the equivalent income requirements of households with proportionately fewer children than the standard consumption unit.[11]

Three examples of equivalency scales specified on the basis of the equal proportions method are shown in Table 1.3 on the next page. The first scale was

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[11] The reverse would be true if equivalent incomes were determined on the basis of the proportion of income spent on luxury items consumed predominantly by children. A more detailed discussion of the bias problems inherent in the Equal Proportion Method given different bases for defining equivalent incomes is provided in J. L. Nicholson, "Appraisal of Different Methods of Estimating Equivalence Scales and their Results," The Review of Income and Wealth, Series 22, No. 1, March 1976, pp. 1-12.

designed for British households and the last two for American households. The first two scales define equivalent incomes on the basis of the proportion of household income spent on food, while the third scale defines equivalent income on the basis of the proportion of household income saved. To facilitate comparison of the scales, all have been adapted such that the standard consumption unit is two adults.

Table 1.3: Equivalency Scales Based on the Equal Proportions Method

	Equivalency Scales[12]		
Family Composition	I	II	III
One Adult	0.54	0.60	0.70
Two Adults	1.00	1.00	1.00
Two Adults, one child	1.31	1.37	1.28*
Two Adults, two children	1.55	1.67	1.52*
Two Adults, three children	1.75	1.94	1.73*
Two Adults, four children	1.94	2.20	1.93*

*The household composition is actually only given by persons for this scale (unknown whether adults or children).

A fourth approach to estimating equivalency scales, the Expenditure Systems Approach, is a refined version of the Equal Proportions Method just discussed. Here, commodity-specific equivalency scales are estimated on the basis of complete expenditure systems, and the general equivalency scale is specified as a "weighted average" of the commodity specific equivalency scales. Severe econometric estimation problems are involved and have not been completely resolved as yet. Accordingly, no firm consensus has been reached concerning the most appropriate estimation technique.

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[12]These scales were adapted from examples of equivalence scales given in Nicholson, ibid., p. 10. The first scale specified equivalency on the basis of the proportion of net household income spent on food, and was originally published in J.L. Nicholson, Redistribution of Income in the U.K. in 1959, 1957, and 1953, London: Bowes & Bowes, 1965. The second scale specified equivalency on the basis of equi-proportion food expenditure/money income for different family types. It was originally published by the U.S. Bureau of Labor Statistics, in Survey of Consumer Expenditures, 1960-61: Revised Equivalence Scale. The third scale was specified on the basis of the percent of income saved by households. It was originally published by the U.S. Bureau of Labor Statistics, "Workers' Budgets in the U.S., City Families and Single Persons, 1946/1947," Bulletin 927, 1948.

The econometric model used by the pioneers of this general approach is empiricist in nature and uses an iterative procedure to overcome identification problems.[13] Newer econometric models are more firmly rooted in the neoclassical economic theory of consumer preference and in fact, call on this theory for the additional information necessary to solve the econometric identification problem.[14] In addition to the econometric problems, a second factor limiting the practicality of this approach is its immense appetite for data. Nothing short of an exceedingly detailed consumption survey will suffice.

One example of an equivalency scale based on the Expenditure Systems Approach is given below in Table 1.4. The econometric model used to specify the equivalency scale was developed by Nanak Kakwani, and the equivalency scale was estimated for Australian households. The data source was The Australian Survey of Consumer Expenditures and Finances, 1966-1968. The presentation format of the equivalency scale has been modified to facilitate comparison with the equivalency scales presented earlier. In its modified format, a household comprised of two adults serves as the standard consumption unit.

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[13] Prais and Houthakker introduced this approach in 1955 in The Analysis of Family Budgets, Cambridge: Cambridge University Press, 1955. Further work on their approach has been undertaken by, among others, F.G. Forsyth, "The Relationship between Family Size and Family Expenditure," Journal of the Royal Statistical Society, 123, 1960, pp. 367-397; J.S. Cramer, Empirical Econometrics, Amsterdam: North Holland, 1969; and B. Singh and A.L. Nagar, "Determination of Consumer Unit Scales," Econometrica, 41, 1973, pp. 347-356, and "Identification and Estimation of Consumer Unit Scales," Econometrica, 46, 1978, pp. 231-233.

[14] Notable among this newer generation of models are those developed by John Muellbauer, "The Estimation of the Prais-Houthakker Model of Equivalence Scales," Econometrica, 48, 1980, pp.153-176; and Nanak Kakwani, Income Inequality and Poverty: Methods of Estimation and Policy Applications, London: Oxford University Press, 1980.

Table 1.4: Equivalency Scale Based on the Expenditure Systems Approach (Kakwani Model, Australian Data Base)[15]

Household Composition	Equivalency Scale[16]
One Adult	0.60
Two Adults	1.00
Two Adults and one child	1.21
Two Adults and two children	1.38
Two Adults and three children	1.48
Two Adults and four children	1.54
Two Adults and five children	1.59
Two Adults and six children	1.64

One final approach can be used for setting up a consumer unit equivalency scale, the Needs Approach. The Needs Approach defines the equivalency scale on the basis of objective standards of what households of different sizes and compositions "need" to meet their biological requirements. This, of course, amounts to specifying a poverty line directly and separately for households of different sizes and compositions. The techniques available for doing so are those described under the section headed "Techniques for Estimating the Reference Poverty Line." These household size and composition specific poverty lines can then be applied directly to determine whether or not a household is poor; or an equivalency scale can be derived from them by taking the ratios of the poverty line for households of each size and composition to the poverty line for the standard consumption unit.

This approach is simpler than the Expenditure Systems Approach, and is more accurate for our purposes than any of the other approaches discussed. Two examples of equivalency scales derived on the basis of the Needs Approach are shown in Table 1.5.

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[15] See Nanak Kakwani, Income Inequality and Poverty: Methods of Estimation and Policy Applications, Ibid., pp. 351-364.

[16] The equivalency scale shown above is designed to ensure the standard of living enjoyed by households with two adults and two children earning les. than 1,220 Australian Dollars per capita. The equivalency scales designed to ensure a higher standard of living do not differ by a sizable amount.

Table 1.5: Equivalency Scales Based on the Needs Approach

Example I[17] Household Composition	Scale	Example II[17] Household Composition	Scale
Two Adults	1.00	Two People	1.00
Two Adults, boy 13	1.30	Three People	1.38
Two Adults, boy 13, girl 8	1.50	Four People	1.70
Two Adults, boy 13, girl 8, child 6	1.70	Five People	1.97
Two Adults, boy 13, girl 8, child 6, child 4	1.91	Six People	2.21

Both are specified for the American population and take as the standard consumption unit a household comprised of two adults. The first example defines need on the basis of a maintenance level consumption bundle, while the second defines need on the basis of the income required to attain nutritional adequacy.

Having discussed in some detail the different facets of defining a monetary poverty line and the techniques available to deal with each facet, let us step back for a moment and examine the concept of poverty implicitly adopted when a monetary poverty line is utilized to identify the poor. Let us also assume that an ideal data base has permitted an accurate resolution of complications arising from differences in regional prices, differences in households' degree of participation in the monetary economy and differences in households' size and composition. There is a subtle, but important difference in the concept of poverty embedded in the monetary approach to poverty identification. Both the medical and consumption adequacy approaches seek to

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[17] Both scales are as reported in J. L. Nicholson, "Appraisal of Different Methods of Estimating Equivalence Scales and Their Results," op. cit., p. 10, with the exception that a standardized household of two adults has been given a weight of 1.00 instead of 2.00. Nicholson reports the original source for the first example as: Lelia M. Easson and Edna C. Wentworth, "Techniques for Estimating Cost of Living at WPA Maintenance Level for Families of Different Composition," Social Security Bulletin, March 1947 (scales from cost of WPA Maintenance Budget, St. Louis 1941), and the source for the second example as: Rose D. Friedman, "Poverty Definition and Perspectives," American Enterprise Institute for Public Policy Research, February 1965 (income levels at which households of different size achieve adequate nutrition, 1955 at 1962 prices; nutritive adequacy = 75% of families meeting two-thirds of National Research Council's recommended allowances).

identify those individuals who in fact suffer biological deprivation. However, the monetary approach only identifies those who in some sense "need" not suffer biological deprivation.

When a monetary poverty line is used to identify the poor, poverty identifications are made by comparing a household's income (per consumption unit) to the poverty line (per consumption unit). All members of households whose incomes are below the poverty line are identified as poor -- that is, biologically deprived. In fact, however, many individuals identified by this method as non-poor will suffer biological deprivation and many individuals identified as poor will not suffer any biological deprivation.

There are two basic reasons for this. First, households may not allocate income (or consumption goods) to household members strictly on the basis of biological need. This source of inaccuracy may eventually be resolved as data on household allocation patterns become increasingly available. Second, households will always differ in their preference patterns, and for a given level of income per consumption unit, say the poverty line level of income, will choose consumption bundles satisfying their biological needs to different extents. Part of the difference in preference patterns will reflect differences in levels of knowledge concerning nutrition, part will reflect differences in survival strategies and value structures, and part will reflect differences in tastes pure and simple.

This type of error can be lessened when the poverty line is defined using a technique accounting for behavioral norms, and by dividing households into different groups on the basis of dominant differences in preference patterns they exhibit (or behavioral norms they conform to) and setting separate poverty lines for each culturally distinct group. But, the error can never be eliminated and is intrinsic to the income approach to poverty identification. Monetary poverty lines can only approximate an accurate identification of those individuals who are in fact biologically deprived.

This approach does, however, identify those who "need" not be biologically deprived. The word "need" should be interpreted variably as:

1. "could meet their biological needs if they had the knowledge available to the researchers and behaved so as to maximize their biological welfare,"
2. "have the ability to meet their biological needs without seriously violating cultural norms" or
3. "have the ability to meet their biological needs while indulging their preferences so long as their preference patterns do not deviate markedly from typical households' in the community."

Which is the appropriate interpretation depends upon whether the poverty line is specified on the basis of a theoretical minimum-cost exercise, a culturally-constrained minimum-cost exercise, or an exercise of averaging the expenditures of those households coming within some small range of meeting their biological needs, respectively. In addition, should the Engel's Proportion method be used to specify the non-food component of the poverty line, the word biological needs must be replaced in each interpretation by the phrase "their nutritional needs plus that proportion of non-food biological needs typically satisfied before fully satisfying nutritional needs."

Poverty Identification via Correlates of Poverty

One final method of identifying the poor exists — identification on the basis of the amount of some good which households or individuals possess that correlates highly with a household or individual's economic well-being. For example, Professor U.A. Aziz proposed the Sarong Index of poverty for Malaysian households in 1964 after discovering that the number of sarongs (dresses) per capita was highly correlated with the standard of living of rural Malays.[18] Specifically, he determined that households with fewer than one sarong per capita lived under conditions of extreme deprivation.

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[18] U. A. Aziz, "Poverty and Rural Development in Malaysia," Kajian Ekonomi Malaysia, June 1964.

Obviously, identification of the poor via some correlate of poverty requires that previous studies have been undertaken to identify those goods or household characteristics which are highly correlated with poverty. The advantage of identifying the poor on the basis of correlates of poverty is the low cost of collecting information on the correlates of poverty, and hence the low cost of gathering the necessary information upon which to base poverty identification. The accuracy of the method depends upon the strength of the correlation between the chosen characteristic and poverty for the population of concern.

There is a danger in using this method of poverty identification to assess changes in the magnitude of poverty. First, cultural expressions of wealth change over time with the process of development itself. Thus, a good or characteristic which is highly correlated with poverty at a given time, may cease to be correlated with poverty ten years hence. Second, development programs may directly affect the correlation of a particular good or characteristic with poverty and, in doing so, induce faulty readings of actual changes in poverty. For example, imagine that the number of cattle per household correlates highly with poverty in some area and accordingly is chosen as the basis upon which the poor are identified in that area. Now, imagine that a cattle breeding program is initiated in the region. Any poverty survey undertaken ten years after the initiation of the cattle breeding program and using the number of cattle per household to identify poor households, is bound to indicate a marked reduction in the number of poor households in the area, whether or not the number of households unable to meet their basic needs has in fact decreased.

This review has covered the basic methods of identifying the poor. Next we need to consider how to move beyond this methodological step, to assess the magnitude and distribution of poverty in a country or region according to some summary measure of poverty. This is the subject of Chapter II.

Chapter II
ASSESSMENT OF THE MAGNITUDE OF THE POVERTY PROBLEM

Merely identifying the poor provides little direct guidance to policy makers and program planners. The identification exercise, however, forms the essential basis for any assessment of the magnitude of poverty -- a first step for policy and program design and evaluation. This chapter offers a review of measures for poverty assessment. Three general types of measures exist -- headcount measures, poverty gap measures, and weighted poverty gap measures. Headcount measures assess the frequency of poverty, while poverty gap measures focus on the intensity of poverty among the poor and appraise the tractability of poverty. Weighted poverty gap measures address both the frequency and the intensity aspects of poverty and, in addition, pay heed to inequality among the poor. The final section of this chapter examines the suitability of each of the poverty measures as an indicator of the absolute magnitude of biological deprivation. Readers with limited time may wish to consult this final section first, select from it those measures meeting their own minimum criteria, and then selectively read the discussion on these measures. To facilitate selective reading, the name of each measure is underlined when it is first introduced.

Explicit examples of the computation of all poverty measures presented follow the definition and discussion of each general type of measure. All of the poverty measures discussed, with the exception of the headcount measures of poverty, assume poverty identification is accomplished through a monetary poverty line. Accordingly, examples illustrating the computational procedures use a monetary poverty line. For the sake of convenience and clarity, the discussions and examples which follow uniformly adopt a prime-aged adult male as the standard consumption unit and assume a calorie-based consumer unit scale. The issues discussed, however, apply regardless of the consumer unit scale adopted, and the computational techniques illustrated will not differ markedly when alternative consumer unit scales and reference units are used.

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Headcount Measures — The Simplest and Most Traditional Statistics

The headcount measures are both simple and intuitive. They boast a long history[1] and the distinction of serving as the mainstay of poverty assessment until the last decade. Headcount measures continue to enjoy considerable currency.

The Simple or Pure Headcount measure is nothing more than the number of poor individuals. Counting up the number of individuals who fall below the poverty line is a straightforward matter. If poverty identification was based on households, simply sum the number of individuals in all poor households. Two points of caution warrant consideration when obtaining the Headcount measure of poverty. The first concerns the unit of summation, and the second concerns averaging assumptions.

First, it must be emphasized that interest centers on the number of poor individuals subject to poverty and not on the number of households or the number of adult equivalents. Counting up the number of poor households to obtain the Headcount would equate a large household's total suffering with a small one's. Counting up the number of adult equivalents would imply that poverty burdens children and females less than it does adult males.[2]

Second, averaging assumptions are frequently and erroneously employed to arrive at the Headcount poverty measure. Averaging assumptions are most persistently used

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[1]See C. Booth, Life and Labour of the People in London, London, 1889.

[2]This caution applies regardless of the reference consumer unit chosen. However, the precise interpretation of the effects of counting up the number of consumer units differs by reference consumer unit. For example, consider the case of two households, comprised of two and six adults respectively, and choose a consumer unit scale accounting for household economies of scale and a standard consumption unit of two adults. The equivalency weight of the household comprised of six adults is likely to be around 2. If both households fall 20 percent short of the poverty line per standard consumption unit (that is all persons in both households suffer the same degree of ill-fare), counting up the number of consumer units will weight the suffering of the large household's members only two-thirds as much as the suffering of the small household's members--that is, it implies that members of the larger household suffer less than members of the smaller household despite the fact that all persons concerned experience the same degree of biological deficiency.

when data are not available on individual households, and researchers must estimate the Headcount poverty measure from grouped data — that is, from summary tabulations and cross-tabulations of the number of individuals or households by various household characteristics. The use of averaging assumptions, such as assigning all households the average number of adult equivalents or individuals, to estimate the Headcount poverty measure appears innocuous. It is not. The magnitude of error can be startling. The relative error typically involved was demonstrated by Randolph using Egyptian data from 1975-1976.[3] It is shown for Egypt that if one assumes all households are the size of the average household, the proportion of individuals who are poor is computed as 26.9 percent. When this assumption is dropped and computations are based on the actual number of individuals in households, the proportion of individuals who are poor stands at 49.3 percent, or 83 percent more. The basic reason why such error comes about is that averaging assumptions result in incorrect identifications. The reader who wishes to learn more of the origin of this error is referred to the Appendix at the end of this chapter and to the reference listed in footnote 3 below.

The Simple Headcount's meaning is sharpened when it is divided by the total population. This results in the aggregate Incidence of poverty -- nothing more than the number of poor individuals as a percentage of the total population. While the Pure Headcount measure indicates the absolute magnitude of poverty, the Incidence measure indicates the magnitude of poverty relative to population size.

Figure 2.1, Panel A, illustrates calculation of the headcount measures. The chart shows the frequency distribution of individuals by income per adult equivalent for an imaginary economy with a population of sixty persons. Each square represents one individual and individuals are numbered from the poorest to wealthiest. The poverty line has been established at fourteen dollars per adult equivalent. The Pure Headcount

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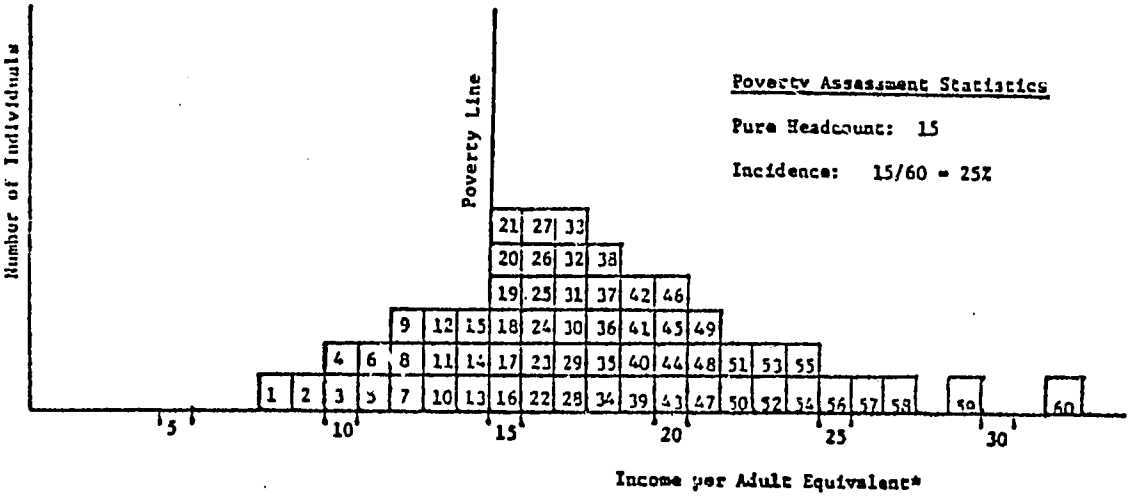
[3]See I. Harik and S. Randolph, Distribution of Land, Employment and Income in Rural Egypt, Rural Development Committee, Cornell University, Dec. 1979, Appendix A, pp.139-153.

for this economy is the highest numbered square to the left of the poverty line — number 15. The aggregate Incidence of poverty is 25 percent: the Pure Headcount, 15, divided by the population, 60.

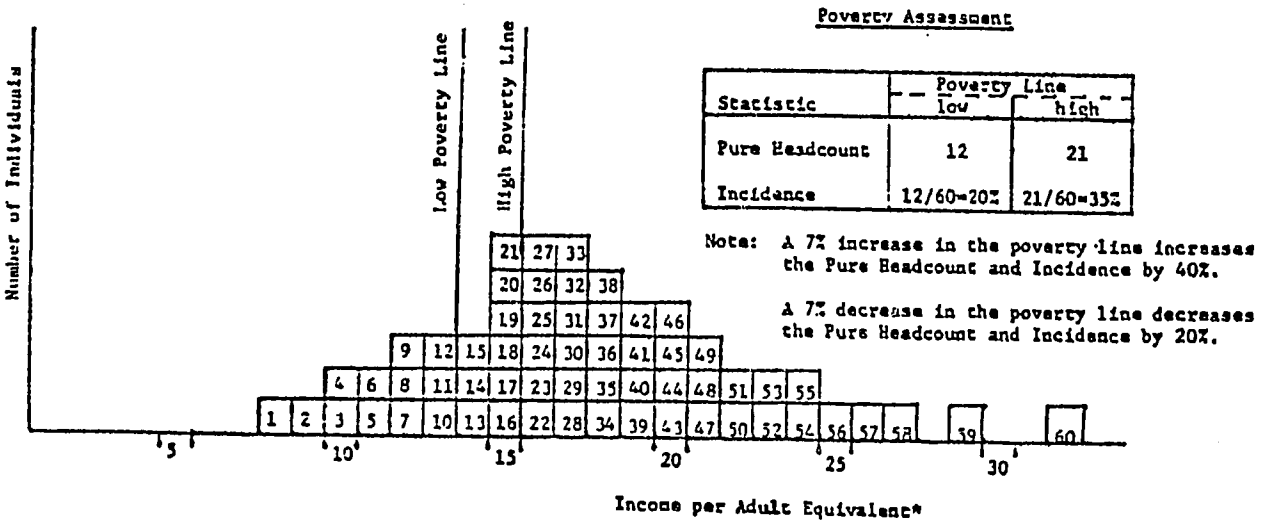
Figure 2.1: Headcount Measures of Poverty

Single and Multiple Poverty Lines

Panel A



Panel B



*To get income per adult equivalent, take the household income and then divide it by the number of adult equivalents in the household. This yields income per adult equivalent, the income assigned to each member of the household for purposes of drawing up the income distribution.

The previous chapter should have dispelled any hopes that a flawless poverty line, applauded by all, could be established. Even poverty lines established with impeccable

care and an ideal data base can and will be legitimately challenged. Sensitivity analysis proves a useful tool in the face of this reality. To undertake sensitivity analysis, marginally raise and lower the poverty line, recalculating the headcount statistics in each instance. If the headcount statistics fail to increase or decrease substantially as the poverty line is raised and lowered, then squabbles over fine points in the definition of the poverty line are of no consequence. If, on the other hand, statistics on the magnitude of poverty change dramatically, then prudence obliges the definition of both a low and high poverty line and the presentation of the corresponding low and high headcount statistics.

Figure 2.1, Panel B, demonstrates sensitivity analysis for the imaginary economy just discussed and shown in Panel A. Panel B differs from Panel A in that the single poverty line of Panel A has been replaced by two poverty lines -- a low one and a high one. Both poverty lines differ from Panel A's poverty line by one dollar, or about 7 percent. The Pure Headcount is now 12 for the low poverty line and 21 for the high poverty line and the Incidence of poverty stands at 20 and 35 percent for the low and high poverty lines, respectively. Notice that the seven percent increase in the poverty line causes a forty percent increase in both headcount measures. Also, the seven percent decrease in the poverty line causes a twenty percent decrease in both measures.

In this imaginary economy, the headcount measures are clearly quite sensitive to marginal changes in the poverty line. For most income distributions, the closer the poverty line is to the median or mode of the distribution, the more sensitive headcount measures will be to small changes in the poverty line. Accordingly, issues of poverty line definition become more critical. Sensitivity analysis can be used in a similar manner with all the poverty gap measures and weighted poverty gap measures as well.

Headcount measures receive high marks for simplicity, intuitive appeal and wide use. They can be reckoned from the simplest methods of operationally defining the

poor such as the Sarong method. Furthermore, with headcount statistics the contribution of various subgroups in the population to total poverty can be asssessed. This property greatly facilitates poverty policy formulation and program design, an issue detailed in Chapter III. Unfortunately, headcount statistics, when used alone to assess the magnitude of poverty, suffer from two major flaws. First, they fail to gauge the intensity of poverty among the poor, and second, they ignore the distribution of income among the poor.

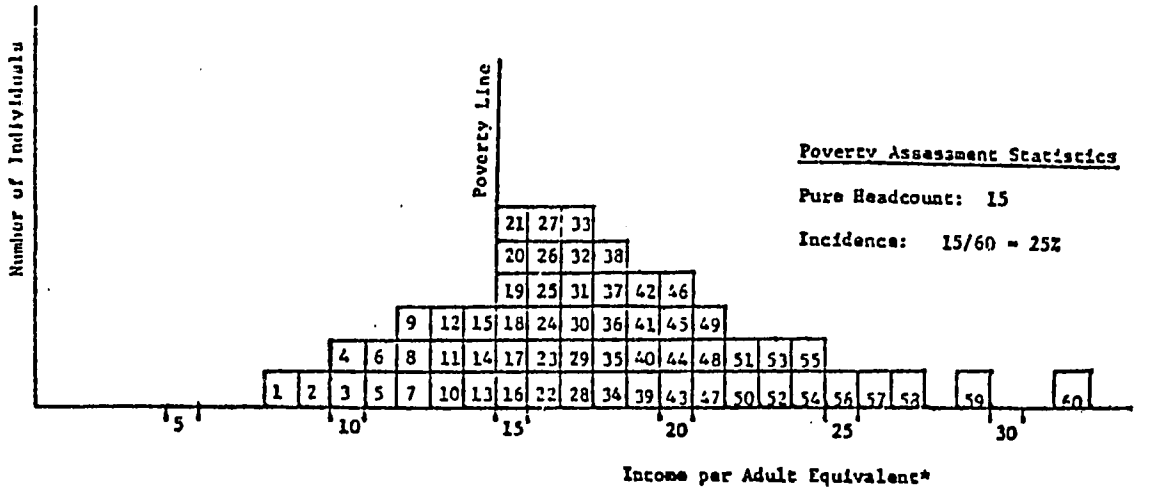
Because headcount statistics fail to gauge the intensity of poverty among the poor, they proclaim identical magnitudes of poverty whether all poor have incomes just barely below the poverty line or all poor have incomes well below the poverty line, so long as identical numbers are poor in each case. Figure 2.2 illustrates the problem. Panel A shows the income distribution for Figure 2.1's imaginary economy. Panel B shows a second economy where poverty is not as acute as in the initial economy. Panel C shows a third economy where poverty is more intense than in either the first or second economy. Notice how the headcount measures assess identical magnitudes of poverty for all three economies.

The headcount measures can be forced to account for the intensity of poverty if numerous poverty lines, each indicating different intensities of poverty, are defined and the corresponding headcount statistics calculated. Unfortunately, this obscures the summary quality of the headcount measures. Users of the results must subjectively or explicitly weight the arrayed assessment to come up with an overall assessment of the magnitude of poverty. The waters are further muddied when sensitivity analysis counsels multiple basic poverty lines or when decomposition analysis is envisioned. A different sort of statistic, poverty gap statistics, directly address the intensity of poverty.

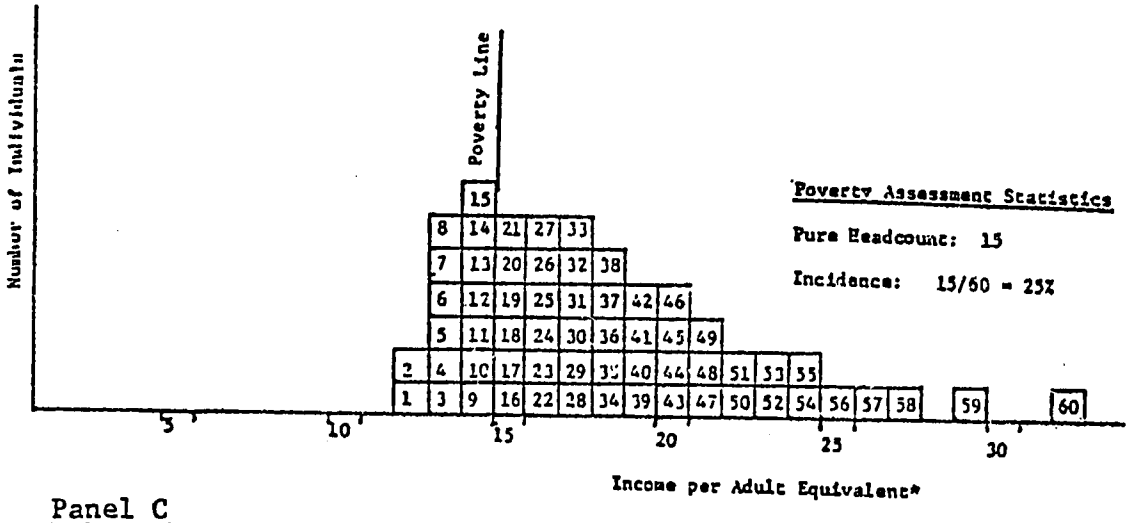
Figure 2.2: Headcount Measures of Poverty

Differences Headcount Measures Obscure

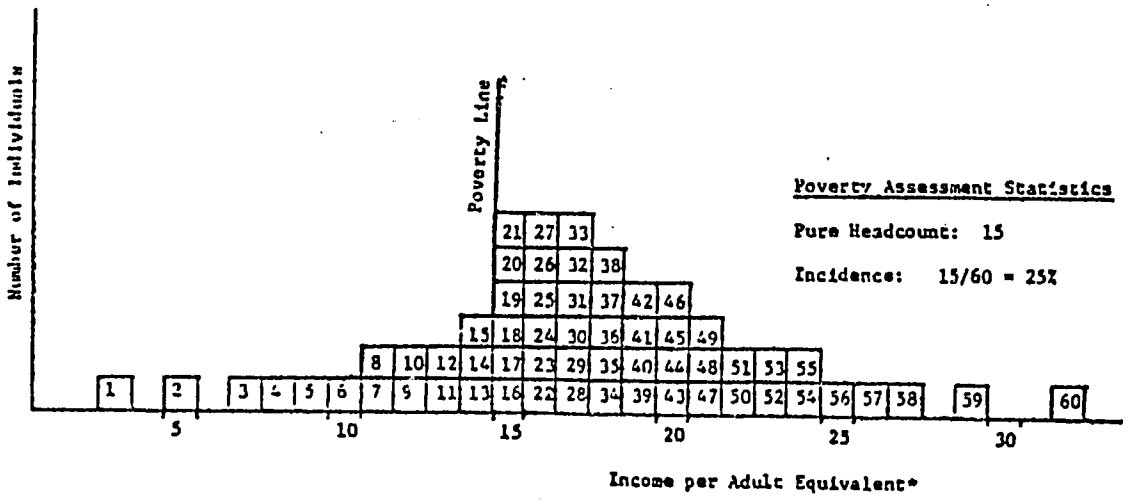
Panel A



Panel B



Panel C



*To get income per adult equivalent, take the household income and then divide it by the number of adult equivalents in the household. This yields income per adult equivalent, the income assigned to each member of the household for purposes of drawing up the income distribution.

The second flaw of the headcount statistics — failure to account for the distribution of income among the poor — permits inequalitarian transfers of income to remedy poverty. Should a poor individual transfer some income to a wealthier individual, the headcount measures either remain unchanged or, if the recipient crossed the poverty line as a result of the transfer, are lowered — surely a perverse result. Not even obtuse solutions, based on headcount measures, respond to this distribution criticism. Only simple and weighted poverty gap measures guard against illusory poverty remedy through making the very poor still poorer.

Poverty Gap Measures — Assessing the Intensity and Tractability of Poverty

Poverty gap measures capture not only the intensity aspect of poverty but also address other issues, namely poverty's overall magnitude and its tractability. They appeal to intuition and are easy to compute. Poverty gap measures have long held a central role in the assessment of poverty in the United States, and they are increasingly employed in international studies.

The most common poverty gap measure, the Aggregate Poverty Gap, is the building block for all other poverty gap measures. As its name implies, it indicates the net amount by which the income of the poor must be augmented to eliminate all poverty. The Aggregate Poverty Gap is derived from a monetary poverty line, although measures similar in construction, but somewhat different in substance, could be devised from non-monetary poverty lines.[4] In assessing the magnitude of poverty, it combines two aspects of poverty — the extent and intensity of poverty. The Aggregate Poverty Gap is equivalent to the number of poor multiplied by the average intensity of poverty among the poor. The Aggregate Poverty Gap measure can be broken down to assess the contribution of various subgroups in the population to aggregate poverty. This property

[4]For example, if the poverty line were based on caloric adequacy, an "aggregate caloric poverty gap" could be calculated as the aggregate shortfall in calories of all the poor.

further recommends use of the Aggregate Poverty Gap when assessing the overall magnitude of poverty.

When a picture of only the intensity aspect of poverty is desired, this aspect can be separated from the Aggregate Poverty Gap by dividing it by the number of adult equivalents in poverty. The resulting statistic, the Average Poverty Gap, specifies the average absolute income shortfall of an adult male (the age and sex characteristic of individuals receiving a weight of one adult equivalent), and thereby signifies the average gravity of poverty. Should the average absolute income shortfall of individuals with different age and sex characteristics be desired, simply multiply the Average Poverty Gap by the adult equivalent weight for that age/sex subgroup.[5]

Two versions of the Average Poverty Gap are sometimes employed to measure the intensity of poverty. They are derived from the Aggregate Poverty Gap by dividing the number of poor individuals or the number of poor households, instead of the number of poor adult equivalents. When the number of poor individuals is used as the divisor, the resulting statistic shows the average absolute income shortfall for the average poor individual — a statistical age/sex hybrid. Similarly, when the number of poor households is used as the divisor, the resulting statistic shows the average absolute income shortfall with respect to the size, age and sex composition of the average poor household. Because the age and sex of the "average" poor individual and the size, age and sex composition of the "average" poor household are not immediately apparent, these versions of the Aggregate Poverty Gap hold much less intuitive appeal.

A sharper picture of the average intensity of poverty among the poor emerges when the Average Poverty Gap is divided by the poverty line per adult equivalent. This

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[5]When some other consumer unit scale is used, the Average Poverty Gap is computed by dividing the Aggregate Poverty Gap by the number of consumer units in poverty, and specifies the average absolute income shortfall for households whose size and composition is equal to the size and composition of the standard consumption unit. Should the average absolute income shortfall of households with a different size and composition be desired, simply multiply the Average Poverty Gap by the consumer unit weight of the desired household type.

measure is alternately referred to as the Poverty-Gap Ratio or the Income-Gap Ratio. Multiplying by one hundred yields the percentage by which income falls short of the poverty line on average, for any and all age/sex subgroups. Although the Aggregate Poverty Gap provides an acceptable assessment of the magnitude of the poverty problem, the Poverty-Gap Ratio, when presented alongside the Incidence measure, draws a bolder, more readily understood picture of the severity of poverty.

Neither the Average Poverty Gap nor the Poverty-Gap Ratio will indicate the number of poor. Increases in the number or proportion of poor can well leave these measures unaffected. The Aggregate Poverty Gap, Average Poverty Gap, and Poverty-Gap Ratio are also all insensitive to the distribution of income among the poor. One implication is that inequalitarian transfers of income among the poor, such as the extremely poor transferring a portion of their income to the just poor, leave these poverty measures unchanged so long as the total number of poor remains unchanged after the transfers. This result occurs because these three gap measures equate the welfare loss of the giver to the welfare gain of the recipient by implicitly assuming a proportional relationship between income shortfall and biological deprivation.

In fact, inequalitarian transfers of income increase the magnitude of biological deprivation — our core concept of poverty. There is not a proportional relationship between income shortfall from the poverty line and biological deprivation. Rather, diminishing biological returns to income operate through two mechanisms. First, consumption studies show that the closer a person's income is to the poverty line, the smaller is the proportion of income allocated towards satisfaction of strictly biological needs.[6] Second, there is some medical evidence indicating that the higher the level of biological deprivation, the greater the impact on biological deprivation of a further dollar's reduction in expenditure on strictly biological needs. For these two reasons,

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[6] This first argument is not applicable if the poverty line has been defined on the basis of a least-cost linear programming exercise which takes no account of cultural norms or practices.

poverty measures based on a monetary poverty line and purporting to measure the magnitude of biological deprivation must weight individual's income shortfalls from the poverty line with weights which increase with the size of the income shortfall. The rationale for weighting income shortfalls from the poverty line with weights which increase with the size of the income shortfall is not unique to the concept of poverty as absolute biological deprivation.

A second popular approach to poverty measurement embraces both the biological concept of poverty and the psychological concept of poverty inherent in both the inequality and relative poverty approaches. This approach to poverty measurement also counsels progressively weighting individual's income shortfalls from the poverty line, not so much to reflect accurately the intensity of biological deprivation, but rather to capture more adequately the psychological or relative deprivation component of poverty. This approach calls for weighting income shortfalls to reflect the relative position of an individual in the income distribution. An income transfer from a poorer person to a wealthier one is seen as increasing the psychological deprivation of the giver by more than it decreases the psychological deprivation of the recipient, thus resulting in a net increase in poverty. Accordingly, the weights on income shortfalls must increase with the size of the income shortfall to capture changes in psychological deprivation caused by income transfers and the resultant directional change in poverty.

One final justification for weighting income shortfalls follows from the basic tenets of welfare economics. Welfare economics views poverty as the sum of all individuals' deficits in welfare from some minimum acceptable welfare level. The need for weighting stems from welfare economics' acceptance of the economists' law of diminishing marginal utility. This law claims that successive constant increases in income result in ever decreasing additions to satisfaction. Since satisfaction -- or in economists' jargon, utility -- determines welfare, this means that an individual's absolute welfare deficit increases at an ever increasing rate as his income shortfall

from the minimum acceptable income level is increased by successive dollar amounts. Accordingly, if person A transfers some income to person B, and person A has a larger pre-transfer welfare deficit than person B, the absolute welfare loss suffered by person A through the inequalitarian transfer will not be fully offset by person B's welfare gain. That is, the aggregate welfare deficit has increased. If the poverty measure is to mirror this increase, individuals' income shortfalls from the poverty line must be adjusted with weights which increase with the size of the income shortfall.

In summary, many justifications exist for weighting income shortfalls with increasing weights when poverty measures are based on a monetary poverty line. Not surprisingly, recent work on poverty measurement has focused on specifying the precise weighting system to be employed. The systems proposed to date are discussed in the section entitled "Weighted Poverty Gap Measures." Before moving on to a discussion of these weighted poverty gap measures, measures based on the unweighted aggregate poverty gap which address the tractability of poverty are presented.

Two alternative normalizations of the Aggregate Poverty Gap assess a country's ability to alleviate poverty. They will be called here the Tractability Ratio and the Poverty Burden Ratio. Neither of these measures focuses on the intensity of poverty as such, but rather they focus on a country's ability to eradicate poverty by means of intra-country income transfers. To accomplish this, both measures assess the Aggregate Poverty Gap relative to some measure of country resources.

The Tractability Ratio is the more commonly used of the two measures. It is generally computed by dividing the Aggregate Poverty Gap by the country's Gross National Product, although dividing by the Gross Domestic Product or the sum of all individuals' (poor and non-poor) income can produce acceptable variants of the Tractability Ratio. The larger the ratio is, the less tractable poverty is. There is some value of the ratio below which poverty is in some sense tractable and above which

poverty cannot be eliminated without economic growth or income transfers from abroad. That value, however, is different for every country.[7]

The Poverty Burden Ratio improves upon the Tractability Ratio by making explicit the cutoff below which poverty is tractable. The Poverty Burden Ratio is arrived at by dividing the Aggregate Poverty Gap by the total luxury income of non-poor households (the total income of non-poor households in excess of their poverty lines). This measure when multiplied by one hundred is the percentage of the non-poors' luxury income which would need to be transferred to the poor to eliminate poverty. Poverty could not be eliminated, even hypothetically, through transfers by the non-poor to the poor if the ratio is greater than one, for this implies that more than one hundred percent of the non-poors' luxury income would be required, reducing the non-poor to paupers.

A few words of caution and clarification are in order concerning both the Tractability Ratio and the Poverty Burden Ratio. Neither measure indicates the absolute magnitude of poverty in any way since growth in the incomes of the non-poor without a reduction in either the number of poor or the severity of poverty among the poor, reduce their value. That is, these measures can easily decrease, suggesting less poverty, in the absence of the reduction of poverty in any meaningful sense of the word. Furthermore, the tractability assessment assumes that transfers are costless and that the political and social will exists to make such transfers. Obviously transfers entail real administrative costs. If the experience of the United States has any relevance, it is by no means certain that the political and social will can be mustered to eliminate poverty, even when the poverty gap is extremely small.

Calculation of all of the simple gap measures is demonstrated in Figure 2.3 for a situation where households are the primary unit of observation. To keep things simple,

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[7]That value can be determined by dividing the Aggregate Poverty Gap by the product of the poverty line per adult equivalent and the total number of adult equivalents in the population.

the economy under study is assumed to have only ten households, numbers 1 through 10 in column 1 on the chart. Household membership is classified by age/sex groupings in columes 3, 5, and 7; and the actual income of each household is listed in column 12. A very simple adult equivalency scale is used in this example with adult males, adult females, and children assigned adult equivalency weights of 1.0, 0.7, and 0.5, respectively, as indicated in columns 4, 6, and 8. The poverty line per adult equivalent is assumed already to have been established at $10 as is indicated in column 10.

Computation of the Aggregate Poverty Gap is described first since it is the numerator of all the other simple gap measures. Given the data base described above, four steps are required to compute the Aggregate Poverty Gap. First, the number of adult equivalents in each household must be calculated and listed in column 9 of the table. To do this, for each household, sum for all age/sex classifications the product of the number of household members in the specific age/sex classifications and the adult equivalency weight for that age/sex classification (number of adult equivalents in household = Col. 3 x Col. 4 + Col. 5 x Col. 6 + Col. 7 x Col. 8). Second, establish each household's poverty line by multiplying the number of adult equivalents in the household by the poverty line per adult equivalent. (Household Poverty Line = Col. 9 x Col. 10.) Third, compute each household's poverty gap (or income shortfall) by subtrating the household's income from its specific household poverty line. (Household Poverty Gap = Col. 11 - Col. 12.) Finally, as the fourth step, the Aggregate Poverty Gap is established by summing poor households' poverty gaps. (Aggregate Poverty Gap = the sum of positive entries in Col. 13.)

With the Aggregate Poverty Gap in hand, computation of the other simple gap measures is straightforward. The Average Poverty Gap is determined by dividing the Aggregate Poverty Gap by the number of poor adult equivalents (Average Poverty Gap = Aggregate Poverty Gap/Sum for poor households of Col. 9.) Dividing the Average Poverty Gap by the poverty line per adult equivalent produces the Poverty-Gap Ratio.

Figure 2.3: Computation of Simple Gap Measures

Household Number	Number of Members in Household	Number of Adult Males	Adult Equivalency Weight Adult Males	Number of Adult Females	Adult Equivalency Weight Adult Females	Number of Children	Adult Equivalency Weight Children
1	2	0	1	1	.7	1	.5
2	2	1	1	1	.7	0	.5
3	6	1	1	2	.7	3	.5
4	3	1	1	1	.7	1	.5
5	7	2	1	2	.7	3	.5
6	6	1	1	1	.7	4	.5
7	4	2	1	0	.7	2	.5
8	5	1	1	1	.7	3	.5
9	8	3	1	2	.7	3	.5
10	6	2	1	1	.7	3	.5
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8

Total Number of Adult Equivalents in Household	Poverty Line per Adult Equivalent	Household Poverty Line	Household Income	Household Poverty Gap	Household Poverty Status
1.2	$10	$12	$ 5	$ 7	poor
1.7	10	17	30	-13	non-poor
3.9	10	39	29	10	poor
2.2	10	22	60	-38	non-poor
4.9	10	49	105	-56	non-poor
3.7	10	37	31	6	poor
3.0	10	30	42	-12	non-poor
3.2	10	32	20	12	poor
5.9	10	59	75	-16	non-poor
4.2	10	42	43	-1	non-poor
Column 9	Column 10	Column 11	Column 12	Column 13	Column 14

Aggregate Poverty Gap = $7+$10+$6+$12 = $35
Average Poverty Gap = $35/(1.2+3.9+3.7+3.2) = $2.92
Poverty Gap Ratio = $2.92/$10 = .292
or Poverty Gap Ratio = $35/($12+$39+$37+$32) = .292
Tractability Ratio: Version A = $35/Gross National Product
Version B = $35/Gross Domestic Product
Version C = $35/($5+$30+$29+$60+$105+$31+$42+$20+$75+$43) = .080
Poverty Burden = $35/($13+$38+$56+$12+$16+$1) = .257

Alternatively, the Poverty-Gap Ratio can be computed by dividing the Aggregate Poverty Gap by the total income requirements of poor households (Poverty-Gap Ratio = Aggregate Poverty Gap/ [-1] [Sum for poor households of Col. 11]). When the Aggregate Poverty Gap is divided by Gross National Product, or Gross Domestic Product, one obtains versions A and B, respectively, of the Tractability Ratio. Version C of the Tractability Ratio is found by dividing the Aggregate Poverty Gap by the sum of all households' incomes (Version C of Tractability Ratio = Aggregate Poverty Gap/Sum for Col. 12.) Finally, notice that the poverty gaps of non-poor households represent, when the negative signs are dropped, the amount of "luxury" income at the disposal of non-poor households. Accordingly, the Poverty Burden Ratio measure comes from dividing the Aggregate Poverty Gap by the absolute value of the sum of all non-poor households' poverty gaps (Poverty Burden Ratio = Aggregate Poverty Gap/[-1] [Sum for non-poor households of Col. 13.]).

The results for this imaginary economy draw the following picture. Thirty-five dollars, or 8.0 percent of country resources, are required to eliminate poverty. That is, an average of $2.92 is required to eliminate biological deprivation for each poor person. On average, every poor man, woman and child meets only 70.8 percent of his or her biological needs leaving a deficit of 29.2 percent. Poverty is tractable, but to eliminate poverty, the non-poor would need to transfer 25.7 percent of their luxury income to the poor.

Weighted Poverty Gap Measures — The Income Distribution among the Poor Matters

Intuition assures us that the distribution of income among the poor affects poverty. In particular, transfers of income from the poorest of the poor to the less poor would seem to increase poverty. This intuitive notion is etched into the logic of three accepted concepts of poverty — the biological concept followed in this monograph and in addition the economic and psychological concepts of poverty. When the poor are identified by a monetary poverty line, the intensity of poverty can only be measured

adequately by adjusting the income shortfalls from the poverty line with weights which increase with the size of the income shortfall. Weighted poverty gap measures do just that. They are the newest of the poverty measures and are only beginning to be seen in empirical work. All, however, were motivated by the psychological concept of poverty.

Amartya Sen introduced the first weighted poverty gap measure in 1976.[8] His index, the Sen Index of Poverty, amounts to the Incidence measure multiplied by the Poverty-Gap Ratio when all poor have the same income, and thus it boldly and intuitively sizes up both the extent and intensity aspects of poverty. When there is inequality in the distribution of income among the poor, the Sen Index converges to the Incidence of poverty multiplied by a Poverty-Gap Ratio, augmented to capture the additional poverty burden imposed by inequality.[9] Specifically, the augmentation factor is one minus the Poverty-Gap Ratio multiplied by the well known Gini Index of Inequality.

Sen defines an individual's degree of poverty as the product of biological and psychological deprivation, as can be seen from the computational formula for the Sen Index of Poverty shown as Figure 2.4 on the next page. The Sen Index of Poverty is the normalized sum of poor individuals' degree of biological deprivation weighted by their degree of psychological deprivation. The term to the left of the summation sign, $2/(q+1)n$, is just the normalization factor required to make the index equal the product of the Incidence and Poverty-Gap Ratio measures of poverty when all poor receive the same income. The first term to the right of the summation sign, $(z-y_i)/z$, is the proportionate income shortfall from the poverty line of the ith individual and is equivalent to the Poverty-gap ratio of the ith individual. In Sen's view, individuals'

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[8]See Amartya Sen, "Poverty: An Ordinal Approach to Measurement," Econometrica, Vol. 44, No. 2 (March 1976).

[9]Sen's Index converges to $I\,[PGR + (1-PGR)G]$ as the quantity $[q/(q+1)]$ approaches 1, where I = Incidence of poverty, PGR = Poverty-Gap Ratio, G = Gini Index of Inequality and q = the number of poor individuals.

poverty-gap ratios adequately reflect their degree of biological deprivation. The last term, q+1-i, is the weight attached to individuals' proverty-gap ratios and is intended to reflect their degree of psychological deprivation. In essence, these weights are the reverse ordered ranks of the poor. That is, if there are 10 poor individuals, the weight on the poorest individual's poverty-gap ratio will be 10, while the weight on the least poor individual's poverty-gap ratio will be 1. This weighting system implies that the degree of psychological deprivation suffered by an individual depends solely on the number of individuals between him and the poverty line.

Figure 2.4

Sen Index of Poverty

$$\text{Poverty} = \frac{2}{(q+1)n}\left[\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)(q+1-i)\right]$$

where:
- q = the number of poor individuals
- n = the number of poor individuals plus the number of non-poor individuals
- z = the poverty line per adult equivalent
- y_i = the income of the ith person
- i = rank in the income distribution where individuals are ranked from poorest to wealthiest.

Maximum Value = 1
Minimum Value = 0

Nanak Kakwani, although applauding the spirit of the Sen Index, criticizes the measure of psychological deprivation used by Sen.[10] Kakwani feels that the perception of relativities (psychological burden imposed by each additional person between one's self and the poverty line) is greater the lower one's rank in the distribution.

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[10]See Nanak Kakwani, "On a Class of Poverty Measures," Econometrica, Vol. 48, No. 2, March 1980.

Accordingly, the poverty measure should increase more, the smaller is the value of i, when a small amount of income is transferred from the ith ranked individual to the (i+p)th ranked individual. The response of Sen's Index to a transfer of a given size is invariant with respect to the rank of the transferer. Kakwani generalizes the Sen Index to a family of poverty indices whose members differ in the magnitude of psychological burden attributed to each additional individual between a given person and the poverty line. The size of the exponent, k, differentiates between class members. The greater is

Figure 2.5

Kakwani Family of Poverty Indices

$$\text{Poverty} = \frac{q}{n\sum_{q} i^k}\left[\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)(q+1-i)^k\right]$$

where:
- k = exponent differentiating family members
- q = the number of poor individuals
- n = the number of poor individuals plus the number of non-poor individuals
- z = the poverty line per adult equivalent
- y_i = the income of the ith ranked person
- i = rank in the income distribution where individuals are ranked from poorest to wealthiest

Maximum Value = 1 for all values of k
Minimum Value = 0 for all values of k

k, the stronger the perception of relativities implied. If k is set equal to zero, individuals are judged to be totally unaffected by relative deprivation inequality, and the measure collapses to the Incidence and Poverty-Gap Ratio poverty measures multiplied together. If k is set at one, the index becomes the Sen Index, and the perception of relativities is judged to be independent of an individual's rank. When k is set to any value greater than one, individuals are judged to perceive their relative rank

disadvantage more intensely the lower their rank. This judgment corresponds with Kakwani's notion of the factors determining the degree of psychological deprivation.[11]

The Sen Index and Kakwani Indices with k values greater than one increase appropriately when transfers of income are made from poor individuals to wealthier individuals so long as the number of poor individuals is not changed as a result of the transfers. But if a poor individual transfers income to a less poor individual who becomes non-poor as a result, these indices decrease. That is, according to these measures, poverty can be decreased by transferring income from the very poor to the less poor. This behavior violates every common sense notion of the way a poverty measure should respond. In fact, it violates the axioms by which Sen and Kakwai themselves judge poverty measures.

Dominique Thon identified this defect in the Sen Index in 1971.[12] According to Thon, the fault resides in the Sen Index's extreme sensitivity to the number of poor. The Sen Index always decreases when the Incidence of poverty decreases, and always increases when the Poverty-Gap Ratio increases. But the Sen Index's decrease resulting from the lowered Incidence of poverty inappropriately outweighs the increase resulting from the greater Poverty-Gap Ratio, when a very poor individual transfers income to a less poor individual, thereby making him non-poor.

Thon proposes a poverty index modeled after the Sen Index, but purged of this defect. He admits, however, that the purification has been achieved at a real cost. As Thon states it, his index is "insensitive to a *ceteris paribus* change in the number of the poor."[13] The Thon Index is different from the Sen and Kakwani indices in two other

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[11] For values of k sufficiently greater than 1, the poorer is individual i, the more a transfer of t dollars from individual i to an individual with income $(y_i + h)$, where h is positive, will increase Kakwani's Index. Kakwani argues that this behavior is also required of any reasonable poverty measure, but Greer, et al. disagree. See Kakwani, 1980, p. 439, and Greer, Thorbecke and Foster, "A Class of Decomposable Poverty Measures," Working Paper No. 243, Dept. of Economics, Cornell University 1980, p. 9.

[12] Dominique Thon, "On Measuring Poverty," Review of Income and Wealth, December, 1979.

[13] Ibid., 438.

important respects. First, when all poor have the same income, the Thon Index does not become identical to the product of the Incidence and Poverty-Gap Ratio measures of poverty as do both the Sen and Kakwani indices. Second, the concept of relative deprivation implicit in the Thon Index is different from that used by both Sen and Kakwani. The weight given poor individuals' poverty-gap ratios used by Thon to reflect the degree of psychological deprivation is (n+1-i) instead of (q+1-i). This weighting system implies that the degree of psychological deprivation suffered by a poor individual depends on the number of individuals in the population with higher incomes rather than just the number of poor individuals with higher incomes.

Figure 2.6

The Thon Index

$$\text{Poverty} = \frac{2}{n(n+1)} \left[\sum_{i=1}^{q} \left(\frac{z-y_i}{z} \right) (n+1-i) \right]$$

Minimum Value = 0
Maximum Value = 1

where: q = the number of poor individuals
n = the number of poor individuals plus the number of non-poor individuals
z = the poverty line per adult equivalent
y_i = the income of the ith ranked person
i = rank in the income distribution where individuals are ranked from poorest to wealthiest

Noriyuki Takayama is also troubled by Sen's concept of psychological deprivation, and like Thon, he feels that an individual's sense of psychological deprivation depends on the total number of individuals who are wealthier and not just on the number of poor individuals who are wealthier.[14] He suggests a poverty measure importantly different

[14] See Noriyuki Yakayama, "Poverty, Income Inequality, and Their Measures: Professor Sen's Axiomatic Approach Reconsidered." Econometrica, Vol. 47, No. 3, May, 1979.

from Thon's but psychological deprivation is measured in essentially the same manner. Takayama's index of poverty is in reality the Gini Index of Inequality applied to the "censored" income distribution. Takayama defines the "censored" income distribution as the actual income distribution with non-poor individuals reassigned the poverty line income. Although it is not apparent from the index's formula shown below, Takayama demonstrates that like Sen's Index, his index can be rewritten as a normalized weighted sum of poor individuals' Poverty-gaps. Be this as it may, the Takayama Index is hypersensitive to the aspect of psychological deprivation and does not adequately capture the level of biological deprivation. Two properties recommend its use only as a

Figure 2.7

Takayama Index

$$\text{Poverty} = 1 + \frac{1}{n} - \frac{2}{\mu^* n^2}\left[\sum_{i=1}^{n} (n+1-i)y_i^*\right]$$

Maximum Value: 1
Minimum Value: 0

where:
- n = the number of poor individuals plus the number of non-poor individuals.
- y_i = the income of the ith ranked individual
- y_i^* = the income of the ith ranked individual in the censored income distribution. In the censored income distribution, $y_i^* = y_i$ if $y_i < z$, and $y_i^* = z$ if $y_i \geq z$.
- z = the poverty line income per adult equivalent
- μ^* = the mean income of the censored income distribution
- i = rank in the income distribution where individuals are ranked from poorest to wealthiest.

measure of the psychological deprivation suffered by the poor. First, the Takayama Index often decreases, indicating less poverty, when a wealthy individual suffers a loss in income and thereby joins the ranks of the poor. The Takayama Index permits the

decrease in psychological deprivation (misery loves company) to outweigh the increase in biological deprivation. Second, if no one has income sufficient to meet his or her biological needs, but all individuals suffer the same level of biological deprivation, the Takayama Index attains its minimum value, 0, indicating the absence of poverty. No concept of poverty that intends to address biological deprivation can concur with these assessments.

One final class of weighted poverty gap measures has recently been proposed by Joel Greer, Erik Thorbecke and James Foster.[15] Like all the other weighted poverty gap measures, their indices define an individual's degree of poverty as the product of psychological and biological deprivation. However, Greer et al.'s notion of psychological deprivation is substantially different from the others'. Instead of using individuals' rank orders to reflect psychological deprivation, they use the individuals' poverty-gap ratios to reflect psychological deprivation. As they argue, "the deprivation felt by a family is based <u>not</u> (emphasis added) on the number of families between it and

Figure 2.8

<u>The GTF Family of Poverty Indices</u>

$$\text{Poverty} = \frac{1}{n}\left[\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)\left(\frac{z-y_i}{z}\right)^{k-1}\right] = \frac{1}{n}\left[\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^{k}\right]$$

Minimum Value = 0
Maximum Value = 1

where:
- n = the number of poor individuals plus the number of non-poor individuals
- q = the number of poor individuals
- z = the poverty line per adult equivalent
- i = rank in the income distribution where individuals are ranked from poorest to wealthiest
- y_i = the income of the ith ranked person
- k = exponent differentiating family members

[15] See Greer, Thorbecke and Foster, "A Class of Additively Decomposable Poverty Measures," mimeo, July 26, 1980.

the poverty line, but on the gap between its income and the income it feels it needs to reach a socially acceptable life style. In other words, households measure themselves against other families' incomes and what is important is the difference in living standards between families, not simply their ranking."[16]

The weighting factor Greer, Thorbecke and Foster adopt to reflect psychological deprivation is $[(z-y_i)/z]^{k-1}$ — the last term in the first formulation of the GTF Family of Poverty Indices shown in Figure 2.8. This term is an individual's poverty-gap ratio raised to some power. By using the poverty-gap ratio, they argue that the norm against which individuals compare themselves is the standard of living afforded by the poverty line income. The exponent, k, differentiates between members of their family of indices. The larger the value of k, the more important is relative deprivation in the poverty assessment. Furthermore, the larger the value of k, the stronger the perception of relativities, since greater k values magnify the difference between individuals' shortfalls from the poverty line.

Choosing to set k equal to zero implies that neither relative deprivation nor degree of biological deprivation are important aspects of poverty since in this case, the GTF Index is equivalent to the Incidence measure of poverty. When k is set equal to one, the GTF Index equals the Incidence of poverty multiplied by the Poverty-Gap Ratio, and psychological deprivation is not accounted for. When k is set equal to two, all three aspects of poverty — the extent, the intensity of biological deprivation, and the intensity of psychological deprivation — are accounted for, and in addition the index is not excessively sensitive to the headcount as both the Sen and Kakwani Indices are.

With this measure, however, all individuals are judged to suffer the same degree of psychological deprivation from each dollar shortfall from the poverty line. This violates Kakwani's notion of an increasing sense of relative deprivation the lower is one's income. By setting k greater than two, one incorporates all three aspects of

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[16] Ibid., p. 10.

poverty and satisfies Kakwani's notion of psychological deprivation as well.[17] One additional factor recommends the GTF Family of Indices. Whatever the selected value of k, the GTF Index is additively decomposable.

Tables 2.1, 2.2, and 2.3 and Figure 2.9 on the following pages illustrate the data manipulations and computational procedures needed to compute each of the weighted poverty gap measures for the case where households are the primary unit of observation. The economy under study is Figure 2.3's imaginary economy comprised of ten households, with an established poverty line of $10 per adult equivalent. All of the

Table 2.1: Information on Households

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Household Identification Number	Household Income	Number of Adult Equivalents in Household	Household Income per Adult Equivalent	Number of Members in Household	Ranks of Household Members in Distribution of Income Among Individuals
1	$ 5	1.2	$ 4.167	2	1 - 2
2	30	1.7	17.647	2	38 - 39
3	29	3.9	7.436	6	8 - 13
4	60	2.2	27.273	3	47 - 49
5	105	4.9	21.426	7	40 - 46
6	31	3.7	8.378	6	14 - 19
7	42	3.0	14.000	4	34 - 37
8	20	3.2	6.250	5	3 - 7
9	75	5.9	12.712	8	26 - 33
10	43	4.2	10.238	6	20 - 25

formulas for the weighted poverty gap measures have been presented as they relate to individuals' shortfalls from the per adult equivalent poverty line to avoid complications and confusions resulting from multiple poverty lines, each applying to different household compositions.

[17] Kakwani formally states his perception of psychological deprivation in his Axioms 2.2 and 2.3. See Kakwani, 1980, pages 438-439 for a formal statement of these axioms and a more detailed discussion of their implications than that covered on pages 64-66 of this monograph.

Table 2.2: Information on Individuals

y_i	y_i^*	i	$(y_i - z)/z$	(n+1-i)	(q+1-i)
4.167	4.167	1	.583	49	19
"	"	2	"	48	18
6.250	6.250	3	.375	47	17
"	"	4	"	46	16
"	"	5	"	45	15
"	"	6	"	44	14
"	"	7	"	43	13
7.436	7.436	8	.256	42	12
"	"	9	"	41	11
"	"	10	"	40	10
"	"	11	"	39	9
"	"	12	"	38	8
"	"	13	"	37	7
8.378	8.378	14	.162	36	6
"	"	15	"	35	5
"	"	16	"	34	4
"	"	17	"	33	3
"	"	18	"	32	2
"	"	19	"	31	1
10.238	10.00	20	-	30	-
"	"	21	-	29	-
"	"	22	-	28	-
"	"	23	-	27	-
"	"	24	-	26	-
"	"	25	-	25	-
12.712	10.00	26	-	24	-
"	"	27	-	23	-
"	"	28	-	22	-
"	"	29	-	21	-
"	"	30	-	20	-
"	"	31	-	19	-
"	"	32	-	18	-
"	"	33	-	17	-
14.000	"	34	-	16	-
"	"	35	-	15	-
"	"	36	-	14	-
"	"	37	-	13	-
17.647	"	38	-	12	-
"	"	39	-	11	-
21.426	"	40	-	10	-
"	"	41	-	9	-
"	"	42	-	8	-
"	"	43	-	7	-
"	"	44	-	6	-
"	"	45	-	5	-
"	"	46	-	4	-
27.273	"	47	-	3	-
"	"	48	-	2	-
"	"	49	-	1	-

See Notation Key and Table 2.3 on p. 73.

Table 2.3: Aggregate Information

Item	Value
z	$10
n	49
q	19
u*	8.867

Notation Key

Symbol	Definition
i	rank of individual in the personal income distribution where individuals are ranked from poorest to wealthiest.
y_i	per adult equivalent income of individual with rank i.
z	poverty line per adult equivalent.
y_i^*	per adult equivalent income of individual with rank i based on the censored income distribution. $y_i^* = y_i$ if $y_i < z$; $y_i^* = z$ if $y_i \geq z$
n	number of poor plus non-poor individuals.
q	number of poor individuals.
$(y_i - z)/z$	individuals' Poverty-Gap Ratios.
μ^*	mean income of the censored income distribution.

The first step is to transform the household income distribution into the individual distribution of income per adult equivalent. Lacking information on how households actually distribute income between members, it is assumed that household income (or the consumption goods purchased out of household income) is distributed to members on the basis of need, or more precisely, in proportion to their adult equivalency weight.[18] Since the poverty line used in the formulas for the weighted poverty gap measures is the per adult equivalent poverty line, each member of a household is assigned that household's income per adult equivalent.[19] Table 2.1 illustrates this procedure.

[18]This assumption is made because it is necessary for simplicity's sake, not on the basis of presumed validity. Evidence is accumulating which indicates that, at least in some cultures, the consumption needs of males are met in preference to the consumption needs of females.

[19]If information is available about the household's distribution of income between household members, then household members should be assigned their actual income (or value of consumption) receipt on a per adult equivalent basis. That is, if an individual receives $ k income and that individual's adult equivalency weight is .7, their assigned income is $k/.7.

Figure 2.9

Computation of Weighted Povery Gap Measures

Sen Index: $\frac{2}{(q+1)n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)(q+1-i) = \frac{2}{(20)(49)}$ [(.583)(19+18)+(.375)(17+16+...+13)+(.256)(12+11+...+7)+ (.162)(6+5+...+1)] = .1381

Kakwani Indices:

k=0: $\frac{q}{n\sum_{i=1}^{q} i^0}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)(q+1-i)^0 = \frac{19}{49(19)}$ [(.583)(2)+(.375)(5)+(.256)(6)+(.162)(6)] = .1132

k=1: $\frac{q}{n\sum_{i=1}^{q} i^1}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)(q+1-i)^1 = \frac{19}{49(1+2+...+19)}$ [(.583)(19+18)+(.375)(17+16+...+13)+(.256) (12+11+...+7)+(.162)(6+5+...+1)] = .1381

k=2: $\frac{q}{n\sum_{i=1}^{q} i^2}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)(q+1-i)^2 = \frac{19}{49(1^2+2^2+...+19^2)}$ [(.583)(19^2+18^2)+(.375)($17^2+16^2+...+13^2$) + (.256)($12^2+11^2+...+7^2$)+(.162)($6^2+5^2+...+1^2$)] = .1524

Thon Index: $\frac{2}{n(n+1)}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)(n+1-i) = \frac{2}{(49)(50)}$ [(.583)(49+48)+(.375)(47+46+...+43)+(.256)(42+41+...+37)+ (.162)(36+35+...+31)] = .1912

Takayama Index: $1 + \frac{1}{n} - \frac{2}{\mu^* n^2}\left[\sum_{i=1}^{n}(n+1-i)y_i^*\right] = 1 + \frac{1}{49} - \frac{2}{(8.967)(49^2)}$ [(49+48)(4.167)+(47+46+...+43)(6.25)+ (42+...+37)(7.463)+(36+...+31)(8.378)+(30+...+1)(6)]=.0897

GTF Indices:

k=0: $\frac{1}{n}\left[\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^0\right] = \frac{1}{n}\sum_{i=1}^{q}1 = \frac{1}{49}[1+2+...+19]$ = .3878

k=1: $\frac{1}{n}\left[\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^1\right] = \frac{1}{49}$[(2)(.583)+(5)(.375)+(6)(.256)+(6)(.162)] = .1132

k=2: $\frac{1}{n}\left[\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^2\right] = \frac{1}{49}$[(2)$(.583)^2$+(5)$(.375)^2$+(6)$(.256)^2$+(6)$(.162)^2$] = .0395

Household income divided by the number of adult equivalents in the household yields household income per adult equivalent (Column 2/Column 3 = Column 4). All individuals are then ranked from poorest to wealthiest on the basis of their household per adult equivalent income.

Looking at Table 2.1 we see that the household with the lowest income per adult equivalent is Household 1. This household has two members (as indicated in Column 5) and so the two members in Household 1 are assigned ranks 1 and 2, respectively, in the distribution of income among individuals. Column 6 of Table 2.1 shows the ranks of each member in each household with respect to the per adult equivalent distribution of income among individuals.

On the basis of the information in Columns 4 and 6 of Table 2.1, the ordered per adult equivalent distribution of income among individuals is drawn up and presented as Columns 1 and 3 in Table 2.2. From Table 2.2 it can be seen that 19 individuals have per adult equivalent incomes less than $10, the poverty line per adult equivalent. Thus, 19 out of the 49 individuals in the population are poor. Columns 2, 4, 5 and 6 of Table 2 are calculated from Columns 1 and 3 and the aggregate information on the poverty line per adult equivalent, the number of poor individuals in the population and the population size. Table 2.3 lists this aggregate information and in addition, the mean of the censored income distribution which is calculated from Column 2 of Table 2.2. The information from Tables 2.2 and 2.3 can be directly plugged into the formulas for the weighted poverty gap measures. Figure 2.9 illustrates the computation of each of the weighted poverty gap measures for this imaginary economy comprised of ten households.

The point of view taken here is that whenever the elimination of biological deprivation is considered a priority in its own right, and whenever mass biological deprivation exists, issues of biological and psychological deprivation should be addressed separately. Accordingly, we have defined poverty as the magnitude of absolute biological deprivation in this monograph. The simple poverty gap measures discussed earlier are deemed inadequate measures of the intensity of biological deprivation. There is not a proportional relationship between income shortfall from the poverty line and biological deprivation. Rather, diminishing biological returns to income operate over the entire range of poverty level incomes.

All of the weighted poverty gap measures just discussed adjust income shortfalls with weights which increase with the size of the shortfall. However, none of the weighted poverty gap measures developed to date have been designed with the purpose of improving upon income shortfall as an indicator of biological deprivation. Rather, all have accepted income shortfall from the poverty line as an adequate measure of biological deprivation and have sought instead to incorporate the psychological aspect of poverty into the poverty measure.

Despite the intent of the weighting systems adopted, these weighted poverty gap measures may be better indicators of the absolute magnitude of biological deprivation than either the headcount or simple poverty gap measures. The next section aims to define the properties any poverty measure must have if it is to be consistent with a concept of poverty focused essentially on the magnitude of absolute biological deprivation.

Sizing Up the Poverty Measures

No poverty measure is perfect. The poverty measure which is most appropriate depends upon one's concept of poverty, the purpose of poverty measurement and data availability. This section delineates seven basic characteristics which, taken together, determine both a poverty measure's consistency with the definition of poverty as the magnitude of absolute biological deprivation and a poverty measure's versatility with respect to a range of empirical uses. All of the poverty measures described in this chapter are evaluated both against these properties and according to whether they can be used with the simple, inexpensive non-monetary methods of identifying the poor.

Five characteristics are required to ensure a poverty measure's consistency with the concept of poverty as the magnitude of absolute biological deprivation when a

monetary poverty line is used to identify the poor.[20] They are the properties of headcount sensitivity, income shortfall sensitivity, deprivation sensitivity, non-poor's income insensitivity, and cardinality. Each will be formally stated and discussed in turn.

Property 1: Headcount Sensitivity: An increase (decrease) in the number of poor will increase (decrease) the poverty measure, given other things equal.

This property requires that the poverty measure take into account the extent of poverty. The phrase "given other things equal" requires a bit of clarification. Property 1 requires only that if the number of poor individuals increases (because of births among the poor, the immigration of poor individuals into the area under study, or the loss of income by a non-poor individual to no one else's gain in the area) given all else equal (except factors changing as a consequence of a simple increase in the number of poor individuals), then the poverty measure must register an increase.

Property 2: Income Shortfall Sensitivity: A decrease (increase) in income received by a poor individual must increase (decrease) the poverty measure, given other things equal.

This property provides partial assurance that the poverty measure takes into account the intensity aspect of poverty. The degree of biological deprivation and income shortfall from the poverty line are perceived to be positively related. If an individual's income shortfall from the poverty line increases, then the degree of biological deprivation he suffers has also increased. Accordingly, if a poverty measure accounts for the intensity of poverty, then when the income received by a poor individual decreases, the income shortfall increases, and the poverty measure must increase.

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[20] Each method of identifying the poor would require a separate set of characteristics to ensure that it was faithful to the concept of poverty as the magnitude of absolute biological deprivation. Because all the measures developed to date, except the simple headcount measures, rely on a monetary poverty line for poverty identification, the characteristics formulated here assume use of a monetary poverty line for identification.

Property 3: Deprivation Sensitivity: In response to some unit increase (k) in a poor person's income, the poverty measure will decrease by a greater amount the poorer is the individual concerned, regardless of whether the person crosses the poverty line as a result of the income augmentation, but given other things equal. Furthermore, in response to a k unit decrease in a person's income (whether he be poor or non-poor), the poverty measure will increase by a greater amount the greater is the person's resultant income shortfall from the poverty line,[21] regardless of whether the poverty line is crossed as a result of the income diminution, but given other things equal.

This property provides additional assurance that the poverty measure takes into account the intensity aspect of poverty. Although it sounds complex, Property 3 simply ensures that the poverty measure weights poorer individual's income shortfalls from the poverty line more heavily as is consistent with the perceived diminishing marginal biological returns to income. This is appropriate, since the biological benefit afforded from a given increase in income is believed to be greater, the greater is the individual's degree of biological deprivation. The qualification concerning income changes which simultaneously result in a change in the number of poor is important. Compare the effects on the aggregate level of biological deprivation of providing k dollars to two different individuals. The aggregate magnitude of biological deprivation will decrease more if the k dollars are provided to the poorer of the two individuals for two reasons. First, a larger proportion of the income receipt will be allocated to the relief of biological deprivation. Second, each dollar allocated toward the fulfillment of biological needs will purchase a greater amount of biological benefit. Any poverty measure which reflects the aggregate magnitude of biological deprivation must decrease more if the k dollars are provided to the poorest of the two individuals. This is true even if the number of poor is reduced by only giving the k dollars to the less poor of two individuals instead of to the poorest individual.

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[21] Here, income shortfall from the poverty line is defined as zero for all non-poor individuals.

Many of the available poverty measures conform to Property 3, except in those cases where income receipts or losses cause someone to cross the poverty line. Because a poverty measure that generally exhibits diminishing marginal biological returns to income is superior to one that never does, a qualified version of Property 3, denoted as Property 3a, is offered to distinguish between the two types of measures.

Property 3a: Qualified Deprivation Sensitivity: In response to a k unit increase (decrease) in a poor person's income, the poverty measure will decrease (increase) by a greater amount the poorer is the individual, assuming the number of poor is unchanged, and all other things are equal.

Property 4: Non-poor's Income Insensitivity: An increase (decrease) in a non-poor person's income will not affect the poverty measure, given other things equal, including the number of poor individuals.

Clearly, the level of absolute biological deprivation cannot be lessened by providing additional income to individuals who are already fulfilling their biological needs. Any absolute measure of biological deprivation must be independent of the level and distribution of income among the non-poor. Property 4 ensures that the poverty measure is an absolute measure in this sense.

Property 5: Cardinality: Specification of the intensity aspect of poverty must be based on an interval or ratio weighting scale.

Property 5 guarantees that the poverty measure is an absolute measure not only with respect to the incomes of the non-poor, but with respect to the incomes of the poor as well. It insists that once the poverty line has been defined, the degree of poverty experienced by an individual is determined without reference to any other individual's income level. With respect to the construction of monetary poverty measures, this property requires cardinal weighting of income shortfalls when transforming income shortfall into a measure of the intensity of poverty. Cardinality rules out poverty measures which weight income shortfalls ordinally, such as all those

using rank in the income distribution as weights. In addition, the cardinality property enables one to determine the percentage contribution to aggregate poverty of different subgroups in the population. This is an extremely useful property for applied work. Not only does it permit the determination of percentage shares in poverty of subgroups in the population, but it permits compilation of an aggregate poverty measure from the poverty measures computed separately for subgroups in the population.

Two further properties increase a poverty measure's convenience and versatility in applied work. They are the properties of independence with regard to income scale and independence with regard to population scale. Both are borrowed from the inequality literature with its broader base of empirical research.[22]

Property 6: Income Scale Independence: If all incomes and the poverty line are multiplied by a constant factor, the poverty measure must remain constant, given other things equal.

Poverty measures whose magnitudes do not depend upon the units which income and the poverty line are measured in offer enormous convenience for comparative poverty studies since it becomes unnecessary to adjust for inflation or to deal with currency conversions. Measured poverty can be compared directly over different time periods and in study areas with different units of currency even though the value of the currency has changed. This property does no harm to the concept of poverty since the degree of biological deprivation experienced by a person is intrinsically independent of the units in which it is measured.

Property 7: Population Scale Independence: If the income distribution is copied k times so that there are k times as many individuals, the poverty measure must remain constant, given other things equal.

Cross-national, cross-regional and longitudinal comparative poverty studies generally aim to discover whether poverty differences exist which are not simply due to

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[22] See, for example, A. K. Sen, On Economic Inequality, Oxford: Clarendon Press, 1973; and Fields and Fei, "On Inequality Comparison," Econometrica, Vol. 46, No. 2, 1978, pp. 303-316.

differences in population size. Poverty measures whose magnitudes are independent of population size are exceedingly useful for this type of comparative study since measured poverty can be compared directly. Poverty measures exhibiting this property offer further convenience when poverty measurement is based on sample data, since the sample's poverty level is at the same time the estimate of poverty for the whole population.[23]

Figure 2.10 indicates which of the seven properties the different poverty measures possess. In addition, in the last column, Figure 2.10 indicates, as Property 8, whether the poverty measure can be used when poverty identification is not based on a monetary poverty line. Poverty measures exhibiting a property are indicated with a +, while those that do not have the property are indicated with a -.

The GTF Index with $\underline{k}$=2 is decidedly superior to all other poverty measures as an indicator of the magnitude of absolute biological deprivation. It does not, however, exhibit all of the elementary properties necessary to mirror the absolute magnitude of biological deprivation. Specifically, the GTF Index ($\underline{k}$=2) inappropriately registers a decrease in poverty when one more person enters the population with an income above the initial mean income among the poor. A clear need exists for the development of poverty measures more faithful to our concept of poverty.

The Incidence poverty measure offers the greatest virtuosity for empirical work exhibiting independence to both population and income scale and facility for use with non-monetary methods of identifying the poor. Unfortunately it is a poor indicator of

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[23] So long as a known population scaling factor exists, poverty measures which do not exhibit population scale independence can be used both to make poverty inferences from sample data to the sampled population and to compare poverty levels in different populations independent of the effects of population size. Inferences and comparisons cannot, however, be made directly. Before comparisons are made, the appropriate adjustments must be made to scale the poverty measurements to a standard population size. Before inferences to the population sampled are made, the sample's poverty measurement must likewise be rescaled. Poverty measures which do not have known scaling factors cannot be used to make inferences from a sampled population, nor can poverty comparisons be made which control for the effects of population size.

Figure 2.10: Poverty Measures and Their Properties

Measure	Property 1	2	3	3a	4	5	6	7	8
Pure Headcount	+	-	-	-	+	+	+	-	+
Incidence	+	-	-	-	+	+	+	+	+
Aggregate Poverty-Gap	+	+	-	-	+	+	-	-	-
Average Poverty-Gap	-	-	-	-	+	+	-	+	-
Poverty-Gap Ratio	-	-	-	-	+	+	+	+	-
Incidence x Poverty-Gap Ratio	-	+	-	-	+	+	+	+	-
Tractability Ratio: Version C	-	+	-	-	-	+	+	+	-
Poverty Burden Ratio	+	+	-	-	-	-*	+	+	-
Sen Index	+	+	-	+	+	-	+	-	-
Kakwani Indices: k=0	-	+	-	-	+	+	+	+	-
k=1	+	+	-	+	+	-	+	-	-
k=2	+	+	-	+	+	-	+	-	-
Thon Index	-	+	+	+	+	-	+	-	-
Takayama Index	-	-	+	+	+	-	+	+	-
GTF Indices: k=0	+	-	-	-	+	+	+	+	-
k=1	-	+	-	-	+	+	+	+	-
k=2	-	+	+	+	+	+	+	+	-

*Property 5 holds unless there is some subgroup without any luxury income.

Properties

Property 1: Headcount Sensitivity
Property 2: Income Shortfall Sensitivity
Property 3: Deprivation Sensitivity
Property 3a: Qualified Deprivation Sensitivity
Property 4: Non-poor's Income In sensitivity
Property 5: Cardinality
Property 6: Income Scale Independence
Property 7: Population Scale Independence
Property 8: Poverty Identification using Non-Monetary Poverty Line

the magnitude of absolute biological deprivation, since it fails to assess the intensity of poverty (it does not exhibit properties 2 or 3). The GTF Index with $\underline{k}=2$ exhibits both population and income scale independence as well, but its sophistication as an indicator of absolute biological deprivation defies use with non-monetary methods of identifying the poor.

Although no measure of poverty is perfect, most can provide substantial assistance when it comes to locating poverty groups for poverty redress, unraveling the causes of poverty and designing redress programs responding to these, and evaluating the effectiveness of poverty programs. These are the topics of Chapter III.

Appendix to Chapter II

EFFECTS OF USING SEEMINGLY INNOCUOUS AVERAGING ASSUMPTIONS TO ESTIMATE HEADCOUNT MEASURES OF POVERTY

Headcount measures of poverty are often based upon published data, but their use may require some dangerous averaging assumptions because published data are often grouped data, i.e., summary tabulations and cross-tabulations of individuals (or households) by various household characteristics. The chart below lists some of the summary tables (by unit of observation), which may be found in published data. Important types of tables are indicated by the letters A to F, and as we will see, these table types vary in the adequacy of the information provided.

Figure 2A.1

Common Types of Summary Tables

Characteristic	Cell Entries: Number of Individuals	Cell Entries: Number of Households
Tabulations		
Household income interval	A	B
Household per adult equivalent income interval	C	
Cross-Tabulations		
Household income interval/household size[1]		D
Household income interval/household adult equivalent size	E	
Household per adult equivalent income interval/ household size		F

[1]Household size for purposes of this discussion means the number of individuals in the household, whereas household adult equivalent size means the number of adult equivalents in the household.

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Such published data almost always provide: 1) information to calculate the average household size (defined for this discussion as the average number of individuals in households); 2) information to calculate the average number of adult equivalents per household;[2] and 3) the kind of tables labeled above as types A, B, and D. Such tables have often been used to estimate headcount poverty measures, and the results have footnotes giving explanations of the seemingly innocuous averaging assumptions employed. Unfortunately, estimates made from any of these three table types can be extremely inaccurate. Accurate headcount measures of poverty can only be deduced from tabulations of type C, E, and F. To see why this is so, let us consider the standard procedures for estimating the Headcount poverty measures from tables A, B, and D.

Estimates of the Headcount measure based on tabulations of the number of individuals in each household income interval -- Table Type A -- start by defining an "average household poverty line" as the product of the poverty line per adult equivalent and the average number of adult equivalents per household in the population at large. With the "average household poverty line" thus defined, the Headcount poverty measure is computed by summing the number of individuals in the cells for income intervals less than this "average household poverty line." Table Type A in Figure 2A.2 illustrates the procedure. Assume that the per adult equivalent poverty line has already been set at $50, and that the average number of adult equivalents in each household is three. The "average household poverty line" then is specified at $50 x 3, or $150. This poverty line is shown in the table as the double line separating the sixth and seventh income intervals. Poor individuals are then identified as all individuals classified in cells above the double line, while non-poor individuals are identified as all individuals classified below this double line. This procedure for tabulating the Headcount measure of poverty

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[2]Here it is assumed that the standard consumption unit is one adult. The general argument presented in this Appendix is relevant no matter what consumption unit is selected as the standard consumption unit.

makes the implicit assumption that all households are comprised of an identical number of adult equivalents — the average number of adult equivalents in the study area. This assumption, of course, is wrong. More importantly, it leads to serious error in the poverty estimate.

The problem comes into sharper focus when the information contained in Table Type A is cross-tabulated with additional information on the number of adult equivalents in households. The resulting cross-tabulation is Table Type E, shown to the right of Table Type A in Figure 2A.2. As can be seen, Table Type A is contained within

Figure 2A.2: Comparison of Headcount Measure of Poverty Derived from Table Types A and E

Table Type A

Household Income Interval	# of Households in Income Interval
$ 0-24	
25-49	
50-74	
75-99	
100-124	
125-149	
150-174	
175-199	
200-224	
225-249	
250-274	
275-299	
300+	

Table Type E

Household Income Interval	Number of Adult Equivalents in Household Income Interval											Row Sum
	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	
$ 0-24												
25-49												
50-74	*											
75-99	*	*										
100-124	*	*	*									
125-149	*	*	*	*								
150-174						*	*	*	*	*	*	
175-199							*	*	*	*	*	
200-224								*	*	*	*	
225-249									*	*	*	
250-274										*	*	
275-299											*	
300+												

Table Type E as Table Type E's first and last columns. For comparative purposes, the "average household poverty line" applied earlier to Table Type A has been extended to Table Type E. An estimate of poverty identical to that obtained from Table Type A results from summing the number of individuals listed in the final column's cells (row sum cells) above the poverty line. This is, of course, equivalent to the sum of all the

separate cell entries in the eleven center columns above the poverty line. Examination of these separate cell entries in Table Type E will demonstrate the problem with Table Type A, which has aggregated results in these individual cells.

Recall that the original definition of poverty upon which the "average household poverty line" was based was $50 per adult equivalent. Look now at the first starred cell in the second column of Table Type E. All individuals in this cell come from households comprised of one adult equivalent with a household income between fifty and seventy-four dollars. These individuals have been incorrectly identified as poor. They come from households with income over $50 per adult equivalent. In fact, with the additional information on adult equivalents in households, it can be seen that the poverty status of all those individuals classified in the starred cells have been erroneously classified in the poverty esitmate based on Table Type A.

In general, individuals coming from households comprised of fewer adult equivalents than average are incorrectly identified as poor, while individuals coming from households with a greater number of adult equivalents than average are incorrectly identified as non-poor. There is no reason to expect the number of incorrectly identified poor to equal the number of incorrectly identified non-poor and thus cancel the errors. Furthermore, there is no a priori way to discern either the net direction of the error or the magnitude of the error. In the unlikely event that the two errors do cancel out and yield an accurate Headcount, poverty profiles and extensions thereof as discussed in Chapter III will still be incorrect.

A similar problem arises when cross-tabulations of household incom interval by household size (defined here as the number of individuals in the household), i.e. tables of type D, are used to estimate the headcount poverty measures. Here the standard practice is to set a separate poverty line for households of each size group, by multiplying the poverty line per adult equivalent by the average number of adult equivalents in the various household size categories. Still, however, some households

with a higher than average number of females and children will be incorrectly identified as poor, and some households with a lower than average number of females and children will be incorrectly identified as non-poor. The magnitude of error involved, however, will not be as great as that resulting from estimates based on Table Type A.

The misidentification problem is compounded when tabulations of the number of households in household income intervals, table of type B, are used to estimate the Headcount poverty measure. Like estimates based on tables of type A, some households with fewer than the average number of adult equivalents are incorrectly identified as poor, and some households with more than the average number of adult equivalents are incorrectly identified as non-poor. In addition, however, because the cell count is in terms of households instead of individuals, the household count must be translated to an individual headcount. This requires the additional assumption that all households are the same size — the average size of households in the population. This assumption is certain to be invalid.

There are, of course, many other tabulation and cross-tabulation tables published upon which headcount poverty measures could be based. The tables and procedures employed are as numerous as the researchers employing them. Reasonably accurate estimates of the headcount poverty measures can be obtained from tables of type C, E, and F. They remain rough estimates, however, unless by happy coincidence poverty lines coincide with income interval extremes. As for estimates based on table types not discussed here, if averaging assumptions must be employed, beware! The more sweeping the averaging assumption, the more caution is in order.

Chapter III
APPLICATIONS OF POVERTY MEASURES

Once the overall magnitude of the poverty problem has been assessed and the eradication of poverty accepted as a policy goal, the task of designing poverty alleviation programs arises. But which subgroups in the population should be the focus of poverty programs? How can a set of programs be designed that reaches all the poor, without leaking program benefits to the non-poor?[1] What should be the content of programs? What sorts of programs are likely to be effective and which of potential programs are likely to be most effective? Once programs have been implemented, how can their success be monitored? The tools of poverty measurement can be wielded to help answer these questions.

Traditionally, poverty program designs have been guided by two analytical techniques based on the Pure Headcount or Incidence measures of poverty. The first analytical technique, decomposition analysis, delineates the contribution to aggregate poverty of population subgroups, while the second technique, poverty profiling, isolates the household and personal characteristics strongly associated with poverty. The traditional decomposition analysis based on the Headcount and Incidence measures of poverty is discussed in the first section of this chapter. In addition, the nuts and bolts of compiling decomposition analyses are demonstrated, and suggestions for improving the reliability and accuracy of decomposition analyses are made. The second section of this chapter introduces the traditional poverty profile and demonstrates two standard

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[1]The view taken here is admittedly "economic," in which a value is placed on the efficiency with which resources intended to alleviate the poverty of the poor serve that purpose. This requires a minimum "leakage." From a more political point of view, however, some leakage may be politically "optimal" for attracting sufficient support to sustain programs benefiting the poor, who have generally little weight within the political system. A discussion of this question of political optimality is laid out by Norman Uphoff in "Political Considerations in Human Development," in Peter T. Knight, ed., Implementing Programs of Human Development, World Bank Staff Working Paper No. 403, June 1980, pp.3-102. The methodology for assessing the extent of leakages described in the text can be adapted to political optimization as well.

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runs counter to the definition of poverty as the magnitude of absolute biological deprivation, while the latter assumption will always be violated.

Accordingly, when poverty is conceived of as the magnitude of absolute biological deprivation, the distribution of poverty plotted by decomposition analyses based on headcount measures of poverty is distorted and inaccurate, causing funding decisions or any program design decisions utilizing the results to stray from their intended objectives. Fortunately, decomposition analyses can be undertaken with any of the poverty measures which exhibit the property of cardinality (see page 79) and the actual distribution of poverty can be traced as accurately as the poverty measure reflects the preferred concept of poverty.

When poverty is conceived as the absolute magnitude of biological deprivation, the GTF Index with k=2 (hereafter referred to as the GTF2 Index) traces the distribution of poverty most accurately. The decomposition formula for this index and for all the other decomposable poverty measures is given in Column 2 of Figure 3.1. With the provision that each individual in the population is a member of one and only one subgroup, aggregate poverty is the simple or weighted sum for all subgroups of the poverty in each subgroup. To compute the poverty level for each subgroup, split the population into subgroups and directly compute each subgroup's poverty level by substituting n_j (the number of individuals in the subgroup) and q_j (the number of poor individuals in the subgroup) into the formula for n and q respectively. The share of each subgroup in total poverty is then that subgroup's weighted poverty level as a proportion of aggregate poverty.

A comparative example of decomposition analysis is given in Figure 3.2 on page 96. The economy under study is Chapter II's imaginary economy comprised of ten households whose poverty line is specified at ten dollars per adult equivalent. The population has been split into two subgroups, one rural and the other urban, and two separate decomposition analyses have been undertaken -- one based on the Pure

Figure 3.1

Decomposition Formulas for the Poverty Indices

Measure	Decomposition Formula	Weighting Factor	Proportion of Total Poverty Contributed by Subgroup
Pure Headcount, H	$H = \sum_j Hj$	none	Hj/H
Incidence, I	$I = \sum_j Ij(nj/n)$	share of subgroup in total population	[Ij(nj/n)]/I
Aggregate Poverty Gap, PG	$PG = \sum_j PGj$	none	PGj/PG
Average Poverty Gap, APG	$APG = \sum_j APGj(qj/q)$	share of subgroup in poverty population	[APGj(qj/q)]/APG
Poverty Gap Ratio, PGR	$PGR = \sum_j PGRj(qj/q)$	share of subgroup in poverty population	[PGRj(qj/q)]/PGR
Incidence x Poverty Gap Ratio, IPGR	$IPGR = \sum_j IPGRj(nj/n)$	share of subgroup in total population	[IPGRj(nj/n)]/IPGR
Tractability Ratio: Version C, TRC	$TRC = \sum_j TRCj \left(\frac{\sum_i yji}{\sum_j \sum_i yji}\right)$	share of subgroup in total income	$[TRCj(\sum_i yji / \sum_j \sum_i yji)]/TRC$
Kakwani Index (k=0)*, KO	$KOj = \sum_j KOj(nj/n)$	share of subgroup in total population	[KOj(nj/n)]/KO
GTF Index (k=k)**, GTFK	$GTFK = \sum_j GTFKj(nj/n)$	share of subgroup in total population	[GTFKj(nj/n)]/GTFK

*The Kakwani Index with k=0 is in fact the IPGR measure of poverty.

**The GRF Index with k=0 is identical to the Incidence measure of poverty, and the GTF Index with k=1 is identical to the IPGR measure of poverty.

Notation: j = subscript for subgroup. The subscript j runs from 1 to the total number of mutually exclusive subgroups in the exhaustive categorization scheme.
nj = number of individuals in subgroup j.
n = number of individuals in the total population.
qj = number of poor individuals in subgroup j.
q = number of poor individuals in total population.
i = subscript for individuals in a subgroup. The subscript i runs from 1 to the total number of individuals in the subgroup.
yij = income of the ith individual in the jth subgroup.

Headcount measure of poverty and the other based on the GTF2 Index of poverty. For both decompositions, each subgroup's poverty level has been computed by substituting n_j (the number of individuals in the subgroup) and q_j (the number of poor individuals in the subgroup) for n and q respectively, into the poverty measures' formulas. The share of each subgroup in overall poverty is then computed by weighting the subgroup's share appropriately (the weights are 1 for the headcount decomposition, and the subgroup's share in the total population for the GTF2 decomposition) and viewing these weighted shares as a proportion of aggregate poverty.

The Headcount decomposition attributed 58 percent of poverty to urban areas and the remaining 42 percent to rural areas. The GTF2 decomposition results differ dramatically. Here only 44 percent of poverty is attributed to urban areas, while the bulk of poverty, 56 percent, is attributed to rural areas. The discrepancy is reconciled by noticing that while urban areas have a higher proportion of poor individuals than rural areas, the average intensity of poverty is much less in urban areas than it is in rural areas. By ignoring the higher average intensity of poverty among the rural poor, the Headcount decomposition understated the intensity of poverty in rural areas and as a result the rural subgroup's contribution to overall poverty.

Decomposition analyses locate the regions or sectors of an economy where poverty is concentrated. However, poverty may be concentrated in a region or sector simply because most of the population is concentrated in that region or sector. So, one would want to compare percentages such as given in Figure 3.2 with the aggregate sizes of the sectors in question. Furthermore, a large proportion of the population in the region where poverty is concentrated may be non-poor. Targeting programs simply where the absolute number of poor is greatest may end up benefiting more non-poor than poor if the situation of greatest population concentration is quite heterogeneous. If the elimination of poverty is to be achieved at minimum cost, the subgroups in the population which are homogeneously poor must be identified by other means. The

Figure 3.2: Decomposing Poverty: An Illustration

BASIC DATA

Household Identification #	Household Income Per Adult Equivalent	Number of Household Members	Poverty Status	Summary Statistics
Subgroup 1: Rural Households				
1	4.167	2	Poor	
3	7.436	6	Poor	$n_1 = 29$
5	21.426	7	Non-Poor	$q_1 = 8$
9	12.712	8	Non-Poor	
10	10.238	6	Non-Poor	
Subgroup 2: Urban Households				
2	17.647	2	Non-Poor	
4	27.273	3	Non-Poor	$n_2 = 20$
6	8.378	6	Poor	$q_2 = 11$
7	14.000	4	Non-Poor	
8	6.250	5	Poor	
Aggregate				$n = 49$ $q = 19$

HEADCOUNT DECOMPOSITION

Group	Poverty in Group	% Share of Poverty
Rural = Subgroup 1	$H_1 = 6 + 2 = 8$	$H_1/H = 8/19 = 42\%$
Urban = Subgroup 2	$H_2 = 6 + 5 = 11$	$H_2/H = 11/19 = 58\%$
Aggregate	$H = 6 + 2 + 6 + 5 = 19$	100%

GTF2 DECOMPOSITION

Group	Poverty in Group	% Share of Poverty
Rural = Subgroup 1	$GTF2_1 = \frac{1}{29}\left[2\left(\frac{10 \times 4.167}{10}\right)^2 + 6\left(\frac{10 \times 7.436}{10}\right)^2\right] = \frac{1}{29}\left[.6805 + .3944\right] = \underline{.037}$	$\frac{GTF2_1 \times \frac{n_1}{n}}{GTF2} = \frac{.037 \times \left(\frac{29}{44}\right)}{.040} = 56\%$
Urban = Subgroup 2	$GTF2_2 = \frac{1}{20}\left[6\left(\frac{10 \times 8.378}{10}\right)^2 + 5\left(\frac{10 \times 6.25}{10}\right)^2\right] = \frac{1}{20}\left[.1579 + .7031\right] = \underline{.043}$	$\frac{GTF2_2 \times \frac{n_1}{n}}{GTF2} = \frac{.043 \times \left(\frac{20}{49}\right)}{.040} = 44\%$
Aggregate	$GTF2 = \frac{1}{49}\left[.6805 + .3944 + .1539 + .7031\right] = \underline{.040}$	100%

design of effective poverty alleviation programs requires an understanding of the causes of poverty, whereas poverty decomposition by itself offers few clues to the causes of poverty. Poverty profiling, the topic of the next section, is more adept at identifying homogeneous pockets of poverty, and in addition, provides clues to the causes of poverty.

Traditional Poverty Profiles

Statistical poverty profiling is a relatively new technique in the program design tool kit. Poverty profiles seek to identify those socio-economic characteristics which place individuals in poverty's high risk group. These high risk subgroups are the ideal focus of poverty programs since directing programs to these subgroups limits program benefit leakages to the non-poor. As the socio-economic characteristics associated with poverty in a particular country emerge, clues to the causes of poverty are gathered.

Two techniques have commonly been employed to identify the socio-economic characteristics associated with poverty. The first technique compares the proportion of poor households possessing a particular characteristic with the proportion of non-poor households possessing the same characteristic.[2] If the proportion of poor households possessing the characteristic is greater than the proportion of non-poor possessing the characteristic, then the characteristic carries with it a higher-than-average poverty risk. The second technique utilizes the Incidence measure of poverty.[3] When the Incid-

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[2]Examples of studies using this technique include: Albert Fishlow, "Brazilian Size Distribution of Income," American Economic Review, May 1972, pp. 391-402; and W. Kuo, "Income Distribution by Size in Taiwan Area: Changes and Causes," in Income Distribution, Employment, and Economic Development in Southeast and East Asia, Papers and Proceedings of the Seminar Sponsored Jointly by the Japan Economic Research Center and the Council for Asia Manpower Studies, July 1975, pp. 80-153.

[3]Examples of studies using this technique include: O.A. Meesook, "Income Inequality in Thailand, 1962/63 and 1968/69" in Income Distribution, Employment and Economic Development in Southeast and East Asia, ibid., pp. 345-388; and Sudhir Anand, "Aspects of Poverty in Malaysia," Review of Income and Wealth, March 1977, pp. 1-16.

ence of poverty for the subgroup exhibiting a characteristic is higher than the national Incidence of poverty, the characteristic poses a higher-than-average poverty risk. Both of these techniques can be used to assess the magnitude of leakages to non-poor individuals resulting from potential poverty programs directed towards subgroups in the population possessing a particular characteristic. When using the first profiling technique, one needs to examine the proportion of non-poor exhibiting the characteristic. The lower the proportion of non-poor exhibiting the characteristic, the lower the leakages expected to result from poverty programs directed toward individuals with that characteristic. For the second technique, the Incidence of poverty in the subgroup directly assesses the magnitude of expected leakages. The higher the Incidence of poverty within the subgroup, the lower the expected leakages to the non-poor of programs directed to the subgroup.

In discussing the general profiling techniques, households were referred to as the unit of analysis. If the sources and causes of poverty are to be illuminated through the profiling exercise, then the unit of analysis must be the primary economic unit interacting with the wider economy. However, both households and individuals interact with the wider economy as primary economic units. A question arises concerning the most appropriate unit of analysis — households or individuals. In fact, there are sound but different reasons for using each one.

Several factors justify the adoption of households as the unit of analysis for the profiling exercise. Households deal with the wider economy as a primary economic unit in many ways. Many productive resources are held jointly by the household, and the household frequently decides as a unit how these resources as well as members' independent productive resources will be allocated. Some income is earned jointly by the household, particularly in agricultural settings, and this income as well as much of the income earned independently by household members is shared by household members according to allocation criteria tacitly or explicitly agreed upon by household members.

As a result of the widespread productive and distributive processes and decisions shared by the household, many of the causes of poverty can only be identified by viewing the household as a single unit. Furthermore, many of the sources of poverty can best be eliminated through poverty programs which interact with the household as a unit rather than with the separate household members. The household is clearly an appropriate unit of analysis.

An argument for using individuals instead of households as the unit of analysis in poverty profiles concerns the distribution of income within households. Households may not always distribute income within the household according to needs. If households fail to distribute income according to needs, some household members may be poor while other household members are not poor. To the extent that this is true, poverty profiles which use the household as the unit of analysis will not be able to identify accurately subgroups with a high poverty risk, nor will they adequately identify homogeneously poor subgroups.

This argument against using households as the unit of analysis is theoretically sound, but is of little practical significance given data availability and the cost of collecting poverty information on individuals instead of households. Because data on the distribution of income within households are not available, the poverty status of individuals can in practice only be inferred from household poverty status. Thus, household members must either all be classified as poor or all be classified as non-poor.

There are, nonetheless, compelling reasons to choose individuals as the poverty profile's unit of analysis. First, the amount of income available to a household depends not only on the household's production as a unit, but also on the earnings of individual household members in the external labor market. Household members who engage in wage labor are rewarded according to their personal characteristics and not according to their household's characteristics. An understanding of why some households are poor, then, requires an understanding of the characteristics of household members, the

sectors of the economy in which individual members work, and their occupations. This can only be accomplished if individuals are taken as the unit of analysis for the profile.

Most of the available studies have responded to the need for poverty profiles at both the household and individual level by profiling the socio-economic characteristics of poor households and in addition by profiling the socio-economic characteristics of household heads. The household characteristics commonly examined are: number of households members, number of children or dependents, number of earners, dependency rate, the extent of land assets, migratory status, and geographic location. The characteristics of household heads typically examined have focused on the labor market connection and include: education level, labor force status, occupation, sector of employment, age, sex and race. The employment characteristics have generally been studied at the "one digit" level of detail.

In most countries, households have been found to face a high risk of poverty whenever they have:

(1) few earners

(2) many members

(3) many children

(4) high dependency rates

(5) few land assets

(6) rural location

(7) female heads

(8) heads with little education

(9) self-employed or unemployed heads

(10) heads who are farmers or otherwise work in the agricultural sector.

Households with any of these characteristics are likely to face an increased risk of poverty.

The profiling exercise clearly provides a sense of the contexts in which poverty flourishes. In doing so, it offers clues to poverty's causes and potential remedies. For example, the large household size, and high dependency rates associated with an increased poverty risk suggest excessive fecundity as a cause of poverty and a family planning program as a potential remedy for poverty. The small landholdings and rural location associated with an increased poverty risk suggest rural land reform as a potential remedy for poverty. It must, however, be emphasized that these are merely clues to poverty's causes and potential remedies.

Poverty profiles uncover the factors associated with poverty, but they cannot specify the cause and effect mechanism. The large household size and high dependency rates common to poor households might be an effect rather than a cause of poverty. It may be that poor households combat poverty by merging with other households and that if they did not merge, they would be poorer still. It may also be that within the economic context these households operate, large numbers of children improve the household's long-term survival prospects and the bearing of many children is a survival strategy. Should either of these scenarios be the reality, the implementation of family planning programs will fail to remedy poverty.

Similarly, although the immediate cause of rural poverty might be the limited landholdings of some rural households, land reform will only provide a temporary solution to poverty if there are larger forces which will lead to the reconcentration of land assets. The poverty profile's primary value lies in its illumination of the relationships which must be probed to understand the causal mechanisms of poverty.

Figure 3.3 presents an example of the standard techniques of poverty profiling, using Chapter II's illustrative economy of ten households. Two characteristics are examined for their association with poverty -- location of the household by sector and the sex of the household head. Table A of Figure 3.3 shows the household data.

Figure 3.3: Profiling Poverty: An Illustration

TABLE A: Household Data

Household ID Number	Household* Poverty Line	Household Income	Household Poverty Status	Household Location	Sex of Head of Household
1	12	5	poor	rural	female
2	17	30	non-poor	urban	male
3	39	29	poor	rural	male
4	22	60	non-poor	urban	male
5	49	105	non-poor	rural	male
6	37	31	poor	urban	female
7	30	42	non-poor	urban	male
8	32	20	poor	urban	male
9	59	75	non-poor	rural	male
10	42	43	non-poor	rural	male

*The method for computing the household poverty line is explained on page 60 of Chapter II.

TABLE B: Summary Data and Notation

Population Size	Notation	Value	Number of Poor	Notation	Value
Aggregate # Households	n	10	Aggregate # Poor Households	q	4
# Rural Households	n_1	5	# Rural Poor Households	q_1	2
# Urban Households	n_2	5	# Urban Poor Households	q_2	2
# Female Headed Households	n_3	2	# Female Headed Poor Households	q_3	2
# Male Headed Households	n_4	8	# Male Headed Poor Households	q_4	2

TABLE C: Poverty Profile Using Technique I

Characteristic	Percentage Poor	Percentage Non-Poor
Location		
Rural	$q_1/q = 50\%$	$(n_1-q_1)/(n-q) = 50\%$
Urban	$q_2/q = 50\%$	$(n_2-q_2)/(n-q) = 50\%$
Sex of Household Head		
Female	$q_3/q = 50\%$	$(n_3-q_3)/(n-q) = 0\%$
Male	$q_4/q = 50\%$	$(n_4-q_4)/(n-q) = 100\%$

TABLE D: Poverty Profile Using Technique II (Aggregate Incidence Poverty = 40%)

Characteristic	Incidence of Poverty
Location	
Rural	$q_1/n_1 = 40\%$
Urban	$q_2/n_2 = 40\%$
Sex of Household Head	
Female	$q_3/n_3 = 100\%$
Male	$q_4/n_4 = 25\%$

The second and third columns provide the information necessary to calculate household poverty status, while the last two columns list the relevant characteristics by household. Table B of Figure 3.3 summarizes the data necessary to compute the poverty profiles from Table A.

The poverty profile shown in Table C of Figure 3.3 uses the technique of comparing the proportion of poor households having a particular characteristic with the proportion of non-poor households having the characteristic. As can be seen, in this economy neither rural nor urban location carries with it a higher-than-average poverty risk, since the percentage of poor rural households is identical to the percentage of non-poor rural households and the percentage of poor urban households is identical to the percentage of non-poor urban households. Female-headed households, on the other hand, face a high risk of poverty, since the proportion of poor households that are female-headed is much greater than the proportion of non-poor households that are female-headed (50 percent as compared with zero percent). Furthermore, this profile indicates that poverty programs directed to female-headed households would not suffer any leakages of program benefits to the non-poor, since in this economy there are no female-headed non-poor households.

The poverty profile shown as Table D of Figure 3.3 uses the second technique of poverty profiling — comparison of the incidence of poverty within a subgroup with the national incidence of poverty. Although at first glance the results appear different from those obtained in Table C, the conclusions emerging from this poverty profile are the same as those using the first technique. Because the Incidence of poverty among rural and urban households is identical to the national Incidence of poverty, location is shown not to influence a household's poverty risk in this economy. However, the Incidence of poverty among female-headed households is much higher than the national Incidence of poverty, 100 percent as compared to 40 percent, and so households with female heads are shown to face a high poverty risk. Furthermore, because 100 percent

of all female households are poor, poverty programs directed to female-headed households would not experience leakages. It will never matter which technique of poverty profiling is used, the conclusions will be the same for a given economy regardless of the technique used.

Improving Poverty Profiles and Decomposition Analysis

Because statistical poverty profiling is a relatively new technique in the program design tool kit, its power to assist program design is only beginning to be explored. The newest generation of poverty profiles offers increased assistance to poverty program planners. Refinements of the poverty profile and the use of poverty profiles in combination with decomposition analysis are explored in this section.

All of the poverty profiles computed to date, except one, have used fairly general categories for breakdown. For example, the primary employment characteristics -- labor force participation status, occupation, and sector of employment -- are only broken down into four or five subcategories each. As a result, only fairly general notions of the factors affecting poverty are obtained, and when it has been possible to identify adequately homogeneous subgroups, they have only accounted for a very small proportion of aggregate poverty.

The exception to this rule is Sudhir Anand's profile analysis in his book on poverty in Malaysia.[4] Anand extends the profiling technique both by increasing the number of subcategories which each characteristic is broken into, and by cross-classifying characteristics to obtain a multi-dimensional poverty profile. The resulting profile of poverty offers many more specific clues to the causes of poverty and pinpoints larger homogeneous subgroups of poor.

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[4]Sudhir Anand, Inequality and Poverty in Malaysia: Measurement and Decomposition, Oxford University Press, 1982.

Using the household as the unit of analysis, Anand begins with a standard decomposition of poverty based on the Headcount measure. This is, in fact, the same as calculating the "Percentage Poor" Column of Table C in Figure 3.3. For the same categories and category breakdowns (henceforth referred to as variables and variable levels respectively), Anand runs a poverty profile using the Incidence technique. When analyzing the profile, Anand searches for levels of each variable where poverty is virtually universal. Up to this point, the variables and number of variable levels are the standard set used in traditional profiling exercises.[5]

The next step is to look at the decomposition analysis and to search for the levels of each variable which capture a sizable proportion of the poverty problem. The variable levels which capture a sizable proportion of poverty are then broken down into finer subgroups, say, the 'two-digit' level of detail, and the Incidence of poverty calculated for each of the new smaller subgroups. The finer calibration of variables succeeds in identifying a number of additional subgroups, some reasonably large, where the Incidence of poverty is high enough to warrant the direction of poverty programs to the entire subgroup.

As a third step, Anand employs multivariate analysis for the identification of larger, reasonably homogeneously poor subgroups. From the decomposition analysis, levels of variables where the largest proportions of poor are found, are identified and cross-classified. The Incidence of poverty is then calculated for the cross-classifications. For example, Anand finds that within the general category of race, most of the poor are Malay; within the general location stratum, most of the poor live in rural areas, and within the general category of occupation, most of the poor

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[5]The primary characteristics (with the number of breakdown groups within these categories given in brackets) were: Race (4), Location by Stratum (2), Location by State (11), Employment Status of Household Head (5), Occupation of Household Head (8), Sector of Employment of Household Head (9), Education of Household Head (6), Sex of Household Head (2), Age of Household Head (6), Household size (10), Number of Children (6), and Number of Earners (5).

household heads are farmers. The Incidence of poverty could then be calculated among Malay households who live in rural areas and whose heads are farmers. This subgroup is likely to be much more homogeneous with respect to the economic context in which it operates and likely to be more homogeneously poor than subgroups located through one-way classifications. The detail can be further increased by cross-classifying the variables at even finer levels of calibration or by increasing the number of variables which are cross-tabulated.

The poverty measure used by Anand in the decomposition exercises is the Pure Headcount measure of poverty. By using this measure, he ignores the intensity of poverty and accordingly, his maps of the distribution of the poverty problem are somewhat inaccurate, though the details of his mapping itself provides a precision lacking in most analyses. The more refined poverty measures, and specifically the GTF2 Index of poverty, would be more appropriately used in the decomposition role.[6] It does not seem advisable, on the other hand, to use the more refined poverty measures in the profiling aspect of the "decomposition-profile" analysis, since here one is really concerned with whether a household is poor — and thus an intended beneficiary of program benefits — or not, in contrast to being concerned with how poor a household is.

The extensions Anand brings to the poverty profile promise to improve dramatically the cost-effectiveness of poverty programs as a result of their identification of more homogeneously poor subgroups. Anand's extensions also greatly

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[6]Should the household be chosen as the unit of analysis for the "decomposition-profiling" exercise, a somewhat different computational procedure is required to decompose the GTF2 Index than that given in Figure 3.1 of this chapter. Specifically, instead of defining z as the invariant poverty line per adult equivalent, z_i, the household-specific poverty line (z_i = the poverty line per standard consumption unit multiplied by the number of consumption units in the particular household) should be used in conjunction with y_i, which is redefined as the household-specific income, and q, which is redefined as the number of poor households. The value n, however, remains the number of individuals. This conversion of the GTF2 Index for use when households are the unit of analysis assumes that entire households have been classified as poor or non-poor.

sharpen one's sense of the causes of poverty and pinpoint the relationships which need to be studied further if the causes of poverty are to be fully understood in varied economic contexts. Other extensions of the profiling technique could increase the power of poverty profiles still further in these directions. Three such extensions are discussed below.

First, none of the profile analyses have yet examined the connection of household members other than the household heads with the labor market, nor have questions been asked about the secondary jobs of any household members. These secondary attachments to the labor market could well influence whether a household will be poor or non-poor in a given economic context.[7] Second, the range of variables examined could usefully be expanded. In particular, since poverty does seem to be concentrated in rural areas and among agriculturally-based households, a promising variable would be one with levels specifying the different agricultural ecosystems. Both of these sorts of extensions would be most valuable when combined in multivariate profile analyses.

Finally, the technique of profiling could enhance our understanding of the mechanisms through which poverty operates if it were applied to longitudinal analysis. Over time, some households escape poverty while others become trapped by it. (See pages 111-113 for a fuller discussion of this issue and some estimates of the magnitudes of temporary and permanent poverty.) Profiling techniques could be used to determine whether certain characteristics are more common among households which escape poverty than among those who remain poor. The clues provided through these profiles about the avenues of escape from poverty will facilitate the design of poverty programs which enlarge the avenues of escape and thereby increase the flow of households out of poverty. On the side of poverty prevention, profiles identifying the

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[7]Secondary sources of farm income were found to strongly influence the level of rural household welfare in Egypt. See S. Randolph, "Working Paper Number Two: The Order 116 Village Survey," Center for International Studies, Cornell University, October 1978, Mimeo.

characteristics which increase a household's risk of becoming poor would assist in the design of programs aimed at stemming the flow of households into poverty.

Once the subgroups which are a suitable focus of poverty programs have been identified, and programs designed to remedy their poverty, choices will need to be made concerning which of the potential programs should be implemented for a given subgroup, and the order of implementation of programs for different subgroups. An extension of decomposition analysis can assist in these choices. Just how poverty measures can be used in cost-effectiveness analysis is addressed following a brief discussion of ecological issues.

Introducing Ecological Factors

One of the refinements which is appropriate in any rural area where there is much differentiation in terms of environmental capabilities and vulnerabilities, with corresponding differences in the occupations of rural households exploiting the natural resource base, is to make distinctions among households by source of income as well as amount. It is common observation that the poorest households are often forced into the most marginal and unproductive environmental niches and occupations. One of the consequences of their struggle for survival may be to undermine the stability and productivity of the resources they draw on -- whether hillside soils, forests, fishing banks, estuarial areas, arid areas subject to overgrazing and wind erosion, etc. In such instances, a poverty analysis which looks only at income levels and standards of living is short-sighted, since the situation is likely to get worse as the natural resources further diminish, and any development interventions which intensify production may only hasten the decline.

Addressing these issues adequately would require a whole other paper, at least as involved as this one, so here we only highlight the problem. Fortunately, there has been a very useful analysis done in connection with the program of the AID mission in the

Philippines, a poverty profile of the Western Visayas region which differentiates occupational categories of the rural poor as they relate to specific environmental niches, analyzed in terms of five homogeneous agricultural zones (HAZ).[8] In this way, both the distribution and causes of poverty, as well as magnitudes, are assessed in ways that lend themselves to project planning. As other analyses done by the Philippine mission show, many of the conventional approaches to economic development are likely to worsen the situation. Agricultural package programs, forestry projects, mechanization of fishing and other intensification schemes can either upset fragile ecological balances, or displace small producers or artisans, quite likely driving them into even more tenuous efforts in still more vulnerable areas.

Rather than elaborate on these issues or on the corresponding methodologies, readers are referred to the innovative poverty profile noted above done by the AID/Philippines mission. The sources of data used — mostly existing Philippine government data — are described in the study. No very elaborate statistical manipulations were involved, once the appropriately disaggregated data were in hand. The analytical task is mostly one of developing appropriate -- economically and ecologically meaningful--categories and cross-classifying households accordingly.

Choosing Between Alternative Poverty Programs

The funds available for the remedy of poverty are never commensurate with the task. Even if they were, the entire society gains when the cost of poverty reduction is minimized. But what criteria can be used to choose between alternative poverty programs proposed for a particular poverty subgroup or to decide which subgroups should be the beneficiaries of the limited funds available for poverty programs? The tool of decomposition analysis based on poverty measures can assist in these decisions.

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[8]USAID/Manila, Poverty Profile of Western Visayas (Region VI), January 5, 1981.

The usefulness of the tool depends ultimately upon how well the distribution of benefits from proposed poverty program can be predicted.

Choices between alternate poverty programs can be made by comparing the magnitude of reduction of poverty per dollar input through the proposed poverty programs. Different poverty programs will be most effective among different subgroups in the population, and so the reduction in poverty through alternative proposed poverty programs must be evaluated on a subgroup-by-subgroup basis. Accordingly only poverty measures which exhibit the property of cardinality (see p.79) are appropriate for this type of analysis. This means that only those measures whose decompositions are given in Figure 3.1 of this chapter can be used.

Not only does a reduction in the number of individuals confronting poverty decrease the aggregate magnitude of poverty, but overall poverty is also reduced when the intensity of poverty faced by poor households is decreased. Accordingly, measures incorporating the intensity aspect of poverty are clearly preferred. The GTF2 Index, although imperfect, is the best available measure of the absolute magnitude of biological deprivation, and so it is the preferred measure for this purpose.

The first step is to measure the current contribution of a subgroup to the amount of overall poverty. For the GTF2 Index, this is simply the degree of poverty in the subgroup (the GTF2 Index computed for the subgroup) multiplied by the subgroup's share in the total population. The second step is to calculate the expected "post-program" contribution of the subgroup to overall poverty. Considerable conjecture is required here, since the "post-program" distribution of income within the subgroup must be predicted. Generally, the best that can be done is to predict an average expected income increase common to all households in the subgroup. The expected decrease in aggregate poverty due to the different programs is estimated by subtracting the subgroup's post-program contribution to aggregate poverty from the subgroup's current contribution to aggregate poverty. Finally, the relative efficiency of the alternative

programs can be judged by viewing the program-induced change in poverty relative to the projected program costs and comparing the cost-effectiveness of the different programs under consideration. Once the most cost-effective program for each subgroup has been determined, and the best program for each subgroup selected, the cost-effectiveness of programs slated for each subgroup can be compared across subgroups to assist in decisions concerning the order of program implementation.

A slightly different approach could be used when considering poverty programs expected to affect many subgroups simultaneously, but to affect households in different subgroups to different extents. The average income value of program benefits projected to accrue to households in each different subgroup would then be used to estimate the change in each subgroup's contribution to overall poverty, and the change in poverty aggregated over subgroups. The relative efficiency of the alternative broad programs can, as before, be judged by viewing the program-induced change in aggregate poverty relative to the projected program costs and comparing the cost-effectiveness of the different programs under consideration.

The procedures described for evaluating the expected cost-effectiveness of alternative program proposals could be refined in a number of ways to account for differences in programs' time streams of benefits and other relevant differences. However, given the generally low level of accuracy with which program benefits can be predicted, it is unlikely that such refinements are warranted. The prediction of the impact of poverty programs is no substitute for evaluation of actual program impacts. Program evaluation is discussed in the following section.

Longitudinal Poverty Comparisons

Just as a key indicator of a country's well-being is the magnitude of absolute poverty in the country, a key indicator of a country's developmental progress is the extent to which it has eliminated or reduced poverty. The change in poverty over time

among the beneficiaries of a poverty program is similarly a valuable evaluation tool since it is an indicator of the effectiveness of a poverty program. The change in poverty between two time periods is, of course, just the measured level of poverty in the first time period subtracted from the measured level of poverty in the second time period. There are, however, pitfalls which must be avoided if the poverty comparisons are to be legitimate. The first problem relates to changes in the value of currency, the second to changes in population size, and the third to seasonal variations in the magnitude of poverty.

It is essential when using monetary poverty measures to ensure that income bears a constant relationship to biological deprivation in both time periods. When measures which are independent of income scale are used, one need only be concerned that the poverty lines identifying poor individuals are equal in real terms. Accordingly, it is only necessary to adjust the nominal poverty line used in the first period's identification exercise for inflation (or deflation) prior to undertaking poverty identification in the second time period. When poverty measures which are not neutral to income scale (such as the Aggregate Poverty Gap and the Average Poverty Gap) are used in longitudinal comparisons, the adjustment procedures are more complicated. The poverty line used to identify poor individuals in both time periods must be constant in nominal as well as real terms. This means that the second period's entire income distribution will have to be deflated (or inflated) to the first period's income value scale.

A decision needs to be made concerning whether poverty changes should be measured relative to population size or not. It is quite possible for the absolute magnitude of absolute poverty to increase while the per capita magnitude of absolute poverty has decreased if the population increases. The per capita magnitude of absolute poverty is the more appropriate indicator of a country's well being. When this is the perspective chosen, then measures independent of population scale should be used

for the longitudinal comparison. If, on the other hand, interest lies in changes in the absolute magnitude of absolute poverty, then only measures which increase k-fold when the income distribution is replicated k times (such as the Aggregate Poverty Gap and the Pure Headcount measures) can be compared directly. The other measures must be adjusted to reflect population levels in both time periods. For the measures independent of population scale, multiplication by the time period's population size before comparing measured poverty is all that is necessary.

The larger issue of the "transience" of poverty is an important issue, to be assessed if possible in poverty analyses. In part it is a measurement problem where certain measures (or definitions) distinguish (or do not) between those who are "temporarily" in a poverty status and those who are "permanent." In the U.S., there has developed a considerable literature, with different definitions and measures coming up with different magnitudes. Without question there are substantial differences, as seen in the literature review by Evanson.[9]

Depending on how the poverty line is drawn, and how long the period considered is, just a few percent or as many as about 10 percent were "persistently poor" in the U.S., with an additional 20-35 percent "transitorily poor." Of equal or greater interest are the characteristics that distinguish the two groups, as this analysis focuses on factors accounting for persistent poverty. One of the most recent analyses concludes from such a longitudinal analysis that programs to reduce persistent poverty should be directed toward households headed by blacks, women, and those working less than full-time.[10] Research on the temporary and permanent components has yet to begin in less developed countries.

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[9]Elizabeth Evanson, "The Dynamics of Poverty," Focus (Institute for Research on Poverty, University of Wisconsin), Summer, 1981, 9-20.

[10]Martha Hill, "Some Dynamic Aspects of Poverty," in M. Hill, D. Hill and J.N. Morgan, Five Thousand Families -- Patterns of Economic Progress (Institute for Social

Seasonal Influences

One additional pitfall concerns the seasonal comparability of poverty levels. The number of poor households and the intensity of their poverty may vary considerably with the season, particularly in economies where a large proportion of the population is engaged in agriculture. In a study of poverty in Malaysia, Visaria found the estimated incidence of poverty to vary between 30.7 percent and 43. 7 percent depending upon the survey month.[11] If measured changes in poverty are not to be biased by seasonally cyclical influences, either the income distributions upon which poverty measurement is based must be yearly income distributions, or income measurement must have been conducted in the same season for both time periods being compared.

An example of the misleading or contested effect of comparing income or consumption data from different times of the year can be found in Isenman's analysis of poverty in Sri Lanka.[12] He very properly takes issue with E.H. Lee's contention that inequality increased in Sri Lanka between 1963 and 1973. Income distribution data analyzed by others had shown a movement toward greater equality in this period, but two consumption surveys showed a smaller share accruing to the bottom 20 percent. Isenman points out that the 1963 consumption data had been gathered during the national consumption festival, when all households, rich and poor alike, have high

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Research, University of Michigan), Vol. 9, 1981. The classical study in the U.S. based on extensive population survey data but from just two years was by Terence Kelly for the President's Commission on Income Maintenance Programs. Technical Studies, U.S. Government Printing Office, 1970. Using multiple classification analysis (described in the study), coefficients were calculated for the various population characteristics associated with continuing poverty (race, age, sex, etc.). In effect, multiple regression analysis was done using dummy variables for the respective characteristics, with poverty status as the dependent variable.

[11] Pravin Visaria, Incidence of Poverty and the Characteristics of the Poor in Peninsular Malaysia, 1973, World Bank Staff Working Paper No. 460, May 1981, p.42.

[12] Paul Isenman, "Basic Needs: The Case of Sri Lanka," World Development, March 1980, pp.237-258.

consumption, whereas the 1973 data were collected just before the main harvest season when there was the greatest shortage of food, particularly in poorer households. This underscores the need to be sensitive to intra-year variations.

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This monograph has concerned itself with the art and tools of poverty measurement. It has aimed to increase understanding of the uses and limitations of various means of measuring poverty. The value of poverty measurement must ultimately be judged by the extent it increases our understanding of poverty, the cures leading to the reduction and elimination of biological deprivation, and the assessment of our progress towards the eradication of poverty.

Poverty measurement can increase our understanding of poverty by answering three key questions — how serious is poverty? where are the poor? and who are the poor? Poverty measurement also enables us to gauge more adequately our progress toward the elimination of poverty. But poverty measurement does not answer all the relevant questions. To the questions of why are some people poor, and how can we ensure that today's poor participate more fully and equally in the economic benefits of the future, the art and tools of poverty measurement at best hint at answers and suggest relevant issues for further investigation. Clearly, much remains to be done, both analytical and theoretical work by researchers and practical work by planners, policy-makers and the poor themselves.

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