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## Poverty Measurement and Analysis

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# Chapter 1

## Poverty Measurement and Analysis

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## 1.1 Introduction

This chapter offers a primer on poverty, inequality, and vulnerability analysis and a guide to resources on this topic. It is written for decisionmakers who want to define the type of information they need to monitor poverty reduction and make appropriate policy decisions and for the technical experts in charge of the analysis. The chapter takes a broad look at tools for analysis and provides a brief introduction to each topic. It also outlines why certain information is essential in policymaking and how this information can be generated.

The measurement and analysis of poverty, inequality, and vulnerability are crucial for cognitive purposes (to know what the situation is), for analytical purposes (to understand the factors determining this situation), for policymaking purposes (to design interventions best adapted to the issues), and for monitoring and evaluation purposes (to assess the effectiveness of current policies and to determine whether the situation is changing).

Various definitions and concepts exist for well-being, and this chapter focuses on three of its aspects. First, it addresses what is typically referred to as poverty, that is, whether households or individuals possess enough resources or abilities to meet their current needs. This definition is based on a comparison of individuals' income, consumption, education, or other attributes with some defined threshold below which individuals are considered as being poor in that particular attribute. Second, the chapter focuses on inequality in the distribution of income, consumption, or other attributes across the population. This is based on the premise that the relative position of individuals or households in society is an important aspect of their welfare. In addition, the overall level of inequality in a country, region, or population group, in terms of monetary and nonmonetary dimensions, is in itself also an important summary indicator of the level of welfare in that group. (A detailed analysis of inequality is given in chapter 2, "Inequality and Social Welfare.") Finally, the chapter considers the vulnerability dimension of well-being, defined here as the probability or risk today of being in poverty—or falling deeper into poverty—at some point in the future. Vulnerability is a key dimension of well-being, since it affects individuals' behavior (in terms of investment, production patterns, coping strategies) and their perception of their own situation.

Although the concepts, measures, and analytical tools can be applied to numerous dimensions of well-being, such as income, consumption, health, education, and assets ownership, the chapter focuses mainly on income and consumption and refers only casually to the other dimensions. (See technical note A.12 in the appendix at the end of volume 1 for a brief discussion of the multidimensional aspects of extreme poverty and social exclusion.) Other chapters in this book focus on the dimensions of well-being excluded here. It should also be noted that this chapter outlines general principles that should be valid in many settings, but the methods used for analyzing well-being must always be adapted to country circumstances and the availability of data.

The chapter is arranged into several sections so that readers can easily find the information of greatest interest to them. The chapter begins with the essentials of poverty measurement and analysis (section 1.2) before turning to inequality (section 1.3) and vulnerability (section 1.4). In each of these sections, the chapter first defines some of the concepts, indicators, and measures that can be used, and then discusses the various analytical tools available. Section 1.5 presents an overview of different sources and types of data that can be used for the analysis. The section includes a reference table linking the analytical methods described in this chapter with the data sources necessary for their application. Finally, a reference list contains resources and web sites for further study, and the technical notes explore specific issues in greater depth.

## 1.2 Poverty Measurement and Analysis

The section provides an introduction to the concept and measurement of poverty as defined above, that is, poverty being defined as not having enough today in some dimension of well-being. It starts with a discussion of what needs to be done to measure poverty (section 1.2.1) before turning to the analyses that can be carried out using the selected measures (section 1.2.2).

### 1.2.1 Poverty concept and measurement

Three ingredients are required in computing a poverty measure. First, one has to choose the relevant dimension and indicator of well-being. Second, one has to select a poverty line, that is, a threshold below which a given household or individual will be classified as poor. Finally, one has to select a poverty measure to be used for reporting for the population as a whole or for a population subgroup only.

#### ***Defining indicators of well-being***

This section focuses on the monetary dimensions of well-being, income and consumption. In particular, the concentration is on quantitative, objective measures of poverty. Subjective and qualitative measures of income or consumption poverty receive only cursory treatment in this chapter, as do measures related to nonmonetary dimensions (such as health, education, and assets). The typical data source for the indicators and measures presented here is the household survey (see section 1.5.2).

#### **Monetary indicators of poverty**

When estimating poverty using monetary measures, one may have a choice between using income or consumption as the indicator of well-being. Most analysts argue that, provided the information on consumption obtained from a household survey is detailed enough, consumption will be a better indicator of poverty measurement than income for the following reasons:

- ***Consumption is a better outcome indicator than income.*** Actual consumption is more closely related to a person's well-being in the sense defined above, that is, of having enough to meet current basic needs. On the other hand, income is only one of the elements that will allow consumption of goods; others include questions of access and availability.
- ***Consumption may be better measured than income.*** In poor agrarian economies, incomes for rural households may fluctuate during the year, according to the harvest cycle. In urban economies with large informal sectors, income flows also may be erratic. This implies a potential difficulty for households in correctly recalling their income, in which case the information on income derived from the survey may be of low quality. In estimating agrarian income, an additional difficulty in estimating income consists in excluding the inputs purchased for agricultural production from the farmer's revenues. Finally, large shares of income are not monetized if households consume their own production or exchange it for other goods, and it might be difficult to price these. Estimating consumption has its own difficulties, but it may be more reliable if the consumption module in the household survey is well designed.
- ***Consumption may better reflect a household's actual standard of living and ability to meet basic needs.*** Consumption expenditures reflect not only the goods and services that a household can command based on its current income, but also whether that household can access credit markets or household savings at times when current income is low or even negative, perhaps because of seasonal variation, harvest failure, or other circumstances that cause income to fluctuate widely.

One should not be dogmatic, however, about using consumption data for poverty measurement. The use of income as a poverty measurement may have its own advantages. For example, measuring poverty by income allows for a distinction to be made between sources of income. When such distinctions can be made, income may be more easily compared with data from other sources, such as wages, thereby providing a check on the quality of data in the household survey. Finally, for some surveys consumption or expenditure data might not be collected.

When both income and consumption are available, the analyst may want to compute poverty measures with both indicators and compare the results. A simple way of testing the sensitivity of the results to the choice of consumption or income (or to any other choice) entails computing a transition matrix. To construct a transition matrix, divide the population into a number of groups—for example, 10 deciles, each representing 10 percent of the population, from the poorest 10 percent to the richest 10 percent. Each household belongs to only one decile for each indicator, but some households may belong to one decile for income and another for consumption, in which case many households would not

belong to the diagonal of the matrix. Since income and consumption capture different aspects of poverty, the matrix might show that household ranking is affected by the definitions, which can in turn provide information on other aspects of well-being, such as the ability of households to smooth consumption (for an example, see Hentschel and Lanjouw 1996).

Whether one chooses income or consumption, it is typically necessary to aggregate information provided at the household or individual level for many sources of income or consumption in the survey. This aggregation is a complex process. Some adjustments might be necessary to ensure that the aggregation process leads to the desired measures. Most adjustments require access to good information, particularly on prices, which might be unavailable. Complicated adjustments may also limit the understanding some users will have of the poverty analysis and the use they will be able to make of it. Basic guidelines for aggregation are as follows (see technical note A.3 for related issues in the case of Uganda):

- *Adjust for differences in needs between households and intrahousehold inequalities.* Households of different size and composition have different needs, which are not easy to reflect in poverty measures. Two crucial decisions are necessary. First, should adjustments be made to reflect the age of the household members—adults and children—and perhaps their gender? Second, should households of different sizes be treated differently to reflect the fact that larger households may be able to purchase goods in bulk at cheaper rates and to economize on the purchase of some products, especially consumer durables? Box 1.1 discusses the issues related to equivalence scales (adjustments of basic needs for different age groups and by gender) and economies of scale (adjustments for household size). The analyst may want to test for the impact of the choice of equivalence scales and economies of scale on poverty measures and for the validity of conclusions made regarding comparison of these measures between household groups. If feasible, the analyst may also want to investigate the magnitude of intrahousehold inequalities.
- *Adjust for differences in prices across regions and at different points in time.* The cost of basic needs might vary between areas and over time. Expenditure and income data are proxies for the real level of household welfare. Nominal expenditures or incomes need to be made comparable in

#### Box 1.1. Differences in Needs Between Households and Intrahousehold Inequalities

When computing poverty measures, analysts should examine two important assumptions inherent in these calculations: the assumptions about equivalence scales and about economies of scale in consumption.

**Equivalence scales.** The standard means of determining whether a household is poor involves a comparison of its per capita spending or income to a per capita poverty line. The calculation of the poverty line is based on assumptions about the cost of basic needs of men and women of different ages. Most often, the poverty line is computed for a typical family of two adults and three children, with adjustments made for lower needs among children. Analysts can vary such equivalence assumptions in deriving the poverty line to quantify the changes this implies. A “pure” means of measuring poverty would be to assign each household in the dataset its own poverty line that reflects the actual demographic composition of the household. Calculating poverty measures with alternative scales allows us to test the degree to which they affect the results.

**Economies of scale.** When calculating a household’s per capita spending or income by dividing total household resources by the number of people living in the household, the implicit assumption is made that no economies of scale in consumption exist; that is, a two-person household with a consumption of 200 would be equally well off as a one-person household with a consumption of 100. However, larger households generally have an advantage over smaller households because they can benefit from sharing commodities (such as stoves, furniture, housing, and infrastructure) or from purchasing produce in bulk, which might be cheaper. If economies of scale exist in consumption, it will especially affect the relationship between household size and the risk of being poor. There is no single agreed-on method to estimate economies of scale in consumption (see Lanjouw and Ravallion 1995; Deaton 1997). Simple tests can be made to determine the degree of sensitivity of a poverty profile to the assumption about economies of scale (see, for example, World Bank 1999b, p. 69; see also the references on sequential stochastic dominance in technical note A.5).

Another issue relates to intrahousehold inequalities. Measuring intrahousehold allocations and inequality is difficult when the analysis is confined to income and consumption because the available data typically fail to directly capture individual spending and consumption. Intrahousehold inequality has not been systematically measured, but evidence points to its existence. A study by Haddad and Kanbur (1990) suggests that relying on household information only could lead to underestimating inequality and poverty by more than 25 percent. Evidence on differences in health and education outcomes confirms that discrimination within households does exist in certain regions and countries. Capturing intrahousehold inequality and assessing its importance can be achieved partly through qualitative and participatory surveys (section 1.5.3). Another alternative is to analyze nonincome measures of well-being, such as nutrition (anthropometric measures), education, or health, for which measures of individual well-being are possible.

spatial terms by adjusting for different price levels in different parts of the country. The more diverse and vast a country, the more important the spatial adjustments (factors of diversity include the degree of rural–urban integration, remoteness of areas, and so on). Adjustments are sometimes needed over time and within a given survey. For example, the relative degree of inflation could be important during data collection, making it significant whether a household is interviewed at the beginning or the end of the data collection period. Once regional price indexes or inflation data are available, adjustments can be made in two ways: (1) apply spatial and time deflators to the income or consumption of each household and compare them against a single poverty line, or (2) compute one poverty line for each region and date. Technical note A.2 presents an example from Bangladesh.

- **Exclude input and investment expenditure.** Care must be taken not to interpret spending on inputs into household production, including outlays for tools or other inputs like fertilizer, water, or seed in agricultural production, as spending for consumption or as income. If we included spending on inputs in the consumption or income aggregate, we would overstate the actual welfare levels achieved by households.
- **Impute missing price and quantity information.** Not all households provide information on the various income or consumption sources available in a survey. In the case of consumption, when information is lacking on the amounts and prices of the goods known to be consumed by the household, these data may need to be estimated (imputed). One of the most common imputations is for owner-occupied housing, that is, a hypothetical rental value for those households not paying rent. In the case of income, when it is known that household members are working, an imputation may also be needed if no labor earnings are reported.
- **Adjust for rationing.** When constructing a consumption aggregate, even if prices are available for each household in the survey, it is important to keep in mind that markets may be rationed. In other words, there may be restrictions on the quantities available for purchase—for example, for public water or electricity services. In such cases, the price paid by the consumer is lower than his or her marginal utility from consumption, and yet the latter is the yardstick for measuring welfare levels. If possible, the shadow price of the goods consumed should be estimated.
- **Check whether adjustments for underreporting can be made.** In some regions of the world such as Latin America, it is often a common practice to adjust income or consumption for underreporting in the surveys. There is a presumption of underreporting when the mean income (or consumption) in the surveys is below that suggested in the disposable income or private consumption information available in the national accounts aggregates. Underreporting tends to be more severe when poverty measures are based on income instead of consumption. Before adjusting household income or consumption estimates for underreporting, however, it is necessary to carefully examine the reliability of the national accounts data. Furthermore, adjustments generally make very strong assumptions about the structure of underreporting across households (for instance, that each household underdeclares income or consumption to the same degree). Such assumptions must be carefully reviewed.

### **Nonmonetary indicators of poverty**

Although poverty has been traditionally measured in monetary terms, it has many other dimensions. Poverty is associated not only with insufficient income or consumption but also with insufficient outcomes with respect to health, nutrition, and literacy, and with deficient social relations, insecurity, and low self-esteem and powerlessness. In some cases it is feasible to apply the tools that have been developed for monetary poverty measurement to nonmonetary indicators of well-being. Applying the tools of poverty measurement to nonmonetary indicators requires the feasibility of comparing the value of the nonmonetary indicator for a given individual or household to a threshold, or “poverty line,” under which it can be said that the individual or household is not able to meet basic needs.

Various chapters in this book, particularly chapter 18, “Health, Nutrition, and Population,” and chapter 19, “Education,” provide examples of indicators that might be suitable for such analysis. Technical note A.6 also provides examples. The relevant chapters offer more detail, but, in brief, analysts

could focus on important dimensions of capabilities, such as literacy and nutrition. A few examples of dimensions of well-being for which the techniques could be used include the following:

- **Health and nutrition poverty.** The health status of household members can be taken as an important indicator of well-being. Analysts could focus on the nutritional status of children as a measure of outcome as well as the incidence of specific diseases (diarrhea, malaria, respiratory diseases) or life expectancy for different groups within the population. If data on such health outcomes are unavailable, input proxies could be used, such as the number of visits an individual makes to hospitals and health centers, access to specific medical services (such as pre- and post-natal care), or the extent to which children receive vaccinations in time as an input for their future health status.
- **Education poverty.** In the field of education, one could use the level of literacy as the defining characteristic and some level judged to represent the threshold for illiteracy as the poverty line. In countries where literacy is nearly universal, one might opt for specific test scores in schools as the relevant outcome indicator to distinguish among different population groups. Another alternative would be to compare the number of years of education completed to the expected number of years that, in principle, should be completed.
- **Composite indexes of wealth.** An alternative to using a single dimension of poverty could be to combine the information on different aspects of poverty. One possibility is to create a measure that takes into account income, health, assets, and education. It is also possible that information on income is unavailable though other dimensions are covered. Describing the various techniques available goes beyond the scope of this chapter, but technical note A.14 describes the use of Demographic and Health Surveys. It is important to note that a major limitation of composite indexes is the difficulty of defining a poverty line. Analysis by quintile or other percentile remains possible, however, and offers important insights into the profile of poverty.

Other measures can also be based on subjective assessments of one's poverty, or on self-reporting, as presented in box 1.2.

### **Choosing and estimating a poverty line**

Once an aggregate income, consumption, or nonmonetary measure is defined at the household or individual level, the next step is to define one or more poverty lines. Poverty lines are cutoff points separating the poor from the nonpoor. They can be monetary (for example, a certain level of consumption) or nonmonetary (for instance, a certain level of literacy). The use of multiple lines can help in distinguishing among different levels of poverty. There are two main ways of setting poverty lines—relative and absolute.

- **Relative poverty lines.** These are defined in relation to the overall distribution of income or consumption in a country; for example, the poverty line could be set at 50 percent of the country's mean income or consumption.
- **Absolute poverty lines.** These are anchored in some absolute standard of what households should be able to count on in order to meet their basic needs. For monetary measures, these absolute poverty lines are often based on estimates of the cost of basic food needs, that is, the cost of a nutritional basket considered minimal for the health of a typical family, to which a provision is added for nonfood needs. Considering that large parts of the populations of developing countries survive with the bare minimum or less, reliance on an absolute rather than a relative poverty line often proves to be more relevant. Technical note A.2 presents the process for setting a poverty line in Bangladesh. Box 1.3 summarizes alternative methods of setting absolute poverty lines.

Alternative poverty lines are also sometimes used. They can be set on the basis of subjective or self-reported measures of poverty (see box 1.2). Moreover, absolute and relative poverty lines can be combined. This technique allows for taking into account inequality and the relative position of households while recognizing the importance of an absolute minimum below which livelihood is not possible. When deciding on the weight to give to the two lines when combining them, one can use

**Box 1.2. Subjective Measures of Poverty**

Subjective perceptions can be used to measure poverty. Such measures of poverty are based on questions to households about (a) their perceived situation, such as, “Do you have enough?” “Do you consider your income to be very low, rather low, sufficient, rather high, or high?” (b) a judgment about minimum standards and needs, such as, “What is the minimum amount necessary for a family of two adults and three children to get by?” or “What is the minimum necessary for your family?” or (c) poverty rankings in the community, such as “Which groups are most vulnerable in the village?” On the basis of the answers to these questions, poverty lines can be derived. Answers to the second group of questions could provide a line for different types of reference households, and answers to the first group of questions can be compared with actual income to infer the income level that households judge to be sufficient. This income level could then be used as the poverty line.

Subjective measures can be used not only to assess the situation of a particular household but also to set or inform the choice of poverty lines, equivalence scales, economies of scale, and regional cost-of-living differences. It can also be useful to compare subjective and self-reported measures of well-being to objective measures based on observed income and consumption data.

Self-reported measures have important limitations, however. Subjective measures might reproduce existing discrimination or exclusion patterns if these patterns are perceived as normal in the society. This might be the case in discrimination against girls or other particular groups in society. Subjective assessments could then fail to capture discrimination, which should be addressed by public policy. More generally, the observed perceptions of poverty need not provide a good basis to establish priority public actions. This may be the case if policymakers have a different time horizon or a different understanding of the determinants of social welfare from the population providing the subjective measures of poverty. It might also be the case that people perceive the elderly to be those most in need, but that public policy aimed at improving nutrition practices or providing preventive health care would have a higher impact on poverty.

For more information, refer to Goedhart and others (1977). For an application, see Pradhan and Ravallion (2000).

information contained in the consumption or income data and information from qualitative data (if the qualitative data show that people consider a specific good to be a basic need, the elasticity of ownership of that good to income can be used [see Madden 2000]).

The choice of a poverty line is ultimately arbitrary. In order to ensure wide understanding and wide acceptance of a poverty line, it is important that the poverty line chosen resonate with social norms, with the common understanding of what represents a minimum. For example, in some countries it might make sense to use the minimum wage or the value of some existing benefit that is widely known and recognized as representing a minimum. Using qualitative data (see section 1.5.3) could also prove beneficial in deciding what goods would go in the basket of basic needs for use in constructing an absolute poverty line.

**Choosing and estimating poverty measures**

The poverty measure itself is a statistical function that translates the comparison of the indicator of household well-being and the chosen poverty line into one aggregate number for the population as a whole or a population subgroup. Many alternative measures exist, but the three measures described are most commonly used (see technical note A.1 for the formulae used to derive these poverty measures):

- *Incidence of poverty (headcount index)*. This is the share of the population whose income or consumption is below the poverty line, that is, the share of the population that cannot afford to buy a basic basket of goods. An analyst using several poverty lines, say, one for poverty and one

**Box 1.3. Methods of Setting Absolute Poverty Lines**

Different methods have been used in the literature to define absolute poverty lines (see Deaton 1997; Ravallion and Bidani 1994; Ravallion 1994; and Wodon 1997a). The choice of method can greatly affect poverty measures and who is considered poor. It is important to derive poverty lines that provide consistency in welfare measurement in space and time: two people with the same real consumption should be considered either poor or nonpoor. As discussed in Ravallion and Bidani (1994) and Wodon (1997a), the food-energy intake method defines the poverty line by finding the consumption expenditures or income level at which a person’s typical food energy intake is just sufficient to meet a predetermined food-energy requirement. If applied to different regions within the same country, the underlying food consumption pattern of the population group consuming only the necessary nutrient amounts will vary. This method can thus yield differentials in poverty lines in excess of the cost-of-living differential facing the poor. An alternative is the cost of basic needs method, where an explicit bundle of foods typically consumed by the poor is first valued at local prices. To this a specific allowance for nonfood goods, consistent with spending by the poor, is added. However defined, poverty lines will always have a high arbitrary element; for example, the calorie threshold underlying both methods might be assumed to vary with age. Ordinal ranking of welfare—crucial for the poverty profile—is more important than cardinal ranking, with one household above and another below the line. For comparisons over time, however, the stability and consistency of the poverty line need to be ensured.

for extreme poverty, can estimate the incidence of both poverty and extreme poverty. Similarly, for nonmonetary indicators the incidence of poverty measures the share of the population that does not reach the defined threshold (for instance, the percentage of the population with less than three years of education).

- **Depth of poverty (poverty gap).** This provides information regarding how far off households are from the poverty line. This measure captures the mean aggregate income or consumption shortfall relative to the poverty line across the whole population. It is obtained by adding up all the shortfalls of the poor (assuming that the nonpoor have a shortfall of zero) and dividing the total by the population. In other words, it estimates the total resources needed to bring all the poor to the level of the poverty line (divided by the number of individuals in the population). This measure can also be used for nonmonetary indicators, provided that the measure of the distance is meaningful. The poverty gap in education could be the number of years of education needed or required to reach a defined threshold (see technical note A.6 for a discussion of this and other examples of the application of poverty measurement tools to nonmonetary indicators). In some cases, though, the measure does not make sense or is not quantifiable (for example, when indicators are binary, such as literacy, in which case only the concept of the headcount can be used). Note also that, as discussed in technical note A.1, the poverty gap can be used as a measure of the minimum amount of resources necessary to eradicate poverty, that is, the amount that one would have to transfer to the poor under perfect targeting (that is, each poor person getting exactly the amount he/she needs to be lifted out of poverty) to bring them all out of poverty.
- **Poverty severity (squared poverty gap).** This takes into account not only the distance separating the poor from the poverty line (the poverty gap), but also the inequality among the poor. That is, a higher weight is placed on those households further away from the poverty line. As for the poverty gap measure, limitations apply for some of the nonmonetary indicators.

All of these measures can be calculated on a household basis, that is, by assessing the share of households that are below the poverty line in the case of the headcount index. However, it might be better to estimate the measures on a population basis—in terms of individuals—in order to take into account the number of individuals within each household.

The measures of depth and severity of poverty are important complements of the incidence of poverty. It might be the case that some groups have a high poverty incidence but low poverty gap (when numerous members are just below the poverty line), while other groups have a low poverty incidence but a high poverty gap for those who are poor (when relatively few members are below the poverty line but with extremely low levels of consumption or income). Table 1.1 provides an example from Madagascar. According to the headcount, unskilled workers show the third highest poverty rate, while this group ranks fifth in poverty severity. Comparing them with the herders shows that they have a higher risk of being in poverty but that their poverty tends to be less severe or deep. The types of interventions needed to help the two groups are therefore likely to be different.

Depth and severity might be particularly important for the evaluation of programs and policies. A program might be very effective at reducing the number of poor (the incidence of poverty) but might do so only by lifting those who were closest to the poverty line out of poverty (low impact on the poverty gap). Other interventions might better address the situation of the very poor but have a low impact on the overall incidence (if it brings the very poor closer to the poverty line but not above it).

This section has discussed how to define income and consumption as well as the cutoff point of the poverty line and how to use this information for poverty measurement. Some basic questions that must be asked by the poverty analysts in the process of producing a poverty profile or trend are outlined box 1.4 below.

## 1.2.2 Poverty analysis

Once the indicator, line, and measures have been chosen, the various characteristics of the different poverty groups (poor and nonpoor) can be compared to shed light on correlates of poverty. One can also

**Table 1.1. Poverty Groups by Socioeconomic Groups (Madagascar 1994)**

<b>Socioeconomic group</b>	<b>Headcount</b>	<b>Rank</b>	<b>Poverty gap</b>	<b>Rank</b>	<b>Poverty severity</b>	<b>Rank</b>
Small farmers	81.6	(1)	41.0	(1)	24.6	(1)
Large farmers	77.0	(2)	34.6	(2)	19.0	(2)
Unskilled workers	62.7	(3)	25.5	(4)	14.0	(5)
Herders/fishermen	61.4	(4)	27.9	(3)	16.1	(3)
Retirees/handicapped	50.6	(5)	23.6	(5)	14.1	(4)

Source: World Bank (1996b, p. 21).

compare poverty measures for groups of households with different characteristics or over time. Tools to analyze the determinants of poverty and poverty changes are presented in the section below headed “The correlates of poverty.”

When comparing, it is important to test whether the observed differences in characteristics among different poverty groups, or the differences in poverty incidence among specific groups or over time, are statistically significant. All measures from household surveys are only estimates of “true” poverty because they are derived from a population sample, not a population census. All estimates therefore carry margins of error that must be computed in order to provide an indication of the precision of the estimates. Moreover, since poverty measures are sensitive to the assumptions made by analysts in the estimation (see box 1.1), it is important to test whether the poverty rankings obtained among household groups or periods of time are robust to these assumptions.

### **Characteristics of individuals and households in different poverty groups**

A first step in constructing a poverty profile is to analyze the characteristics of the different socioeconomic income or consumption groups in the country. This allows for a better understanding of who are the poor and what are the differences between the poor and the nonpoor. The profile may include information on the identity of the poor in addition to their locales, habits, occupations, means of access to and use of government services, and their living standards in regard to health, education, nutrition, and housing, among other topics. It is important that the data gathered in the profile to describe the living conditions of the poor be placed in the political, cultural, and social context of each country. In other words, qualitative and historical information as well as institutional analysis are necessary to complement and give meaning to the profile.

When doing such analysis, it might be useful to separate the tabulations for those groups that are expected to be very different. In table 1.2, we present information on households’ education,

#### **Box 1.4. Key Questions to Ask When Measuring Poverty**

##### **Income or consumption aggregate:**

- Which module of the household survey is better developed, income or consumption?
- Does the household survey include the necessary price data for spatial and intertemporal deflation of the welfare aggregate? If not, are there other price data available that can be used? Does this price information truly reflect price variations by, for instance, agroclimatic zone?
- Are certain markets rationed? Do certain consumption or income components have to be shadow-priced?
- Which consumption or income series is incomplete for households? What information must be imputed?

##### **Poverty line:**

- Does a poverty line already exist in the country? If so, is it well accepted?
- If a new poverty line is derived, should international standards of setting the poverty line be followed?
- Can a basic nutritional basket underlying poverty line computations be derived from the existing household survey?

##### **Poverty measure:**

- Are poverty comparisons by region stable across different measures, such as headcount, gap, and severity?
- How do estimated poverty measures change with small alterations in the poverty line (sensitivity test)?
- Which poverty measure, and at which aggregation level, is most used in a country?
- Is it important for the national debate on poverty to focus more on distribution-sensitive forms of income-poverty measurement?

**Table 1.2. Some Characteristics of the Poor in Ecuador (1994)**

	<i>Urban</i>		<i>Rural</i>		<i>Total</i>	
	<i>Poor</i>	<i>Nonpoor</i>	<i>Poor</i>	<i>Nonpoor</i>	<i>Poor</i>	<i>Nonpoor</i>
<b>Education</b>						
Education of head (years)	5.2	9.1	3.2	4.7	4.0	7.5
<b>Employment</b>						
Informal sector	54.6	44.1	27.9	35.8	39.2	41.7
Regulated sector	15.5	35.3	3.4	9.9	8.6	26.7
<b>Access to basic services</b>						
Sewerage connection (%)	57.3	83.4	12.4	28.2	29.6	63.8
Electricity supply (%)	97.8	99.5	62.0	75.8	75.8	91.1
Water from public net (%)	61.2	78.8	18.3	23.0	34.8	59.3
Waste collection (%)	59.7	76.7	1.1	5.6	23.5	51.5

Source: World Bank (1996a).

employment, and access to services in Ecuador by urban and rural areas. The table shows that the poor have, on average, lower education levels and less access to services. However, on average, the same proportion of households is engaged in the informal sector among the poor and the nonpoor (although patterns differ in urban and rural areas). When looking at urban and rural areas separately, it appears that access to services such as electricity is very similar for the poor and nonpoor in urban areas. Thus, it can be concluded that this dimension is not a correlate of urban poverty. When carrying out such an analysis, one should remember that we are looking at averages only, which can hide very large variations; for instance, some of the poor might be highly educated, while some of the nonpoor may be minimally educated.

The analysis can also be carried out by quintiles or deciles of the selected indicator rather than simply by poor and nonpoor. This is particularly relevant in the case of those indicators for which a poverty line cannot be drawn. Table 1.3 presents some results from Senegal for a composite welfare indicator derived from a Demographic and Health Survey (see technical note A.14). The table distinguishes among five wealth quintiles of the population and reveals that those in the lower quintiles have higher mortality, higher fertility, and have less likelihood of receiving care from trained persons when giving birth. The table also reports the ratio of the poorest to the richest, a measure allowing an appreciation of the size of the gap between the two groups (this measure of inequality is similar to the decile dispersion ratio presented later in section 1.3.1).

### **Poverty comparisons between groups and over time**

#### **Poverty comparisons between groups**

The poverty profile focuses on presenting the poverty characteristics of various household groups. The choice of the types of groups will be driven by some ex ante knowledge of important dimensions (where qualitative data can help) or by dimensions that are relevant for policies. For instance, geographic location, age, or gender might be dimensions along which policies can be developed. Another dimension that can provide useful insights for policy elaboration is the link between employment and poverty. This

**Table 1.3. Socioeconomic Differences in Health (Senegal 1997)**

<i>Indicator</i>	<i>Quintiles</i>					<i>Population Poorest/Richest</i>	
	<i>Poorest</i>	<i>Second</i>	<i>Middle</i>	<i>Fourth</i>	<i>Richest</i>	<i>Average</i>	<i>Ratio</i>
Infant mortality rate	84.5	81.6	69.6	58.8	44.9	69.4	1.9
Total fertility rate	7.4	6.8	6.2	5.2	3.6	5.7	2.1
Deliveries attended by medically trained person (%)	20.3	25.4	45.3	69.3	86.2	46.5	0.2

Source: Gwatkin and others (2000), based on the Demographic and Health Survey of 1997.

could indicate which sectoral pattern of growth would have the highest impact on poverty (see section 3.3 for techniques to simulate changes in poverty that result from growth in various sectors).

The three main ways to present a poverty profile follow.

- **Poverty measures according to household groups.** The first and most common method of presenting poverty data is to give poverty measures for various household groups. For example, table 1.4 shows that, in Malawi, households without education have higher poverty incidence than those with higher levels of education. Table 1.5 presents another example that shows households living in Barisal in Bangladesh had a poverty incidence of 60 percent in 1996 as compared to 53 percent for the country as a whole.
- **Contribution of various household groups to poverty measures.** An alternative way to present a poverty profile is to assess how various household groups contribute to the overall poverty of the country. The contribution of a household group to overall poverty is a function of that group's population share and the incidence of poverty in the group. Table 1.5 shows that the population living in the Barisal division represents 7 percent of the population, and the headcount index is 60 percent, against a national average of 53 percent. Therefore, the share of all the poor living there is 8 percent ( $8 = 7 * 60/53$ ). In the case of Madagascar, the table shows that 14 percent of the country's poor live in urban areas ( $14 = 21 * 47/70$ ).
- **Relative risk.** Poverty measures can be translated into relative risks of being poor for different household groups. These risks estimate the probability that the members of a given group will be poor in relation to the corresponding probability for all other households of society (all those not belonging to the group). In Madagascar, the table indicates that urban households are 39 percent less likely to be poor than nonurban (that is, rural) households ( $0.39 = 1 - 47/77$ ), while rural households are 63 percent more likely to be poor than nonrural (that is, urban) households ( $0.63 = 1 - 77/47$ ). Similar calculations could be carried out relative to the entire population or to a select group.

The extent to which a detailed poverty profile can be constructed depends on the type of data available. Multitopic surveys are ideal for developing detailed poverty profiles, but many other types of surveys can be used as well. For example, Demographic and Health Surveys can be used to relate household characteristics with household wealth (see technical note A.14). Monitoring surveys can also

**Table 1.4. Poverty Incidence Among Various Household Groups in Malawi (1997/98)**

<i>Characteristics of household or household head</i>	<i>Poverty incidence</i>	<i>Poverty depth</i>	<i>Poverty severity</i>
Southern region	68.1	0.254	0.134
Central region	62.8	0.212	0.105
Northern region	62.5	0.231	0.111
Rural	66.5	0.239	0.122
Urban	54.9	0.191	0.097
Male	57.9	0.22	0.11
Female	65.6	0.28	0.15
Under 20	40.7	0.17	0.09
20 to 29	49.6	0.18	0.08
30 to 44	61.2	0.25	0.13
45 to 64	61.5	0.25	0.13
65 and older	66.9	0.25	0.12
No education	70.6	0.31	0.17
Less than standard IV	63.2	0.25	0.13
Standard IV	58.1	0.22	0.11
Primary school	47.2	0.15	0.06
Secondary school	29.8	0.08	0.03
University	15.5	0.07	0.04

Source: National Economic Council, Malawi (2000).

**Table 1.5. Geographic Poverty Profile for Bangladesh (1995–96) and Madagascar (1994)**

<b>Bangladesh (1996)</b>	<b>Barisal</b>	<b>Chittagong</b>	<b>Dhaka</b>	<b>Khulna</b>	<b>Rajshahi</b>	<b>National</b>
Population share	7	26	31	12	24	100
Headcount index	60	45	52	52	62	53
Share of all poor	8	22	30	12	28	100
Relative risk	+14%	-20%	-3%	-3%	+24%	
<b>Madagascar (1994)</b>	<b>Total urban</b>	<b>Capital city</b>	<b>Major urban</b>	<b>Other urban</b>	<b>Rural</b>	<b>National</b>
Population share	21	10	5	7	79	100
Headcount index	47	41	43	59	77	70
Share of all poor	14	6	3	6	86	100
Relative risk	-39%	-44%	-41%	-17%	+63%	

Source: From various resources developed by authors.

be used to establish links between income or wealth and variables such as school enrollment rates, access to basic services, and satisfaction with service delivery.

While certain variables like education, health, and access to service will almost always be part of a poverty profile, the relevance of many variables will depend on country circumstances and on the data source available. The profile should, if possible, identify the major production and consumption characteristics of the poor: whether the rural poor farm their land, function as agricultural wage laborers, or work in various nonfarm activities, or whether the urban poor work as wage employees or as microentrepreneurs in the informal sector. Data on asset holdings by the poor are also relevant, as are their production technologies, use of inputs, and access to social and infrastructure services. Information on the composition of poor people's consumption, including their access to public goods, is also valuable. Cross-links to other forms of poverty, such as lack of education, health care, and security, can also be established. Box 1.5 summarizes key questions to ask when constructing a poverty profile.

If the surveys were designed to be representative of relatively small geographic areas (the district level, for example), the various measures could also be presented graphically on a poverty map. More than one poverty measure could be presented on the map (child malnutrition incidence and income poverty incidence could be presented simultaneously). A particularly useful combination would be to include indicators of outcomes and indicators of access to services to study the correlation and to guide the allocation of resources among local administrative units.

If the survey's design is not representative at a level that is sufficiently small—for instance, at a level larger than the administrative area covered by a ministry (some surveys are representative at the regional level only, while ministries operate at the district level), census and survey data can then be combined to predict poverty measures at the municipal level, using a model for the determinants of poverty estimated with the household survey and comprising variables in the census itself (see technical note A.4).

Poverty comparisons across countries are difficult for several reasons. The best option would be to use a fixed poverty line, since households would then uniformly be labeled “poor” if they consume less than a fixed bundle of goods. However, both absolute and relative prices of different goods and services differ across countries. In order to allow comparison, one can develop conversion factors, which reflect how many goods the local currency buys within each country. On the basis of information on prices, gross domestic product (GDP) structure, population figures, and exchange rates, a set of purchasing power parity (PPP) conversion factors have been developed to allow such comparisons. However, even once PPP factors are used (and assuming they reflect reality), cross-country comparisons still rely on the assumption that consumption and income are measured homogeneously across countries. Significant distortions can be introduced if survey instruments differ from each other or purchasing power parities do not reflect the actual price differentials between a basket of goods important to the poor. Comparing national poverty rates based on nationally derived poverty lines—those anchored in nationally specific consumption patterns and food requirements—is a feasible alternative only to the extent that the

**Box 1.5. Key Questions to Ask When Preparing a Poverty Profile**

- How robust is a ranking of poverty by area or group to variations in the poverty line?
- How is income poverty correlated with gender, age, urban and rural, racial, or ethnic characteristics?
- What are the main sources of income for the poor?
- On what sectors do the poor depend for their livelihood?
- What products or services—tradables and nontradables—do the poor sell?
- To what extent are the rural poor engaged in agriculture? In off-farm employment?
- How large a factor is unemployment? Underemployment?
- Which are the important goods in the consumption basket of the poor? How high is the share of tradables and nontradables?
- How is income poverty linked with malnutrition or educational outcomes?
- What are fertility characteristics of the poor?
- To what public services do the poor have access? What is the quality of the service?
- How important are private costs of education and health for the poor?
- Can the poor access formal or informal credit markets?
- What assets—land, housing, and financial—do the poor own? Do property rights over such assets exist?
- How secure is their access to, and tenure over, natural resources?
- Is environmental degradation linked to poverty?
- How variable are the incomes of the poor? What risks do they face?
- Does poverty vary widely between different areas in the country?
- Are the most populated areas also the areas where most of the poor live?
- Are certain population groups in society at a higher risk of being poor than others?
- If so, can those groups be defined by age, gender, ethnicity, place of residence, occupation, and education?

Source: Based in part on World Bank (1992).

poverty lines estimated in the various countries represent similar welfare levels (see [http:// www.worldbank.org/data/ppp/](http://www.worldbank.org/data/ppp/) and <http://pwt.econ.upenn.edu/>).

**Poverty comparisons over time**

If consecutive rounds of a household survey, several separate surveys, or a survey with a panel component are available, changes in income poverty over time can be assessed (see section 1.5.2 for definitions). (A survey with a panel component is a survey with consecutive rounds during which the same households or individuals are interviewed at different points in time.) This requires poverty measures comparable with and reflective of differences over time in the cost of living across regions. The standard method for preparing comparisons over time consists of converting nominal income or consumption data from different surveys and regions into real income and consumption by deflating the indicators in space and time. A constant poverty line can then be applied to these real values to infer poverty measures. Ideally, to obtain robust poverty comparisons over time, one would want to use surveys with similar sampling frame and methods, with corrections for price differences, and with similar definitions of consumption or income. In practice, however, differences exist in some of these dimensions. This does not imply that no comparison can be made; it simply means that the analyst will need to:

- correct for major differences in the sampling frame and sampling method for the different surveys or the different rounds of a panel survey;
- use regional and temporal price indexes to ensure a similar definition of the poverty line over time and across regions; and
- adjust the definition of consumption or income aggregates over time to ensure a similar definition is used. Changes in definitions, particularly in the degree to which home production is included in the definition, can lead to important distortions of poverty measurement. Technical note A.3 presents an example of the types of adjustments that can be made.

Box 1.6 highlights key questions to be considered before proceeding with comparisons over time.

When several rounds of a survey are available, the analyst can investigate changes in the regional distribution of poverty or in the major characteristics of the poor, such as ethnicity, gender, age, urban and rural location, employment, access to social programs and basic services, and so forth. Although the various population groups identified in the first period of time should clearly form the basis of the analysis over time, it is also important to investigate whether or not “new” groups of poor people have appeared. This is particularly relevant for countries that undergo rapid changes linked to such factors as economic reforms, conflicts, natural disasters, and epidemics such as HIV/AIDS. For example, figure 1.1 compares the headcount indexes of poverty by sector of employment in Burkina Faso in 1994 and 1998. The incidence of poverty declined for those employed in export agriculture and for households without working members, and it increased for all other categories. These types of results can provide insights into the stability of poverty characteristics and the relevance of various policies, including the use of targeting devices.

One can also look at changes in the characteristics of different poverty groups (along the lines of tables 1.2 and 1.3). For example, the distribution of access to services in the base year can be compared with the distribution of services in the second year. The patterns can then be compared to uncover whether changes made in the supply of the services have been pro-poor. In Ghana, as shown in figure 1.2, while the nonpoor saw their access to services increase over time (those with access to electricity increased from 73 to 85 percent), the situation of the very poor and poor did not improve over the period. In some cases, it even worsened. This information, and further disaggregation by locality, can help improve the provision of services.

The concept of relative poverty risk introduced above can also be applied to the analysis of changes in poverty over time using repeated cross-section surveys. The objective is to examine whether the relative poverty risk of specific population groups increases or decreases over time. Table 1.6 compares the relative poverty risk of various groups in Peru in 1994 and 1997. It shows, for example, that the poverty risks of households of seven persons or more increased over time (from 71 percent to 106 percent), while that of households where the spouse of the head is working diminished (from -11 percent to -21 percent).

It is also possible to decompose a national change in poverty into the effects of changes in poverty within groups or among groups or sectors. This allows the analyst to assess whether poverty has changed because poverty within certain groups has changed or because people have moved to more affluent or poorer groups. More specifically, the national change in poverty is decomposed into intrasectoral effects (changes in poverty within sectors), intersectoral effects (changes in population shares across sectors), and interaction effects (correlation between sectoral gains and population shifts—

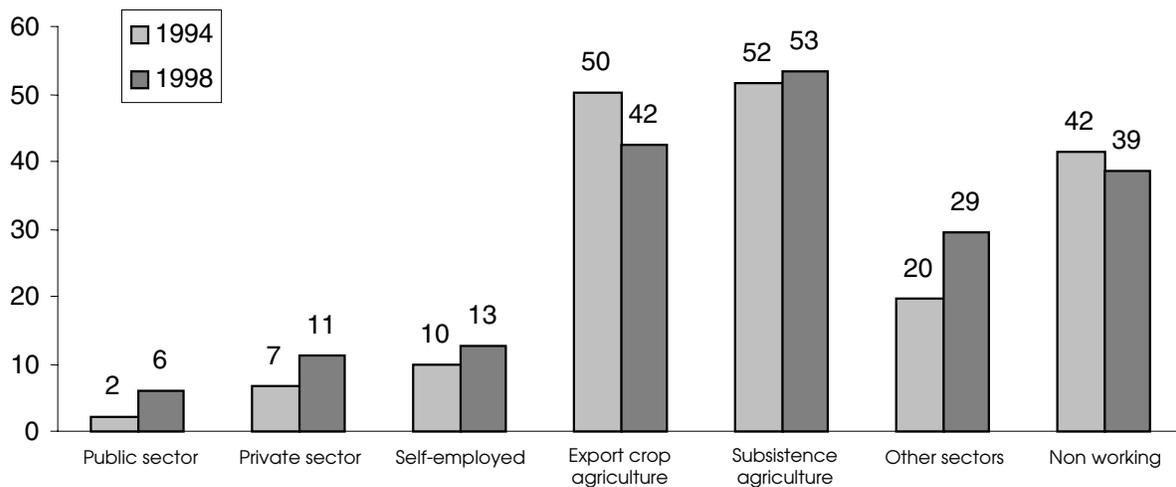
#### **Box 1.6. Key Questions to Ask When Comparing Poverty Measures Over Time**

When comparing poverty over time, the indicators of well-being should be identical to avoid distortions. The distortions can result from changes in the questionnaire.

- Are the number of items covered in the surveys the same? For example, the indicator in the second survey might include expenditures and auto-consumption of a specific food item that was not included in the first survey round. In this case households with the same true consumption in the two periods will appear to have higher measured consumption in the second period. If the poverty line is fixed, the computations will report a reduction in poverty even though there may not have been any real improvement.
- Is the level of detail for specific items the same? This is especially important when prices for different types of the same item are likely to be different; for example, when only one type of flour is subsidized or when some goods are available only in urban areas.
- Are questions phrased in an identical way? Different phrasing can influence the level and structure of responses.
- Is the recall period the same? It has been shown that the accuracy of reporting varies with the length of the recall period.
- Is the method used for estimating specific items identical across surveys? Differences might arise, for example, when consumption from self-production is given either in monetary terms or by quantities.

Since the distortions can be substantial, the questionnaires and definitions should be carefully examined. When indicators are not comparable, specific approaches can still permit poverty comparisons. These approaches may involve assumptions that the consumption measures are monotonically increasing in total expenditure, that relative prices do not change dramatically over time, and that the data contain no measurement errors. Then robust poverty comparisons can be made by using the headcount measure and a poverty line based on the cost of basic needs method (Lanjouw and Lanjouw 1997).

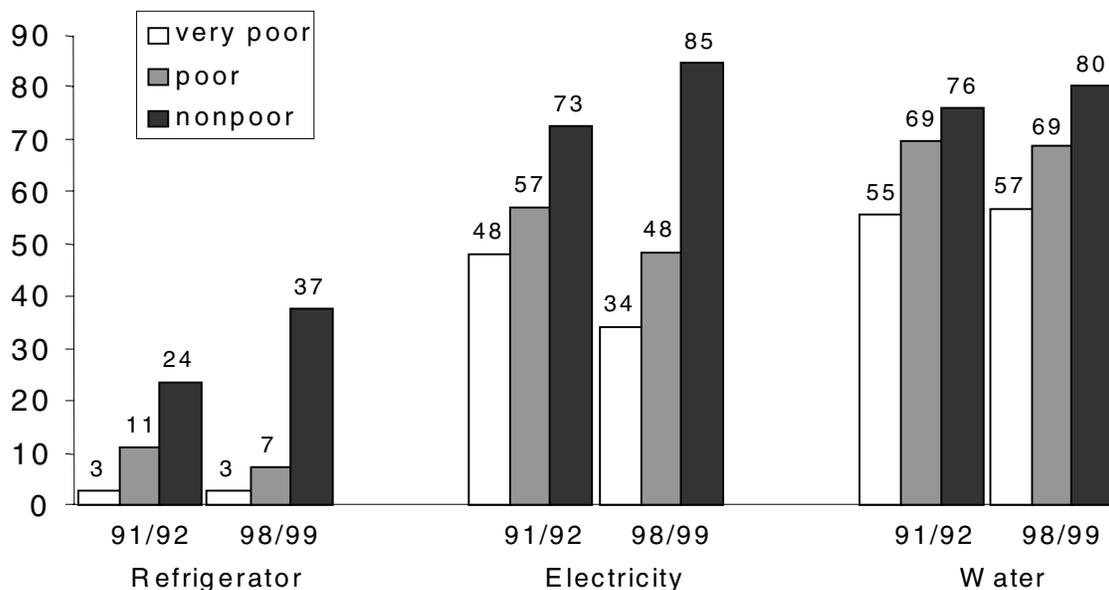
**Figure 1.1. Poverty Incidence Across Sectors of Employment (Burkina Faso), 1994–98**



Source: Institut National de la Statistique et de la Démographie, Enquête Prioritaire (1999).

depending on whether or not people tend to move to sectors where poverty is falling). This poverty decomposition for Uganda shows that 54 percent of the total change in poverty is the result of poverty reduction in the cash crop sector alone (table 1.7). Interaction effects are small but positive, showing that those who moved tended to enter sectors where poverty was falling faster. Population shifts between sectors explain only 2 percent of total change in poverty, suggesting the relative immobility of the workforce in terms of employment sectors. This might reveal barriers to entry into some sectors. Either such barriers would need to be removed if the poor are to benefit from growth in the more promising sectors, or interventions would have to focus more on generating growth in the sectors where the poor work (see technical note A.1 for technical details).

**Figure 1.2. Percentage of Households, by Poverty Group, with a Refrigerator, Access to Electricity, and Access to Water (Ghana 1991/92–1998/99)**



Note: Access to water denotes access to water from private pipe, neighbor/private source, or public pipe.  
Source: Ghana Statistical Service (2000).

**Table 1.6. Poverty Risks for Selected Groups of Households  
(Peru 1994 and 1997) (percent)**

<i>Household characteristic</i>	<i>1994</i>	<i>1997</i>
Households using house for business purposes	-28	-29
Rural households with at least one member in off-farm employment	-24	-23
Households with head's spouse working*	-11	-21
Households without water or sanitation	+54	+50
Households without electricity	+63	+69
Households with head having less than a secondary education	+73	+72
Households of seven persons or more	+71	+106

\*Engaged in remunerated work for at least seven days before the survey was conducted.

Source: World Bank (1999b, p. 25).

### **The correlates of poverty**

Poverty and poverty changes are affected by both microeconomic and macroeconomic variables. Within a microeconomic context, the simplest method of analyzing the correlates of poverty is to use regression analysis to see the effect on poverty of a specific household or individual characteristic while holding constant all other characteristics, which is the focus of this section. Obviously, the overall economic and social development of a country also will be an important determinant of poverty—whether jobs are created through economic growth, in which sectors such growth occurs, and whether the fruits of growth are spread equally or benefit certain groups in society more than others. Section 1.3.3. explores simple models for assessing the impact of growth and inequality on poverty.

**Table 1.7. Sectoral Decomposition of Changes in Poverty (Uganda 1992/93–1995/96)**

<i>Sector</i>	<i>Poverty incidence (headcount)</i>			<i>Population share</i>		<i>Change (percentage point)</i>	<i>Contribution to change in total poverty incidence (percentage)</i>
	<i>1992/93</i>	<i>1995/96</i>	<i>Change (percentage point)</i>	<i>1992/93</i>	<i>1995/96</i>		
Food crop	64	62	-2	47	44	-3	10
Cash crop	60	44	-16	23	27	3	54
Noncrop agriculture	53	40	-13	3	2	-1	5
Mining	32	74	43	0	0	0	-1
Manufacturing	45	27	-17	4	3	0	9
Public utilities	34	11	-23	0	0	0	0
Construction	38	35	-4	1	1	0	1
Trade	26	19	-7	7	7	0	6
Hotels	30	20	-11	1	1	1	1
Transport/communication	32	15	-17	2	2	0	4
Government services	26	29	3	2	2	1	-1
Other services	35	28	-7	7	6	-1	7
Not working	60	63	3	4	5	1	-2
<i>National total</i>	56	49	-7	100	100	0	
<i>Total intrasectoral</i>							94
<i>Total intersectoral</i>							2
<i>Total interaction</i>							4

Source: Appleton (1999).

Analysis of correlates of poverty can be carried out if a multitopic household survey is available, using multivariate income and consumption regressions (see technical note A.8). In these regressions, the logarithm of consumption or income (possibly divided by the poverty line) is typically used as the left-hand variable. Right-hand explanatory variables span a large array of possible poverty correlates, such as education of different household members, number of income earners, employment characteristics, household composition and size, and geographic location. Special care must be taken when including variables that themselves are likely a function of income or consumption availability—for example, access to basic services. The regressions will return results only for the degree of association or correlation, not for causal relationships.

Before proceeding, it is important at this stage to note that numerous correlates or determinants of poverty are not quantifiable. For some other variables, one might only be able to use a proxy, which might not fully reflect the underlying dimensions. The method used here is able to take into account only those dimensions that are quantifiable or for which a proxy is available. It is also important that the various coefficients obtained from a regression will have different degrees of significance.

These multivariate regressions will estimate the partial correlation coefficient between income or consumption per capita and the included “explanatory” variables while holding all other impacts constant. For example, the results could tell us how strongly an additional year of education for the household head or his spouse is associated with a change in income or consumption per capita while holding gender, employment, age, location, and all other possible influences constant. The results can tell us, then, much more than the simple relative poverty risks discussed in the previous section, since high relative poverty risk of a specific population group could indeed be attributable to individual characteristics, such as education, rather than to a group characteristic.

Table 1.8 shows an example of such a regression in Côte d’Ivoire. It indicates that education plays a different role in urban and rural areas (where it does not seem to significantly influence consumption), as do different types of assets. In rural areas, infrastructure has substantial predictive power—households located in villages that are nearer to both paved roads and public markets are better off, as are households located in areas with higher wage levels. The results pose further questions that could be addressed in putting together a poverty reduction strategy—questions about the quality of education in rural areas and the importance of rural infrastructure in helping families out of poverty.

The information obtained from multivariate regression can be used to construct easy-to-use software that permits simulations of the impact of changes in household characteristics on the expected per capita income of a household and its probability of being poor or extremely poor. Technical note A.8 details an example of such software.

Several variations of these multivariate income regressions can be used to examine the correlates of the income of the poor. Poverty analysis focuses on correlates of income and expenditure at the lower end of the distribution rather than the correlates at the top end. One can then perform different regressions for each quintile, or quartile, of the population. Whether these regressions can be conducted will depend partly on the sample size of the survey. Alternatively, the regression can examine structural differences in parameter estimates for different income or expenditure groups. Box 1.7 describes types of regression analysis.

When multiple cross-sectional surveys are available, the same regression can be repeated for different years to see how the association of certain correlates with income or consumption varies over time. Variations over time will be reflected in changes in coefficients or parameters. The results of repeated cross-section regressions can also be used to decompose changes in poverty between changes in household characteristics and changes in the returns to (or impact of) these characteristics (see, for example, Wodon 2000). Another possibility is to use parameters from the regression model obtained for year 1 in order to predict household income or consumption in year 2, and to compare this prediction with the prediction obtained using the regression estimates for year 2 applied to the data for year 2. The differences in the predictions with the two models can then be analyzed, and one can test whether changes in income between years is due to changes in structural conditions or changes in the behavior of households between the two years.

**Table 1.8. Determinants of Household Spending Levels in Côte d'Ivoire**

	<i>Urban</i>	<i>Rural</i>
<b>Education level of most educated male</b>		
Elementary	.38 (5.3)	0.04 (0.6)
Junior secondary	.62 (8.6)	0.08 (0.9)
Senior secondary	.80 (9.6)	0.05 (0.4)
University	.93 (9.4)	–
<b>Education level of most educated female</b>		
Elementary	.11 (1.7)	0.07 (1.0)
Junior secondary	.24 (3.1)	0.27 (2.2)
Senior secondary	.34 (3.4)	–
University	.52 (4.1)	–
<b>Value of selected household assets</b>		
Home	.06 (5.3)	–
Business assets	.04 (3.3)	0.16 (4.9)
Savings	.08 (4.7)	–
<b>Hectares of agricultural land</b>		
Cocoa trees	–	0.17 (4.3)
Coffee trees	–	0.04 (1.3)
<b>Distance to nearest</b>		
paved road	–	-0.04 (-2.9)
market	–	-0.09 (-3.3)
<b>Unskilled wage (males)</b>	–	0.37 (6.4)

– = Not applicable.

Note: T-statistics are in parentheses.

Sources: Adapted from Grosh and Munoz (1996, p. 169), based on Glewwe (1990).

Apart from income and consumption regressions, several other types of multivariate regressions can provide additional insights into the determinants of poverty. These can be applied particularly to other dimensions of poverty, such as child nutrition, mortality, morbidity, literacy, or other measures of capabilities. Box 1.8 highlights key questions that can be addressed. The techniques are also sometimes applied to understand the determinants of employment and labor income and to estimate the returns to education (technical note A.10). They can also be used to better understand agricultural production patterns by estimating agricultural production functions (which relate production to information on type of crops grown per area, harvest, inputs into agricultural production, and input and output prices).

### **Tests for the robustness of poverty comparisons**

Poverty comparisons inform policy design and the evaluation of poverty reduction strategies. For example, if poverty decreases from one year to the next, this may suggest a good performance of the

#### **Box 1.7. Income Regressions versus Probit/Logit/Tobit Analysis**

An alternative to exploring the correlates of poverty by using the logarithm of income per capita as the endogenous variable is to run a probit, logit, or tobit regression. In a probit or logit, the endogenous variable is a dummy variable, with 1 representing the individual being poor, and 0 the nonpoor. Probits and logits have been used in many poverty assessments. However, the underlying variable with which the dummy for poverty is constructed is income or consumption per capita. The probit/logit uses an artificial construct as the endogenous variable. Much of the information about the actual relationship between income and determining factors is lost. In addition, probit/logit regressions are much more sensitive to specification errors than linear regressions. Since there is no difficulty in predicting poverty from a linear regression, this type of regression should be used instead of probits/logits. The same argument holds for tobit models in which the poverty gap (difference between the poverty line and a household's per capita income) is the endogenous variable. Again, the use of a tobit implies that the income distribution is artificially truncated.

There are, however, some appropriate uses of probit or logit regressions. First, for targeting analysis, probit and logit regressions can be used to assess the predictive power of various variables used for means testing (see technical note A.9). Second, when panel data are available, probit or logit regressions can be used to analyze the determinants of transient versus chronic poverty. The use of panel data for poverty analysis will be discussed later.

**Box 1.8. Key Questions in Addressing Multiple Correlates of Poverty**

- **Building on the poverty profile, what are the important variables correlated with income and expenditure levels that can be included in regression analyses?**
- **Are such factors directly linked to income and expenditures, or are other, nonmeasurable factors responsible?**
- **Which factors cannot be captured directly or indirectly through surveys but are likely to determine income and expenditure levels of households?**

authorities in charge of poverty reduction. However, due to the many assumptions involved in poverty measurement, it is important to test these assumptions for the robustness of poverty comparisons between groups or over time. Three main ways of testing for robustness are described below.

- **Standard errors.** The fact that poverty calculations are based on a sample of households, or a subset of the population, rather than the population as a whole, has implications. Samples are designed to reproduce the whole population, but they can never be exact because the information does not cover all households in a country. Samples carry a margin of error, and so do the poverty measures calculated from household surveys. The standard errors, which most statistical packages will easily calculate, depend on the sample design—essentially stratification and clustering—and the sample size in relationship to the size of the total population (see Deaton 1997 and Ravallion 1994 for a description of the standard errors of various poverty measures). When the standard errors of poverty measures are large, it may be that small changes in poverty, although observed, are not statistically significant and, thereby, cannot be interpreted for policy purposes.
- **T-statistics.** When carrying out multivariate regressions, it is also important to compute the T-statistics or standard errors, which inform the degree of significance of the various coefficients. It might be the case that the coefficient on a specific variable is large but not significantly different from zero. Attention should be paid to these significance levels when interpreting the results.
- **Sensitivity analysis.** Apart from taking into account standard errors when comparing poverty measures between groups or over time, it is important to establish the robustness of the poverty comparisons to the assumptions made by the analyst. This may call for repeating the analysis for alternative definitions of the income aggregate and alternative ways of setting the poverty line. The sensitivity analysis, for example, may focus on the impact of changes in the construction of the income or consumption aggregate when imputations for missing values or corrections for underreporting of income in the surveys are implemented. Alternatively, one can test results with various lines—for instance, the base poverty line plus and minus 5 percent in monetary value. Tests can also be conducted for checking the sensitivity of poverty comparisons to the assumptions regarding economies of scale and equivalence scales within households.
- **Stochastic dominance.** Profiles allow a ranking of various household groups (or various time periods) in terms of their level of poverty. However, it is important to test whether the ranking is robust to the choice of the poverty line. This leads to a special type of robustness test, referred to as stochastic dominance, that deals with the sensitivity of the ranking of poverty levels between groups or between periods of time to the use of different poverty lines. The simplest way to do this (for the robustness of poverty comparisons based on the headcount index of poverty) is to plot the cumulative distribution of income for two household groups or two periods of time, as shown in figure 1.3 and box 1.9. One can then see whether the curves intersect. If they do not intersect, then the group with the highest curve is poorer than the other group. If they do intersect, then for any poverty line below the intersection, one group is poorer, and for any poverty line above the intersection, the other group is poorer. For further details on stochastic dominance tests, see technical note A.5.

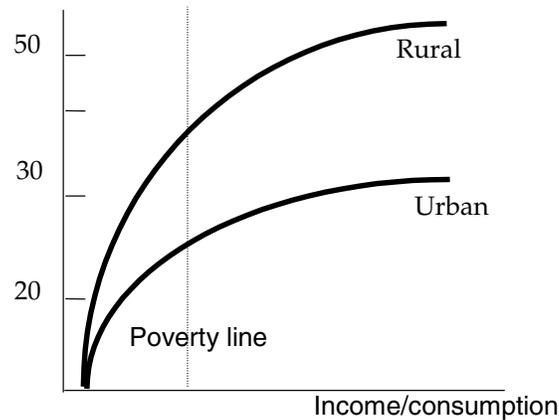
### 1.3 Inequality Measurement and Analysis

A second definition of welfare often considered in analysis is that of “relative” poverty, defined as having little in a specific dimension compared to other members of society. This concept is based on the idea that the way individuals or households perceive their position in society is an important aspect of

**Box 1.9. Cumulative Distribution Functions**

Cumulative distribution functions indicate the change in poverty incidence resulting from changes in the poverty line. In figure 1.3, the horizontal axis shows monetary values while the vertical axis shows cumulative percent of the population. If the poverty line intersects a steep part of the distribution function, small variations in the poverty line will cause large variations in the calculated poverty rates. Distribution functions are also powerful tools to compare well-being in different areas of the country as, for example, between rural and urban areas (figure 1.3). Another way of testing the sensitivity of calculated poverty measures is simply to calculate the various poverty indexes for various lines, such as the base poverty line plus and minus 5 percent in monetary value. One can then compare the results across different groups or periods of time.

**Figure 1.3. Cumulative Distribution Functions  
(percent population)**



their welfare. To a certain extent, the use of a relative poverty line in the previous sections does capture this dimension of welfare by classifying as “poor” those who have less than some societal norm.

The overall level of inequality in a country, region, or population group—and more generally the distribution of consumption, income, or other dimensions—is also an important dimension of welfare in that group. This section summarizes the concept and the most commonly used inequality measures (section 1.3.1) and then turns to some analysis that can be carried out on the basis of these indicators (section 1.3.2). Finally, section 1.3.3 ties together our discussions about inequality in this section with the definitions and measurement of poverty in section 1.2. It explores how inequality, growth, and poverty are linked and presents simple simulations that can help to assess the likely impact of future growth and its distribution on poverty.

### 1.3.1 Inequality concept and measurement

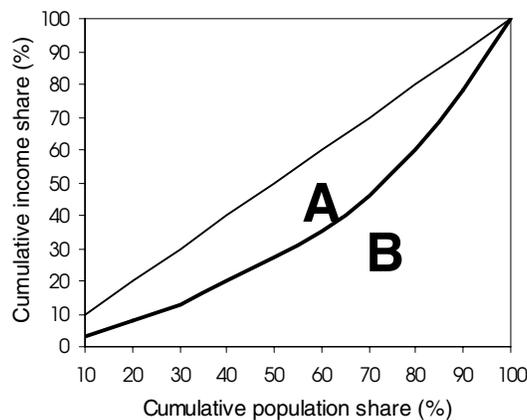
Poverty measures depend on the average level of income or consumption in a country and the distribution of income or consumption. Based on these two elements, poverty measures therefore focus on the situation of those individuals or households at the bottom of the distribution. Inequality is a broader concept than poverty in that it is defined over the entire population, not only below a certain poverty line. Most inequality measures do not depend on the mean of the distribution (at least this is considered to be a desirable property of an inequality measure). Instead, inequality is concerned with distribution.

Inequality indicators can be harder to develop than income poverty indicators because they essentially summarize one dimension of a two-dimensional variable. Note that inequality measures can be calculated for any distribution—not just for consumption, income, or other monetary variables—but also for land and other continuous and cardinal variables.

Some commonly used measures are provided in the list below. (The formulas for the computation of these indicators are presented in technical note A.7. A more detailed analysis of inequality and its impact on well-being, with many policy applications, is provided in chapter 2, “Inequality and Social Welfare.”)

- **Gini coefficient of inequality.** This is the most commonly used measure of inequality. The coefficient varies between 0, which reflects complete equality, and 1, which indicates complete inequality (one person has all the income or consumption; all others have none). Graphically, the Gini coefficient can be easily represented by the area between the Lorenz curve and the line of equality. In figure 1.4, the Lorenz curve maps the cumulative income share on the vertical axis against the distribution of the population on the horizontal axis. In this example, 40 percent of the population obtains around 20 percent of total income. If each individual had the same income, or total equality, the income distribution curve would be the straight line in the graph—the line of total equality. The Gini coefficient is calculated as the area A divided by the sum of areas A and B. If income is distributed equally, then the Lorenz curve and the line of total equality are merged, and the Gini coefficient is 0. If one individual receives all the income, the Lorenz curve would pass through the points (0, 0), (100, 0), and (100, 100), and the surfaces A and B would be similar, leading to a value of 1 for the Gini coefficient. It is sometimes argued that one of the disadvantages of the Gini coefficient is that it is not additive across groups; that is, the total Gini of a society is not equal to the sum of the Ginis for its subgroups.
- **Theil index.** While less commonly used than the Gini coefficient, the Theil index of inequality has the advantage of being additive across different subgroups or regions in the country. The Theil index, however, does not have a straightforward representation and lacks the appealing interpretation of the Gini coefficient. The Theil index is part of a larger family of measures referred to as the general entropy class.
- **Decile dispersion ratio.** The decile dispersion ratio is also sometimes used. It presents the ratio of the average consumption or income of the richest 10 percent of the population divided by the average income of the bottom 10 percent. This ratio can also be calculated for other percentiles (for instance, dividing the average consumption of the richest 5 percent—the 95<sup>th</sup> percentile—by that of the poorest 5 percent—the 5<sup>th</sup> percentile). This ratio is readily interpretable by expressing the income of the rich as multiples of that of the poor.
- **Share of income and consumption of the poorest x percent.** A disadvantage of both the Gini coefficients and the Theil indexes is that they vary when the distribution varies, no matter if the change occurs at the top, the bottom, or the middle (any transfer of income between two individuals has an effect on the indexes, irrespective of whether it takes place among the rich, among the poor, or between the rich and the poor). If a society is most concerned about the share of income of the people at the bottom, a better indicator may be a direct measure, such as the share of income that goes to the poorest 10 or 20 percent. Such a measure would not vary, for example, with changes in tax rates resulting in less disposable income for the top 20 percent to the advantage of the middle class rather than the poor.

**Figure 1.4. Lorenz Curve of Income Distribution**



### 1.3.2 Inequality analysis

#### *Inequality comparisons*

Many of the tools used in the analysis of poverty can be similarly used for the analysis of inequality. One could draw a profile of inequality that would look at the extent of inequality among certain groups of households. This provides information on the homogeneity of the various groups, an important element to take into account when designing interventions.

Analysis of changes in inequality over time can also be carried out. One could focus on changes for different groups of the population to show whether inequality changes have been similar for all or have taken place, say, in a particular sector of the economy. While rural incomes increased substantially in rural Tanzania between 1983 and 1991, inequality also increased (with a Gini coefficient increasing from 0.52 to 0.72), especially among the poor. This can be linked to important reforms that took place in the agricultural price policy, which has intensified inequalities, with the poor and less efficient farmers unable to participate in the growth experienced by wealthier, more efficient farmers (Ferreira 1996).

Another aspect of inequality analysis is the comparison of the level of inequality in different dimensions. In a country where public health provision is well developed and reaches all strata of the population, one could expect to see lower levels of inequality in health outcomes than in income levels. This comparison can be done using tabulations along the lines of table 1.3, presenting measures of inequality (in table 1.3, the ratio of the average for the higher quintile to that of the lower quintile) for different dimensions and comparing the value of the measures.

Analysis could also focus on the inequality of different consumption categories or income sources. In Egypt it was found that agricultural income represents the most important inequality-increasing source of income, while nonfarm income has the greatest inequality-reducing potential. Table 1.9 presents the decomposition and shows that, while agricultural income represents only 25 percent of total income in rural areas, it contributes to 40 percent of the inequality.

#### *Decomposition of income inequality*

The common inequality indicators mentioned above can be used to assess the major contributors to inequality, by different subgroups of the population and regions as well as by income source. In static decompositions, household and personal characteristics—education, gender, occupation, urban and rural, and region—are determinants of household income. If that is the case, then at least part of the value of any given inequality measure must reflect inequality between people with different educational levels, occupations, genders, and so on. This inequality is referred to as the between-group component.

For any such partition of the population, whether by region, occupation, sector, or any other attribute, some inequality will also exist among people within the same subgroups; this is the “within-group” component. The Theil index and those of the generalized entropy class can be decomposed across these partitions in an additive way (see technical note A.7). Using the Theil coefficient, the within-area (within rural areas and within urban) contribution to inequality in Zimbabwe in 1995/1996 was 72

**Table 1.9. Decomposition of Income Inequality in Rural Egypt (1997)**

<i>Income Source</i>	<i>Percentage of households receiving the income source</i>	<i>Share in total income (percent)</i>	<i>Gini coefficient for the income source</i>	<i>Percentage contribution to overall income inequality</i>
Nonfarm	61	42	0.63	30
Agricultural	67	25	1.16	40
Transfer	51	15	0.85	12
Livestock	70	9	0.94	6
Rental	32	8	0.92	12
<i>Total</i>	100	100		100

*Note:* The Gini coefficient for agricultural income is high because of the numerous negative incomes in that category.  
*Source:* Adams (1999).

percent, while the between-area (between urban and rural areas) component was 28 percent. In other words, differences among residents living within rural or within urban areas were much larger relatively than differences between rural and urban areas. In many Latin American countries, the between-area component of inequality has a much higher share in explaining total inequality.

In Ghana, both poverty and inequality decreased between 1988 and 1992. Table 1.10 shows an increase in mean expenditure and a decrease in inequality, mainly at the lower end of the distribution [GE(0) decreased by 5.6 percent]. However, when focusing on income and inequality levels in different localities, analysis shows that improvements in terms of income only took place in cities other than Accra and in rural areas. In Accra, poverty actually increased, from 9 to 23 percent, even if it still has the lowest poverty incidence in the country. In terms of inequality, the situation worsened in Accra for both measures. On the contrary, other cities improved throughout the distribution (for both measures), while in rural areas improvements were noted at the lower end of the distribution [decrease in GE(0) by 7.7 percent], with a very small overall deterioration. A more detailed analysis showed that all socioeconomic groups within each region had similar patterns. In Accra, the decline was linked to the important downsizing in the public sector (which employed 50 percent of the population), but in other cities, where a similar downsizing occurred, the development of the informal sector seems to have allowed the retrenched civil servants to find alternative sources of income.

Of equal interest is the question of which of the different income sources, or components of a measure of well-being, are primarily responsible for the observed level of inequality. For example, if total income can be divided into self-employment income, wages, transfers, and property income, one can examine the distribution of each income source. If one of the income sources was raised by 1 percent, what would happen to overall inequality? Table 1.11 shows the results for the Gini coefficient for both income and wealth sources in Peru (1997). As the table shows, self-employment income is the most equalizing income source, while agricultural property is the most equalizing wealth asset. Increase in some income sources would actually lead to increased inequality (when these sources are less equally distributed than overall income). The results depend on two factors: (1) the importance of the income source in total income (for larger ones, 1 percent increase is larger in absolute terms), and (2) the distribution of that income source (if it is more unequal than overall income, it will lead to a reduction; if

**Table 1.10. Within-Group Inequality and Contribution to Overall Inequality by Locality (Ghana)**

	<i>Accra</i>			<i>Other cities</i>		
	<i>1988</i>	<i>1992</i>	<i>Change (%)</i>	<i>1988</i>	<i>1992</i>	<i>Change (%)</i>
Mean expenditure	314	260	-17.1	206	225	9.0
Poverty incidence	9	23		33	28	
GE(0)	18.5	21.4	15.7	20.2	18.9	-6.4
Contribution (%)	7.9	9.5	20.3	26.8	25.6	-4.5
GE(1)	20.9	23.6	12.9	21.6	20.2	-6.5
Contribution (%)	13.4	11.5	-14.2	28.4	25.8	-9.2
	<i>Rural</i>			<i>All Ghana</i>		
	<i>1988</i>	<i>1992</i>	<i>Change (%)</i>	<i>1988</i>	<i>1992</i>	<i>Change (%)</i>
Mean expenditure	181	206	13.9	198	215	
Poverty incidence	42	34				
GE(0)	19.4	17.9	-7.7	19.5	18.4	-5.6
Contribution (%)	65.3	64.9	-0.6			
GE(1)	19.9	20.0	0.5	20.5	20.4	-0.5
Contribution (%)	58.2	62.7	7.7			

*Note:* Expenditure in thousand 1992 Accra Cedis. GE(0) and GE(1) are inequality measures of the general entropy family (see technical note A.3). E(0), the mean log deviation, is sensitive to changes at the lower end of the distribution. E(1), the Theil index, is equally sensitive to changes across the distribution.

*Source:* Canagarajah, Mazumdar, and Ye (1998).

it is less unequal, it will result in an increase in overall inequality). The size of impact will be greater the greater the distance from the overall level of inequality. A more detailed discussion of these types of simulations and their relevance for the analysis of well-being can be found in the chapter 2, “Inequality and Social Welfare.”

### 1.3.3 Inequality, growth, and poverty

Given that poverty is fully determined by the mean income or consumption and the inequality in income or consumption, it is feasible to simulate the impact of growth (an increase in mean income or consumption) and changes in inequality (a shift in the distribution across the population) on poverty. This type of analysis can be used to set targets for poverty reduction and to simulate the impact of various policy changes (which affect growth and/or distribution) on poverty levels. (Alternative methods for simulating the impact on poverty of economic growth and changes in inequality are presented in chapter 4, “Development Targets and Costs.”)

It is important to note that these techniques have important limitations, linked to the underlying strong assumptions. For example, if per capita GDP growth is used as a proxy for the growth in disposable income or private consumption, the implicit assumption is that GDP growth translates directly into household income or consumption. Also, when sectoral decompositions are used to analyze the poverty reduction impact of growth in various parts of the economy, the simulations typically assume that sectoral growth rates translate directly into household consumption and income growth rates in the same sectors; that is, that sectoral growth raises the wages of workers affiliated with the sector. Labor movements and secondary effects are also typically assumed to be absent. Growth in exports, for example, could have a positive technology spillover in other sectors of the economy. Thus, the tools presented in this section should be used with caution.

Figure 1.5 shows the difference between growth effects and inequality effects. The figure presents the distribution function of income or consumption (that is, the vertical axis shows the percentage of households with incomes of different levels, represented on the horizontal axis). The vertical dotted lines represent the means of the distribution and the poverty lines (set in this example at 50). The lines that link the distributions to the horizontal axis represent the 5<sup>th</sup> and the 95<sup>th</sup> percentiles of the population, that is, 5 percent of households have incomes below the left line, and 5 percent of households have incomes above the right line. The arrows between these lines give a measure of inequality (see section 1.3.1). The higher the dispersion between the 5<sup>th</sup> and the 95<sup>th</sup> percentile, the higher the inequality.

Figure 1.5a shows the impact of a uniform growth (where all individuals get an increase in income by 30), without any change in inequality. The entire distribution is simply shifted to the right. Figure 1.5b shows the impact of a decrease in inequality with constant mean (no growth). The two distributions have an equal mean, but the lower inequality distribution has lower dispersion (distance between 5<sup>th</sup> and 95<sup>th</sup> percentile). The impact on poverty is measured by the share of households below the poverty line (that is, the part of the distribution to the left of the line). In both cases, poverty is reduced. The purpose of this section is to distinguish between these two effects in order to better understand past changes or to design various simulations of future poverty levels.

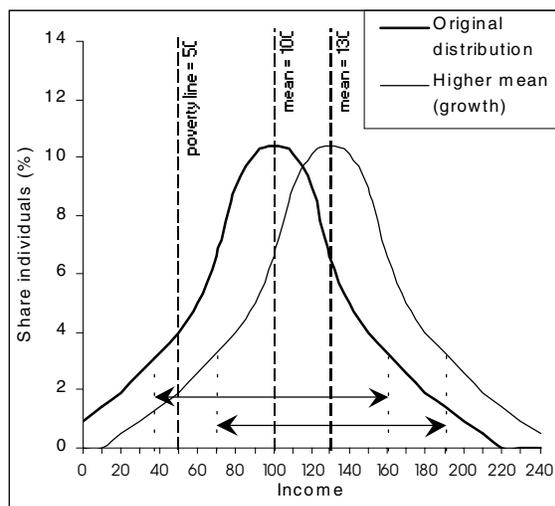
**Table 1.11. Peru: Expected Change in Income Inequality Resulting from 1 Percent Change in Income Source (1997) (percent of Gini change)**

<i>Income source</i>	<i>Expected change</i>	<i>Wealth sources</i>	<i>Expected change</i>
Self-employment income	-4.9	Housing	1.9
Wages	0.6	Durable goods	-1.5
Transfers	2.2	Urban property	1.3
Property income	2.1	Agricultural property	-1.6
		Enterprises	0

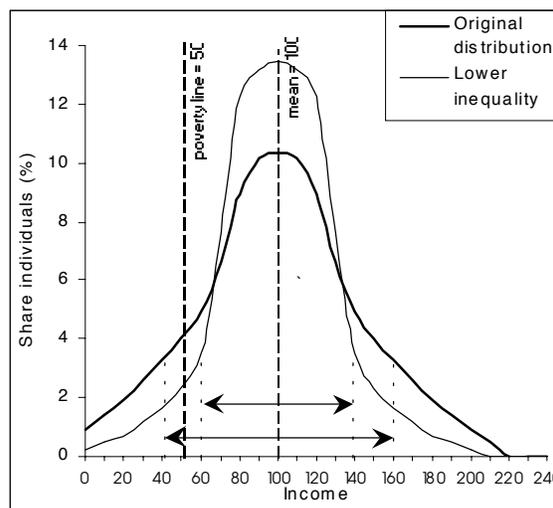
Source: World Bank (1999b, p. 16).

**Figure 1.5. Effect of Income/Consumption Growth and Inequality Changes on Poverty Levels**

**Figure 1.5a. Effect of Growth (higher mean)**



**Figure 1.5b. Effect of Reduced Inequality**



**Simulations of future poverty with a single household survey**

A single household survey with income and/or expenditure modules can be used to simulate the effect of growth and inequality on poverty. Such simulations can make different assumptions about inequality (it may remain constant, increase, or decrease), the sectoral distribution of growth (agriculture may be the engine of growth, in which case the population linked to agricultural activities would have a higher growth rate in personal incomes and expenditures than other groups), or the geographic distribution of growth.

Using 1993 as a baseline for Tanzania, table 1.12 shows how per capita growth rates and changes in inequality would translate into changes in poverty over a 20-year period. With a zero real per capita growth rate and no change of inequality, the poverty rate would remain unchanged. A 1.5 percent sustained per capita growth rate with no change in the distribution of income (all households get a 1.5 percent income gain per year) would yield a substantial reduction in poverty. If inequality were to improve at the same time, the poverty reduction would be greatly accelerated, even with a similar growth level (see section 1.3.1 for concept and measures of inequality).

The technique can be further refined to assess the impact of growth in different parts of the country—urban versus rural areas or by different sectors of the economy. Table 1.13 shows simulations for Peru. The simulations calculate how much severe poverty would change from 1997 to the year 2002 under different scenarios in terms of the growth of different sectors: first, it is assumed that the high-poverty sectors grow by 6 percent, then the medium-poverty sectors are assumed to grow at 6 percent, and the low-poverty sectors are assumed to grow at 6 percent (for each of these scenarios, the rest of the economy is assumed to grow at a much lower rate so that the overall growth rate is always 3 percent).

**Table 1.12. Poverty, Inequality, and Growth in Tanzania**

	1993	2005	2015
<b>Poverty rate with</b>			
0 percent growth, no change in Gini	50	50	50
1.5 percent growth, no change in Gini	50	35	18
1.5 percent growth, Gini reduction by 0.5 percent/year	50	30	3
3.0 percent growth, no change in Gini	50	25	5

Source: World Bank (1996d, p. 76).

Table 1.13 shows that pro-poor growth in Peru would mean especially that the economic upturn materializes in the agriculture and construction sectors. Similarly, a 6 percent growth is assumed to take place first in Lima, then in other urban areas, and, finally, in rural areas (while the growth in other regions is much lower, such that overall growth is 3 percent). Geographically, rural growth would result in larger poverty reduction.

### **Decomposition of changes in poverty with two or more surveys**

When successive surveys are available, it is feasible to find how much of observed changes in poverty over time can be attributed to changes in distribution and to changes in mean income or consumption (see section 1.2.2 and technical note A.3 for limitations and difficulties in comparability). For example, lower poverty could result either from a general increase in the income of all households (without change in the income distribution) or from a decrease in inequality (redistribution from the rich to the poor without change in mean income or consumption). A change in poverty can always be decomposed into a growth component, a redistribution component, and a “residual” component (see technical note A.1 for details of the methodology).

An example can be taken from rural Tanzania, which experienced a decrease in poverty but an increase in inequality (see section 1.3.2). Decomposing changes in poverty incidence (headcount) and depth (poverty gap) reveals that, while the poor benefited from growth over the period, the rich captured a much greater share of economic improvement. If the distribution of income hadn’t changed, the reduction in poverty incidence would have been much larger and the poverty gap would have also decreased. Table 1.14 presents the results of the analysis and show that, using a high-poverty line, the head count would have decreased by 38 percent and the poverty gap by 24 percent. The changes in distribution (and interaction factors) resulted in a decrease in the head count of only 14 percent and in the poverty gap of only 2 percent.

Figure 1.6 provides another illustration that further distinguished among various locations. It shows that the greatest part of the overall reduction in poverty in Ghana in the 1990s was the result of growth in mean consumption (responsible for a drop of 7 percentage points in poverty). A small reduction in inequality contributed to an additional poverty reduction of 2 percentage points. A similar pattern was observed in the regions with the largest reduction in poverty (Accra and rural forest). In other regions, however, the pattern was different, because an increase in inequality reduced to a certain extent the gains in poverty reduction due to growth (in the rural coastal region, poverty reduction would have reached 6 percentage points with growth only, but an increase in inequality reduced that to only 4 percentage points). The policies to pursue in the different regions will have to take these differences into account.

**Table 1.13. Poverty, Inequality, and Growth in Peru**

	1997	2002
Extreme poverty rate at per capita growth rate of 3 percent with growth in:		
high-poverty sectors (agriculture, construction)	14.8	7.5
medium-poverty sectors (mining, petroleum, manufacturing, trade, transport, communication)	14.8	10.7
low-poverty sectors (services)	14.8	11.1
Lima	14.8	11.5
other urban areas	14.8	10.9
rural areas	14.8	7.8

Source: World Bank (1999b, p. 35).

**Table 1.14. Decomposition of Changes in Poverty in Rural Tanzania (1983–91)**

Poverty line	Growth component	Redistribution component	Residual	Total change in poverty
<b>Head count index</b>				
High	-38.5	11.8	12.6	-14.1
Low	-34.4	16.7	5.7	-12.0
<b>Poverty gap index</b>				
High	-23.7	20.5	1.6	-1.6
Low	-19.0	22.9	-1.9	2.0

Source: Ferreira (1996).

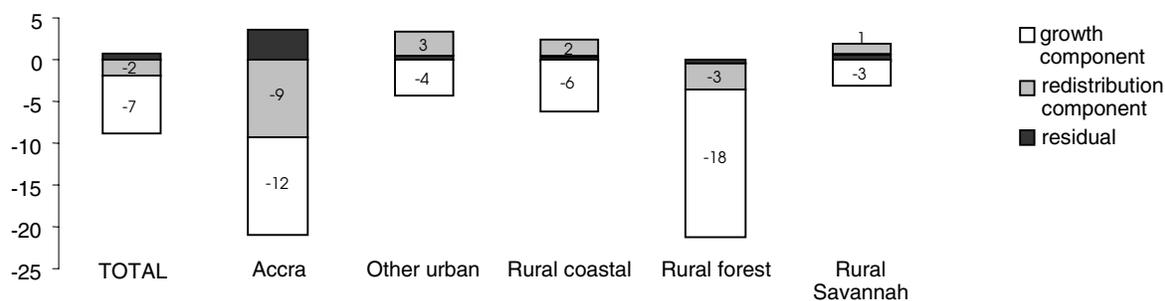
## 1.4 Vulnerability Measurement and Analysis

Insecurity is an important component of welfare and can be understood as vulnerability to a decline in well-being. The shock triggering the decline can occur at the microeconomic (household) level (for example, illness or death), at the meso or community level (pollution or riots), or at the national or international level (national calamities or macroeconomic shocks). In poor rural areas, the most common risks are those affecting the harvest (see chapter 15, “Rural Poverty”). Vulnerability is not necessarily unexpected but could be seasonal. The risk of illness is a prime concern of the poor everywhere (see chapter 18, “Health, Nutrition, and Population”). The chapters on macroeconomic and structural issues (see chapters 12–13) and the private sector and infrastructure (see chapters 20–25) discuss the types of economic shocks that lower the living standards of the poor. Structural reforms could be associated with increased short-term vulnerability for certain groups. Declines in income are more devastating for the poor than for the better off because the poor are less likely to have the assets they need or to have access to insurance or credit to hedge against income shocks. In addition, even a small change is likely to have a substantial impact on their ability to meet their basic needs.

### 1.4.1 Vulnerability concept and measurement

Vulnerability is defined here as the probability or risk today of being in poverty or of falling into deeper poverty in the future. It is a key dimension of welfare, since a risk of large changes in income may constrain households to lower investments in productive assets—when households need to hold some reserves in liquid assets—and in human capital. High risk can also force households to diversify their income sources, perhaps at the cost of lower returns. Vulnerability may influence household behavior and coping strategies and is thus an important consideration of poverty reduction policies. The fear of bad weather conditions or the fear of being expelled from the land they cultivate can deter households from investing in more risky but higher productivity crops and affect their capacity to generate income.

**Figure 1.6. Decomposition of Changes in Poverty by Location (Ghana 1991/1992–1998/99)**



Source: Ghana Statistical Service (1999)

Section 1.4.1 presents some of the measures that can be used to capture or proxy vulnerability. Section 1.4.2 then turns to the analysis of determinants of vulnerability.

Vulnerability is difficult to measure: anticipated income or consumption changes are important to individuals and households before they occur—and even regardless of whether they occur at all—as well as after they have occurred. The probability of falling into poverty tomorrow is impossible to measure, but one can analyze income and consumption dynamics and variability as proxies for vulnerability. Such analysis could be replicated for specific nonmonetary variables likely to fluctuate—for instance, health status, weight, asset ownership, and so forth.

Measuring income and consumption dynamics and variability requires specific types of data as described below.

- In countries where only one cross-sectional survey is available, quasipanel data can sometimes be derived if income and consumption are recorded at different points in time. Surveys sometimes record information on demographics, activities, and income in a first visit, and repeat for one year thereafter the income module quarterly. Also, some surveys ask households to recollect their income or consumption for previous time periods. Even when no quasipanel components are available, it may be possible to build measures of household vulnerability that rely on the variation within communities or other subgroups, or on external information on the seasonality of prices and production.
- When two or more cross-sectional surveys are available, changes and trends in levels and patterns of poverty over time can be analyzed. Comparison over time requires careful techniques and analysis but allows insights into the dynamics of poverty and its determinants. Repeated cross-sections reveal trends for population groups but do not allow tracking of individuals or households within groups over time. They reveal only net aggregate changes; they would not capture large movements into or out of poverty.
- Panel data follow the same households over time and relate their patterns of consumption and income to changes in other characteristics, such as demographics, migration, labor market situation, durable goods ownership, access to services, and health and education status. The welfare and income variability of households can be followed only when panel data are available. Panel data allow the analyst to determine factors that underlie mobility and estimate changes at the individual level (see section 1.5.2 for a discussion of panel data).
- Alternatively, qualitative information can complement the picture by allowing the analysis of important aspects of vulnerability, such as the following (see technical notes A.12 and A.13):
  - households' participation in informal networks;
  - variation patterns in household income and consumption (seasonal variations, for example);
  - people's perceptions of their vulnerability and its determinants; and
  - various strategies households put in place to reduce their vulnerability: households can engage in depletive strategies—selling their productive assets diversify their income sources to reduce the probability of income changes, reduce their consumption in case of income change, or find new means to increase their income—by, for instance, changing their labor supply.

Some measures that can be used as proxies for vulnerability are discussed below.

### ***Movements in and out of poverty, entry and exit probability***

When two observations in time are available (in a panel or in a cross-section that contains a quasipanel component), transition matrices can be used to map changes—improvement or decline—in household welfare.

Table 1.15 presents a transition matrix depicting the movements in and out of poverty for households in rural Ethiopia between 1989 and 1995. The headcount index of poverty declined from 61 percent to 46 percent. This type of information would be revealed by an analysis based on two cross-sections of data. The use of panel data provides a more revealing picture. Despite poverty reduction between the two years, half of those that were poor in 1989 remained poor in 1995 (31 out of 61). The other

**Table 1.15. Movements In and Out of Poverty in Rural Ethiopia  
(cell percentages)**

<i>Status in 1989</i>	<i>Status in 1995</i>		<i>Total</i>
	<i>Poor</i>	<i>Nonpoor</i>	
Poor	↔ 31	↑ 30	61
Nonpoor	↓ 15	↔ 24	39
<i>Total</i>	46	54	100

Source: Dercon (1999).

half of the population that was poor in 1989 had emerged from poverty by 1995, but more than one-third of the nonpoor in 1989 had fallen into poverty by 1995 (15 out of 39). The data still suggest significant flows in and out of poverty, a sign of vulnerability.

When data are available for several periods within the same year, the analysis can also distinguish between seasonal and nonseasonal poverty. Table 1.16 presents results of quarterly panel data from rural Rwanda in 1983, which shows that while some households appear to be poor all year round, others fall into poverty only at the end of the dry season, when food stocks are almost exhausted, and then recover later. These households can be said to be vulnerable to seasonal risk. Such data identify periods of hardship, and the groups most at risk and can suggest specific interventions (see chapter 17, “Social Protection”).

Another way to look at flows into and out of poverty is to compute poverty entry and exit rates—the probability that a household enters in, or emerges from, poverty. Table 1.17 shows that in rural Pakistan the probability of entering poverty increased over the years of the panel, while the probability of escaping fluctuated. Altogether, the ratio of the entry to exit probabilities increased, leading to an increase in the poverty headcount. This probability can then be computed for different groups in order to assess their vulnerability.

### **Length and frequency of poverty spells**

When several years of panel data are available, it becomes possible to distinguish households according to the time they spend in poverty and the frequency of their poverty spells. There are many different ways of naming these groups, and we present only one of them here. Some households will have a very low probability of falling below the poverty line (some time referred to as the transiently poor); they are not very vulnerable, even if they do experience poverty every now and then. Others will have a higher probability of falling into poverty (sometimes referred to as the chronic poor); they are vulnerable. Some households will typically spend most of their time in poverty and have a high probability of falling into poverty (the persistently poor); they are very vulnerable.

Definitions and names can vary from one example to the other. In the example from rural China presented in table 1.18, households have been classified as “very vulnerable” or “persistently poor” when

**Table 1.16. Transition Matrices in Rural Rwanda (1983)  
(row percentages)**

		<i>Second quarter</i>					<i>Third quarter</i>					<i>Fourth quarter</i>								
		1	2	3	4	5			1	2	3	4	5			1	2	3	4	5
<i>First quarter</i>	1	50	14	24	4	7	<i>Second quarter</i>	1	52	21	12	7	8	<i>Third quarter</i>	1	66	21	8	4	1
	2	30	31	27	10	3		2	19	18	28	13	21		2	40	30	17	7	6
	3	30	35	16	12	7		3	28	13	20	17	22		3	29	26	27	12	7
	4	13	23	21	27	16		4	5	24	12	27	32		4	15	15	22	19	29
	5	10	8	23	15	43		5	2	11	12	19	56		5	9	15	24	16	32

Source: Muller (1997).

**Table 1.17. Entry and Exit Probabilities (Rural Pakistan, 1986–91)**

	<i>Probability of entering poverty, for nonpoor households (percentage)</i>	<i>Probability of escaping poverty, for poor households (percentage)</i>
<b>From year to year:</b>		
1986/87 – 1987/88	15	51
1987/88 – 1988/89	17	43
1988/89 – 1989/90	20	51
1989/90 – 1990/91	20	46
<b>Over entire period:</b>		
1986/87 – 1990/91	24	49

Source: Baulch and McCulloch (1998).

their income is always below the poverty line; as “vulnerable” or “chronically poor” when their income is on average below the poverty line but sometimes above it; and as “not very vulnerable” or “transiently poor” when their income is on average above the poverty line but sometimes below the line. Table 1.18 shows that, over the period 1985–90, 33 percent of households were not very vulnerable, 14 percent vulnerable, and 6 percent very vulnerable. Analysis of the characteristics of these groups would inform on the determinants and correlates of vulnerability and on the policy options.

In practice, surveys often suggest that the group of “not very vulnerable” or “transiently poor” households is larger than the group of the “very vulnerable” or “chronically poor.” For instance, 60 percent of households were found to be transiently poor and 11 percent chronically poor in Zimbabwe over the period 1992–96. In South Africa, 32 percent of households were found to be transiently poor and 23 percent chronically poor over the period 1993–98.

### ***Income variability and mobility***

A last measure that can sometimes be used to proxy vulnerability is that of income variability. Some households may be, on average, slightly below the poverty line and experience low income variability—an unskilled wage worker in an urban area, for example. Other households may be on average slightly above the poverty line but experience higher income variability, such as a rural agricultural household. Standard static poverty analysis might classify the first type of household as poor and the second as nonpoor. However, both types experience some form of poverty, and if the second type of household does not have access to instruments to smooth its consumption, it may need some form of temporary support from the state. In contrast, the first type of household may need a very different type of support on a more regular basis. The first group could be considered nonvulnerable while the second group is vulnerable. The analysis of income variability thus reveals alternative policy options for alternative groups of households (see technical note A.11 on the use and limitations of variability measurement).

Information on the movements in and out of poverty can be combined with measures of income variability. The results for rural Pakistan given in table 1.19 show that the chronically poor have, on

**Table 1.18. Classification of Households in Rural China, 1985–90 (percent)**

	<i>Persistently poor</i>	<i>Chronically poor</i>	<i>Transiently poor</i>	<i>Never poor</i>
Guangdong	0.4	1.0	18.3	80.3
Guangxi	7.1	16.1	37.4	39.4
Guizhou	11.9	21.2	40.2	26.7
Yunnan	4.9	18.0	35.6	41.5
<i>Full Sample</i>	6.2	14.4	33.4	46.0

Source: Jalan and Ravallion (1999).

average, lower income levels than the transiently poor, but that the transiently poor have a higher coefficient of variation (a variability measure) and are therefore more exposed to shocks. The coefficients of variation of the chronically and the transiently poor are higher than those of those people who are never poor. This means that those who are better off not only have higher incomes levels, but also more stable incomes, so that they are less vulnerable to shocks.

### 1.4.2 Vulnerability analysis

In addition to some of the analysis presented earlier (“Poverty comparisons between groups and over time,” section 1.2.2, on changes over time and their determinants) that looks at aggregate changes for groups of the population, one can carry analysis on changes of households or individuals. As was the case for poverty and inequality analysis, different types of analysis can be done: vulnerability profile and regression analysis of changes in consumption over time and of movements in and out of poverty.

#### ***Vulnerability comparisons across groups***

With panel data, poverty profiles can also prove a powerful tool to reveal differences in poverty dynamics between various household groups. For example, one may analyze the movements in and out of poverty of population groups defined according to various characteristics such as demographics and place of residence. This approach answers such questions as: are female-headed households more likely to remain poor and are households in specific regions more likely to escape poverty? In the case of China, the answer to that question is provided in table 1.18 above, which shows that most of those who experienced poverty in Guangdong were transiently poor, while a larger share were persistently poor in Guizhou. Such differences suggest different underlying characteristics of poverty and, therefore, different policy responses.

In the same way that a static poverty profile can be presented in two different ways (see “Characteristics of individuals and households in different poverty groups” and “Poverty comparisons between groups and over time,” section 1.2.2), when long observation periods are available, one may compare the characteristics of the “vulnerable,” “very vulnerable,” and “nonvulnerable,” and how these change over time.

#### ***Determinants of vulnerability***

In the same way that regressions can be used to assess the determinants of poverty at any given point in time, regressions can also be used to assess the determinants of changes in income or poverty over time. Again, the advantage of panel data is that they go beyond finding the static correlates of poverty to identify the determinants of income or spending changes over time. Some of the problems of mutual causality with cross-sectional data do not arise in this case, since the initial conditions of households cannot be caused by the changes in household welfare. There are different ways to address the issue. First, when data are observed for two periods, one can run regression of income or consumption in the second period on household and individual characteristics in the first period. This permits estimation of the households’ ex ante distribution of future consumption or income and, therefore, the estimation of each household’s probability of falling into poverty in the future. An alternative would be to relate change in household welfare over time to exogenous variables and to initial starting conditions of the household. Regressions could also be run to explain entry and exit rates and the duration of poverty.

**Table 1.19. Poverty Type and Income Variation in Rural Pakistan (1986–91)**

	<b>Chronically poor</b>	<b>Transiently poor</b>	<b>Never poor</b>
Mean income	1,594	3,148	5,998
Standard deviation	716	1,715	2,482
Coefficient of variation	0.449	0.545	0.414

Source: McCulloch and Baulch (1999).

Finally, the analyst can carry out regressions of low vulnerability (in the sense of transient poverty) and high vulnerability (in the sense of chronic poverty).

### **Ex ante distribution of consumption**

Vulnerability is defined as the risk today of falling below the poverty line tomorrow. One way to analyze the determinants of poverty is to see which factors influence the probability of low income in the future. When two observations are available, one can carry out a regression of income in the second period on household characteristics observable in the first period. This will allow the analyst to see which characteristics influence ex ante distributions of future consumption. The methodology has been developed and applied to consumption in Northern Mali (Christiaensen and Boisvert 2000). The methodology could easily be adapted to study vulnerability regarding other dimensions of well-being, such as nutrition or income. Table 1.20 presents the results and shows that female-headed households have, on average, a larger expected consumption and a smaller variance, suggesting they are less vulnerable to drought shocks. This might be explained partly by the existence of community solidarity actions to help those in greatest need. Results also show that ownership of productive assets increases expected consumption and decreases variability, because fishing and transport equipment provide a relatively secure source of income when agricultural production is low.

### **Changes in consumption or income over time**

One can also carry out a regression analysis of the determinants of changes in consumption or income over time. This approach does not capture vulnerability in the sense used above (that of probability of falling into poverty), but rather focuses on explaining absolute changes in consumption. (In order to focus on vulnerability, one could carry out the regression only with those households that fell into poverty in the second period of observation.) Table 1.21 presents results of a regression on changes in consumption in Peru in the period 1994–97. It reveals that the household head's education is not only an important determinant of consumption levels but also results in a higher probability of welfare growth in the future. Female-headed and migrant households also have a higher probability of increase, that is, lower vulnerability, and access to financial savings has the expected positive influence. Interestingly, households that used at least one room in their house for business purposes, most of them in the informal sector, also have lower vulnerability (significantly higher growth rates). Moreover, the results suggest that access to public services, such as water, electricity, sanitation, and telephone, may be important factors in reducing vulnerability and promoting consumption growth, especially when there is access to several services.

The analysis can also be based on initial conditions and changes in conditions, allowing the analyst to identify the changes that influence increases and decreases in welfare. In the analysis in Côte d'Ivoire, a regression explained the change in per capita spending. The regression included base-year conditions, as in the case of Peru, such as income, human capital, physical capital, region, socioeconomic status and income composition, and change in these variables over the period of analysis. Not only was human capital found to be a key factor explaining welfare, it was also found to be the most important endowment that explains welfare changes over time in urban areas. In rural areas, physical capital, especially the amount of land and farm equipment, had a significant impact. The results also show that households with more diversified income sources managed better.

### **Determinants of movements in and out of poverty**

The analysis of entry and exit rates, particularly the analysis of poverty duration, usually requires long panels, which are not as common in low-income countries. Therefore, only a brief description of these techniques is given here. Regression models can explain the probabilities of entering, exiting, staying in, or staying out of poverty. One way to analyze these issues entails using logit and probit regressions of the probability of each event (see box 1.7). These regressions can help explain the triggers that cause households to fall into poverty, such as death of a family member, illness, or unemployment, and the triggers that pull them out of poverty. They also allow the analyst to test the impact of potential alternative policies; for example, social protection interventions, on the probability of exit from and entry

**Table 1.20. Estimates of Conditional Mean and Conditional Variance of Consumption During the Hunger Season (Northern Mali), 1997/98**

<i>Dependent variable: Log calorie intake per capita at t+1</i>	<i>Conditional Mean</i>		<i>Conditional variance</i>	
	<i>Coefficient</i>	<i>t-statistic</i>	<i>Coefficient</i>	<i>t-statistic</i>
<i>Explanatory variables</i>				
<b>Intercept</b>	7.4839	29.05	-0.4132	-0.26
<b>Human capital</b>				
No. adult male at t	-0.0165	-0.94	-0.0812	-0.65
No. adult female at t	0.0082	0.36	-0.2106	-1.35
No. children at t	-0.0837	-6.40	0.2205	2.54
No. children * potential to send children away (interaction)	0.0289	1.87	-0.0380	-0.40
No. elderly at t	0.0126	0.25	0.1122	0.34
Age household head	0.0081	0.81	-0.0987	-1.60
Age household head squared	-0.0001	-0.67	0.0008	1.39
Female headed household	0.0823	1.17	-0.8055	-1.55
<b>Productive capital</b>				
No. draft animals at t	0.0648	1.53	0.0856	0.31
Value agric., fishing, and transport equipment at t	0.0005	1.60	-0.0061	-2.34
Access to perimeter	0.0577	0.91	-0.7403	-1.69
<b>Income diversification</b>				
% income from migrant remittances at t-1	-0.0713	-0.77	-106820	-2.22
<b>Savings/credit</b>				
Value food stock carried over at t	0.0028	2.89	0.0112	1.63
Value food stock * % agric. Income at t-1 (interaction)	-0.0031	-2.45	-0.0077	-0.82
No. goat/sheep at t	0.0029	1.15	0.0072	0.49
No. cattle at t	-0.0002	-0.04	-0.0193	-0.65
Value of consumer durables at t	0.0008	3.58	0.0005	0.38
<b>Insurance</b>				
Official food aid received between t and t+1	0.0248	0.44	-0.8956	-1.86
Official food aid * migration of household head or main adults between t and t+1 (interaction)	–	–	1.5425	2.05

– = Not applicable.

Note: Value in 1,000 CFA francs. Survey carried out in Zone Lacustre, northern Mali. The model estimate values for the Hunger period of August 1998 (t+1) on the basis of information from the preceding post-harvest season (t).

Source: Christiaensen and Boisvert (2000).

into poverty. Other models rely on duration analysis. These techniques, which are frequently used in the study of unemployment, aim to find the characteristics of households and their environment, which explains the length of time they spend in poverty. They can be useful in identifying the policy actions that could act on the characteristics that determine whether a household is likely to be able to exit poverty quickly or is likely to be trapped in poverty for a long period of time. Duration analysis, however, requires long and large panels that are not often available.

#### **Determinants of vulnerability as measured in terms of transient and chronic poverty**

Using data for rural China and probit regressions for the determinants of transient and chronic poverty, Jalan and Ravallion (1998, 1999) suggest that both “acute vulnerability” or “chronic poverty” and “vulnerability” or “transient poverty” are reduced by greater command over physical capital, such as wealth and land, and certain demographic characteristics. These are, however, the only similarities. Smaller and better educated households, and those who live in areas with better attainments in health and education, have lower chronic poverty, but these factors have little influence on transient poverty. Thus interventions aimed at reducing chronic poverty may have little impact on transient poverty.

**Table 1.21. Consumption Change Regression in Peru (1994–97)**  
*(dependent variable: change in household consumption per capita)*

<i>Variable</i>	<i>Parameter</i>	<i>t-statistic</i>
Constant term	5.11	(18.4)
Initial consumption per capita in 1994	-.68	(-21.6)
Years of education of the household head in 1994	.03	( 7.1)
Quechua speaking households in 1994	-.10	(-2.4)
Age of the household head in 1994	.01	(4.6)
Female-headed households in 1994	.11	(2.4)
Household size in 1994	-.10	(-3.7)
Household size (squared) in 1994	.01	(2.3)
Households that used at least one room in their house for business purposes in 1994	.15	(3.7)
Households with financial savings in 1994 and 1997	.20	(2.2)
Migrant households in 1994	.05	(1.4)
Dependency ratio in 1994	-.01	(-0.9)
Households with one basic service in 1994	.04	(0.8)
Households with two basic services in 1994	.05	(0.9)
Households with three basic services in 1994	.16	(3.2)
Households with four basic services in 1994	.28	(3.9)

*Source:* World Bank (1999b, p. 52).

Similar regressions for Pakistan (McCulloch and Baulch 1999) also revealed interesting results, since some of the variables that influence the probability of entry or exit were different from those that explained poverty and income levels in a standard (static) regression analysis.

## 1.5 Data

Before applying the analysis tools described above, the analyst will first have to assess all available data sources and then plan accordingly for the analytical work to be done. Each data source tends to have particular strengths. After broadly reviewing the different aggregation levels and collecting agencies, different types of data sources are examined (section 1.5.1). Special attention is devoted to the various types of household surveys (section 1.5.2) and to the use of qualitative tools (section 1.5.3).

### 1.5.1 Types of data

As indicated in table 1.22, many sources of data can be useful for poverty analysis and the evaluation of policy interventions. Some data, such as central public finance data and national accounts, exist only at the national level. Often, these data are collected centrally by the statistical institute or the central bank. Local-level data—for example, by region, province, or district—often include availability and use of services, such as education, health, water, and electricity, and may include economic and price information, such as regional inflation, and are often collected through local offices of the statistical institute or the Ministry of Finance. Few countries produce national accounts at the subnational level. Household or individual-level data on welfare components, such as income, consumption, illness patterns, and household priorities and perceptions, present the most disaggregated data. These data are typically gathered through household surveys, and they can be summarized at higher levels (at the local or national level) to produce aggregate statistics. For example, household-level data are needed to determine whether the members of a particular household are income-poor. Aggregation across households will provide regional or national estimates of poverty. Along with providing national averages, local-level data can be important because local realities vary, and so do the key dimensions of poverty and the indicators that are useful to analyze and monitor. Moreover, some decisions—increasingly more as decentralization advances—are made at the local-level and require local information. In many

**Table 1.22. Data Types and Agencies**

<i>Data</i>	<i>Agency</i>	<i>Source</i>	<i>Frequency</i>
<b>National-level data</b>			
National accounts: GDP, consumption, investment, exports, imports, and so on	Central statistical agency	System of National Accounts, trade statistics	Monthly or quarterly where possible—trade statistics, for example; at least yearly
Public finance data: revenues, spending by category	Ministry of Finance, central statistical agency, sectoral ministries	Budgets and actuals	Monthly or quarterly where possible—trade statistics for example; at least yearly
Consumer and producer prices	Central statistical agency, central bank	Price surveys	Monthly; consumer price index basket updated at least every five years
Social Indicators	Management information systems of sectoral ministries	Administrative systems	Yearly where possible
<b>Local-level data</b>			
Consumer and producer prices, climatic data, national accounts at regional level	Central statistical agency, central bank	Price surveys, systems of national accounts	Monthly; consumer price index basket updated at least every five years
Availability of services	Local administration, sectoral ministries	Multitopic household surveys; employment surveys, qualitative studies	Yearly
Use of services	Local service providers	Rapid monitoring and satisfaction surveys	Yearly
<b>Individual and household-level data</b>			
Household consumption and income; living conditions, social indicators	Central statistical agency, Ministry of Labor/Employment	Household budget, expenditure, income surveys, multitopic household surveys, Demographic and Health Surveys	Every three to five years
Population statistics, access to services—no consumption or income; literacy	Central statistical agency	Population census	Every 5 or 10 years
Household living standards—no detailed consumption or income; illness patterns, malnutrition, education profile	Central statistical agency, Ministry of Labor/Employment, others	Rapid monitoring surveys, Demographic and Health Surveys	Yearly
Household priorities, perceptions of well-being, user satisfaction	Central statistical agency, sectoral ministries, others	Qualitative studies; rapid monitoring surveys	Every one to three years

*Source:* From various resources developed by authors.

instances, however, the collection and monitoring of local level data will be set up differently, since local capacities and community involvement vary.

The following describe the role of administrative data and the population census:

- **Administrative data.** In many countries, administrative data are the most accessible data source. Usually provided by line ministries and specialized agencies, these data describe specific activities and programs such as school enrollment, disease prevalence, malnutrition information, hospital expenses, road network information, and income and expenditure for decentralized units. This information is important in assessing levels of public and private inputs, outputs, and outcomes, as well as their distribution within the country. For example, it is possible to compare how the distribution of enrollment rates matches spending on primary schools; how the structure of health

spending—primary versus tertiary care—reflects disease patterns; or how agricultural productivity of main crops varies with land tenure patterns. Administrative data can often provide an important entry into poverty analysis, especially if such data are used to compare need and demand for services. Administrative data, however, do not allow for cross-tabulating or analyzing poverty across different dimensions. For example, it is generally not possible to look at enrollment rates of children by the income group of their parents. (Multitopic household surveys, which are discussed below, differ from administrative systems in that they allow the analyst to relate indicators with each other.)

- **Population census.** A population census contains basic information on all citizens of a country. The census is carried out for all households to obtain basic information on the population, its demographic structure, and its location. The census is typically carried out by the national statistics institute, which then provides data to lower levels of government tailored to local information needs. Since the census covers the whole population, it is costly, and most countries conduct a census only once a decade. The census can provide policymakers with important data for planning in the years directly following its implementation, but its usefulness diminishes afterward. Since the census is carried out across millions of households, the information gathered is, by necessity, limited. Information on household income, consumption, disease patterns, and poverty perceptions are generally not included. However, the census usually contains descriptive statistics of the housing stock; access to basic services such as water, electricity, and sanitation; information on education and employment patterns; and population statistics. The census has the advantage of being able to provide information at low levels of aggregation, such as the municipality level. Census data are also an important tool to check the representativeness of other surveys. The usefulness of sample surveys can be increased substantially if they are combined with census information, such as for providing poverty maps.

## 1.5.2 Household surveys

Household surveys are essential for the analysis of welfare distribution and poverty characteristics. At the same time, aggregate household-level analysis can provide only limited understanding of the intrahousehold distribution of resources, especially of income and consumption. Moreover, while the census covers the whole population in the country, surveys interview only a subset, generally a small fraction, of all households. This sample of households must be carefully chosen so that the results of the survey nevertheless accurately describe living conditions in the country and in different parts of the country. Sampling should be based on mapping of actual settlements, including newly formed informal urban ones. Sampling is most often informed by a recent population census. The sample size—the number of households interviewed—will vary with several factors, including the indicator to be measured. A survey that aims to measure countrywide averages of income, for instance, may require a larger sample than a survey designed to measure the percentage of the population with water connection, partly because the latter is easier to measure. Another variable may be the level at which the policymaker needs the information. A national electricity connection rate, for example, will require fewer households to be interviewed than regional or district rates. Different types of household surveys exist (table 1.23):

- **Living Standard Measurement Study (LSMS) surveys and other multitopic surveys.** Multitopic welfare surveys, like the LSMS, are geared toward measuring and analyzing poverty and are important instruments for poverty diagnostics. LSMS surveys collect information on household expenditures and income, health, education, employment, agriculture, the ownership of assets such as housing or land, access to services, and social programs. Dozens of countries have implemented multitopic surveys and many now have several rounds of surveys that allow rich comparisons across time. Multitopic surveys can also be used to measure the impact of public policies and programs on poverty.
- **Expenditure and income surveys.** Contrary to multitopic surveys, expenditure and income surveys are narrower in scope. They are useful instruments to measure different dimensions of poverty—such as income or education poverty—but are limited in their ability to relate household well-being to underlying causes such as asset distribution or productive activities.

**Table 1.23. Household Survey Types**

<i>Household Survey</i>	<i>Advantage</i>	<i>Limitations</i>
Multitopic surveys	Measurement and analysis of different poverty dimensions, their interrelationships, and correlates	Time-intensive (collection and evaluation)
Demographic and Health Surveys	Health-poverty measurement, health behavior analyses, basic poverty diagnostics	Measurement of other dimensions of poverty limited, diagnostics limited
Employment surveys	Analysis of employment patterns, wage income analysis (link to education)	Limited use for poverty measurement and diagnostics
Single-topic surveys	Income-poverty measurement (or one other dimension)	Limited diagnostics possible
Rapid monitoring surveys and service satisfaction surveys	Quick and cost-effective monitoring of key welfare indicators	Income-poverty measurement not possible, limited diagnostics

Source: From various resources developed by authors.

- **Employment surveys.** Labor ministries use employment surveys to gather information on employment and wages. These surveys include questions about household income, demographics, and housing features. They can be good sources for employment statistics, income-based poverty indicators—if the income module is good—and input indicators such as access to basic services. Employment surveys tend to be more important information sources for heavily urbanized countries.
- **Demographic and Health Surveys.** These are special household surveys geared to exploring the incidence of diseases and use of health facilities. They collect anthropometric data—height, weight, and age of children, that can be used to calculate malnutrition rates—and many other health and health behavior variables that enable such factors as survival rates, birth histories, and disease incidences to be computed. The surveys also contain basic data about housing conditions, educational attainments, and employment patterns. Although they do not include income or expenditure data, they can be used to calculate household wealth and carry out important poverty diagnostics (see technical note A.14).
- **Rapid monitoring and satisfaction surveys.** These surveys are generally large, contain relatively short questionnaires, and include predetermined data entry packages. They are easy to implement and have a rapid turnaround time. The Core Welfare Indicator Questionnaire (CWIQ)—widely applied in Africa—is one example. Unlike other surveys, the CWIQ is not designed to serve as a tool for measuring whether poverty levels are increasing or decreasing. It is intended to measure only whether or not public services and development programs are reaching and benefiting the poor and to monitor selected indicators—those that contain advance warnings of the future impact of policies and events—and assess household living conditions, access to basic social and infrastructure services, and the satisfaction of the population with these services. Satisfaction surveys are best viewed as complements to multitopic household surveys and have been used in many countries to monitor access to and quality of basic services.
- **Specialized surveys.** Many other specialized surveys exist that can be used for poverty diagnostics. These can range from violence surveys—for example, in Lima, Peru—to opinion surveys such as those conducted by the Social Weather Station in the Philippines. Several countries also have surveys of health centers, schools, or other public institutions. Firm surveys can be essential to understanding the impact of crisis on employment and specific groups at risk and were used extensively in understanding the impact of the East Asian crisis. Food security assessments identify high-risk groups and are often used by relief organizations. Typically, the Web sites of national statistical institutes and international organizations will provide information about the availability of such data.

It is clear from the list above that a number of different surveys and other data sources can be used for analyzing income poverty and its correlates. Table 1.24 distinguishes cases of severe data limitation (1) to a good data situation (9). The data sources discussed and ranked include the population census,

rapid monitoring surveys, income and expenditure surveys, Demographic and Health Surveys, and multitopic surveys. Based on data availability, table 1.24 identifies which tools among those reviewed in the previous sections can be used for poverty analysis. Income poverty measurement is possible only if at least one multitopic or income and expenditure survey exists. Other data sources—such as a population census, Demographic and Health Surveys, and rapid monitoring surveys—do not lend themselves to poverty measurement. Even in cases where income and consumption poverty measurement is not possible, as table 1.24 illustrates, several analysis tools can be applied that are important for policymaking. For example, spatial poverty maps can in most cases be developed using proxies for income or consumption. Rapid monitoring surveys and Demographic and Health Surveys also lend themselves to developing a basic profile of the poor. Still, although many different surveys can be and are used for poverty and welfare analysis, it should be emphasized that a multitopic survey is a key tool for measuring and understanding a wide range of issues related to poverty. In the short run, Demographic and Health Surveys or more specialized surveys can supply important information but, in the long run, the availability of a multitopic survey is essential.

Apart from the type of survey available, it matters whether analysts have access to only one single cross-section of data, several cross-sections, or panel data. In principle, insights into the dynamics of poverty require the availability of several multitopic household datasets collected at different times. Such information allows for measuring changes in poverty as well as the underlying characteristics causing these changes (cases 8 and 9). In countries where only one cross-sectional survey is available (5 and 7 in table 1.24), quasipanel data can sometimes be derived if income and consumption are recorded at different points in time. Surveys sometimes record information on demographics, activities, and income in a first visit, and repeat the income module quarterly for a year thereafter. Some surveys also ask households to recollect their income or consumption for previous time periods. Even when no quasipanel components are available, it may be possible to build measures of household vulnerability that rely on the variation within communities or other subgroups, or on external information on the seasonality of prices and production. More can be done when two or more cross-section surveys are available (6 and 8 in table 1.24) because changes in the levels and patterns of poverty over time can be analyzed. As mentioned earlier, poverty comparisons over time require careful analysis, but they give insights into the dynamics of poverty and its determinants, and they can be used for evaluation. While repeated cross-sections reveal trends for population groups, they do not allow the tracking of individuals or households over time. They reveal aggregate changes, but they do not capture individual movements into or out of poverty.

Box 1.10 summarizes key questions in assessing data availability for poverty analysis. Panel data (9 in table 1.24) follow the same individuals or households over time, so that one can relate their patterns of consumption and income to changes in other characteristics, such as demographics, migration, labor market situation, durable goods ownership, access to services, and health and education status. Panel data have advantages over repeated cross-sectional surveys. They permit the analysis of the factors that underlie mobility. They also record information on past events more precisely than the retrospective questions sometimes included in cross-sectional surveys, and they help in assessing the impact of public programs and services on poverty outcomes. Only panel data allow analysis of the determinants of poverty, while cross-sectional data are limited to revealing correlates of poverty. Correlates are characteristics that are found to be closely linked to poverty—for example, family size might be linked to poverty—but no causality pattern can be inferred from their analysis. For example, it is impossible to say whether a family is poor because it is large or whether a family is large because it is poor. On the contrary, determinants of poverty provide information on the causes of poverty and can be analyzed by looking at households over time and analyzing their welfare changes in light of their characteristics.

Some limitations of panel data are that households can change over time, disappear entirely from the sample (because of death or migration), or split or regroup because children grow up or household members are married or divorced. If the disappearance from the panel (attrition) is linked to certain characteristics—for example households with good education move away from poor neighborhoods—then the estimation results of panel regressions have to be treated with care. Furthermore, as time passes panel surveys can become less representative if they fail to include new members of the population—new births or immigrants. As with other surveys, panel data can also suffer from measurement errors, especially those related to household income and consumption, which can affect the quality of mobility statistics.

**Box 1.10. Questions for Assessing Quantitative Data Availability for Poverty Analysis**

**Is a recent multitopic household survey available? Is the survey representative in the most important areas in the country? Can the survey be used to learn about gender, urban and rural, racial, or ethnic dimensions of poverty?**

**Are single-topic surveys available that could be used in measuring and analyzing income and consumption poverty? Has one Demographic and Health Survey been conducted, or have repeated surveys been conducted?**

**How old is the census? Can it still be used to derive a map of service access?**

**Are poverty monitoring surveys executed or planned?**

### 1.5.3 Qualitative data

Qualitative data and research (technical notes A.12 and A.13) can be very useful to complement a quantitative poverty analysis. Qualitative techniques have been used to analyze household participation in informal networks; patterns in household income and consumption, particularly seasonal variations; people’s perceptions of poverty and vulnerability; the strategies put in place by households to reduce their vulnerability to income changes; and so forth. In the latter case, it is important to see whether households engage in depletive strategies—when they sell their productive assets; diversify their income sources to reduce the probability of income changes; reduce their consumption in case of income change; or manage to find new means to increase their income—for instance, by changing their labor supply.

Qualitative techniques help in understanding household behavior, and the interpretation of quantitative results can be complemented, triangulated, and enriched with qualitative work. Institutional, political, and sociological analysis is needed to understand many issues, such as:

- why the informal sector might play a minor or major role in absorbing the labor supply of the poor. The determinants of the role of the informal sector can be legal (regulations), economic (entry costs), sociological (stigma effects, gender bias), and so on;
- why certain factors are correlates of poverty. For example, certain groups in society, as classified by gender or by ethnicity, may be poorer than others because they are discriminated against. Qualitative work can help uncover such discrimination;
- what factors influence poverty outcomes that are not easily quantifiable—for example, the degree to which trust in institutions or corruption undermine the working of education and health programs; and
- how the intrahousehold distribution of resources is structured along gender or age lines, that is, whether intrahousehold poverty is hidden in households that theoretically have sufficient resources (see chapter 10, “Gender”).

Qualitative research tools range from participatory assessments (see technical note A.13) to ethnographic and sociological case studies, to institutional political investigations. Some of these tools are described in table 1.25. These tools help in gathering information that household surveys cannot capture, or can capture only in part (for instance, subjective dimensions of poverty and variations in perceptions along gender, urban/rural, or ethnicity lines; barriers that poor people themselves believe are stopping them from advancing; intrahousehold inequalities; poor people’s priorities for action; cultural factors determining poverty, such as gender roles and some traditional beliefs; political factors determining poverty, such as trust, corruption, and conflict; certain social factors determining poverty, such as the role of community networks, and so on). The tools may also help in the design appropriate to household survey questionnaires—for example, in the section on reasons for use or nonuse of health and education facilities. Finally, the tools may help to assess the validity of survey results at the local level and evaluate how much general policy design should consider the heterogeneity of local conditions.

Participatory assessments can help policymakers determine the type of indicators important for the poor—is it housing, employment, or income? They can also capture information other sources cannot, such as the incidence and effect of domestic violence (see chapter 7, “Participation” and technical note A.13). Beneficiary and participatory assessments also involve the population more than household surveys. They can take different forms. In townhall or village meetings, citizen groups or their representatives can discuss poverty problems and policies, rank what they consider the causes of poverty, and map out new infrastructures in actual planning exercises. Individual interviews can investigate the

**Table 1.24. Income Poverty: Data Availability and Analyses Tools**

<i>Case No.</i>	<i>Data availability</i>	<i>Income-poverty measurement (IPM)</i>	<i>Analytical tools</i>
1	No surveys (multi- or single-topic surveys) exist. Only census data or administrative data available	IPM not possible	<ul style="list-style-type: none"> <li>• Geographic maps: access to services; housing deficit; literacy, GDP per capita but not income poverty</li> <li>• Geographic incidence: of spending or enrollment in relation to access maps</li> </ul>
2	One round of rapid monitoring surveys exists (CWIQ), priority survey	IPM not possible; wealth index can be calculated as proxy for income (but no absolute line applied)	<p>By wealth quintile:</p> <ul style="list-style-type: none"> <li>• geographic maps (depends on size of survey) using poorest 20 or 40 percent of wealth indicator</li> <li>• risk of being in bottom 20 percent wealth quintile (by group, characteristic)</li> <li>• profile of wealth relationship with education, enrollment, access, and satisfaction with services; basic service access; basic labor market statistics</li> <li>• incidence analysis (distribution of health, education, specific program spending by area and wealth quintile)</li> </ul>
3	One cross-section Demographic and Health Survey	IPM not possible; wealth index can be calculated as proxy for income (but no absolute line applied)	<p>By wealth quintile:</p> <ul style="list-style-type: none"> <li>• geographic maps (depends on size of survey) using wealth indicator (20 or 40 percent poorest)</li> <li>• risk of being in bottom 20 percent wealth quintile (by group, characteristic)</li> <li>• profile of wealth relationship by quintile with education, enrollment, health outcome indicators; basic service access; basic labor market statistics</li> <li>• incidence analysis (distribution of health, education, specific program spending by area and wealth quintile)</li> </ul>
4	Repeated cross-section Demographic and Health Surveys	IPM not possible; wealth index can be calculated as proxy for income (but no absolute line applied)	<p>As above, plus the following:</p> <ul style="list-style-type: none"> <li>• changes in risks, profile, incidence (by wealth quintile)</li> </ul>
5	One cross-section single-topic survey (with income/consumption variable)	IPM possible—one time period	<p>By poor/nonpoor groups or by using income variable:</p> <ul style="list-style-type: none"> <li>• geographic maps (depends on size of survey)</li> <li>• profile (limited) of poverty group and quintile to labor market, education</li> <li>• risk analysis (limited)</li> <li>• incidence (limited)</li> <li>• static decomposition (inequality)</li> <li>• correlates (limited)</li> </ul>

**Table 1.24. Income Poverty: Data Availability and Analyses Tools (continued)**

<b>Case No.</b>	<b>Data availability</b>	<b>Income-poverty measurement (IPM)</b>	<b>Analytical tools</b>
6	Repeated cross-section single-topic surveys (with income/consumption variable)	IPM possible—several time periods	As above, plus the following: <ul style="list-style-type: none"> <li>• dynamic decomposition analysis (inequality and growth)</li> <li>• risk, profile, correlates, incidence, welfare changes over time (limited)</li> </ul>
7	One cross-section of multitopic survey	IPM possible—one time period	By poor/nonpoor groups or by using income variable: <ul style="list-style-type: none"> <li>• geographic maps (depends on size of survey)</li> <li>• profile</li> <li>• risk analysis</li> <li>• correlates</li> <li>• static decomposition (inequality)</li> <li>• incidence</li> </ul>
8	Repeated cross-section of multitopic survey	IPM possible—several time periods	As above, plus the following: <ul style="list-style-type: none"> <li>• dynamic decomposition of poverty changes</li> <li>• repeated cross-section regression</li> <li>• map, profile, risk, incidence, welfare changes in time</li> </ul>
9	Repeated multitopic survey with panel component	IPM possible—several time periods	As with case 7 plus case 8, plus the following: <ul style="list-style-type: none"> <li>• panel growth regressions (determinants)</li> <li>• mobility/vulnerability analyses, entry/exit modeling, duration analysis</li> </ul>

**Table 1.25. Data Collection Methods for Qualitative and Participatory Assessments**

<i>Data collection</i>	<i>Methods</i>
Beneficiary assessments	Participant observation and more systematic data collection methods like structured interviews over a limited time span
Ethnographic investigations	Anthropological research techniques, especially direct observation, to analyze the influence of ethnicity, gender, and village stratification on the household and group well-being and behavior
Longitudinal village studies	Wide variety of methods ranging from direct observation and recording (tabulation), periodic semistructured interviews with key informants (for example, health center staff) and village population, to survey interviews in several different observation periods
Participatory assessments	Ranking, mapping, diagramming, and scoring methods are prominent together with open interviews and participant observation. The time horizon of participatory assessments is often short. They build on local populations describing and analyzing their own reality surrounding poverty and well-being.

problems of women or children in households. Participatory methods do not necessarily guarantee, however, that all groups in the community are given an equal voice. There is a danger that women may be underrepresented. This danger may be even more present for the very poor. Box 1.11 summarizes key questions to consider in assessing qualitative data availability.

Whenever possible, it is important to link participatory and qualitative investigations with household surveys and population censuses in a formal way. This can be done by collecting variables in participatory studies that allow for easy comparison with regional or national averages obtained from quantitative sources; designing qualitative case studies so that they are done on subsamples of larger surveys; and following formal sampling and data recording procedures that allow for systematic analysis and replicability of qualitative results. Technical note A.13 suggests ways to assess whether sufficient qualitative and participatory information is available to inform poverty analyses and antipoverty policy formulation.

## 1.6 Conclusion

This chapter focused on analytical techniques to measure and understand the income or consumption dimension of poverty, inequality, and vulnerability. The techniques described ranged from developing a simple poverty profile to conducting panel regressions to examine vulnerability, and from using transition matrixes to examine the stability of welfare rankings to a decomposition of inequality measures. However, the range of tools that can be applied to better understand poverty will depend crucially on data availability. The richest understanding of income poverty can be gained if several rounds of multitopic household surveys are present, especially if they contain a panel component of identical households being visited at different points in time. The analysis of income poverty presented here should ideally be complemented with an examination of other dimensions of poverty and how the dimensions are related to each other. Determinants of different dimensions of poverty can then be compared and common factors singled out for policy interventions. For example, health poverty analysis of the determinants of malnutrition often reveals that a mother's education is a key determinant of the nutritional status of her children. Income poverty can also be closely associated with the same variable so that policies that aim to improve female education can have important synergistic effects on both malnutrition and income poverty. However, analyzing the determinants of various aspects of poverty can also reveal important differences in the determinants, which would then imply that policymakers would have to make important choices as to which dimension of poverty they would want to tackle first.

### **Box 1.11. Questions for Assessing Qualitative Data Availability for Poverty Analysis**

**Are community case studies, ethnographic studies, and participatory assessments available to complement the household survey results? Are they recent?**

**Have the qualitative studies been properly integrated in survey findings and design?**

**Do qualitative studies uncover additional factors linked to income and consumption poverty? How can these be addressed at the political level?**

## Guide to Web Resources

- United States Census Bureau: List and links to statistical agencies worldwide. These provide information on the latest census, household surveys, and specialized datasets. Available at [http://www.census.gov/main/www/stat\\_int.html](http://www.census.gov/main/www/stat_int.html).
- Core Welfare Indicators Questionnaire—joint initiative by World Bank, UNDP, and UNICEF to monitor social indicators in Africa. Available at <http://afr.worldbank.org/aft2/cwiq/overvw.htm>.
- World Bank *Research Observer*, master list of articles. Available at <http://www.worldbank.org/research/journals/wbromast.htm>.
- World Bank Web site on Inequality: Measurement and Decomposition. Available at <http://www.worldbank.org/poverty/inequal/methods/index.htm>.
- World Bank Web site on Living Standards Measurement Study—a household survey in measuring and understanding poverty. Available at <http://www.worldbank.org/lms>.
- Demographic and Health Surveys—complete list of surveys available and description of data. Statistics on population, health, and nutrition in developing countries. Available at <http://www.macromint.com/dhs>.
- Philippine social weather surveys—data on Philippine economic and social conditions. Available at <http://www.sws.org.ph/swr.htm>.
- Web site of International Food Policy Research Institute, a member of the Consultative Group on International Agricultural Research. Available at <http://www.cgiar.org/ifpri/index.htm>.
- World Bank Web site on Geographic Aspects of Inequality and Poverty. Available at <http://www.worldbank.org/poverty/inequal/povmap/index.htm>.
- Web site of United Nations Environment Program’s Global Resource Information Database, use of Geographic Information System for agricultural research and poverty mapping. Available at <http://www.grida.no/prog/global/poverty/index.htm>.

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# Annex A

## Poverty Measurement and Analysis: Technical Notes

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## **Technical Note A.1 Measuring Poverty and Analyzing Changes in Poverty over Time**

This note provides mathematical expressions for the most commonly used poverty measures and for their decomposition by sector or, more generally, by group. The note focuses on the first three poverty measures of the so-called FGT class (Foster, Greer, and Thorbecke 1984), namely, the headcount, the poverty gap, and the squared poverty gap.

### **A.1.1 Poverty measures**

*Poverty Headcount.* This is the share of the population that is poor, that is, the proportion of the population for which consumption or income  $y$  is less than the poverty line  $z$ . Suppose we have a

population of size  $n$  in which  $q$  people are poor. Then the headcount index is defined as

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

**Poverty Gap.** The poverty gap, which is often considered as representing the depth of poverty, is the mean distance separating the population from the poverty line, with the nonpoor being given a distance of zero. The poverty gap is a measure of the poverty deficit of the entire population in which the notion of “poverty deficit” captures the resources that would be needed to lift all the poor out of poverty through perfectly targeted cash transfers. It is defined as follows:

$$PG = \frac{1}{n} \sum_{i=1}^q \left[ \frac{z - y_i}{z} \right]$$

where  $y_i$  is the income of individual  $i$ , and the sum is taken only on those individuals who are poor (in practice, we often work with household rather than individual income, but individual income can still be defined as being equal, say, to the per capita income of the household). The poverty gap can be written as being equal to the product of the income gap ratio and the headcount index of poverty, where the income gap ratio is itself defined as

$$PG = I * H, \text{ with}$$

$$I = \frac{z - y_q}{z} \quad \text{where} \quad y_q = \frac{1}{q} \sum_{i=1}^q y_i \quad \text{is the average income of the poor.}$$

It must be emphasized that the income gap ratio  $I$  in itself is not a good measure of poverty. Assume that some households or individuals who are poor but close to the poverty line are improving their standards of living over time and, thereby, become nonpoor. The income gap ratio will increase because the mean distance separating the poor from the poverty line will increase (this happens because some of those who were less poor have emerged from poverty—so that those still in poverty are, on average, farther away from the poverty line), suggesting a deterioration in welfare, while nobody is worse off and some people are actually better off. Although the income gap ratio will increase, the poverty gap  $PG$  will decrease, because the headcount index of poverty will decrease, suggesting an improvement toward poverty reduction. The problem with the income gap ratio is that it is defined only on the population that is poor, while the poverty gap is defined over the population as a whole.

The poverty gap is a useful statistic to assess how many resources would be needed to eradicate poverty through cash transfers perfectly targeted to the poor. Assume, for example, that the poverty gap is equal to 0.20. This means that, on average, the cash transfer needed to lift each poor person out of poverty represents 20 percent of the poverty line. If the mean income in the country is equal to twice the poverty line, the cash transfer would represent 10 percent of the country’s mean income. If the mean income of the nonpoor equals twice the poverty line, and if half the population is poor, it can be shown that the tax rate that would have to be imposed on the nonpoor to lift the poor out of poverty with perfectly targeted transfers again would be 20 percent. If the mean income of the nonpoor is equal to four times the poverty line, under the same assumption the necessary tax rate would be 10 percent. Such simple simulations can be used to communicate intuitively the meaning of the poverty gap. In practice, however, given that perfectly targeted cash transfers to eradicate poverty are neither feasible nor necessarily a good thing (high tax rates could stifle economic growth and, thereby, future poverty reduction), one must be careful with their use.

**Squared Poverty Gap.** This is often described as a measure of the severity of poverty. While the poverty gap takes into account the distance separating the poor from the poverty line, the squared poverty gap takes the square of that distance into account. When using the squared poverty gap, the poverty gap is weighted by itself, so as to give more weight to the very poor. In other words, the squared poverty gap takes into account the inequality among the poor. It is obtained as follows:

$$P2 = \frac{1}{n} \sum_{i=1}^q \left[ \frac{z - y_i}{z} \right]^2$$

The headcount, the poverty gap, and the squared poverty gap are the first three measures of the FGT class of poverty measures. The general formula for this class of poverty measures depends on a

parameter  $\alpha$ , which takes a value of zero for the headcount, one for the poverty gap, and two for the squared poverty gap in the following expression:

$$P\alpha = \frac{1}{n} \sum_{i=1}^q \left[ \frac{z - y_i}{z} \right]^\alpha$$

It is important to use the poverty gap or the squared poverty gap in addition to the headcount for evaluation purposes, since these measure different aspects of income poverty. Indeed, basing an evaluation on the headcount ratio would consider as more effective those policies that lift the richest of the poor (those close to the line) out of poverty. On the basis of the poverty gap  $PG$  and the squared poverty gap  $P2$ , on the other hand, the emphasis is put on helping those who are further away from the line, the poorest of the poor.

### A.1.2 Decompositions for changes in poverty over time

Two main decompositions have been used in the literature to analyze changes in poverty over time. The first decomposition deals with shifts in poverty between sectors or groups (Ravallion and Huppi 1991). The second decomposition deals with the contribution of income growth and changes in inequality to changes in poverty (Datt and Ravallion 1992; Kakwani 1997).

#### Sectoral decomposition

The poverty measures of the FGT class are additive. This means that the poverty measure for the population as a whole is equal to the weighted sum of the poverty measures for the population subgroups, with the weights defined by the population shares of the subgroups. This additive property makes it feasible to analyze the contribution of various population subgroups to changes in overall poverty over time. Assume that households or individuals can be classified according to various sectors in the economy. These may be industrial sectors, geographic sectors (urban versus rural), or any other sectors that the analyst may suggest. The overall change in poverty over time can be decomposed into (a) changes in poverty within specific sectors, or intrasectoral changes; (b) changes in poverty due to changes in the population shares of sectors, or intersectoral changes; and (c) changes due to the possible correlation between intrasectoral and intersectoral changes, or interaction effect. Denote by  $P_{it}$  the poverty measure in sector  $i$  at time  $t$ ; there are  $m$  sectors ( $i = 1, \dots, m$ ), with population share  $n_i$  in sector  $i$ , and two periods (1 and 2). Then, the overall change in poverty is equal to

$$\Delta P = \underbrace{\sum_{i=1}^m n_{i1}(P_{i2} - P_{i1})}_{\text{Intrasectoral}} + \underbrace{\sum_{i=1}^m P_{i1}(n_{i2} - n_{i1})}_{\text{Intersectoral}} + \underbrace{\sum_{i=1}^m (P_{i2} - P_{i1})(n_{i2} - n_{i1})}_{\text{Interaction effect}}$$

#### Growth and inequality decomposition

Changes in poverty rates can also be decomposed into changes due to economic growth (or mean income) in the absence of changes in inequality (or income distribution), and changes in inequality in the absence of growth. Denoting by  $P(\mu_t, L_t)$  the poverty measure corresponding to a mean income in period  $t$  of  $\mu_t$  and a Lorenz curve  $L_t$ , the decomposition is

$$\Delta P = \underbrace{[P(\mu_2, L_\pi) - P(\mu_1, L_\pi)]}_{\text{Growth impact}} + \underbrace{[P(\mu_\pi, L_2) - P(\mu_\pi, L_1)]}_{\text{Inequality impact}} + \underbrace{R}_{\text{Residual}}$$

The first component is the change in poverty that would have been observed if the Lorenz curve had remained unchanged, while the second component is the change that would have been observed if mean income had not changed. The last component is a residual.

## Technical Note A.2 Estimating Poverty Lines: The Example of Bangladesh

As noted in the chapter's main text, to measure poverty one needs (a) an indicator of well-being or welfare such as per capita caloric intake or per capita expenditure, (b) a threshold (the poverty line) to which each individual or household's welfare can be compared, and (c) a poverty measure. Differences in poverty estimates can result from differences in the choice of the indicator, the threshold, or the poverty measure. Using an example from Bangladesh, this note focuses on differences in the choice of the indicator and the threshold. Specifically, the focus is on (a) the degree of representativeness of the indicator, meaning the extent to which the chosen indicator of welfare is able to capture the well-being of the households at a sufficiently broad level; and (b) the degree of consistency of the threshold (poverty line), meaning the extent to which the chosen threshold represents similar levels of well-being over time and across groups, ensuring that the poverty estimates can be used for valid comparisons of poverty over time and across groups.

Three main methods have been used for estimating poverty in Bangladesh. The methods differ in terms of their indicator of welfare and their approach to the threshold or poverty line: direct caloric intake, food energy intake, and cost of basic needs, as summarized in table A.1. The drawback of the direct caloric intake method is that its indicator is not representative, while the drawback of the food energy intake method is the lack of consistency of its threshold or poverty line. The cost of basic needs method can be thought to be both representative and consistent for comparisons over time and across groups, at least more so than the alternative methods.

The Bangladesh Bureau of Statistics (BBS) first relied on the direct caloric intake method to measure poverty, which considers as poor any household not meeting the nutritional requirement of 2,122 kilocalories per day and per person; that is, on the basis of the quantity of food consumed by each household, the BBS computed per capita caloric intakes and considered as poor any household whose intake was below 2,122 kilocalories per person on a daily basis. The difficulty with this method is that it equates poverty with malnutrition or a proxy thereof. If we consider poverty as a lack of command of basic goods and services, measuring poverty by caloric intake only is unlikely to represent adequately the state of deprivation of the poor.

The BBS also relied on the food energy intake method to compute poverty lines. The idea with this method is to find the value of per capita consumption at which a household can be expected to fulfill its caloric requirement; that is, the poverty line is defined by the level of per capita consumption at which people can be expected to meet this requirement. This represents a methodological improvement in terms of representativeness because the food energy intake method provides a monetary rather than purely nutritional concept of poverty. Yet the method suffers from major deficiencies in terms of consistency in that the poverty lines generated might not represent an identical level of welfare (specifically, an identical purchasing power in real terms) over time or across groups and, hence, poverty comparisons may not be valid.

To illustrate the weaknesses of the food energy intake method, imagine that following a decrease in their income, households change their consumption patterns to consume less expensive food. Although their level of welfare has decreased (and, hence, poverty must have increased), the researcher using the food energy intake method may well find that poverty has decreased. This is because in buying lower-

**Table A.1. Strengths and Weaknesses of Alternative Methods for Poverty Measurement**

	<i>Direct caloric intake</i>	<i>Food energy intake</i>	<i>Cost of Basic Needs</i>
Indicator	Caloric intake	Expenditure (or income)	Expenditure (or income)
Threshold	2,122 kilocalories/person-day	Expenditure level at which household members are expected to reach caloric intake threshold	Expenditure level at which household members are expected to meet basic needs (food and nonfood)
Measure	Headcount or other	Headcount or other	Headcount or other
Strengths and Weaknesses	Indicator not representative; threshold consistent (for monitoring caloric intake)	Indicator representative; threshold not consistent (for real expenditures)	Indicator representative; threshold consistent (for real expenditures)

Source: Wodon (1995).

quality food, households meet their caloric requirement at a lower expected level of per capita consumption expenditure and, hence, the estimated poverty line will be lower. This scenario is not hypothetical; in fact, the poverty line in urban areas computed by the BBS with the food energy intake method in 1988–89 was lower than that computed in 1985–86, although prices of most consumption items increased between the two years. Surely, the lower BBS poverty lines of 1988–89 did not represent the same standard of living as the poverty line of 1985–86.

Recently, the BBS has adopted the cost of basic needs method for measuring poverty. With this method, an absolute poverty line is defined as the value of consumption needed to satisfy minimum subsistence needs. Difficulties arise in specifying these needs as well as the most appropriate way of attaining them. For food consumption, nutritional requirements can be used as a guide, as is the case with the other methods. In practice, this is often restricted to caloric (and possibly protein) requirements, but even then there is the question of which food basket to choose in order to meet the requirements. Specifying minimum requirements for nonfood consumption is more difficult, and various methods have been proposed for dealing with nonfood basic needs. Another issue relates to the adjustments that must be made for differences in the cost of food and nonfood items between regions, and possibly over time, either when the survey has been carried over a relatively long period of time such as one year, or when one is using several surveys for poverty monitoring.

The first step consists of the definition of a bundle of food items meeting a given nutritional requirement (2,122 kilocalories per person and per day). Many food bundles can provide this requirement. The bundle used includes rice, wheat, pulses, milk, mustard oil, beef, fresh water fish, potatoes, other vegetables, sugar, and bananas. It could be argued that the use of a common food bundle for the whole country is inadequate because consumption patterns of households may vary across areas (for example, households in coastal areas may eat more fish). Households in different regions might substitute some goods for others if prices vary by area. Other difficulties, such as seasonality in food prices, potential omitted variables or selectivity bias in the choice of food items consumed, or errors of measurement in the database for the imputation of food produced and consumed at home, may lead to bias in the estimates of food prices. In the case of Bangladesh, these considerations are not considered too problematic, but in other countries adjustments may have to be made to the food bundle in various areas.

The second step consists of estimating the cost of the food bundle. Accordingly, prices by geographic area are computed for each component of the food bundle. There are different methods to compute these prices. A first method consists in taking the average prices paid by households in each region (where, for a given household, the prices of the various food items in the food bundle are obtained by dividing the reported food expenditure by the quantity consumed). Because the poor tend to buy goods of lower quality, they usually face, on average, lower prices than the nonpoor. Taking the regional average over all households, therefore, tends to overestimate prices faced and result in a higher poverty line and higher poverty measures. In addition, imagine a situation in which the welfare of the nonpoor increases over time while that of the poor does not change. Because the nonpoor will tend to buy goods of higher quality at higher prices, the poverty line will be higher, suggesting an increase in poverty. A second method consists of taking the average prices over the poor population only. A third method, used by the BBS, consists of using regressions to estimate the differences between regions in the prices paid by households for their food. Having estimated the cost of each food item  $j$  in each region  $k$ , and denoting these prices by  $P_{jk}$ , food poverty lines can be computed for each region  $k$  as  $Z_{kf} = \sum_j P_{jk}F_j$ , where  $F_j$  is the per capita quantity of food item  $j$  in the basic food bundle.

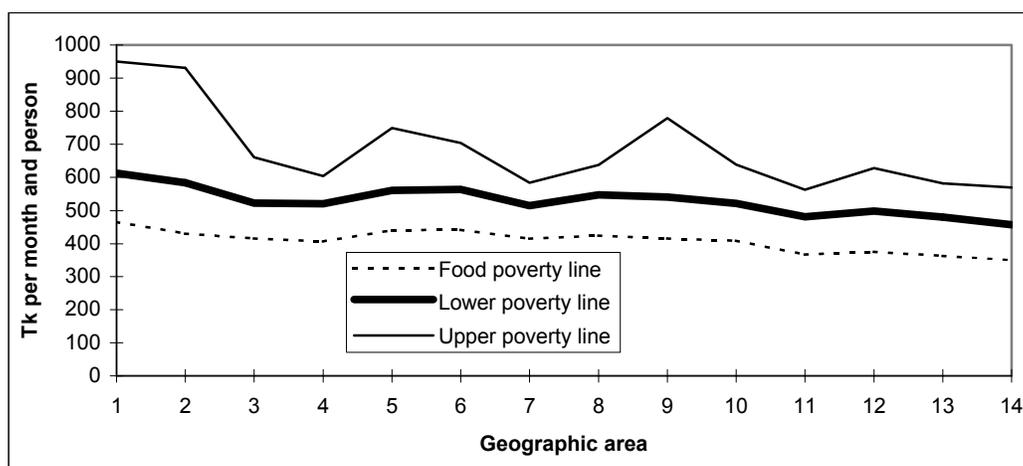
Once the food component of the poverty lines has been estimated, the third step is to estimate a reasonable allowance for nonfood consumption. Various methods can be used (Ravallion 1994). The BBS considered two methods. The first is based on computation of the amount of nonfood expenditures for the households (in geographic area  $k$ ) whose total consumption equals the regional food poverty line  $Z_{kf}$ . The nonfood expenditures of the households in this first case must be necessities, since the households are giving up food expenditures considered necessary to buy nonfood items. In the second method, the share of the nonfood expenditures for the households whose food expenditure is equal to the food poverty line was computed. On average, in the second case, the households “near the poverty line” are able to meet their nutritional requirements, and the nonfood allowance computed this way will be more generous than that in the first case. Various techniques (both parametric and nonparametric) can be used to estimate the nonfood components of the regional poverty lines, but the details go beyond the scope of this technical note. The two estimates, specific to each region, can be denoted by  $ZL_{kn}$  and  $ZU_{kn}$  ( $k$  is the region,  $n$  stands for nonfood, and the subscripts  $L$  and  $U$  refer to the “lower” and “upper” allowances for nonfood consumption obtained, respectively, from the first and second

cases above). Then, the two overall poverty lines that include provisions for both food and nonfood basic needs are defined as  $ZLk = Zkf + ZLkn$  and  $ZUk = Zkf + ZUkn$ , with  $ZLk$  being smaller than  $ZUk$ .

As mentioned in the main text, once computed, the regional and time adjustments can be used in two ways. Either one adjusts the indicator of consumption or income with a price deflator for each region and period and compares that indicator to a unique reference poverty line, or one keeps a different poverty line for each region or period to which the indicator of income or consumption is compared. The final results in terms of poverty comparisons will be the same, since these are simply two alternative ways to use the same adjustments in the poverty comparisons between regions and household groups, or over time.

Figure A.1 provides the results of the estimation of the poverty lines for the various regions for one of the survey years. The vertical axis provides the level of the poverty line in Taka per person and per month. The horizontal axis represents 14 different regions in the country. The food poverty line is the lowest one. The middle line represents the total poverty line with the lower nonfood allowance. The top line represents the total poverty line with the upper allowance for nonfood consumption. Clearly, there are large differences in the cost of living between areas. Not surprisingly, the area in the figure corresponding to 1, which represent the capital city of Dhaka, has the highest cost of living. Overall, there are large variations by city or area within urban and rural areas.

**Figure A.1. Food: Lower and Upper Poverty Lines by Area**



Source: Wodon (1997a).

### Technical Note A.3 Estimating the Indicator of Well-Being: The Example of Consumption in Uganda

This note presents an example of the types of adjustments that one may have to make for the indicator of well-being (income or consumption) computed at the household level in order to better reflect the underlying level of welfare that one is trying to capture, and to make appropriate comparisons over time and between regions. The illustration is based on the Ugandan experience. Table A.2 reports the estimates of consumption per capita as calculated in the official survey reports (that is, before adjustments) as well as after adjustments. The adjustments made by the authors fall into three categories: adjustments for sampling design, for questionnaire design, and for prices.

#### A.3.1 Sampling

The authors used two surveys—the Integrated Household Survey (IHS) and the monitoring surveys (MS), both of which have a sampling frame based on the 1991 census and large samples (10,000 households in the IHS and 5,000 in each MS).

**Table A.2. Mean Consumption per Capita before and after Adjustments  
(ush. per month)**

	<i>IHS</i>	<i>MS-1</i>	<i>MS-2</i>	<i>MS-3</i>	<i>MS-4</i>
	<i>92/93</i>	<i>93/94</i>	<i>94/95</i>	<i>95/96</i>	<i>97/98</i>
Before adjustments (official reports)	11574	13195	15221	17499	20540
1. Adjustment for geographic coverage	11786	13501	15388	17721	20747
2. Adjustment for public transport fares	11981	–	–	–	–
3. Adjustment for food consumed at home	12769	14748	16643	18568	21976
4. Adjustment for differences in regional prices	13187	15267	17064	18973	22139
5. Adjustment for inflation (1989 prices)	5452	5825	6058	6187	6353
6. Adjustment for reweighting MS-1	5452	5718	6058	6187	6353

– Not applicable.

Source: Appleton and others (1999).

- **Changes in geographic coverage.** Security problems led to the exclusion of a few districts (Kitgum, Gulu, Kasese, and Bundibugyo) from MS-4. To ensure comparability over time, the authors excluded the four districts from all calculations. These districts are relatively poor, so that their omission raises mean consumption per capita by 1.8 percent in the IHS and 2.3 percent in the MS-1 (adjustment number 1).
- **Seasonality.** The IHS was conducted throughout an entire year, but MS-1 and MS-2 were conducted only during certain months of the year. This is problematic, since food consumption is reported for a short recall period only and subject to seasonal variations. The authors chose not to adjust for seasonality because of data limitations and the assessment that an adjustment would not affect the main conclusions of the analysis.
- **Panel data.** The MSs have a panel element, with half the enumeration areas being revisited and, within those areas, half of the households being revisited. This led to a very high rate of attrition among households, and the panel structure was abandoned in MS-4. The authors compared the mean levels of per capita consumption in MS-2 and MS-3 among panel and nonpanel households and concluded that no adjustment was needed for attrition. After the Ugandan Statistics Department changed its system for weighting households to take into account the panel structure of the data, however, because this had not been done for the MS-1 survey, the authors amended the weights for this survey, which did alter consumption estimates, raising them in rural areas and lowering them in urban (adjustment number 6).

### A.3.2 Questionnaire design

The MSs have similar questionnaires on consumption, while the IHS has more items. The way in which the data are recorded differs in both surveys, in terms of both what the interviewer must do and of the recall periods. In addition, the IHS has information on health and education expenditures at the individual level, while the MSs provide this information at the household level. To gauge the effects of these differences, the actual composition of expenditures was compared across surveys. The expenditures were similar across the IHS and MSs, but there was a discrepancy in the share of expenditures on transport and communications, reflecting a printing error. To adjust for this, the authors imputed expenditures for transportation using regional shares in the MS-1. Omission from the IHS of health expenditures for one district was dealt with in a similar manner. These adjustments raised the mean consumption figure for the IHS by 1.7 percent (adjustment number 2).

### A.3.3 Prices

Three adjustments were made to obtain consumption estimates in constant prices.

- **Valuation of home food consumption.** Home food consumption expenditures were revalued to be at market prices. This was done using median unit values from the surveys separately for urban and rural areas in each of four regions (eight sets of prices were computed). The adjustment increased the value of home food consumption by around 30 percent (adjustment 3).

- **Regional variation in food prices.** Food prices are markedly higher in some areas than others, particularly urban areas. Median unit values for purchases of important food items were used to construct regional food price indexes for each survey. Nonfood prices, however, were assumed to be constant across the country. This may be problematic, since, as suggested in the previous technical note (figure A.1), variations in nonfood prices between regions (and over time) are typically even larger than variations in food prices (adjustment 4).
- **Inflation over time and within surveys.** The composite national consumer price index (CPI) was used as a price deflator for expenditures recorded in the MS, converting the data into 1989 prices. During the implementation of the IHS, prices increased substantially, so that at the end of the sampling period they were 30 percent higher than at the beginning. To take this into account, the IHS expenditures were deflated using monthly rather than yearly CPI data (adjustment 5).

## Technical Note A.4 Poverty Maps and Their Use for Targeting

A poverty map is a geographic profile of poverty, indicating in which parts of a country poverty is concentrated. Such maps can play an important role in guiding the allocation of public spending to reduce poverty. A poverty map is most useful if it can be constructed at a fine level of geographic disaggregation. Unfortunately, accurate geographic disaggregation requires work with large datasets such as population censuses, which typically do not contain detailed income or spending information because collecting such data for the whole country is very expensive.

There are two ways of dealing with this problem. First, one can develop poverty maps on the basis of indexes of welfare constructed by combining information on variables such as access to water, electricity, sanitation, or educational level of the household head.

A second method consists of combining survey and census data. The idea is to develop simple models in which consumption or income is a function of such factors as housing, employment, household characteristics (such as size and composition), and educational variables (see technical note 8). The estimated parameters are then used in the census to predict household consumption. While consumption is not in the original census dataset, it is artificially added by using structural relationships derived from the survey. This approach can be pursued only if three data requirements are met. First, a household survey with consumption and other household characteristics must be available and should correspond roughly to the same period covered by the census. Second, unit record-level census data must be available for analysis. Third, a sufficient number of variables that are used to predict consumption must be available in the survey *and* in the census—it would not be possible otherwise to use the models based on the surveys to predict census consumption data.

The first step is to estimate a model of consumption or income using household survey data. As mentioned, the only variables that can be used to predict consumption or income are variables that are also available in the census. The second step is to apply the parameter estimates from the regressions to the census data. It is then possible to derive consumption or income estimates based on individual household characteristics in the census. These consumption or income data then allow the estimation of the probability of being poor of each household in the census dataset. Since the estimates are derived from an imperfect model, they will have a margin of error attached to them, and this has to be taken into account (see the heading entitled “Tests for the robustness of poverty comparisons” in the main text). While the accuracy of each household-level estimate may be low, at a more aggregate level these errors will tend to compensate each other, and regional or district estimates will be relatively accurate.

Ultimately, the optimal degree of disaggregation will depend on many factors. First, it will depend on the purpose for which the poverty map is built. Is it, for example, intended to identify government administrative areas so that the desired level of disaggregation is the same as the level of local government? Or is it intended to identify poor villages or neighborhoods within an administrative area so that community-level project interventions can be better targeted? Second, the choice of disaggregation level will depend on the extent to which the parameter estimates from a regression estimated at the regional level can be assumed to apply to subregional breakdowns. Indeed, the parameters have to be estimated at the level at which the household survey is representative (usually broad regions). Applying the parameters to all households in the census who belong to that region relied on the assumption that, within a region, the model of consumption or income is the same for all households regardless of the community in which they reside. Third, the desired degree of disaggregation will also depend on the availability of other sources of information on the poverty of individuals that might be available locally.

The most useful practical application to which this methodology can be devoted probably entails combining consumption-based poverty maps with other indicators of well-being, opportunity, and access for sectoral investment planning. For example, a map documenting, say, regional patterns of access to primary health care centers can be overlaid against a consumption- or income-based poverty map. The map can use other poverty statistics, such as the poverty gap. It might help policymakers decide which efforts to prioritize to expand access to primary health centers; health investment planning can prioritize the poorest areas with the lowest health coverage. Furthermore, a close correlation between, say, regional patterns of rural poverty and road access might also offer clues to possible causes of poverty. This type of exercise could be undertaken for a wide range of indicators: levels of health and education, ethnicity, access to infrastructure and other public services, or land quality and ecology.

See <http://www.worldbank.org/poverty/inequal/povmap/index.htm> for references on poverty maps; see Hentschel and others (2000) for an application.

## Technical Note A.5 Stochastic Dominance Tests

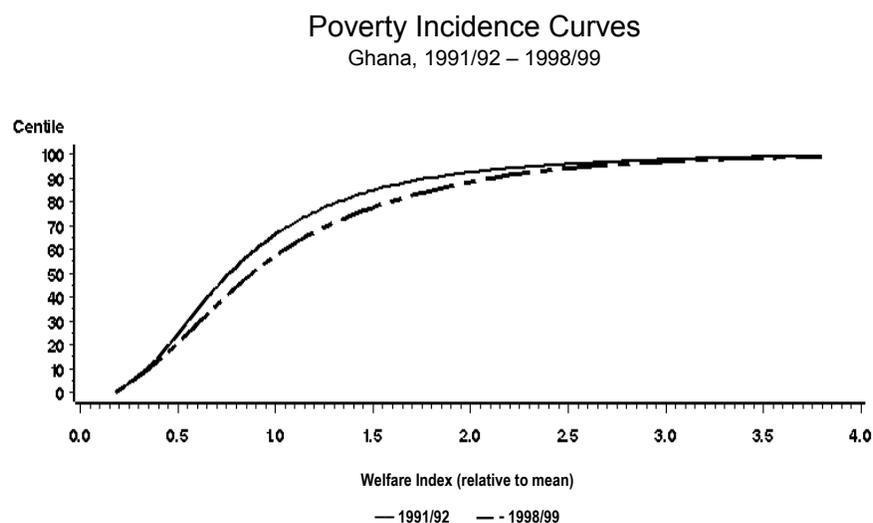
When comparing poverty measures over time or between groups, it is important to test the robustness of the observed changes in poverty indexes. Indeed, the observed changes might depend on the selected poverty line and, at the extreme, using two different poverty lines can suggest changes in opposite directions. Comparing poverty measures using stochastic dominance techniques can help in establishing the robustness of ordinal poverty rankings.

First-order statistical dominance involves comparing the cumulative distribution functions for the indicator of well-being (income or consumption) for each of the survey years, or for the various groups of households for which poverty comparisons are made. One distribution “dominates” another if the income distribution function for that year or that household group lies above that of the year or other group at all levels of income or consumption. If one finds that first-order dominance holds between two different years, or between two different groups, this implies that all FGT poverty measures, including the headcount, poverty gap, and squared poverty gap, in the first year or group are higher than in the other year or group for all poverty lines.

Second-order dominance tests involve analyzing “deficit” curves, or integrals of the cumulative income distribution functions, and similarly determine whether poverty has improved or worsened over time for all poverty measures of the order of the poverty gap or higher, such as the squared poverty gap. Still higher levels of dominance can be established, and multivariate stochastic dominance can be used in the context of multidimensional distributions of poverty.

Figure A.2 shows an example from Ghana, comparing the cumulative distribution functions (for first order stochastic dominance) of 1991/92 and 1998. The cumulative distribution for 1998 always lies below that for 1991/92, which implies that poverty has unambiguously fallen over this time period. If the two distributions had crossed, then poverty measures would have shown an increase for all the poverty lines in the range for which the second distribution is below the first, and a decrease for the others (see also Atkinson and Bourguignon 1982).

So-called sequential stochastic dominance tests have also been developed to check for the robustness of poverty comparisons to assumptions regarding differences in household needs according to household size apart from assumptions regarding the poverty lines (for recent applications, see, for example, Duclos and Makdissi and Makdissi and Wodon 2001).

**Figure A.2. Cumulative Distribution Functions to Establish First-Order Dominance**

Source: Ghana Living Standards Survey, round 3 and 4.

## Technical Note A.6 Applying Poverty Measurement Tools to Nonmonetary Indicators

Although poverty has been traditionally measured in monetary terms, it has many other dimensions: lack of access to public services related to education, health, and infrastructure; deficient social relations; insecurity and vulnerability; and low self-confidence and powerlessness. In some cases, it is feasible to apply the tools that have been developed for poverty measurement to nonmonetary indicators of well-being. The requirement for being able to apply the tools of poverty measurement to nonmonetary indicators is that it must be feasible to compare the value of the nonmonetary indicator for a given individual or household to a threshold or “poverty line” under which it can be said that individuals or households are not able to meet their basic needs. The idea can be illustrated with the three examples described below.

- **Health and nutrition poverty.** Morris, Flores, and Zúniga (2000) analyze the potential for targeting nutrition intervention programs in Honduras. The “nutrition poor” are defined as stunted children, that is, children who have a measure of height for age at least two standard deviations below international standards. The authors simulate a nutrition intervention reaching 20 percent of the children with a gain of half a standard deviation for beneficiaries, with different approaches for targeting the beneficiary children. The impact of the intervention is obtained by computing the incidence of stunting (the headcount for the nutrition poor) as well as the malnutrition gap and the quadratic malnutrition gap before and after the intervention. They find that the simulated program has the potential to substantially decrease the severity but not the incidence of stunting. Household targeting could reduce the malnutrition gap by more than 20 percent and the quadratic malnutrition gap by more than 30 percent, but it could be very expensive to implement. “Broad stroke” geographic targeting could reduce the same measures by 15 percent and 20 percent, respectively, and would be cheaper to implement.
- **Educational poverty.** In the field of education, one can use, for instance, illiteracy among children in age of primary or secondary school as the characteristic identifying the educational poor. Alternatively, in countries where literacy is high among new cohorts of children, one can compare the actual number of years of education completed by each child to a “poverty line” equal to the expected number of years of education for a child of that age without repetition and dropout. The results of such an exercise for Panama suggest that 29 percent of all children at primary school age in urban areas are behind in their level of schooling in terms of age-for-grade versus 51 percent in rural areas. This figure is the equivalent of the headcount index for traditional poverty measurement. The headcount of educational poverty among children in age of secondary school is much higher, at 60 percent for urban areas and 89 percent in rural areas, because delays in completing

primary education carry on to the secondary cycle and some students do not pursue their studies beyond the primary cycle. When the number of years of education separating the children from what they should have achieved at their age under perfect schooling conditions is taken into account, one can compute poverty gaps and squared poverty gaps.

- **Energy or fuel poverty.** Many households in developing countries cannot satisfy their basic energy needs. Although fuel is not a dimension of well-being as such, it is an important input for a healthy life (through cooking and heating), for a better education (lighting), and for higher security. One could define “fuel poverty” as the inability of households to meet basic energy needs (in Guatemala, the energy required to run two 60-watt light bulbs and a 16-watt radio for 4 hours and 10 kilograms of fuelwood each day was taken as the basic need—equivalent to 5.9 kilowatt-hour every day). Table A.3 shows that households with access to electricity consume, on average, 3,804 kilowatts per hour per year and pay 0.52 Quetzales (Qz) per kilowatt hour on average. Meanwhile, households without access to electricity have a lower energy consumption (2,892 kilowatts per hour) and pay a higher price (1.35 Qz per kilowatts per hour). One-fourth of the population with access to electricity is fuel poor (headcount of 25.5 percent), as compared to one-half of the population without access (headcount of 50.9 percent). Using estimates of the impact of access to electricity on the average price paid for energy, the authors estimate that if households without access were given access to electricity, the headcount among that group would be reduced to 36.5 percent.

**Table A.3. Fuel Poverty with and without Access to Electricity in Guatemala (1998/99)**

	<i>Households with access to electricity</i>	<i>Households without access to electricity</i>	
		<i>Current situation</i>	<i>With access</i>
Net consumption (all energy sources, kilowatts per hour)	3804	2892	3967
Price per effective kilowatts per hour	0.52	1.35	0.98
Fuel poverty headcount (percentage)	25.5	50.9	36.5

Source: Foster, Tre, and Wodon 2001.

## Technical Note A.7 Inequality Measures and Their Decompositions

Inequality measures have been introduced in the main text of the chapter. This technical note provides mathematical expressions for the three main measures: the Gini, Theil, and Atkinson indexes. Each index can be generalized in order to put more weight on selected parts of the distribution of income or consumption. As with poverty measures, some inequality measures can be decomposed, and this note presents decomposition formulas for the generalized entropy (GE) class, which includes the Theil index.

### A.7.1 Inequality measures

The standard Gini index measures twice the surface between the Lorenz curve, which maps the cumulative income share on the vertical axis against the distribution of the population on the vertical axis, and the line of equal distribution (see section 1.3.1, figure 1.4, in the chapter’s main text). A large number of mathematical expressions have been proposed for the Gini index, but the easiest to manipulate is based on the covariance between the income  $Y$  of an individual or household and the  $F$  rank that the individual or household occupies in the distribution of income (this rank takes a value between 0 for the poorest and 1 for the richest). Denoting by  $y$ , the mean income, the standard Gini index is defined as

$$Gini = 2 \text{cov}(Y, F) / \bar{y}.$$

The Gini has attractive theoretical and statistical properties that other inequality measures do not, which explains why it is used by most researchers. For a review and discussion of these properties, see chapter 2, “Inequality and Social Welfare.” The extended Gini uses a parameter  $\nu$  to emphasize various parts of the distribution. The higher the weight, the more emphasis is placed on the bottom part of the distribution ( $\nu = 2$  for the standard Gini index):

$$Gini(\nu) = \frac{-\nu \text{cov}(y, [1-F]^{\nu-1})}{y}$$

Another family of inequality measures is the general entropy measure, defined as

$$GE(\alpha) = \frac{1}{\alpha^2 - \alpha} \left[ \frac{1}{n} \sum_{i=1}^n \left( \frac{y_i}{y} \right)^\alpha - 1 \right]$$

$$\text{With } GE(0) = \frac{1}{n} \sum_{i=1}^n \log \frac{\bar{y}}{y_i}, \quad GE(1) = \frac{1}{n} \sum_{i=1}^n \frac{y_i}{y} \log \frac{y_i}{y} \quad \text{and} \quad GE(2) = \frac{1}{2n\bar{y}^2} \sum_{i=1}^n (y_i - \bar{y})^2$$

Measures from the GE class are sensitive to changes at the lower end of the distribution for  $\alpha$  close to 0, equally sensitive to changes across the distribution for  $\alpha$  equal to 1 (which is the Theil index), and sensitive to changes at the higher end of the distribution for higher values.

Atkinson proposed a third class of inequality measures. This class also has a weighting parameter  $\varepsilon$  (which measures aversion to inequality), and some of its theoretical properties are similar to those of the extended Gini index. The Atkinson class is defined as follows:

$$A_\varepsilon = 1 - \left[ \frac{1}{n} \sum_{i=1}^n \left( \frac{y_i}{y} \right)^{1-\varepsilon} \right]^{1/(1-\varepsilon)}$$

### A.7.2 Decomposition of inequality measures: Illustrations for the GE class

Inequality is often decomposed by population groups to assess the contribution to total inequality of inequality within and between groups—for instance, within and between individuals in urban and rural areas. Inequality measures can also be decomposed according to consumption or income sources in order to identify which component contributes most to overall inequality. Finally, decompositions can be used to analyze changes in income inequality over time. Decompositions are provided for the GE class below. Chapter 2, “Inequality and Social Welfare,” includes a detailed discussion of applications of decompositions of the extended Gini class of inequality measures that have especially attractive properties for policy simulations.

### A.7.3 Decompositions at one point in time

Total inequality  $I$  can be decomposed into a component of inequality between the population groups  $I_b$  and the remaining within-group inequality  $I_w$ . The decomposition by population subgroups of the GE class is defined as

$$I = I_w + I_b = \sum_{j=1}^k v_j^\alpha f_j^{1-\alpha} GE(\alpha)_j + \frac{1}{\alpha^2 - \alpha} \left[ \sum_{j=1}^k f_j \left( \frac{y_j}{y} \right)^\alpha - 1 \right]$$

where  $f_j$  is the population share of group  $j$  ( $j = 1, 2, \dots, k$ );  $v_j$  is the income share of group  $j$ ; and  $y_j$  is the average income in groups  $j$ .

Inequality measures can also be decomposed by source of consumption or income. The decomposition for the GE measure with  $\alpha = 2$  is as

$$I = \sum_f S_f = \sum_f \rho_f \frac{\mu_f}{\mu} \sqrt{GE(2) \cdot GE(2)_f}$$

where  $S_f$  is the contribution of income source  $f$ ;  $\rho_f$  is the correlation between component  $f$  and total income; and  $\mu_f/\mu$  is the share of component  $f$  in total income. If  $S_f$  is large, then component  $f$  is an important source of inequality.

### A.7.4 Decompositions for changes in inequality over time

Using subgroup decompositions, changes in inequality can be decomposed into (a) changes in the numbers of people in various groups or “allocation” effects, (b) changes in the relative incomes of various groups or “income” effects, and (c) changes in inequality within groups, or “pure inequality” effects. Because the arithmetic can be complex for some inequality measures, this decomposition is usually applied only to generalized entropy index  $GE(0)$  as follows:

$$\Delta GE(0) = \sum_{j=1}^k \bar{f}_j \Delta GE(0)_j + \sum_{j=1}^k \overline{GE(0)_j} \Delta \bar{f}_j + \sum_{j=1}^k [\bar{\lambda}_j - \overline{\log(\lambda_j)}] \Delta \bar{f}_j + \sum_{j=1}^k (\bar{v}_j - \bar{f}_j) \Delta \log(\mu(y))_j$$

Pure inequality effects

Allocation effects

Income effects

where  $\Delta$  is the difference operator;  $\lambda_j$  is the mean income of group  $j$  relative to the overall mean (that is,  $\lambda_j = \mu(y_j)/\mu(y)$ ), and the over-bar represents averages. The first term captures the pure inequality effects, the second and third terms, the allocation effects; and the fourth term, the income effects.

Using source decompositions, changes can be decomposed by income source. This allows seeing whether an income source  $f$  has a large influence on changes in total inequality over time. For the general entropy index with  $\alpha = 2$ , defining  $S_t$  as above, the decomposition is

$$\Delta GE(2) = \sum_f \Delta S_f$$

## Technical Note A.8 Using Linear Regressions for Analyzing the Determinants of Poverty

It has become a standard practice to analyze the determinants of poverty through categorical regressions such as probits and logits (see box 1.7 in the main text). When using such categorical regressions, it is assumed that the actual (per capita) income or consumption of households is not observed. We act as if we only know whether a household is poor or not, which is denoted by a categorical variable that takes the value of 1 if the household is poor, and 0 if the household is not poor. Under the hypothesis of a normal standard distribution for the error term, the model is estimated as a probit. If the error term is assumed to have a logistic distribution, the model is estimated as a logit. The main problem with categorical regressions is that the estimates are sensitive to specification errors. With probits, the parameters will be biased if the underlying distribution is not normal. More generally, the model does not make use of all the information available because it collapses income or expenditure into a binary variable. This does not mean that probit or logit regressions should never be used. Categorical regressions will typically have better predictive power for targeting, that is, for classifying households as poor or nonpoor (see technical note 9).

The alternative is to use the full information available for the dependant variable (indicator of well-being), and to run a regression of the log on the indicator (if the distribution is log normal.) Assume that  $w_i$  is the normalized indicator divided by the poverty line, so that  $w_i = y_i/z$ , where  $z$  is the poverty line and  $y_i$  is (per capita) income or consumption. A unitary value for  $w_i$  signifies that the household has its level of income or consumption exactly at the level of the poverty line. Denoting by  $X_i$  the vector of independent variables, the following regression can be estimated:

$$\text{Log } w_i = \gamma' X_i + \varepsilon_i.$$

From this regression, the probability of being poor can then be estimated as

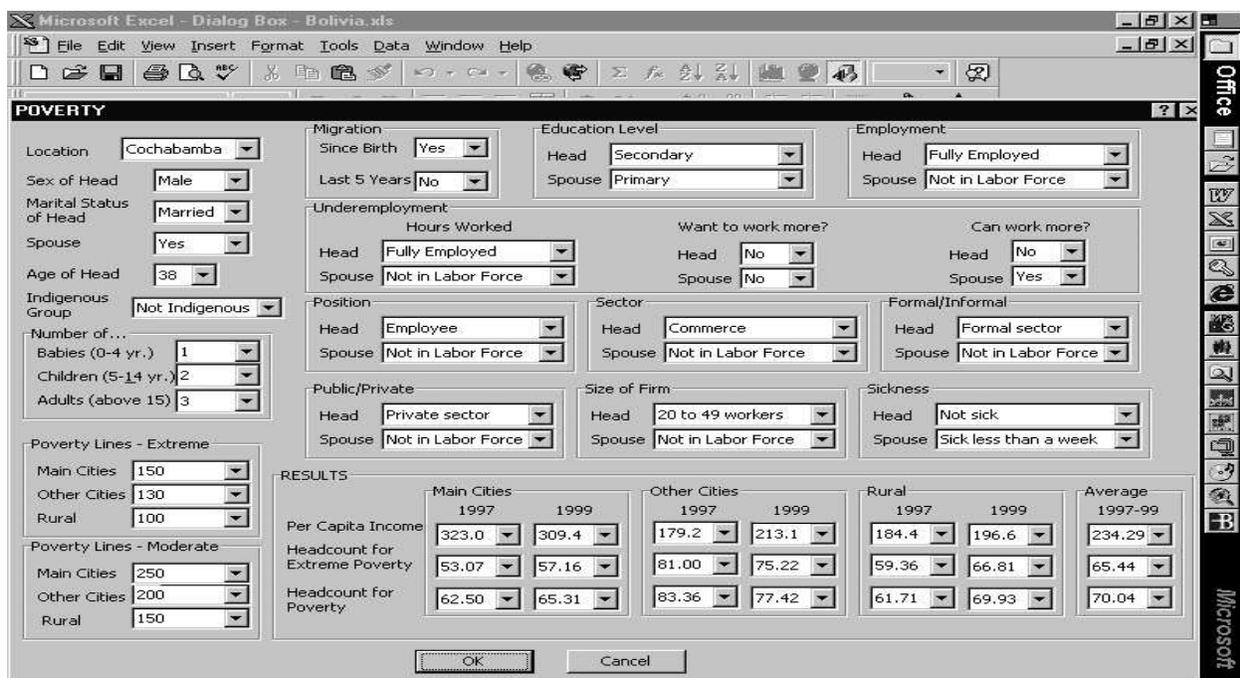
$$\text{Prob}[\log w_i < 0 \mid X_i] = F[-(\gamma' X_i)/\sigma].$$

where  $\sigma$  is the standard deviation of the error terms and  $F$  is the cumulative density of the standard normal distribution.

Once regressions have been estimated to analyze the determinants of poverty, the coefficients on the variables ( $\gamma$ ) can inform on the various correlates of poverty and be used to simulate the impact of various policies. Figure A.3 presents an Excel Dialog Box that was prepared for Bolivia using the coefficients of

multivariate regressions on the determinants of the logarithm of per capita income. Apart from a constant, the independent variables in the regressions, which are done separately for urban and rural areas, include (a) the geographic location of the household according to Bolivia's main cities and departments in rural areas; (b) household-level variables, including the number of babies, children, and adults and their square; whether the household head is a woman; the age of the head and its square; the marital status of the head; the migration status of the head (since birth and/or in last five years); and whether the household head speaks one of the main indigenous languages; (c) characteristics of the household head, including his or her level of education; whether he or she is unemployed and searching for work, not working, and has a secondary occupation apart from his or her primary occupation; his or her sector of activity; his or her position; whether he or she works in the public and/or formal sector; the size of the firm in which he or she works; and whether he or she has been sick and for how long; and (d) the same set of characteristics for the spouse of the household head, when there is one. The Dialog Box can be used to run simple simulations of the impact of any one of these variables on per capita income and the probability of being poor or extremely poor, holding constant all other variables. For example, one can see what the impact of raising the educational level of the head of a given household has on income and poverty. The user can also test how the probability of being poor or extremely poor changes with the choice of the poverty line.

**Figure A.3. Using Regression Estimates to Build Easy-to-Use Excel Software for Simulations**



Source: Wodon 2001a.

## Technical Note A.9 Using Categorical Regressions for Testing the Performance of Targeting Indicators

While categorical regressions should in most cases not be used to analyze the determinants of poverty, they can be used to measure the performance of alternative targeting indicators for social programs and transfers. This is an important issue because governments often use proxies for assessing the level of income or consumption of a household or individual in order to assess eligibility for programs benefits. Categorical regressions can help in choosing the best proxies for identifying the poor and the nonpoor, or more broadly for selecting beneficiaries. Receiving operating characteristics (ROC) analysis is one useful technique based on underlying logit regressions of the probability of being poor. It can be implemented easily with statistical packages such as STATA. The benefits of ROC analysis for selecting targeting indicators or proxies for income or consumption are discussed in Wodon (1997b).

To explain the principles behind ROC analysis, denote by  $P$ ,  $P^-$ , and  $P^+$  the number of the poor, the number of the poor classified as nonpoor, and the number of the poor classified as poor by a given

econometric model. Also denote by  $NP$ ,  $NP^-$ , and  $NP^+$  the number of the nonpoor, the number of the nonpoor classified as nonpoor, and the number of the nonpoor classified as poor. Sensitivity  $SE = P^+ / (P^- + P^+) = P^+ / P$  is the fraction of poor households classified as poor. Specificity  $SP = NP^- / (NP^- + NP^+) = NP^- / NP$  is the fraction of nonpoor households classified as nonpoor. The probability of errors of type I (identifying as poor a nonpoor household or individual) and type II (identifying as nonpoor a poor household or individual), as they are usually defined in economics, are captured by  $(1 - SP)$  and  $(1 - SE)$ .

**Table A.4. Terminology Used in ROC Analysis for Targeting Purposes**

<i>Predicted status</i>	<i>Actual status</i>	
	<i>Nonpoor</i>	<i>Poor</i>
Nonpoor	$SP = NP^- / (NP^- + NP^+)$	$1 - SE = P^- / (P^- + P^+)$
Poor	$1 - SP = NP^+ / (NP^- + NP^+)$	$SE = P^+ / (P^- + P^+)$

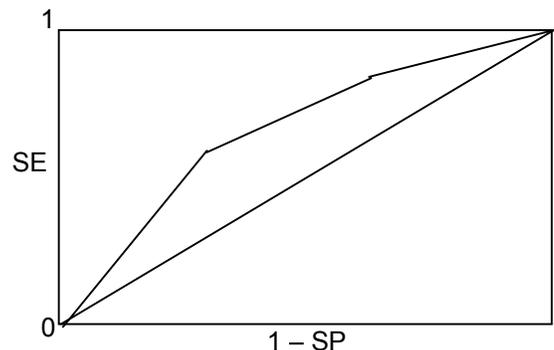
Source: Wodon (1997b).

When using a statistical package and running a probit or logit regression for poverty, each observation is given an index value equal to the predicted right-hand side of the regression. This predicted value is used to classify the households as poor or nonpoor, with the computer typically using one-half as the cutoff point (those above the cutoff point are classified as poor). But this cutoff point can be changed. An ROC curve is a graph that plots  $SE$  as a function of  $1 - SP$  for alternative values of the cutoff point. Figure A.4 shows a hypothetical ROC curve. The higher the ROC curve, the better the predictive power of the model used for making the predictions. A 45 degree line has no predictive power while a vertical line from the origin to the top of the box followed by a horizontal line until the upper-right corner has perfect predictive power. The area below an ROC curve provides a summary statistic of the predictive value of the underlying model used for targeting. An area of 0.5 corresponds to the 45 degree line that has no explanatory power. An area of 1 corresponds to perfect prediction.

If the ROC curve of one targeting indicator (or set of indicators) used to predict poverty lies above the ROC curves of all the alternatives, that indicator will typically be the best to target the poor for the class of social welfare functions based on the two types of errors that can be committed through targeting. If two ROC curves intersect, the choice of the best indicator will depend on the normative weights attached by the policymaker to the two types of errors.

ROC analysis was used, for example, by Estache and others (2001) to assess how well various indicators performed for identifying the poor in order to target electricity subsidies among households with a connection to the public electricity grid in Honduras. Table A.5 gives the results, providing the areas under the ROC curves for the various targeting indicators. The best results (that is, the largest areas under the ROC curve) are obtained using a combination of different characteristics. For single characteristics, electricity consumption has some predictive power, but less so than some other variables, such as the size or quality of the house.

**Figure A.4. A Hypothetical ROC Curve**



**Table A.5. Areas Under ROC Curves for Alternative Targeting Indicators in Honduras**

	<i>Performance in identifying the extreme poor (percentage)</i>	<i>Performance in identifying the poor (percentage)</i>
Socioeconomic status (multiple characteristics)	87	83
Demographics	72	71
Educational attainment	71	72
Employment status	69	66
Geographic location (department)	66	63
Housing characteristics (multiple characteristics)	82	81
Size of house	77	77
Quality of house	72	72
Access to electricity	68	69
Access to water and sanitation	61	58
Electricity consumption	70	73

Source: Estache and others 2001.

Of course, the choice of targeting mechanisms for programs and subsidies depends on several other factors, including administrative targeting costs and political economy considerations. A more detailed a discussion of targeting issues is provided in chapter 6, “Public Spending.”

## Technical Note A.10 Using Wage and Labor Force Participation Regressions

Similar to the analysis of correlates of poverty, regressions can be used to analyze the determinants of individual labor income. To analyze the impact of individual characteristics on labor income, and to measure among other things the impact of a better education on earnings, other types of regressions must be used. The standard approach consists of running a so-called Heckman model. Denote by  $\log w_i$  the logarithm of the wage (or earnings) observed for individual  $i$  in the sample. The wage  $w_i$  is nonzero only if it is larger than the individual’s reservation wage (otherwise, the individual chooses not to work). The difference between the individual’s wage and reservation wage is denoted by  $\Delta^*_i$ . The individual’s wage on the market is determined by geographic location (separate regressions are run for the urban and rural sectors), years of experience  $E$ , and years of schooling  $S$ . There may be other determinants of wages, but these are not observed. The difference between the individual’s wage and his reservation wage is determined by the same characteristics, plus the number of babies  $B$ , children  $C$ , and adult family members  $A$  of the individual (and their square.) The Heckman model is written as

$$w_i = w^*_i \text{ if } \Delta^*_i > 0, \text{ and } 0 \text{ if } \Delta^*_i < 0$$

$$\log w^*_i = \alpha_w + \beta_{w1}E_i + \beta_{w2}E_i^2 + \beta_{w3}S_i + \beta_{w4}S_i^2 + \varepsilon_{wi}$$

$$\Delta^*_i = \alpha_\Delta + \beta_{\Delta1}E_i + \beta_{\Delta2}E_i^2 + \beta_{\Delta3}S_i + \beta_{\Delta4}S_i^2 + \beta_{\Delta5}B_i + \beta_{\Delta6}B_i^2 + \beta_{\Delta7}C_i + \beta_{\Delta8}C_i^2 + \beta_{\Delta9}A_i + \beta_{\Delta10}A_i^2 + \varepsilon_{\Delta i} = m_{\Delta i} + \varepsilon_{\Delta i}.$$

The expected value of  $\varepsilon_{wi}$  is not 0. Denoting by  $\varphi$  and  $\Phi$ , the standard normal density and cumulative density, and noting that  $\sigma_{\Delta}$  the standard error of  $\varepsilon_{\Delta i}$ , is normalized to 1, we have the following:

$$E[\log w^*_i \mid \Delta^*_i > 0] = \alpha_w + \beta_{w1}E_i + \beta_{w2}E_i^2 + \beta_{w3}S_i + \beta_{w4}S_i^2 + \lambda \varphi(m_{\Delta i}) / \Phi(m_{\Delta i})$$

$$E[\log w^*_i \mid \Delta^*_i < 0] = \alpha_w + \beta_{w1}E_i + \beta_{w2}E_i^2 + \beta_{w3}S_i + \beta_{w4}S_i^2 - \lambda \varphi(m_{\Delta i}) / [1 - \Phi(m_{\Delta i})].$$

If  $\lambda$  is statistically different from 0, the returns to education will differ between the employed and the unemployed, although the difference will typically be small. Simple approximations of the private returns to education (or more precisely, of the marginal impact of a better education on individual earnings) can be computed from the above wage regressions by taking the first derivative of the expected wage with respect to the number of years of schooling. Thus the “return” to education for year of schooling  $S$  is  $\partial E[\log w^*_i] / \partial S = \beta_{w3} + 2\beta_{w4}S$  where  $\lambda$  is 0. The returns are increasing (decreasing) with the number of years of schooling if the coefficient  $\beta_{w4}$  is positive (negative). These returns do not take into account the positive impact on the probability of working of education (that is, the fact that  $\beta_{\Delta3}S_i + \beta_{\Delta4}S_i^2$

is typically positive). The returns also do not include estimates of the costs of schooling for parents and society, which reduce the returns, and of the indirect effects and externalities associated with education, which typically increase the returns from the point of view of both the society and the household. For more information on these techniques, see chapter 19, “Education.”

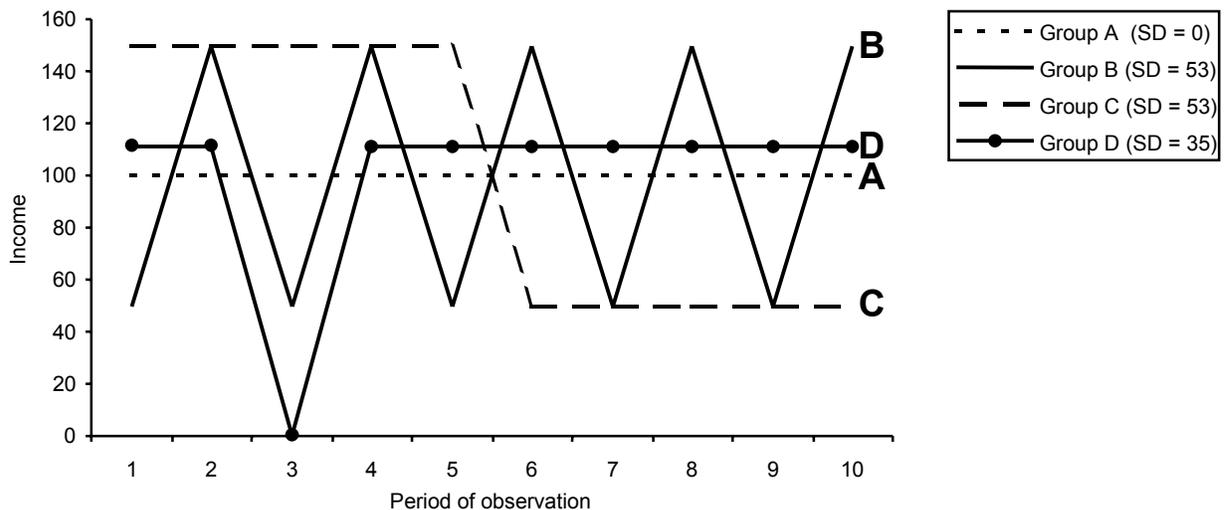
### Technical Note A.11 Limitations of Income Vulnerability Analysis

As explained in the main chapter text, income vulnerability analysis based on standard deviations (SDs) and coefficients of variation can provide some information on the vulnerability of households, yet it has limitations. These can be illustrated with a simulation of various types of households. In figure A.5 below, each group has the same *average* income over the 10 periods (100), but the patterns of their income over time differ greatly. Clearly, Groups B, C, and D are more vulnerable than Group A. This is reflected in their higher SD.

Comparing Groups B and C shows that their SD is similar but their patterns are different. Imagine that B is a rural household with the fluctuations following peak and mean periods. Group C is an urban household that experiences the death of its main breadwinner in period 5, resulting in a permanent loss of income. Its vulnerability is different, but this is not reflected in the SD.

For Group D, imagine that the wage earner of the household has experienced an acute but temporary spell of illness, or a short time of unemployment, in period 3. If the household had stocks or buffers, it probably could have used these to maintain its consumption; but in the opposite case, it could have suffered irremediable losses during that one period, such as the death of a child from undernutrition or the stalled mental development of children. The SD indicates a lower vulnerability for this household than for Group B, which is not necessarily true.

Figure A.5. Comparison of Household Vulnerability



Source: Author's illustration.

### Technical Note A.12 Beyond Poverty: Extreme Poverty and Social Exclusion

There is wide agreement that poverty is multidimensional. In order to go beyond the emphasis placed on income and consumption in analytical work on poverty, this note briefly introduces the concepts of extreme poverty and social exclusion, and how these concepts differ from monetary (that is, income or consumption-based) poverty as it has been traditionally defined.

### A.12.1 Extreme poverty

While it is certainly feasible to define extreme poverty as a very low level of income or consumption, this note suggests another interpretation based on the grassroots work of nongovernmental organizations (NGOs). According to Wresinski (1987) (see also Wodon 2001b), three distinctions can be made between poverty and extreme poverty. First, extreme poverty results from a lack of various “basic securities” or assets in many areas of life (education, health, employment, and so on), rather than in the income or consumption space only. This lack of several basic securities may have a cumulative impact and lead to an insecurity affecting new dimensions in a poor person’s life. This can be analyzed through interaction effects. Second, extreme poverty tends to be associated with the persistence of this insecurity over possibly long periods of time. Third, the extreme poor are often unable to exercise their rights and assume their responsibilities, which has operational implications when conditions are imposed for participation in social programs.

- **Interaction effects.** Various factors or dimensions of poverty may reinforce each other (interaction effects) and prevent the very poor from emerging from extreme poverty. In other words, extreme poverty results not only from a lack of financial resources, but also from a lack of education, employment, housing, and health care, as well as civil and political rights. Beyond some threshold, the lack of many different basic securities has mutually reinforcing effects. The poor become extremely poor and are prisoners of a vicious circle.
- **Long-term dimension.** The time dimension associated with poverty has been discussed in section 1.4, “Vulnerability Measurement and Analysis.” Extreme poverty often persists through time and tends to be transmitted from one generation to the next. A common feature among the extreme poor is the permanence, or at least the recurrence, of their situation. One can think of extreme poverty as being persistent, or at least chronic. The longer the experience of poverty, the harder it is to emerge from extreme poverty. This is difficult to analyze through panel data, but it can be revealed through qualitative work, such as life histories (see technical note 13).
- **Rights and responsibilities.** The third reference in the Wresinski approach to extreme poverty deals with rights and responsibilities and rests on two articulations. The first articulation highlights, for each human right at a time, the existing link between the access to that right and the exercise of a corresponding responsibility. This link is broken when, because of lack of access to the right, the individuals or families in poverty cannot fulfill their corresponding responsibility. In turn, because they cannot demonstrate their ability to fulfill their responsibility, the poor are not in a position to claim their right. For example, a person who has been unemployed for a long period of time will have difficulty acquiring the credentials that would enable him or her to demonstrate the ability to work. The second articulation refers to the interdependence or indivisibility between various rights. For example, without access to one right, it is difficult to exercise other rights.

### A.12.2 Rights and social exclusion

In a series of recent resolutions, various agencies of the United Nations system have suggested that extreme poverty may lead to violations of human rights in their indivisibility. Still, the use of the discourse of human rights to analyze poverty is not as well accepted as the quantitative tools described in the main text of this chapter. The reference to human rights is not meant to be dogmatic. Rather, it is meant to provide a framework for the discussion of some of the institutional issues related to poverty policies. In Freeden’s (1991) terms, a human right is a conceptual device that helps societies to assign a priority to certain human or social attributes regarded as essential to the adequate functioning of a human being. In other words, from a conceptual point of view, at least two requirements are needed for a basic security or need to be elevated to the status of human right. Human rights must be recognized as such by others than their most direct beneficiaries, and they must be essential to our functioning as human beings. These two requirements are linked to each other, since only key human attributes stand a chance to benefit from a consensus for their recognition as human rights by society.

Only society or the community as a whole can grant a right to someone. Conversely, the nonattribution of a right expresses a sanction, an exclusion, whether it is explicit or implicit, of some individuals. In a report on social exclusion and antipoverty strategies, the International Institute for Labour Studies (1996) argues that the concept of social exclusion provides an integrated and dynamic analytical perspective with which to analyze the relationships between well-being and rights. When the nonattribution of a right is explicit, the exclusion from the benefit of the protection granted by a right is operated

through institutional procedures. If the rules for the enjoyment and the exercise of human rights skim some beneficiaries, thereby ending in denials of rights for those who cannot comply with society's rules, institutional change may be needed in order to fight extreme poverty.

Rather than opposing the traditional concepts poverty with those of extreme poverty and social exclusion, and arguing that one set of concepts is more useful than the other, it is better to consider extreme poverty and social exclusion as complementary concepts to that of poverty. Material (consumption or income) poverty is then viewed as a particular form of deprivation, that is, the lack of command over goods and services. Social exclusion is broader than poverty in considering issues of social participation and rights realization, as well as processes. Extreme poverty is deeper than poverty in that it results from many handicaps faced by the very poor.

One important distinction between the concepts of poverty or extreme poverty and that of exclusion is that poverty and extreme poverty are states of well-being, while exclusion is a dynamic process whereby someone excludes someone else. Literally, to exclude means to banish, to send somebody away from a place where she had the right to stay before. By extension, to exclude means to deprive somebody from any right previously granted, or normally granted, to those recognized as full members of a given community or society. The strength of an analysis based on a social exclusion perspective is to put the issues together into a cohesive framework, that is, to allow the analyst to investigate the causes and processes involved in the persistence of poverty, often using both quantitative and qualitative techniques.

A social exclusion perspective can thus function as a flexible analytical framework aimed at understanding social disadvantage (Gacitua-Mario, Sojo, and Davis 2000; Gacitua-Mario and Wodon forthcoming). Beyond being goods-centered, the analysis of social exclusion is people-centered and institution-centered. The analysis of social exclusion also contains both an objective and subjective dimension, to the degree that it considers both the objective conditions of people's lives and their perceptions of being connected or disconnected from wider spheres of social, political, and cultural life. This perspective does not substitute for the traditional income- or consumption-based notion of poverty or other concepts dealing with vulnerability. It rather provides a framework for interrelating different levels of analysis (multidimensionality) and cumulative processes that maintain social groups social disadvantage or pull them into it. The perspective fully recognizes the importance of the traditional dimensions of poverty, such as the inability to generate a sufficient and stable income and to have access to quality social services in order to meet basic needs. However, it also incorporates other dimensions that belong to the relational/symbolic domain: the socio-organizational cultural and the political. The value added by a social exclusion perspective lies in the emphasis on dynamic processes in which both institutions and agents are involved. For institutions, this refers to the ways institutions, rules, and perceptions interact to generate or combat processes of social disadvantage (see also chapter 9, "Community-Driven Development").

### **Technical Note A.13 Qualitative and Participatory Assessments**

The discussion in the preceding note naturally leads to qualitative and participatory research methods. Among these, so-called Participatory Poverty Assessments (PPAs) are tools for consulting the poor directly and systematically. Using PPAs can deepen the understanding of poverty, explain processes of impoverishment and household survey data, convey the priorities of the poor, and assist in analyzing poverty beyond the household unit. PPAs can capture dimensions of poverty that are not always addressed in household surveys. Experience has shown that poor people speak of poverty in different terms from those typically used in policy analysis. They may refer to such characteristics as vulnerability, physical and social isolation, lack of security and self-respect, powerlessness, and lack of dignity. In addition, past PPAs have offered insights into dimensions of poverty that had not been previously examined by household surveys, such as vulnerability, gender, crime and violence, and seasonality.

The types of qualitative data that are important for poverty reduction strategy design and monitoring include the following:

- poor people's priorities for improving their situation—desegregated by sex and by other important characteristics of the community;
- causality data—people's perceptions of causes and consequences of poverty;
- opportunities poor people see for improving their situation;
- constraints and barriers to improving their situation;
- locality differences—differences between districts and between rural and urban centers;

- perceptions on quality of service delivery, infrastructure, and governance at the local level; and
- identification of who are the poor.

PPAs use a variety of methods that combine visual techniques, such as mapping, matrices, and diagrams, with verbal techniques, such as open-ended interviews and discussion groups. The process of undertaking a PPA is different at the community and national levels. The community level involves undertaking the study with the locally led teams. The national-level study involves linking communities to a broader policy dialogue.

### A.13.1 PPAs at the Community Level

Many PPAs use the participatory rural appraisal (PRA). The PRA offers tools such as mapping; diagrams of changes, trends, and linkages; matrices; and scoring. It is a locally led effort and requires a willingness to unlearn assumptions and conditioned responses. The PPA design will depend on the country context, research agenda, sample, and researchers' experience. Table A.6 describes characteristics of the average PPA.

PPAs and household surveys can inform each other, so the sequencing will be determined by the context in-country. If the PPA comes first, its results can help focus the research agenda for the quantitative survey and generate hypotheses. Conversely, the results of quantitative surveys can be used to identify the poorest geographic areas on which participatory research should focus or can be used to identify a specific set of issues that requires further understanding. Good practices often have iterative processes.

The Zambian PPA (see case examples below) illustrates how issues of measuring poverty, and analyzing the behavior of and impact of policies on the poor, can be addressed using qualitative techniques. In particular, issues in rural and urban areas and differences in attitude and behavior between men and women can be explored.

### A.13.2 The Process at the National Level

Participatory policymaking links communities to a broader policy dialogue that includes a cross-section of stakeholders. In general, open political environments provide greater opportunities for building consensus on poverty issues. In Costa Rica, for example, where there is a tradition of bringing marginal groups into the political sphere, the government was eager to understand poverty better from the perspective of the poor and welcomed the PPA. See case examples (below) for illustrations.

Experience has shown that involving key policymakers from the beginning enhances ownership and commitment. Limited government support, or lack of government support, can hinder the impact of the PPA, especially if the research results run counter to the government's interest. Generating a more open

**Table A.6. Design Features for Participatory Poverty Assessments**

<i>Feature</i>	<i>Detail</i>
Cost	\$75–\$125,000
Number of communities selected for research	40–60 communities
Time spent on training	2 weeks
Time spent on field research	3–6 months
Time spent on analysis	2–3 months
Size research team (including team leaders and trainers)	10–20 people
Composition of research team	Country nationals, half men and half women, ability to speak local languages, representatives from various ethnic groups, and a cross-section of age groups
Typical agency conducting the field work	Government extension workers; local and international NGOs; academic institutions; independent consultants and firms
Donors who have contributed to government-led PPAs	Department for International Development, World Bank, Action Aid, Oxfam (U.K.), United Nations Development Program (UNDP), United Nations Children's Fund (UNICEF), Danish International Development Agency (DANIDA), Asian Development Bank

Source: From various resources developed by authors.

climate and starting with small-scale participation and PPAs can initially help make the process of participation less daunting. Where appropriate, the following measures can help increase the policy impact:

- Involve policymakers in the early planning of the PPA.
- Start with small-scale participation in constrained political environments.
- Bring key policymakers to the field to participate in the PPA research.
- After the results are presented, convene workshops with policymakers and local people.
- Negotiate high-level commitment to follow up the PPA and monitor the implementation of key recommendations.

### **A.13.3 Case Examples**

#### ***PPA Highlights the Potential of Women's Groups in Kenya***

The coping strategies of the poor, most of whom do not have access to credit, depend on diversifying their livelihoods and on the strength of their social networks and informal groups. Because their livelihoods are so diversified, no single employment program will reach the poor. The informal groups and associations, on the other hand, engage in a wide range of economic and social welfare activities. The PPA in Kenya highlighted the untapped potential of these groups to reach the poorer segments of society. The study estimated that at least 300,000 groups and associations exist in rural Kenya, including more than 23,000 registered women's groups. Every village was found to have from 5 to 17 different types of groups and more than one active or defunct women's group. The following are some of the findings that emerged about these women's groups:

- During discussions of coping strategies, women's self-help groups were mentioned frequently in every district, particularly by female-headed households.
- In addition to income generation, group objectives frequently included welfare activities: raising cash to pay school fees, meet hospital expenses, or help with transport costs to bring the dead back to the villages for burial.
- Most groups levied membership fees and monthly contributions.
- Although high fees excluded the poor, many groups targeted their activities specifically to assist the poor with food, school fees, and housing construction.
- Women's groups were often formed along clan or kinship lines and often had male members. Generally, they were supported by village men and the community at large.
- Based on the findings of the PPA, proposals to reach the poor by strengthening women's groups include legal registration so that groups are eligible for credit, technical and business management training of group members, and extension of microenterprise credit to groups.

#### ***Zambia's Participatory Poverty Assessment: Objectives and Method***

The key goals of the PPA were to explore local concepts of poverty, vulnerability, and relative well-being in poor urban and rural communities; the poor's perceptions of the main concerns and problems and effective actions for poverty reduction; and local perceptions of key policy changes for economic reform. The PPA included a mix of qualitative techniques, such as unstructured and semistructured interviews, focus group interviews, wealth and well-being ranking, institutional diagrams (Venn diagrams), and seasonality diagramming. Ten research sites were selected to represent a variety of communities, including rural, urban, cultural or ethnic group, and so on. The issues and techniques are presented in table A.7.

### **A.13.4 Assessing existing qualitative data**

#### ***Desk Review***

A desk review is warranted if qualitative data sources cannot be readily identified and the data are not routinely used for poverty profiling and poverty reduction strategies. A desk review is not needed if it has already been performed in the past few years. The review would identify and summarize qualitative data from official poverty assessments, NGO reports, participatory research, and needs assessment processes. Such data would be assessed for timeliness, quality, coverage, and depth—that is, how well the data help policymakers to derive policy. Table A.8 shows criteria for judging the quality of existing qualitative data.

**Table A.7. Issues Addressed and Qualitative Techniques Employed in the Zambian PPA**

<i>Poverty Issue</i>	<i>Qualitative methods used</i>
Perceptions and indicators of wealth, well-being, poverty, vulnerability, powerlessness; local terminology and correspondence with such concepts; differences in perception by gender.	<ul style="list-style-type: none"> <li>• Wealth and well-being ranking or grouping for criteria and indicators</li> <li>• Semistructured interviews</li> <li>• Social mapping</li> </ul>
Perception of change over time in welfare, indicators, terms of trade	<ul style="list-style-type: none"> <li>• Timelines (for migration, terms of trade, environment, and so on)</li> </ul>
Access to (and use of) services such as health, education, credit; preferences, especially where choice between options is available; perceptions of services, including views (or awareness) of recent change; differing perceptions and values for men and women	<ul style="list-style-type: none"> <li>• Institutional diagramming</li> <li>• Semistructured interviews</li> <li>• Trend analysis of services, for example, health, education, agricultural extension, marketing</li> </ul>
Seasonal stress: food security, health, general livelihoods; income, spending, activity (by selected occupational groups)	<ul style="list-style-type: none"> <li>• Seasonal calendar (health, food security, food intake, access to fuel, water, and so on)</li> <li>• Comparative seasonal calendars (good years, bad years, average years)</li> </ul>
Assets of rural communities—access to services, common property resources, other natural resources	<ul style="list-style-type: none"> <li>• Resource mapping</li> <li>• Focus groups</li> <li>• Institutional (Venn) diagramming</li> </ul>
Assets of households	<ul style="list-style-type: none"> <li>• Wealth ranking or grouping</li> <li>• Social mapping</li> <li>• Semistructured interviews</li> </ul>
Coping strategies and fallback strategies in times of crisis	<ul style="list-style-type: none"> <li>• Livelihood analysis</li> <li>• Semistructured interviews</li> <li>• Ranking exercises</li> </ul>
Perception of consumption level in terms of food, clothing, and relation to well-being	<ul style="list-style-type: none"> <li>• Well-being grouping/ranking</li> <li>• Social mapping</li> <li>• Semistructured interviews</li> </ul>
Community-based support mechanisms for the rural poor (community safety nets)	
Local institutions of self-help and support for the urban poor (for example, market traders' association, trade associations, churches, and so on)	<ul style="list-style-type: none"> <li>• Semistructured interviews</li> <li>• Institutional mapping</li> </ul>
Role of community institutions in service and infrastructure provision	<ul style="list-style-type: none"> <li>• Institutional mapping</li> <li>• Semistructured interviews</li> </ul>
Long-term environmental trends, for example, declining soil fertility, declining rainfall	<ul style="list-style-type: none"> <li>• Historical transects</li> <li>• Community timelines</li> <li>• Resource mapping at different points in time</li> <li>• Trend analysis</li> </ul>
Responsibilities, obligations within households (support to children, provision of food, payment of school fees, and so on, by gender)	<ul style="list-style-type: none"> <li>• Semistructured interviews</li> <li>• Decisionmaking matrix</li> </ul>

Source: World Bank (1994b).

**Table A.8. Criteria for Assessing Adequacy of Qualitative Data**

<i>Criteria</i>	<i>Adequate requirement</i>
Age of data	<ul style="list-style-type: none"> <li>• Collected in the past five years</li> </ul>
Methodologies	<ul style="list-style-type: none"> <li>• Participatory methods (PRA), focus groups better</li> </ul>
Coverage and scope: <ul style="list-style-type: none"> <li>• Geographic</li> <li>• Rural and urban</li> <li>• Groups consulted</li> </ul>	<ul style="list-style-type: none"> <li>• All significant agro-ecological zones represented</li> <li>• Both</li> <li>• Both sexes, youth and elderly, other vulnerable groups, principal livelihood groups of the poor</li> </ul>
Dimensions of poverty	<ul style="list-style-type: none"> <li>• Dynamics (especially seasonality), causality, gender, age, livelihood</li> <li>• Identification of vulnerable groups</li> </ul>

**Table A.8. Criteria for Assessing Adequacy of Qualitative Data (continued)**

<i>Criteria</i>	<i>Adequate requirement</i>
Perceptions of services, infrastructure and governance	<ul style="list-style-type: none"> <li>• Explored</li> </ul>
Information flows	<ul style="list-style-type: none"> <li>• Awareness and understanding of poverty-related policies and programs</li> </ul>
Priorities of the poor	<ul style="list-style-type: none"> <li>• Opportunities and constraints improving quality of life, priorities for poverty reduction</li> </ul>

## Technical Note A.14 Use of Demographic and Health Surveys for Poverty Analysis

Although Demographic and Health Surveys typically have not been used for the analysis of well-being, they go far beyond collecting health information. For example, the surveys cover the following:

- (a) **Basic service access.** Source of water, how far to get to water, electricity access, type of toilet facilities, materials used for the floor, ownership of durable goods (for example, car, motorcycle, bicycle, radio).
- (b) **Education.** Highest formal education attained of all household members; reason why women stopped attending school; current school enrollment, but not by school type, of all household members.
- (c) **Occupation of adults.**
- (d) **Migration.** Residence of household.
- (e) **Health.** Infant mortality, fertility, contraception practices and family planning, health attendance during pregnancy, feeding practices, vaccination of children, child illnesses (below 5 years of age), knowledge about disease treatment, sickness and health center use of mothers and children, satisfaction with health service, cost of treatment; knowledge about age; female circumcision; height and weight of children.

The Demographic and Health Surveys do not contain household income or consumption, but “wealth” information can be used to allow derivation of a poverty profile. A household wealth indicator can be constructed using available information on durable goods, basic services, and so on. The indicator is then ranked to construct quintile distributions. There are currently several different methods to derive such a wealth indicator, but the profile tables constructed using the indicator can include the following:

- (a) Distribution of poverty (or, rather, low wealth), basic service access, education and health by region, since the survey is able to produce estimates for many regions
- (b) Profile of health outcomes, access to basic services, health and education by wealth quintile (this can also be done by sector—urban versus rural—and by gender)

This information provides a good base to see whether pockets of (wealth) poverty correlate with health and educational outcome indicators, whether the infrastructure and educational deficit in these areas is particularly high and, implicitly, what the geographic distribution of health and education spending is, since total enrollment and health user information can be derived. Comparing this to the distribution of the poor and to the population gives information on the

- geographic distribution of government spending and necessary reform; and
- potential focus, and locus, of interventions.

If different Demographic and Health Surveys exist over time, a potentially rich analysis can compare developments in time with the various indicators. Such comparisons could include how outcome indicators such as education and health evolved, whether backward regions caught up in basic service access and health and education spending, whether the distribution of poverty changed significantly, and whether incidence of education or health spending improved.

For further reference, see <http://www.worldbank.org/poverty/health/data/index.htm>; Filmer and Pritchett (1999); and Gwatkin and others (2000).

