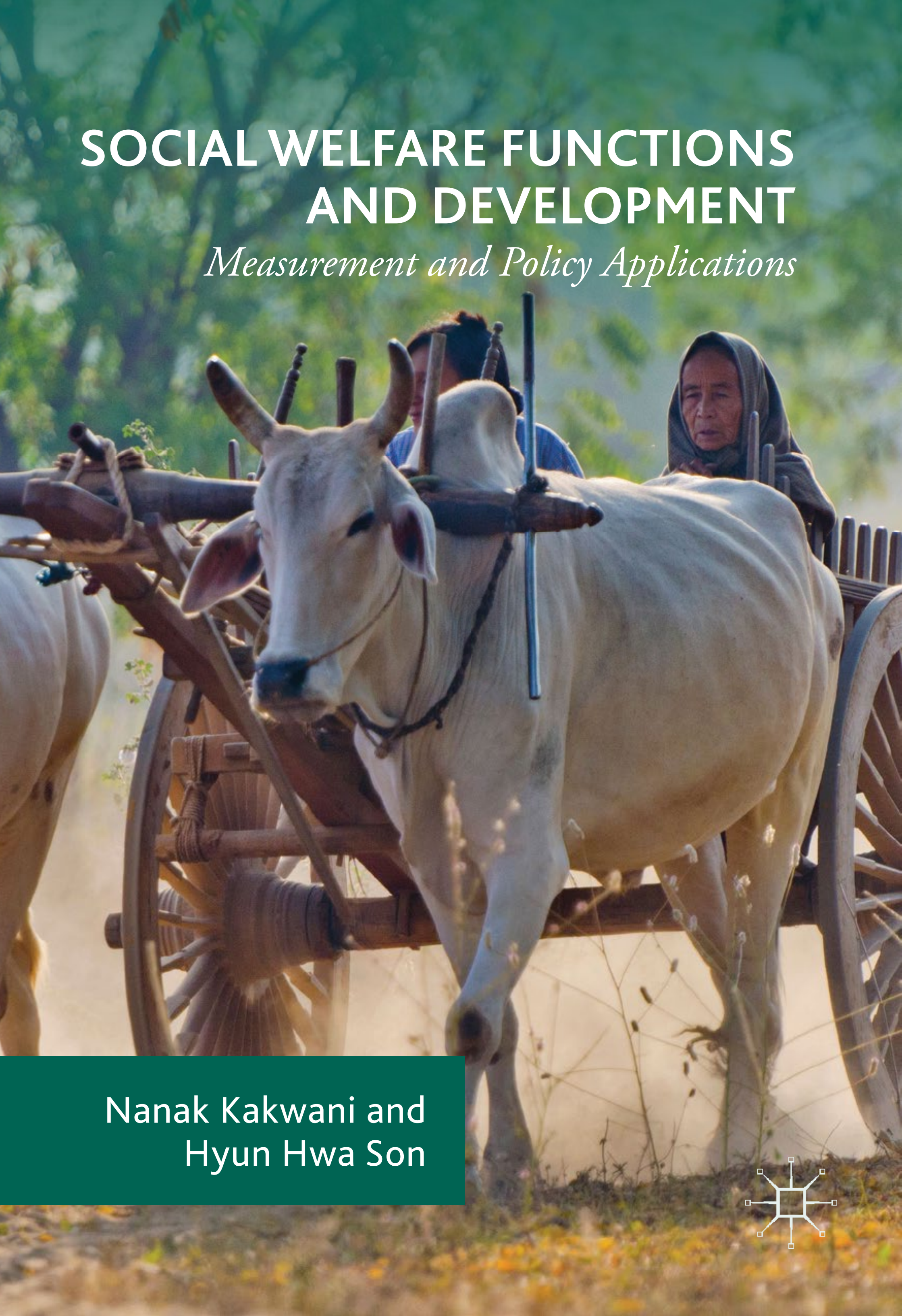
SOCIAL WELFARE FUNCTIONS AND DEVELOPMENT

Measurement and Policy Applications



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Social Welfare Functions and Development

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Foreword

In a recent article entitled "Making sense of economists' positive–normative distinction" Colander and Su (2015) argue that John Stuart Mill held the view that economists should not give advice on policy when that advice is only based on the theorems drawn from economics.

In Mill's words (1844, 1967, p. 312), which are cited by Colander and Su, "[science] deals in facts, [art] in precepts. Science is a collection of truths; art a body of rules, or directions for conduct. The language of science is, This is, or, This is not; This does, or does not, happen. The language of art is, Do this; Avoid that. Science takes cognizance of a phenomenon, and endeavours to discover its law; art proposes to itself an end, and looks out for means to effect it." This contrast between science and art clearly reminds us of the distinction between positive and normative economics.

Colander and Su (2015) emphasize also the fact that John Neville Keynes (1890, 1917, pp. 35 and 36), the father of John Maynard Keynes, took a position similar to that of Mill. For J. N. Keynes economic enquiries should be classified into three different departments. The first one refers to the positive science of political economy and aims at establishing economic uniformities. The second one corresponds to what could be called the normative science of political economy whose purpose is to determine economic ideals. The third one finally could be called the art of political economy and its goal is to formulate economic precepts.

Arthur Cecil Pigou (1920, 2013) had somehow the same kind of "Weltanschauung". He started his famous book, *The Economics of Welfare*, by writing that "when a man sets out any course of inquiry, the object of his research may be either light or fruit—either knowledge for its own sake or knowledge for the sake of good things to which it leads." Referring afterwards to economics Pigou adds that "…It is open to us to construct an economic science either of the pure type represented by pure mathematics or of the realistic type represented by experimental physics…Contrasted with this pure science stands realistic economics, the interest of which is concentrated upon the world in experience…".

In which category should then Nanak Kakwani and Hyun Son's book, *Social Welfare Functions and Development: Measurement and Policy Applications*, be classified? Following Pigou's terminology I would call it a book on realistic economics. The authors do not hide the fact that their approach is normative. They clearly state that "policies have heterogeneous effects on individuals. That is, from a public policy perspective, some individuals might lose while others might gain from a policy. In any evaluation, normative judgments cannot be avoided and social welfare functions explicitly specify normative judgments by assigning weights to different individuals." But the authors' normative approach does not aim at determining economic ideals the way J. N. Keynes viewed normative economics. The main contribution of the book is to develop various tools of analysis in applied development economics. Their starting point is clearly Sen's concept of capabilities. Kakwani and Son however note that the literature did not hitherto deal with the issue of aggregating individual capabilities. The novelty of their book is that they define the concept of social well-being function and suggest ways of weighting the capabilities of different individuals. On the basis of such an approach they propose measures of social tensions, relative deprivation between groups, shared prosperity and food insecurity, derive the link between inequality and social well-being and the concept of social opportunity functions and suggest new ways of determining a global poverty line or evaluating social programs. For each of these topics the authors explain the way they are going to measure the phenomenon under study and then give very useful empirical illustrations, most of them based on the Brazilian experience during the first decade of the twenty-first century. This mixture of methodological considerations and empirical analysis is precisely what makes this book so appealing. This is also the feature that made so attractive *Income Inequality and Poverty: Methods of Estimation and Policy Applications*, a book published by one of the two authors, Nanak Kakwani (1980), 35 years ago. This was the time when I started getting interested in issues related to inequality and poverty and Kakwani's book provided me with the tools I needed to start working in this field. I am convinced that *Social Welfare Functions and Development: Measurement and Policy Applications* will be equally helpful to many young economists, whether the focus of their attention is on pure research or on public policy.

Another very relevant feature of this book is its emphasis on inclusive development. Nanak Kakwani and Hyun Son are here in line with the growing attention paid by economists to the role of groups and their attempt to identify the reasons why some groups succeed and some do not. Specialists of Development Economics are now well aware of the fact that the notion of social groups cannot be ignored if one wishes to understand the genesis of conflicts and determine the preconditions of social cohesion. Kakwani and Son's book is thus at the frontier of what good economic research should be. In my eyes they have implemented Pigou's recommendation: "the type of science that the economist will endeavor to develop must be one adapted to form the basis of an art…" and they have fulfilled his prediction, according to which "Economic Science, when it shall have come to full development, is likely to furnish a powerful guide to practice".

Jacques Silber

References

Colander, D., & Su, H. -C. (2015). Making sense of economists' positive-normative distinction. *Journal of Economic Methodology, 22*(2), 157–170.

Kakwani, N. C. (1980). *Income inequality and poverty. Methods of estimation and policy applications*. A World Bank Research Publication. Oxford: Oxford University Press.

Keynes, J. N. (1890, 1917). *The scope and method of political economy*. London: Macmillan.

Mill, J. S. "(1844, 1967). On the definition of political economy; and on the method of investigation proper to it. In J. M. Robson (Ed.), *Collected works of John Stuart Mill*, CW "(Vol. IV, 309–339). Toronto: Toronto University Press.

Pigou, A. C. (1920, 2013). *The economics of welfare*. Palgrave classics in economics. London: Palgrave Macmillan.

Preface and Acknowledgements

With its many facets and definitions, development proves to be a complex and intricate issue. Gross domestic product (GDP) is often used as a proxy for development. Nobel Laureates Joseph Stiglitz and Amartya Sen along with a renowned economist Jean-Paul Fitoussi, who spearheaded France's Commission on the Measurement of Economic Performance and Social Progress, have pointed out the limitations of GDP as an indicator of economic performance and social progress.

Their report, *Mismeasuring Our Lives: Why GDP Does Not Add Up*, argues that GDP and its related measures cannot be used as the sole measures of living standards or well-being. This conclusion was not surprising. The output generated in an economy provides people with means to better their lives. However, a major failure of traditional development economics is its tendency to excessively concentrate on total output, ignoring completely how different individuals contribute to this output and how much they get in return.

The most comprehensive framework of development, based on individuals' capabilities, was developed by Amartya Sen. According to Sen, the process of economic development has to be concerned with what people can or cannot do—whether they can live long, obtain education, escape avoidable morbidity, be well nourished, or pursue the things that they value. Thus, Sen's conceptualization of development revolves around people and their capabilities. Since all people cannot enjoy the same capabilities, the distribution of capabilities should be front and center to measuring development. The question then is how individual capabilities can be aggregated. What weights should be given to individuals with different capabilities? This book provides answers to this pertinent question on weighting capabilities of different individuals, which has so far received little attention in the literature.

Using social welfare functions, this book derives indicators of development that are related to specific social objectives, such as reduction in inequality and poverty. The measurement of development is not a value-free exercise. If indicators of development have some policy relevance, they should be assessed based on the given social objectives. This book derives indicators that are sensitive to both the level and the distribution of individuals' capabilities. To accomplish this objective, the idea of the social welfare function, which is defined in income space, is extended to the concept of social well-being function that is in turn defined in capability space. Appropriate techniques have been developed to analyze development in different dimensions using actual data. The focus of this book is to evaluate alternative policies affecting people's capabilities to enjoy better life.

This book would not have been produced without the contributions and encouragement of key people. Marcelo Neri, who was then the President of Brazil's Institute for Applied Economic Research (IPEA) and Minister of the Secretariat of Strategic Affairs of the President of Brazil, arranged my visit to IPEA in 2013. Although I had no plan to write a book during my two-month visit to the institute, I started working on some assorted research problems. Marcelo helped obtain various rounds of the Brazilian national household survey called *Pesquisa Nacional por Amostra de Domicilios* covering the period 1992–2012. These were very rich data sets which allowed me to explore numerous research questions relating to labor market performance and social policies. These data sets and Marcelo's encouragement motivated me to consolidate my studies on assorted problems into a book. Hyun H. Son, my co-author, provided me with further motivation to work on this book. If she were not my co-author, I would not have produced this book. I am also grateful to Fabio

Vaz, a researcher at IPEA, who helped me understand the Brazilian data and prepare the datasets ready for analysis.

I would like to express my warm gratitude to Jacques Silber who read various versions of the manuscript and offered many useful comments. His comments helped us avoid many errors and omissions. Finally, I would like to acknowledge the contributions of Jenna Atun and Rizza Leonzon for their excellent editorial and other assistance.

Nanak Kakwani

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Introduction

1.1 The Concept of Development

Development is a complex issue and has different meanings to different people. While a common perspective equates economic growth with development, literature notes that the concept is much broader and is linked with living standards—how people live and what they can do or cannot do. To this end, Amartya Sen has made important contributions in introducing a framework for development.

Although India became independent in 1947, its development agenda was already decided in 1938, when the Indian National Congress constituted a National Planning Committee. The committee consisted of 15 members, including renowned industrialists, financiers, economists, scientists, professors, and representatives of trade union congress. Pundit Jawarlal Nehru, who later became the first prime minister of independent India, was the chairperson of the committee. The committee identified the following definitive social objectives to pursue (Nehru 1946, 418):

(i) Improvement in nutrition, with a balanced diet having a calorific value of 2400–2800 units for an adult worker;

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(ii) Improvement in clothing from the then consumption of about 15 yards to at least 30 yards per capita per annum; and
(iii) Improvement in housing standards, with at least 100 square feet per capita.

The following indicators of progress were also suggested:

(i) Increase in agricultural production,
(ii) Increase in industrial production,
(iii) Diminution of unemployment,
(iv) Increase in per capita income,
(v) Liquidation of illiteracy,
(vi) Increase in public utility services,
(vii) Provision of medical aid on the basis of one unit per 1000 population, and
(viii) Increase in average life expectancy.

These objectives and indicators provide a comprehensive vision of development. To achieve a minimum standard of living, the committee estimated that a typical family would require 15–20 Rupees per person per month. While this amount may seem low compared to western standards, it indicated an enormous increase in existing standard of living in India at that time. The committee viewed growth as a means to provide the minimum standard of living to the population. However, the committee estimated that the country's output needed to increase by 500–600 % in 10 years to achieve this minimum living standard. In addition to this increased production, there had to be more equitable distribution of wealth.

Pundit Nehru did not have a well-defined framework of development, but his social objectives were clear. His primary goal was to provide an adequate standard of living for the population by getting rid of the appalling poverty. Nehru's concept of development is simple: it is about enhancing the living conditions of all people.

The most comprehensive framework of development was developed by Amartya Sen who is a Nobel Laureate in Economics (1998) and the leading thinker on the meaning of development. His framework of development, which was much broader than Pundit Nehru's, was described in a number of papers and books in the 1980s (Sen 1983, 1984, 1985, 1987).

According to Sen (1983), the process of economic development has to be concerned with what people can or cannot do—for example, whether they can live long, get educated, escape avoidable morbidity, be well nourished, or pursue things they value. The possession of commodities or opulence is closely related to the quality of life people lead. With income as the primary currency by which people consume commodities and services, a higher income thus gives people greater command over commodities or services, which in turn provide people with the means to lead a better life. However, income is merely a means to an end. As Sen (1985) writes, "ultimately, the focus has to be on what life we lead and what we can or cannot do, or can be or cannot be."

Using this logic, Sen's ideas of functionings and capabilities emerged. While functioning is an achievement, capability is the ability to achieve. Functionings are directly related to what life people actually lead, whereas capabilities are associated with the freedom people have in choosing their lives or functionings that they value. According to Sen, development should be evaluated according to the extent of freedom people have to achieve the functionings that they value. Development is thus a multidimensional concept defined in terms of a set of capabilities that reflect the extent of freedom people have in leading their lives.

Sen's capability theory of development revolves around people and their capabilities. Since all people cannot enjoy the same capabilities, the distribution of capabilities should be the key to measuring development. A pertinent concern that arises is how individual capabilities can be aggregated to arrive at a composite indicator of development. For instance, what weights should be given to individuals enjoying different capabilities? The problem of assigning weights to capabilities of different individuals has received little attention in the literature.

The United Nations Development Programme created the Human Development Index (HDI) to compare standards of living across countries. It is a composite index reflecting three aspects of well-being: life expectancy at birth, learning, and per capita GDP adjusted for purchasing power parity. Learning is measured by an indicator that gives two third of its weight to literacy rate for adults and one third to the combined gross primary and secondary enrollment. The HDI is composed of three aggregate indicators that are completely insensitive to the distribution of individual capabilities. The literature is replete with examples of the use of aggregate indicators to measure development. Ideally, we should be concerned with the well-being of individuals or groups of individuals. Dasgupta (1990) correctly argues that we should be interested in the distribution of well-being along class, caste, gender, or regional lines. To achieve inclusive development, the indicators of development should not only focus on the average standards of living, but also reflect their distribution across socio-economic and demographic groups. In this book, we derive the indicators of well-being that are distribution-sensitive. To accomplish this objective, this book extends the idea of social welfare function defined in income space to social well-being function defined in capability space.

1.2 The Concept of Social Welfare Function

To examine the distribution of well-being across a population, particularly when designing social programs, social welfare functions are used. In economics, we are often faced with the question of evaluating the allocation of resources that are judged to be economically efficient or distributions of income that are judged to be equitable. Any policy change has heterogeneous effects on individuals. That is, from a public policy perspective, some individuals might lose while others might gain from a implementing a specific policy. In any policy evaluation, normative judgments cannot be avoided and social welfare functions explicitly specify normative judgments by assigning weights to different individuals

The most popular criterion in evaluating economic allocations is that proposed by Pareto in 1897. The simple Pareto rule states that any change in resource allocation improves the welfare of the society if it makes at least one person better-off and no one worse-off. A situation is called Pareto optimal if there are no alternative changes, leading to a Pareto improvement—that is, an economy can achieve its optimality as long as nobody in the society can become better-off without making anyone else worse-off. This condition implies that any given income distribution with fixed total income will always be considered Pareto optimal because the income distribution that makes someone better off will make someone else worse off. Therefore, Pareto optimality has little implication on the distribution of welfare across individuals.

Because of the limitations of the Pareto criterion, Kaldor (1939) and Hicks (1939) proposed an alternative criterion called the net benefit approach. This approach states that a change in the allocation of resources enhances welfare if either (i) the Pareto criterion is met or (ii) the persons who have gained through the resource reallocation could compensate those who have been harmed by it but still be better-off. If the actual compensations are made and there is a net gain in benefits, then winners are still better-off without making anyone worse-off. In this situation, there will be a net benefit to the society and the Pareto criterion will actually be satisfied. If the compensation is not paid and there is a net gain in benefits to the society, social welfare will still increase even if the winners gain more than the losers, provided that the resulting distribution is judged socially desirable. If we are unwilling to make such judgment, we can no longer be sure that the new allocation will make society better off.

Both the Pareto optimality and compensation criteria fail to provide a framework for distribution of welfare. By and large, various types of social tension arise because of the misdistribution of welfare among individuals (see Chap. 3). As such, the two criteria could be rather blunt approaches to assessing any distributional change.

If we are willing to make interpersonal utility comparisons to assess the distribution of welfare, the social welfare function—developed by Bergson in 1938 and further refined by Samuelson in 1947—is the most appropriate tool. It provides a way to aggregate different utilities across consumers. Under certain conditions, the social welfare function offers a legitimate framework for the distribution of welfare across people, thereby suggesting ways in which the welfare distributions can be ranked among the population.

To obtain a measure of welfare change in many consumer economies, there appears to be no alternative but to employ a social welfare function. The Bergson−Samuelson social welfare function is widely used in economic analysis, particularly in the areas of cost-benefit analysis and optimal fiscal policies. While social welfare is seldom discussed in development economics, the relationship between inequality and social welfare has been extensively discussed in the literature (see Chap. 2). With the publication of Atkinson's (1970) and Kolm's (1969) seminal papers on inequality, the idea that inequality measures should be derived from a social welfare function has been increasingly accepted. If inequality has any policy relevance, it should be evaluated based on some social welfare function. This book extensively utilizes social welfare functions to derive measures of social tension in various dimensions (see Chap. 3).

Although the debate on inequality is largely dominated by income inequality, non-income disparities also exist. As Sen (1995) pointed out, society should also be concerned with inequality in different dimensions of well-being such as health, education, employment, and living conditions, among others. To measure the inequality of well-being, this study extends the idea of social welfare function to social well-being function. The inequality in well-being is then derived as a proportional loss of social well-being function (see Chap. 6). The same idea is used to measure equity in social opportunities (see Chap. 7).

1.3 Inequality and Social Welfare Functions

The concept of social welfare is often associated with inequality, but their linkage has yet to be thoroughly examined. Based on the theory of relative deprivation, individuals and households assess their welfare against the incomes of others. Given this, high inequality is deemed to have a negative effect on social welfare.

Chapter 2 derives the social welfare function so that it can be made operational using household surveys. In deriving these applied social welfare functions, normative judgments about assigning weights to different individuals are clearly specified.

Inequality is no longer viewed as a statistical device that measures the dispersion of a frequency distribution. If inequality has a close relevance with policy, measures of inequality need to be derived from some normative notion of social welfare function because any inequality measure must incorporate society's preferences. Atkinson's seminal paper on inequality, published in 1970, brought social welfare to the forefront when measuring inequality. Chapter 2 discusses the linkage between inequality and social welfare function. Every social welfare function has an implicit measure of inequality, which means that every inequality measure can be judged by the normative properties that are incorporated in its social welfare function.

Atkinson (1970) derived a class of social welfare functions based on the concept of an *equally distributed equivalent level of income*. Instead of measuring the actual proportional loss of welfare caused by inequality, he estimated the proportional loss of income that would be incurred by having the actual distribution of income rather than a completely equal one. The concept of *equally distributed equivalent level of income* has been found to have a wide range of applications (Kakwani 1995; Kakwani and Son 2008; Son 2012).

Normative judgments in Atkinson's social welfare function are incorporated through the value of ϵ, a measure of inequality aversion. Inequality aversion captures the relative sensitivity of inequality to income transfers at different income levels. As ϵ rises, more weight is given to transfers at the lower end of the distribution and less weight to transfers at the top. If $\epsilon = 0$, social welfare becomes equal to mean income. This case reflects an inequality-neutral attitude in which the society does not care about inequality at all, but is mainly concerned about increasing its *average* standards of living.

To capture the idea of relative deprivation, Sen (1974) developed a social welfare function by making welfare ranks dependent on the individuals' ranking of their welfare. The lower a person is on a welfare scale, the greater is this person's sense of deprivation with respect to others in the society. Thus, according to Sen's rank order axiom, the weight of income level x depends on the percentage of persons in the society who are richer than the person with income x in the given income vector $x^{\sim}$. This social welfare function is extensively used in this study to derive a wide range of indicators of economic development (see Chap. 3).

Chapter 2 also brings out an important distinction between relative and absolute measures of inequality. Relative measures imply that inequality remains constant if every income is altered by the same proportion. Such measures, according to Kolm (1976), are referred to as relative (or rightist) measures of inequality. As an alternative, Kolm has proposed absolute (or leftist) measures of inequality. These absolute measures do not show any change in inequality when every income is increased or decreased by the same amount. They reflect absolute differences in the levels of living standards rather than relative differences.

Discussions on inequality commonly refer to its relative dimension, even if the concept of absolute inequality is more intuitive. The increasing gap between the rich and the poor, for instance, can be depicted more appropriately using the absolute difference between the rich and the poor. A key question that arises is which of the two concepts of inequality ought to be used to evaluate public policies. For instance, cash transfer programs mostly set their transfer size based on household needs in absolute terms. In evaluating such programs, the absolute concept of inequality would thus be more appropriate. Meanwhile, Atkinson's inequality measure may not be appropriate to be used in this context as it underpins the relative concept.

Chapter 2 also presents empirical analysis of inequality for selected Asian countries including Bangladesh, Bhutan, India, Indonesia, Pakistan, Philippines, Sri Lanka, Tajikistan, and Vietnam. The results reveal that the countries with a higher (lower) social welfare have a higher (lower) absolute inequality. This suggests that the higher the country's level of income, the greater is the absolute inequality. If this result generally holds, then it can be said that absolute inequality increases with economic growth. The same does not seem to hold for the relative measure—economic growth shows little correlation with changes in relative inequality. This result presents a dilemma for policy-makers. While economic growth is one of the main drivers to improve people's lives, it has an adverse effect of increasing absolute inequality. How can a country pursue economic growth and at the same time reduce absolute inequality? Unfortunately, the answer is not clear.

1.4 Social Tension and Social Welfare Functions

A social welfare function can also be used to model and measure various dimensions of social tensions, as demonstrated in Chap. 3. This approach allows for making explicit assumptions and normative values associated with the different dimensions of social tension discussed in the chapter.

Social tension has many dimensions shaped by economic, social, and political factors. Some of these dimensions are not quantifiable but Chap. 3 deals with dimensions of social tension that can be quantified using available data from household surveys. The following dimensions of social tension are considered: high inequality, existence of poverty, shrinking middle class and increased polarization, growth volatility, and social immobility. Each dimension of social tension has an implicit social welfare function. Given such a social welfare function, we can measure social tension in each dimension by calculating the proportional loss of social welfare. The basic idea is that any social tension in the society reduces social welfare. This approach allows us to quantitatively measure the extent of social tension that exists in the society.

The analysis presented in Chap. 3 does not attempt to create a single index that merges the different dimensions of social tension. Since different dimensions are based on different normative judgments, it makes little sense to combine them into a single index. Each dimension is analyzed individually to identify the type of social tension that has an increasing or decreasing trend over time. An increasing social tension is viewed as a source of social unrest, so it is imperative to measure trends in social tensions in each dimension.

Inequality is one source of social tension. Social tension due to inequality can be measured using the Gini social welfare function, which gauges how much relative deprivation the society suffers. Poverty is another source of social tension that can trigger social unrest and, ultimately, the kind of sustained violence that reduces growth (Lustig et al. 2002). Chapter 3 derives social welfare functions corresponding to the class of Foster et al. (1984) poverty measures, widely referred to as FGT measures. For every FGT poverty measure, we obtain a measure of social tension.

The relationship between poverty and inequality has been extensively studied in the literature (Besley and Burgess 2003; Kakwani 1993; Lipton and Ravallion 1995; Ravallion 2005). The following four scenarios are possible when relating poverty and inequality:

(i) Inequality tension increases but poverty tension decreases;
(ii) Both inequality and poverty tensions increase;
(iii) Both inequality and poverty tensions decrease; and
(iv) Inequality tension decreases but poverty tension increases.

Ideally, society should aim at reducing both inequality and poverty tensions, but such a scenario is not very common in developing countries. Brazil has recently achieved reduction in both inequality and poverty tensions (scenario iii). However, a scenario in which an increase in inequality tension is accompanied by a reduction in poverty tension (scenario i) is most prevalent in developing countries, particularly in Asia and the Pacific. China offers a case in point: inequality has been increasing while poverty has been declining rapidly.

The empirical analysis in Chap. 3 gauges how different social tensions in Brazil evolved over the period 1992–2012. The approach proved to be useful in understanding possible relationships between these social tensions. In particular, the sharp decline in inequality observed in Brazil during 2001–12 has provided different implications for trends in social welfare and tension.

Analysis in Chap. 3 shows that from 1992 to 2012, social welfare in Brazil increased at an annual rate of 5.12 % while per capita real household income increased by 3.65 % annually. This implies that reduction in social tension due to inequality contributed to an annual gain in the growth rate of 1.47 % in social welfare. The magnitude of the social tension due to poverty was much smaller than that observed for the social tension due to inequality. However, the rate of decline was much sharper for social tension caused by poverty than by inequality. Trend growth rates show that in 2001–12, the decline in the social tension caused by the severity of poverty was 10.79 % while the decline in the social tension due to inequality was 1.16 %.

Chapter 3 primarily aims to derive the social tension caused by alienation and polarization using particular forms of the social welfare function, as well as to establish the relationship between these two concepts and the size and share of the middle class. The findings reveal that alienation, which does not require specific income brackets, has been particularly useful in predicting changes in the size and the share of the middle class. In Brazil, the social tension caused by alienation and polarization has fallen substantially in the 2000s. This result is also consistent with the expanding middle class in the country.

Analysis in Chap. 3 also indicates that the bottom 40 % of Brazil's population has experienced greater volatility in their per capita household income as compared to the population as a whole. Not only do the poor have lower incomes, but their incomes are also more volatile.

An immobile society is one in which some groups are never able to improve their economic status relative to the whole society. Social mobility measures how the relative welfare of disadvantaged groups such as children and afro-descendants progresses with respect to the overall changes in the social welfare. Social mobility in Brazil has begun to improve since 2001, with the relatively worse-off social groups improving their welfare more than the society as a whole.

1.5 Inequality Among Social Groups

Human beings are quite diverse. They differ in terms of age, gender, education level, occupation, ethnicity, and other characteristics. Given these differences, a population can be classified into various social groups, which makes it possible for these individual differences to be accounted for in the analysis of inequality.

After suffering decades of stubbornly high inequality, Brazil's Gini index began to decline in 2001 and reached its lowest level in 2012, which indicates a likewise declining average deprivation. Despite this decline, inequality in Brazil is still high by global standards, which suggests deprivation across social groups. This means that some social groups might be suffering greater deprivation than others. This leads us to deepen our analysis by disaggregating deprivation by social groups.

Chapter 4 develops a methodology to estimate the average deprivation suffered by various social groups. The methodology identifies social groups that suffer greater deprivation relative to the average for the whole society. Identifying such groups is important because reducing inequality can be more effective through policies that directly target these social groups rather than specific individuals.

The demographic structure in Brazil has changed rapidly in the last two decades. Like many other countries, the aging population is a major challenge that Brazil needs to tackle. The findings in Chap. 4 show that there is a close relationship between demographic structure and inequality. Estimates show that compared to other age groups, relative deprivation is highest among children and lowest among the elderly. In 2012, children suffered 20 % more deprivation than the national average, while the elderly experienced 18 % less deprivation than the national average. In terms of overall trends, the decline in deprivation is most rapid for the elderly group for the 2001–12 period, and this has consequently widened the gap in deprivation between elderly and children over time. Despite this, the decreasing share of children in the population resulted in the reduction in inequality at an annual rate of 0.35 % in 2001–12.

The decline in deprivation among the elderly group is largely attributed to two major pension programs, the *Benefício de Prestação Continuada* (BPC, or Continuous Cash Benefit Program) and the social security benefits. The BPC is a non-contributory program and thus means-tested. It is a temporary social benefit scheme for the disabled and the elderly above 65 with per capita family income of less than 25 % of minimum wage. This large non-contributory pension system coexists with a large contributory system in Brazil—the general regime of social security for private-sector workers and the pension regime for government workers. Meanwhile, the *Bolsa Familia* Program is the conditional cash transfer program in Brazil that aims to reduce poverty among beneficiary households with children. Analysis suggests that the program alone may not be adequate to reduce the relative deprivation among children.

Chapter 4 also explores how migration from rural areas impacts inequality in Brazil. As in other emerging economies, Brazil's urbanization has taken place rapidly. The population has migrated across rural, non-metropolitan, and metropolitan areas. Such a shift in the population from rural to other areas has shown to have a positive effect on inequality in Brazil, particularly during 2001–12. In the 2000s, average deprivation has declined across areas suggesting that the pattern of growth in Brazil has been broad-based and not limited to metropolitan areas. In fact, the rural areas have experienced the largest decline in deprivation. Moreover, the deprivation gap between areas has reduced over time.

There has been a significant shift in the composition of social classes in Brazil. The middle class has expanded and has become better-off, but this had a negligible impact on the reduction in inequality. While it is commonly perceived in the literature that expansion of the middle class reduces inequality, findings presented in Chap. 4 do not support this claim.

The relationship between inequality and racial groups is also explored in Chap. 4. Results indicate that the change in racial composition over time led to an increase in Gini by 0.08 % annually, while the reduction in deprivation among racial groups resulted in the reduction in Gini by 0.73 percentage points annually. Taken together, the net impact was an overall reduction in Gini by 0.65 % annually during 2001–12.

Among the racial groups, the white Caucasians population accounted for the greatest reduction in Gini in the 2000s and this could be explained by two factors. First, the share of white Caucasians population has declined over the period, which led to the reduction in Gini by 0.28 percentage points. Second, the average deprivation among the white Caucasians population has also declined in the recent decade, leading to a further reduction in Gini by 0.31 percentage points. Therefore, the total contribution of the white Caucasians race on inequality was the reduction in Gini by 0.58 percentage points. By contrast, the net impact of black Africans/mixed population on inequality was rather small, reducing Gini only by 0.08 percentage points.

Access to education in Brazil has expanded rapidly in the 2000s. An important policy issue is whether such expansion played a role in reducing inequality in Brazil. The estimates showed that the Gini index has fallen by 0.62 percentage points annually. There are two factors behind this decline—changes in the population composition by educational levels and changes in deprivation among those educational groups. The expansion of education has led to increase in the proportion of population with higher education. This has contributed to the reduction in inequality by 0.34 percentage points in 2001–12. In addition, the decline in deprivation among educational groups also led to the reduction in inequality by another 0.27 percentage points. These findings call for policies that aim to improve the educational level of the labor force and, consequently, to address inequality in Brazil.

1.6 Social Policies and the Labor Market

The World Bank has proposed the concept of shared prosperity that focuses on the poorest 40 % of the population. For growth to foster shared prosperity, the bottom 40 % of the population should benefit from economic growth. Chapter 5 extends the concept of shared prosperity to examine the linkages between mean income, inequality, and social welfare on one hand, and different labor market characteristics and social policies on the other. It demonstrates that the simple idea of shared prosperity could be a powerful tool to answer many policy questions relating to the labor market and social policies. A distinction is made between average prosperity (AP) and shared prosperity (SP), which are linked by an inequity in shared prosperity. A related idea of shared growth is developed through measuring gains or losses in growth rates due to increasing (decreasing) equity in shared prosperity; that is, the larger the gain, the greater the shared growth will be.

Using data from Brazil, the findings reveal that average prosperity increased at 3.64 % annually in 2001–12, while shared prosperity increased by 6.37 % each year. As a result, the annual shared growth rate was 2.73 % during the period. This growth pattern signifies an unprecedented reduction in inequality in the 2000s. Thus, not only has average prosperity in Brazil increased in the period 2001–12, more importantly, its increase has been higher among the bottom 40 % of the population. Moreover, since the SP increased at a faster rate than AP, it can be concluded that growth in Brazil has been sustained and shared equitably among the population.

To explain the pattern of shared growth, Chap. 5 proposes a decomposition method, which identifies the factors that contribute to such growth, including labor market characteristics and social policies. The total shared prosperity and its resulting equity is explained by the following factors: (i) employment rate, (ii) labor force participation, (iii) labor productivity per hour (years of schooling and return from education), (iv) the *Bolsa Familia* Program (BFP), (v) *Beneficio de Prestação Continuada* (BPC), (vi) social security benefits, and (vii) other income.

The BFP and BPC are non-contributory social programs and social security is the largest contributory social program. The empirical results reveal that employment and labor force participation rates have negatively contributed to shared growth. The shared growth seen in the 2000s has been largely because of the increase in labor productivity, which is influenced by years of education among the labor force, as well as increased returns from education.

The shared growth—which measures the equity in per capita household income—was 2.74 % per annum during 2001–12; of which, 1.47 % is explained by the overall expansion of education in the labor force, 0.67 % by the increase in the returns from schooling, and 0.73 % by the *Bolsa Família* Program. Contributions of BPC and social security are relatively small at 0.22 % and 0.16 %, respectively. These results suggest that the expansion of education, accompanied by increasing returns from education for lower income groups, has played the key role in the unprecedented reduction of inequality in Brazil.

Finally, Chap. 5 extends the idea of share prosperity to measure equality in opportunities. The results reveal that Brazil has made impressive progress in generating opportunities for productive employment, especially for the poorest 40 % of the population. Education opportunities also improved sharply. Increase in educational attainment led to a decline in education inequity across population. While high inequity in education attainment continues to exist, Brazil has expanded its education opportunities relatively more to the poorest 40 % of the population. Brazil has almost achieved universal education among the children 6–14 years old. The results also reveal that there is little inequity in school attendance among school-age children.

1.7 Income Inequality and Social Well-Being

Deepening inequality, particularly its impact on growth, poverty, and development, has become the subject of intense debates. While the literature has extensively examined the impact of income disparities on growth and poverty, the relationship between inequality and well-being has yet to be explored comprehensively. Chapter 6 provides evidence that income inequality matters for well-being. Inequality elasticities of 19 indicators of well-being were estimated using three logistic regression models. The findings reveal that a higher Gini index is associated with lower overall well-being. Negative elasticities of well-being were found to be highly significant for 16 of the 19 indicators examined. For instance, a 1 % increase in the Gini index would lower life expectancy at birth by 0.07 % in 2010. The findings also indicate that increasing the income share of the poorest

40 % is linked with a rise in well-being, while a corresponding increase in the share of the richest 60 % is associated with a drop in well-being.

As with income inequality, it is important to be concerned with inequality in different dimensions of well-being such as health, education, employment, and living conditions, among others. Chapter 6 examines inequality in different dimensions of well-being, with the empirical analysis carried out in the context of Brazil. To measure inequality in well-being, this study developed the idea of a social well-being function from the social welfare function. The Gini index of well-being is then derived as the percentage loss of social well-being. The chapter also uses a concentration index to measure disparities in well-being across income.

The findings reveal that Brazil improved health outcomes and reduced the inequality in outcome indicators, including life expectancy at birth and infant and child survival rates. The Gini index of life expectancy at birth, for example, decreased from 3.59 % in 1991 to 1.74 % in 2010. Disparities in education well-being have also declined, albeit they remain higher than inequalities in health well-being. For instance, the Gini index of adult literacy rate dropped from 10.55 % in 1991 to 4.98 % in 2010. Similarly, declining disparities in living conditions and labor market activities were noted. Better-off municipalities were likely to have higher well-being than their worse-off counterparts, with the concentration index declining for all indicators except for those dealing with living conditions.

1.8 Inequity in Opportunity

Inequality is usually measured in income or consumption space, called inequality of outcomes. This is often distinguished from the concept of inequality of opportunity. The two concepts differ with respect to how inequality is generated. According to Roemer (1998), inequalities generated by circumstance variables such as gender, race, place of birth, and father's and mother's education, and father's occupation are unjust and those caused by efforts are just. Society should only be concerned with inequalities that are caused by circumstance variables over which individuals have no control. This inequality is called inequality of opportunity.

Roemer's idea greatly influenced the World Bank's view of inequality. According to the *2006 World Development Report*, public policies should only eliminate or reduce inequality of opportunity. Society should always encourage individuals' efforts that would yield greater prosperity for all. Such an inequality can be regarded as good. The argument to focus only on inequality caused by individuals' circumstances seems very pursuable. Chapter 7 argues that the idea of inequality of opportunity has many conceptual and estimation problems. For instance, if parents create environments that allow children to flourish in life, efforts exerted by parents become circumstance for children, in which case the children get unfair advantage compared to their counterparts who do not have such caring parents. An implication of this is that caring parents are not good for the society.

Chapter 7 proposes a new method of calculating the inequality of opportunity which was applied to India's 2007–08 household expenditure survey, called the National Sample Survey. The chapter examines three circumstance variables: (i) urban–rural sector, (ii) male–female head of household, and (iii) schedule tribe−schedule caste−other social groups. The joint contribution of three circumstance variables to inequality is equal to 4.75 %. Even though these circumstance variables are important, their contribution to total inequality is very small. A pertinent concern would be whether the World Bank is now downplaying the concern for inequality by focusing on inequality of opportunity.

Chapter 7 takes a different view and defines opportunity as access to basic services in education, health, nutrition, clean water, electricity, and sanitary toilets. These are the real opportunities that enhance individuals' well-being. If many individuals in a society are denied adequate access to these basic services, then inequity in opportunity exists. A social objective should be to expand these opportunities and make them accessible to all.

Chapter 7 develops an index of equity of opportunity based on the concept of social opportunity function. Using this index, the chapter presents an analysis of the coverage and distribution of opportunities in basic education and health in Bangladesh, Bhutan, Indonesia, Pakistan, Philippines, Sri Lanka and Vietnam. The findings reveal that Sri Lanka, Vietnam and Indonesia expanded opportunities in basic education and improved the equity of distribution of these opportunities. For instance, all children in Sri Lanka have an opportunity to attend primary school irrespective of their economic circumstances. In contrast, economic circumstances of parents heavily influence children's access to basic education opportunities in Bhutan, Bangladesh, and Pakistan. In Bangladesh, for instance, only 41.92 % of secondary school age children from the poorest quintile are attending school in 2000, compared to 74.87 % from the richest quintile. On health, the poor often have fewer opportunities in utilizing private health facilities compared to their wealthier counterparts. Poor households often rely on community clinics and other miscellaneous health facilities, which focus on preventive health.

1.9 Global Poverty Estimates

The *2000 World Development Report* defines poverty as the pronounced deprivation in well-being. The World Bank defines poverty based on the poverty line of $1.25 per person per day in 2005 Purchasing Power Parity (PPP). This poverty line has been widely used by the international development community as the basis for poverty reduction efforts. The poverty counts based on this poverty line have been the key indicator for assessing progress in the Millennium Development Goals (MDGs). The United Nations' more recent Sustainable Development Goals, adopted in 2015, have also used global poverty rates as a key indicator to assess economic development in the post-MDG era.

Chapter 8 aims to present a new global poverty line based on the 2011 PPP. To calculate a new global poverty threshold based on 2011 PPP, the chapter moves away from the World Bank's method of anchoring a single global poverty line on the national poverty lines of the 15 poorest countries. It instead proposes an alternative method of using equivalent poverty lines. It demonstrates that there is no single international poverty line in 2011 PPP that is equivalent to $1.25 in 2005 PPP. Single poverty lines vary for each region because countries have experienced different inflation rates and PPP conversion rates between 2005 and 2011.

To calculate a single poverty line in 2011 PPP, Chap. 8 measures the weighted average of equivalent poverty lines of 101 countries around the globe with weights proportional to their populations. Based on the new method, the corresponding poverty line is estimated at $1.93 in 2011 PPP, which is not far from the World Bank's poverty line of $1.90 in 2011 PPP. The chapter demonstrates that our proposed poverty line performs better than the World Bank's in terms of preserving the real purchasing power of the previous line of $1.25 in 2005 PPP. Given the new poverty threshold of $1.93, the number of poor is reduced by 6.42 million, with the reduction largely occurring in South Asia and Sub-Saharan Africa.

Based on the poverty line of $1.93 in 2011 PPP, the total number of poor in South Asia and Sub-Saharan Africa is 754.48 million, while the total number of poor in the world based on the same poverty line is 963.85 million. About 78 % of the world's poor are concentrated in the two regions. The incidence of extreme poverty outside these two regions is almost negligible.

The incidence of poverty and the number of poor vary across countries when the PPP's base year changes from 2005 to 2011, as estimated in this study. Based on the poverty line of $1.25 in 2005 PPP, 24.67 % of the Indian population—equivalent to 301 million people—lived in poverty in 2011. The corresponding figure in 2011 for China was 6.26 %, which is equivalent to 84.14 million people. Using the proposed $1.93 poverty line in 2011 PPP, poverty in India declined to 23.63 % (equivalent to 288.56 million people), but poverty in China increased to 8.27 % (equivalent to 111.16 million people). The change in PPP from 2005 to 2011 appears to be favorable to India, but unfavorable to China. Despite the narrowed gap in poverty incidence between the two countries, India needs to significantly scale up its poverty reduction efforts before it can pull alongside China.

More importantly, Chap. 8 shows that the change in PPP conversions should not drastically alter world poverty estimates, given the same absolute poverty line and the same income distributions. Had the World Bank used the idea of equivalent poverty lines developed in the chapter, the dramatic increase in world poverty count by 500 million upon the change in the PPP base year from 1993 to 2005 would not have occurred.

1.10 Food Insecurity

Food security represents one of the most important dimensions of development. It is a complex development issue dealing with physical and economic constraints to safe and nutritious food to maintain healthy living. The Food and Agriculture Organization's (FAO) measures food insecurity by comparing usual food consumption expressed in terms of dietary energy (kilo/calories) with certain energy requirement norms. However, nutrients such as proteins, fats, and carbohydrates are also required to maintain good health. Hence, to ensure food security, households and individuals must have sufficient resources to purchase food that satisfies nutritional requirements.

Chapter 9 proposes a new methodology of measuring food insecurity by calculating the per capita monetary cost of a food basket that satisfies the calorific and nutrient needs for maintaining a healthy body. This nutritious food basket with a balanced diet provides 2100 kilo/calories per person per day and consists of 58 grams of protein per person per day, 375 grams of carbohydrates per person per day, and 37 grams of fats per person per day. The cost of this basket is estimated in international dollars at $1.59 per person per day in 2011 PPP. A household is defined as food insecure if its per capita expenditure is less than this threshold. This method is closely related to Sen's (1981) entitlement approach to measuring food deprivation in the population.

The findings in Chap. 9 reveal notable gains in reducing food insecurity worldwide between 2002 and 2012. Despite the severe food crisis in 2007–08, the percentage of the global population struggling with food insecurity significantly decreased from 23 % in 2002 to 10 % in 2012. In just one decade, the number of food-insecure people declined by more than 576 million.

Progress in combating food insecurity has been notable in all regions. East Asia and Pacific recorded a rapid reduction in food insecurity largely on the back of China's impressive growth. The number of food-insecure people in East Asia and Pacific decreased from 368.93 million to 72.76 million in 2002–12. In South Asia, the percentage of population facing food insecurity has rapidly decreased from 27.07 % in 2002 to 10.02 % in 2012. Some 218.65 million people in South Asia broke out of food insecurity in the given decade. The percentage of food-insecure people is less than 1 % of the population in Europe and Central Asia and Middle East and North Africa, and 4.4 % of Latin America and Caribbean's population in 2012. Food insecurity is however expected to remain a prevalent development concern in Sub-Saharan Africa in the years to come. Although Sub-Saharan Africa has made marked progress in reducing food insecurity, about 37 % of its population continues to suffer from food insecurity.

FAO estimated that only 216 million people escaped hunger in the last 25 years, with the number of hungry people decreasing from 991 million in 1990 to 775 million in 2015. This decrease of 216 million in the number of people dealing with hunger was only about a quarter of the estimated decline in the number of extreme poor at 835 million in 2015.

Chapter 9 explains the discrepancy between the progress in reducing poverty and hunger. As FAO measures hunger by comparing calorie intake with a fixed value of calorie requirement, calorie consumption increases sluggishly or may even remain the same given an increase growth. With a fixed calorie requirement, progress in reducing hunger is expected to be very slow. In contrast, poverty, which is measured through income or expenditure, reduces with growth since people's income increases. With higher incomes, people tend to buy betterquality food containing more nutrients. However, FAO's measure of hunger is only based on calorie intake and does not inform whether people are becoming nutritionally better off or worse off as incomes change.

1.11 Evaluation of Social Programs

Chapter 10 deals with the evaluation of social programs, which have become popular mechanisms for developing countries to reduce poverty and increase social welfare. With these programs becoming widespread around the world, it is crucial, especially for policy-makers, to evaluate them rigorously to know whether they are achieving the intended objectives. This chapter develops a new method for evaluating programs, using the concept of social rate of return (SRR), defined as the social welfare generated by a program as percentage of the cost of the program. Two types of SRRs are used in the chapter: one based on the poverty social welfare function, which focuses on the poorest 20 % of the population, and the other based on the Gini social welfare function, which focuses on inequality as measured by Gini. Empirical analysis was conducted on two existing conditional cash transfer programs: Brazil's *Bolsa Familia* Program and Philippines' *Pantawid Pamilyang Pilipino* Program or 4Ps. Data for *Bolsa Familia* covered the period 2001–12 and data for 4Ps covered only the years 2011 and 2013.

The findings in Chap. 10 reveal that the targeting of *Bolsa Familia* has improved substantially during 2001–12, with the poor comprising almost two-thirds of the beneficiaries in 2012. Meanwhile, 4Ps has rapidly expanded to cover 21 % of the population in 2013, but at the expense of increased leakage of beneficiaries from 45.33 % in 2011 to 52.20 % in 2013. Both programs have become more efficient in alleviating poverty and inequality—albeit *Bolsa Familia* is deemed the more efficient, given its better targeting system and lower operational cost. Nevertheless, 4Ps' targeting efficiency and administrative costs associated with the delivery of transfers have improved within a short period. The findings also indicate that both programs contribute more to reducing poverty than inequality.

The rapid expansion of any social program within a short period comes at a cost. The implementation of a social program is highly complex and requires appropriate social infrastructure. A gradual expansion is desirable because it provides time to learn about the complexities of the program and incorporate lessons learned during implementation.

The conditionality of *Bolsa Familia* and 4Ps requires that in order to receive benefits, families must send their children to school and get their health check-ups and vaccines on time. The findings show that children in the target group have higher school attendance than those in the control group. Thus, both the programs do contribute to higher school attendance among children from poor families. In the case of *Bolsa Familia*, the impact of the program on school attendance among children in the age group 15–17 years is much greater than it is on the attendance of children aged 6–14 years. The impact is higher among the older children because they are more likely to work in the labor market if their families were not enrolled in the program. The program provides incentives for beneficiary families to send their children to school rather than have them work in the labor market.

2

Applied Social Welfare Functions

2.1 Introduction

The main purpose of using a social welfare function is to evaluate the way in which economic resources are allocated in identifying which policies work and which ones do not. Policies have heterogeneous effects on individuals. That is, from a public policy perspective, some individuals might lose while others might gain from a policy. In any evaluation, normative judgments cannot be avoided and social welfare functions explicitly specify normative judgments by assigning weights to different individuals.

The most popular criterion in evaluating economic allocations is the rule of Pareto optimality which indicates whether a change in resource allocation leads to a Pareto improvement by making someone better off but no one worse off. A situation is called Pareto optimal if there are no alternative changes, leading to a Pareto improvement—an economy can achieve its optimality as long as nobody in the society can become better off without making anyone else worse off. This condition implies that a given income distribution with fixed total income will be considered Pareto optimal because the income distribution that makes someone

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better off will make others worse off. Therefore, Pareto optimality has little implication on the distribution of welfare across individuals.

Alternatively, one may evaluate economic allocation of resources based on individual preferences. This exercise requires that each individual ranks all possible alternative states of the society. The question then arises whether such individual orderings can be combined to arrive at a collective social ordering. To this end, Arrow (1963) has shown through his impossibility theorem that a set of extremely mild-looking but desirable conditions completely eliminate the possibility of arriving at a collective decision rule. Similarly, Sen (1973b) presented a theorem that excludes all decision rules that express any distribution judgments.

The Pareto optimality criterion and the theory of social choice seem to be desirable criteria to evaluate alternative states of the society, such that both do not require interpersonal comparisons of utilities. However, these criteria fail to provide a framework for distribution discussion. By and large, various types of social tension arise because of the misdistribution of welfare among individuals. As such, the two criteria could be rather blunt approaches to measuring social tension.

The concept of social welfare function was developed by Bergson in 1938 and was further refined by Samuelson in 1947. This chapter focuses on the concept of social welfare function which provides a way to aggregate different utilities across consumers. Under certain conditions, the social welfare function offers a legitimate framework for the distribution of welfare across people, thereby suggesting ways in which the welfare distributions can be ranked among the population. This chapter is concerned with the social welfare functions that can be made operational using household surveys. In this context, they are called applied social welfare functions and in this derivation, normative judgments about assigning weights to different individuals are clearly specified.

2.2 What is a Social Welfare Function?

A social welfare function provides a rule in aggregating different utilities across individuals in the society. Suppose there are n individuals in the society, with the income distribution denoted by:

$$\tilde{x} \approx [x_1, x_2, \ldots\ldots\ldots\ldots\ldots x_n].$$

Given this, one can construct a utility function, $u_i(\tilde{x})$ that summarizes all individuals' preferences: the *i*th person prefers $\tilde{x}$ to $\tilde{y}$ *if and only if* $u_i(\tilde{x}) > u_i(\tilde{y})$. The social welfare function can be accordingly defined as a function of individual utilities:

$$W(\tilde{x}) = W[u_1(\tilde{x}), u_2(\tilde{x}), \ldots\ldots\ldots\ldots\ldots, u_n(\tilde{x})].$$

For such a general function of social welfare, it is reasonable to assume that the social welfare function is increasing in each individual's utility. This assumption will ensure that if everyone prefers $\tilde{x}$ to $\tilde{y}$, the society will also prefer $\tilde{x}$ to $\tilde{y}$.

One of the most widely-used approaches to aggregate individual utilities is the utilitarian approach which defines social welfare as the sum of individual utilities:

$$W(\tilde{x}) = \sum_{i=1}^{n} u_i(\tilde{x})$$

which is referred to as Benthamite welfare function. A slight generalization of this function leads to the weighted utility function:

$$W(\tilde{x}) = \sum_{i=1}^{n} a_i u_i(\tilde{x})$$

where the weights attached to individual utility add to 1 such that $\sum_{i=1}^{n} a_i = 1$. These weights inform how much importance is given to all individuals' utility in the social welfare function.

In the social welfare function defined earlier, individual preferences are defined over the entire distribution $\tilde{x}$ rather than each bundle of consumption or income. One could judge that individuals care only about their own consumption rather than others'. In this case, given that the utility for ith individual is denoted by $u_i(x_i)$, the social welfare will have the form:

$$W = W\left[u_1\left(x_1\right), u_2\left(x_2\right), \ldots\ldots\ldots\ldots\ldots, x_n\left(x_n\right)\right].$$

This social welfare function is a function of all individuals' utilities, and there are no externalities; that is, one's utility depends only on one's own consumption and not on others'. This is called the individualistic social welfare function, which is popularly known as Bergson–Samuelson's social welfare function.

So far, this section has discussed a general form of social welfare function. To apply the social welfare function for policies, specific functions need to be considered. A particular case is the utilitarian welfare function, which is the most widely used for policy-making. Under the utilitarian welfare function, the objective is to maximize the sum of individual utilities for the society. It can be demonstrated that maximizing the utilitarian social welfare function with a given level of total income leads to a perfectly egalitarian distribution only if everyone in the society has the same utility with diminishing marginal utility. Conversely, if individuals have different utility functions, maximizing social welfare may lead to a highly unequal distribution of income. The relationship between inequality and social welfare has been extensively discussed in the literature. In fact, every inequality measure has an implicit social welfare function. The next section will tackle this important relationship.

2.3 Income Inequality and Social Welfare Function

Inequality measures are useful for answering a wide range of questions: How large is income inequality and which direction is it moving? What are the impacts of government policies on income inequality? Are taxes or transfers improving or worsening the distribution of income? Is there a trade-off between rapid economic growth and inequality? Since inequality is generally perceived as bad for society, these critical issues need to be addressed through deliberate policies.

A measure of inequality indicates the overall dispersion of a given distribution from the perfectively equal distribution of income. Inequality measures are statistical tools to capture the relative dispersion of incomes in the society. If inequality measures are directly associated with policy relevance, they must be based on some normative notion of social welfare.

Dalton (1920), who pioneered an attack on positive measures of inequality, argued that economists are primarily interested not in the dispersion of incomes per se, but in the effect of such dispersions on social welfare. An inequality measure must therefore incorporate society's preferences. He then proposed a measure based on the idea of proportional welfare loss resulting from income inequality.

In deriving his inequality measure, Dalton assumed that the social welfare function is utilitarian and that every individual has exactly the same utility function, which is concave. Given this, the total utility is maximized if income is equally distributed. Any change from a completely equal to an unequal distribution will result in welfare loss. Dalton's measure is thus given by the proportional loss of social welfare caused by the actual distribution rather than by a completely equal distribution of the given total income. The idea of deriving inequality measures from social welfare functions was further refined and elaborated by Atkinson (1970), who developed a class of inequality measures that is now widely used in empirical analysis.

The idea that inequality measures should be derived from a social welfare function is increasingly accepted. Once the function is specified, an inequality measure will be known. The relationship between social welfare function and inequality is given by

$$SWF = \mu\left(1 - I\right) \tag{2.1}$$

where *SWF* stands for social welfare function, μ is the mean income (or consumption) of the society, and I is the inequality measure. Note that the inequality measure referred here is in relative terms; that is, it remains unchanged when everyone's income (or consumption) is increased or decreased by the same proportion. However, there is no one-to-one relationship between social welfare function and inequality measure. This suggests that the inequality measure (I) does not allow one to rank the social welfare derived from any two policies and then choose between the two policies.

For instance, suppose there are two alternative policies, A and B. Assume that policy A increases the average standard of living (μ) to \$100 and at the same time reduces inequality (I) to 0.40. Meanwhile, policy B increases μ to \$120 and also increases I to 0.45. In this scenario, which policy option would be preferred? Policy A would be preferred over policy B if the criterion to choose a policy is based on the lower inequality. In contrast, B would be selected over A if a higher living standard is preferred. Based on (2.1), while A generates additional social welfare of \$60, B adds the social welfare by \$66. As such, the society becomes better-off by \$6 per person if policy B is selected over policy A. This hypothetical example demonstrates that the social welfare function should be taken into consideration in choosing policy options.

While social welfare is seldom discussed in the public domain, inequality is widely perceived as a major concern around the globe, with policymakers and economists often debating about the relationship between growth and inequality. A trade-off between growth and inequality is often acknowledged and can be explained through the concept of a *leaky bucket*. Any measure of inequality holds a property that income transfers from the rich to the poor reduce inequality. This property is called the Pigou–Dalton principle of transfer. The basic idea behind this principle is that the gain of \$1 by the poor is more valuable to the society than the loss of \$1 by the rich. Overall, this principle implies that any redistribution of income from the rich to the poor reduces inequality. There are, of course, costs involved in transferring money across different income strata. According to Okun (1975), the transfer is carried out from one income strata to another in a leaky bucket;[1] thus, there will always be some money lost or leakage during the transfer, and the leakage in this context represents inefficiency. Nonetheless, the transfer from the rich to

[1] See Okun (1975).

the poor leads to a reduction in inequality. This raises the issue of a trade-off between equity and efficiency.

Social welfare in general can be increased either by increasing per capita mean income or reducing inequality. The trade-off between equity and efficiency suggests that any reduction in inequality through redistribution reduces per capita income, thereby lowering overall standards of living for the society. Economists, however, have different views about this trade-off. On the one hand, one group of economists consider that economic growth is the utmost priority of a country and that policies such as income redistribution are not effective tools to help achieve that goal. On the other hand, another group of economists advocate for redistribution policies. This group believes that economic growth bypasses some sections of the society; therefore, some deliberate policies are needed to help those sections participate in the growth process.

The relationship between growth and equity has been extensively studied in the literature.[2] Simon Kuznets was the first to start the debates on this issue in his famous article Economic growth and income inequality which was published in 1955. In the article, Kuznets (1955) hypothesized that in the early phases of industrialization in the underdeveloped countries, income inequality forces become strong enough first to stabilize and then reduce income inequalities. Kuznets introduced the well-known *inverted U-shaped pattern of income inequality*, which depicts how inequality rises and then falls during the development process.

According to the Kuznets hypothesis, there is a trade-off between growth and inequality only in the early stages of economic development but at later stages of development, inequality improves. Since Kuznets' pioneering work, there have been numerous studies that provide little support for the relationship between growth and inequality, and most of these are based on cross-country data (e.g., Anand and Kanbur 1984; Deininger and Squire 1998). Currently, the consensus in the literature is that the growth-inequality relationship is rather insignificant. For instance, Ravallion (2005) has found that while growth in per capita consumption is positively correlated with changes in inequality, the relationship is weak and insignificant. Overall, the literature presents a clear

[2] See Bruno et al. (1998), Deininger and Squire (1998), and Kuznets (1955).

message that there is no trade-off between growth and inequality. In this context, there could be four alternative scenarios: (1) high growth and high inequality, (2) high growth and low inequality, (3) low growth and high inequality, and (4) low growth and low inequality.

Countries could be classified under one of the four scenarios. As will be shown in Chap. 3, Brazil has experienced a high growth in per capita income as well as a sharp decline in inequality during 2001–12. On the other hand, growth in China has been rapid but this growth is accompanied with rising inequality in the past two decades.

2.4 A Class of Atkinson's Inequality Measures and Social Welfare Functions

The social welfare function implicit in Dalton's measure of inequality is not invariant with respect to linear transformation of the utility function. This implies that social welfare cannot be measured in money metric terms—for example, in U.S. dollars. Chapter 10 includes a discussion showing how important it is for social welfare functions to be expressed in money metric terms to calculate social rates of return from different welfare programs.

Atkinson (1970) derived a class of social welfare functions based on the concept of an *equally distributed equivalent level of income*. Instead of measuring the actual proportional loss of welfare caused by inequality, he estimated the proportional loss of income that would be incurred by having the actual distribution of income rather than a completely equal one. Like Dalton, Atkinson also assumed that the social welfare function is utilitarian and that every individual has exactly the same utility function. Under such restricted assumptions, the average welfare of the society is defined as

$$W = \int_0^\infty u(x) f(x) dx$$

where $u(x)$ is the utility derived by an individual with income x and $f(x)$ is the density function. Let x^* be the equally distributed equivalent level of income. We then have

$$u\left(x^*\right) = \int_0^\infty u\left(x\right) f\left(x\right) dx$$

x^* is the Atkinson's money metric social welfare function. Because of concavity of the utility function, the money metric social welfare (x^*) will always be less than the mean income μ. The inequality measure implicit in this social welfare function is given by

$$I = 1 - \frac{x^*}{\mu}.$$

If Atkinson's inequality measure is to be scale-independent (i.e., when all incomes are increased by the same proportion, inequality should not change), further restrictions on the form of the utility function must be considered. It can be shown that the inequality measure will be scale independent *if and only if* the utility function is homothetic, which is of the form:

$$\begin{aligned} u\left(x\right) &= A + \frac{Bx^{1-\in}}{1-\in} \; if \in \neq 1 \\ &= A + Bln\left(x\right) if \in = 1 \end{aligned}$$

This utility function gives a class of money metric social welfare $x^*\left(\in\right)$ as:

$$\begin{aligned} x^*\left(\in\right) &= \left[\int_0^\infty x^{1-\in} f\left(x\right) dx\right]^{\frac{1}{1-\in}} \; if \in \neq 1 \\ &= e^{\int_0^\infty ln\left(x\right) f\left(x\right) dx} \quad if \in = 1 \end{aligned}$$

And inequality measure $I\left(\in\right)$ as:

$$I\left(\in\right) = 1 - \frac{1}{\mu}\left[\int_0^\infty x^{1-\in} f\left(x\right) dx\right]^{\frac{1}{1-\in}} \; if \in \neq 1$$

$$= 1 - \frac{1}{\mu} e^{\int_0^\infty ln(x) f(x) dx} \quad if \in = 1$$

Normative judgments in Atkinson's social welfare function are incorporated through the value of ϵ, a measure of inequality aversion. Inequality aversion captures the relative sensitivity to income transfers at different income levels. As ϵ rises, more weights are given to transfers at the lower end of the distribution and less weights to transfers at the top. If $\epsilon = 0$, the social welfare becomes equal to the mean income (i.e., $x^* = \mu$). This case reflects an inequality-neutral attitude in which the society does not care about inequality at all but is mainly concerned with increasing its *average* standards of living.

Dalton's and Atkinson's inequality measures rely heavily on the value judgments represented by individual utility functions selected. Therefore, both are often referred to as normative measures. There are two alternative ways of quantifying these inequality measures to capture the welfare loss stemming from misdistribution. According to Meade (1976), such welfare loss is distribution waste, and to increase social welfare the social objective should be to reduce the so-called distribution waste while holding the living standards constant.

2.5 Relative Versus Absolute Inequality

The previous section defined and discussed Atkinson's inequality measure. One key property present is that the entire class of measures is means-independent, which implies that inequality remains constant even if every income is altered by the same proportion. Such measures, according to Kolm (1976a), are referred to as relative (or rightist) measures of inequality. As an alternative, Kolm has proposed absolute (or leftist) measures of inequality. These absolute measures do not show any change in inequality when every income is increased or decreased by the same amount. They reflect absolute differences in the levels of living standards rather than relative differences. Ravallion (2004) explains the difference between the two measures intuitively: "Consider an economy with just two households with incomes \$1,000 and \$10,000. If both incomes are doubled in size, then relative inequality will remain the same; the richer household is still 10 times richer. But the absolute difference in their incomes has doubled from \$9,000 to \$18,000. Relative inequality is unchanged, but absolute inequality has risen sharply" (pp. 23–24).

Although the concept of absolute inequality is more intuitive, almost all discussions on inequality refer to its relative concept. Often, the increasing gap between the rich and the poor can also be applied to this context in the field—that is, the absolute difference between the rich and the poor. A key question that arises is which of the two concepts of inequality ought to be used to evaluate public policies. For instance, cash transfer programs mostly set their transfer size based on household needs in absolute terms. In evaluating such programs, the absolute concept of inequality would thus be more appropriate. On the other hand, Atkinson's inequality measure may not be appropriate to use in this context as it underpins the relative concept. The next section deals with the most well-known measure of inequality, the Gini index. It presents both the relative and absolute measure of inequality.

2.6 Gini Social Welfare Function

The Gini social welfare function, proposed by Sen (1974), is defined as the weighted average of income levels. A general form of this function is given by

$$W_G = \int_0^\infty x v(x, \tilde{x}) f(x) dx \tag{2.2}$$

where $f(x)$ is the density function and $v(x, \tilde{x})$ is the weight attached to income x given income distribution $\tilde{x}$. To make the social welfare function egalitarian, the weight function $v(x, \tilde{x})$ must decrease monotonically with x such that greater weights are given to poorer persons than richer ones. Moreover, it should be understood that weight $v(x, \tilde{x})$ is defined as a function of the whole income distribution vector $\tilde{x}$ and not just of income x. This implies a more general social welfare function than the one that is additive separable. An additive separable social welfare is obtained by adding up independent welfare components that are independent of the welfare of others in the society. An additive separable social welfare function implies that each consumer's utility depends only on his consumption; thus, there are no externalities from other consumers' utilities.

The assumption of no externalities might be too restrictive because people do compare their welfare to others in the society and feel relatively deprived if their welfare is lower than others'. This concept was articulated by Runciman in 1966 in his article on relative deprivation and social justice. According to him, a person is relatively deprived of *X* when (1) he finds he does not have *X*, (2) he sees some other person or persons—which may include himself at some previous or expected time—of having *X*, (3) he wants *X*, and (4) he sees it as feasible that he should have *X*.

To capture this idea of relative deprivation, Sen (1974) developed a social welfare function by assigning the weight function $v(x, \tilde{x})$ to depend on the ranking of all individuals in the society. The lower a person is on a welfare scale, the greater this person's sense of deprivation with respect to others in the society. Thus, according to Sen's rank order axiom, weight on income level x depends on the percentage of persons in the society who are richer than the person with income x in the given income vector $\tilde{x}$. Based on this formulation, the weight function $v(x, \tilde{x})$ is derived as:

$$v(x, \tilde{x}) = 2\left[1 - F(x)\right] \tag{2.3}$$

where $F(x)$ is the probability distribution function. Note that the sum of weights over the whole population adds up to 1:

$$2\int_0^\infty \left[1 - F(x)\right] f(x)\,dx = 1$$

Substituting (2.3) into (2.2) yields Sen's social welfare function, as defined by:

$$W_G = 2\int_0^\infty x\left[1 - F(x)\right] f(x)\,dx \tag{2.4}$$

The Gini index is defined as one minus twice the area under the Lorenz curve.[3] Following Kakwani (1980), the Gini index can be written as

$$G = \frac{2}{\mu}\int_0^\infty x\left[F(x) - \frac{1}{2}\right] f(x)\,dx \tag{2.5}$$

Combining (2.4) and (2.5) immediately gives the Gini social welfare function as

$$W_G = \mu(1 - G) \tag{2.6}$$

where μ is the mean income of the society, which is also used as a measure of average standard of living. It is noted from (2.6) that the Gini index (G) is the percentage loss of social welfare due to inequality. If there were no inequality in the society, the social welfare would have been equal to μ. If inequality is present, the society's loss of welfare is μG. Therefore, the percentage loss of social welfare caused by inequality is equal to G, a relative measure of inequality because its value remains unchanged if each income is altered by the same proportion. On the other hand, μG is the absolute measure of inequality as it can easily be shown that its value remains unchanged when each income is increased or decreased by the same amount. Thus, the Gini social welfare function provides both relative and absolute measures of inequality. In contrast, Atkinson's measures are deemed relative because they are derived from a class of homothetic utility functions.

[3] For a detailed discussion of the Lorenz curve, see Kakwani (1980).

2.7 Generalized Gini Social Welfare Function

A social welfare function must satisfy the property that any income transfer to a poorer person from a richer person increases the social welfare given a level of total income of the society. Naturally, a stronger property was proposed in the literature which emphasizes the relative sensitivity to transfers at different income levels (Atkinson 1970; Sen 1973b; Kolm 1976b; Kakwani 1980). If society is particularly averse to inequality among its members, the social welfare must give the maximum weight to the transfers at the lowest level of income and the weight should decrease as income increases. The Gini social welfare function attaches the maximum weight to transfers at the mode of the distribution than at the tails; though it is not clear if such weighting scheme is desirable.

Kakwani (1980) generalized the Gini social welfare function, which allows flexible weightings at different income levels. The generalized Gini social welfare function is defined as:

$$W_G(k) = (1+k)\int_0^{\infty} x\left[1-F(x)\right]^k f(x)\,dx \tag{2.7}$$

where weights attached to individual incomes add to 1. The generalized Gini index implicit in this social welfare function is given by

$$G(k) = (1+k)\int_0^{\infty} \frac{(\mu - x)}{\mu}\left[1-F(x)\right]^k f(x)\,dx \tag{2.8}$$

Combining (2.7) and (2.8) immediately gives the generalized Gini social welfare function as

$$W_G = \mu\left[1-G(k)\right] \tag{2.9}$$

Like the Gini index, the generalized Gini index is also a relative measure of inequality because its value remains unchanged if each income is altered by the same proportion. The value denoted by $\mu G(k)$ is an absolute measure of inequality as it can be easily shown that its value remains unchanged when each income is increased or decreased by the same amount. Additionally, similar to the Gini social welfare function, the generalized Gini social welfare also provides both relative and absolute measures of inequality.

The relative sensitivity to transfers of the generalized social welfare function depends on the value of k. The value of k should be selected such that it reflects the society's preference for the sensitivity of the social welfare to income transfers at different income positions; the larger the value, the greater the society's aversion to inequality is. If $k = 0$, it implies an inequality-neutral attitude of the society, where its main concern lies in accelerating growth in income and not in the distribution of income. This, however, might represent an extreme case. If a society is concerned with inequality at all, it must choose the value of k greater than 0. In the Gini social welfare function, k is set equal to 1, in which case the society is most concerned with the deprivation suffered by individuals clustered around the mode. The larger the value of k, the more weight is attached to the lower end of the distribution and less weight is given to the top. A value of k that is greater than 1 provides a stronger egalitarian criterion.

2.8 Rawlsian Social Welfare Function and Shared Prosperity

A much stronger egalitarian criterion has been provided by Rawls' (1971) *maximin* rule in which the social objective is to maximize the welfare of worst-off individual in the society. It is formally defined as

$$W = min\left[u_1, u_2, \ldots\ldots\ldots\ldots, u_n\right]$$

where n is the total number of persons in the society.

Without loss of generality, it can be assumed that an individual's utility is measured by his income level. Given this, a generalized *maximin* criterion is proposed under which the society aims to maximize the average welfare for the bottom $100 \times h\%$ of the population. When $h = 1$, the social welfare becomes the average income of the society, whereby its inequality aversion is equal to zero. When h takes the lowest value of $1/n$, the society maximizes the welfare of the worst-off person, which is the Rawls' *maximin* criterion. These are two extreme values for h; however, h can take any value between $1/n$ and 1, though such a social welfare function is deemed less egalitarian than the Rawlsian *maximin* criterion.

The World Bank recently proposed a new development model that focuses on the welfare of the bottom 40 % of population in a society. Under this new paradigm, it aims to: (1) lower extreme or absolute poverty in the globe to 3 % by 2030 and (2) foster economic growth that benefits the bottom 40 % of the population (Rosenblatt and McGavock 2013). The second goal is built upon the concept of shared prosperity. According to this concept, growth fosters shared prosperity if the bottom 40 % can also share the fruits of economic growth. The social welfare function under shared prosperity is defined by the mean income of the bottom 40 %. This could be considered to be a weaker version of the Rawlsian *maximin* criterion.

2.9 Estimates of Social Welfare Functions in Asia: An Illustration

This section presents empirical analysis of social welfare functions. The concepts of social welfare functions laid out in the previous sections are applied to household surveys in selected Asian countries (see Table 2.1). Using household surveys, we can estimate social welfare of a country in local currency. However, this does not allow us to compare social welfare across countries. To this end, we have converted the local currencies for selected countries to U.S. dollars using purchasing power parity (PPP) exchange rates. The PPP exchange rates account for the differences in costs of living across countries, thus providing a cross-country comparison of social welfare. A more detailed discussion of PPP is provided in Chap. 8.

Unlike national accounts, survey periods for household surveys differ from one country to another, as shown in Table 2.1. The social welfare for a specific country was first calculated in the local currency at the survey

Table 2.1 2011 purchasing power parity exchange rates in selected Asian countries

	Survey year	CPI in the survey year	CPI in 2011	2011 PPP exchange rates
Bangladesh	2000	100.0	2005.4	23.1
Bhutan	2007	102.5	135.0	16.9
India	2007–08	143.0	201.0	15.1
Indonesia	2009	216.1	239.3	3606.6
Pakistan	2007–08	164.3	260.0	24.3
Philippines	2011	164.4	164.4	17.9
Sri Lanka	2009–10	266.1	292.5	38.7
Tajikistan	2007	258.4	396.5	1.7
Vietnam	2008	178.3	246.6	6709.2

Source: Authors' calculations

CPI consumer price index, *PPP* purchasing power parity

Table 2.2 Generalized Gini social welfare in 2011 purchasing power parity

	$k=0$	$k=1$	$k=1.5$	$k=2$
Bangladesh (2000)	63.2	42.1	38.4	36.0
Bhutan (2007)	215.2	126.4	110.8	100.5
India (2007–08)	88.9	58.4	53.3	49.9
Indonesia (2009)	136.7	89.7	81.4	75.9
Pakistan (2007–08)	125.3	85.2	78.2	73.6
Philippines (2011)	154.3	90.6	79.4	72.0
Sri Lanka (2009–10)	210.9	134.4	121.3	112.5
Tajikistan (2007)	139.2	98.3	90.7	85.4
Vietnam (2008)	163.4	103.7	93.2	86.1

Source: Authors' calculations

year, which was then adjusted for inflation between the survey year and 2011. The adjustment was made using the consumer price indices (CPI), also presented in Table 2.1. The resulting estimates for the social welfare in 2011 local currencies were converted to the corresponding U.S. dollars using 2011 PPP. The social welfare estimates in 2011 PPP are thus comparable across countries because they are measured in common international currency adjusted for their respective costs of living.

Table 2.2 presents the generalized social welfare estimates in 2011 PPP. When $k=0$, the social welfare is completely insensitive to inequality. If $k>0$, the social welfare takes into account both mean income (or average standard of living) and inequality. If k exceeds 0, there is a loss of social welfare caused by inequality, wherein this loss of social welfare represents the absolute inequality of the society.

As shown in Table 2.2, the per capita monthly consumption in India was \$88.9 in 2011 PPP during 2007–08. This was the value of social welfare when k takes the value of 0. As the value of k increased to 1, the social welfare declined to \$58.4. This suggests a loss of \$30.5 in the social welfare. If there was no inequality, the social welfare would have been higher by \$30.5 per person per month. The loss of welfare would have been even higher at \$39 if the society was highly averse to inequality (say, k equal to 2). Note that the value of k is determined based on society's tolerance toward inequality.

Figure 2.1 demonstrates how social welfare can change with different values of k. The social welfare curve is the highest when $k=0$. Comparing the curve when $k=0$ with those when $k>0$, the gap between the two signifies the loss of social welfare due to inequality. This loss is measured in U.S. dollars in absolute term and thus represents a measure of absolute of inequality.

A comparison across countries suggests that the countries with higher (lower) social welfare have higher (lower) absolute inequality: the more affluent the country, the greater the absolute inequality is. Can this finding be generalized or is it just specific to a country? To answer this question, a more in-depth study which expands the empirical analysis to more

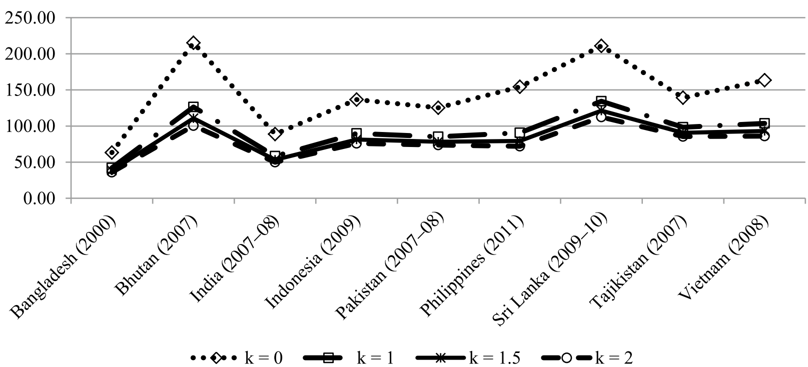

Fig. 2.1 Generalized Gini social welfare in 2011 purchasing power parity

countries may be required. Nevertheless, if the result could be indeed generalized, then the proposition would be that the absolute inequality rises with economic growth. As an economy expands, individuals with higher marginal productivity tend to be rewarded more than those with lower productivity. It is likely the case that the individuals with higher productivity are already better-off than their counterparts with lower productivity. Given this, economic growth can exacerbate the gap between these two groups, thus leading to worsening absolute inequality in the society. As will be discussed in the next chapter, Brazil is a case in point for this phenomenon.

Table 2.3 presents the relative measures of inequality based on the generalized Gini social welfare function for different values of k. The results show that the correlation between level of income and inequality is rather weak. For instance, India and Indonesia both have the same levels of inequality, but Indonesia has higher social welfare than India. This result also implies that economic growth does not necessarily lead to higher or lower relative inequality; inequality can increase or decrease with growth. As shown earlier, this relationship does not apply when inequality is measured in absolute terms.

While the relationship between growth and inequality has been widely studied, it is generally believed that there is no significant relationship between the two; although this statement might be only true for relative inequality but not for absolute inequality. Absolute inequality is determined by both mean income and relative inequality. As such, given that

Table 2.3 Relative inequality based on generalized Gini social welfare

	$k=0$	$k=1$	$k=1.5$	$k=2$
Bangladesh (2000)	0	0.33	0.39	0.43
Bhutan (2007)	0	0.41	0.49	0.53
India (2007–08)	0	0.34	0.40	0.44
Indonesia (2009)	0	0.34	0.40	0.44
Pakistan (2007–08)	0	0.32	0.38	0.41
Philippines (2011)	0	0.41	0.49	0.53
Sri Lanka (2009–10)	0	0.36	0.42	0.47
Tajikistan (2007)	0	0.29	0.35	0.39
Vietnam (2008)	0	0.37	0.43	0.47

Source: Authors' calculations

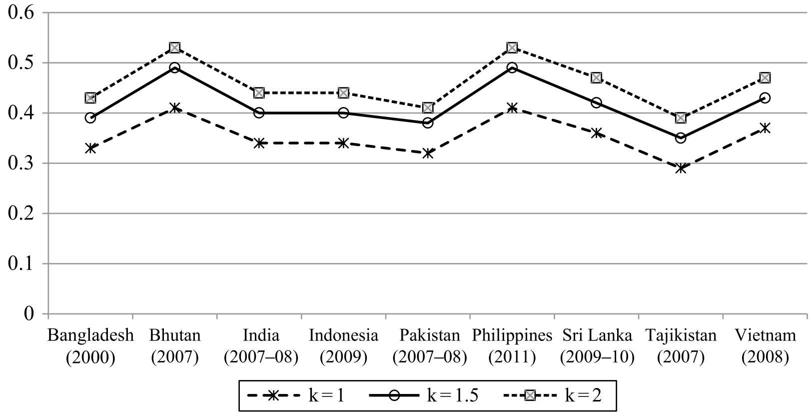

Fig. 2.2 Relative inequality based on generalized Gini social welfare

economic growth has insignificant correlation with relative inequality, it is somewhat obvious that economic growth and absolute inequality are positively correlated with each other. This confirms the proposition that absolute inequality increases with economic growth.

Figure 2.2 plots the relative inequality based on the generalized Gini social welfare function. A comparison of the results in Fig. 2.1 with those in Fig. 2.2 reveals that relative inequality is less sensitive to higher levels of income as opposed to absolute inequality.

2.10 Concluding Remarks

This chapter dealt with the concept of social welfare function, which provides a way to aggregate utilities across consumers. One can use the social welfare function as a tool to assess the allocations of economic resources to determine which policies work and do not work. Different policies affect individuals in different ways as well, such that some individuals will lose while others will gain. In this context, it is inevitable to make normative judgments. A social welfare function allows us to explicitly specify such normative judgments by choosing different weights assigned to different sections of the population.

Since the social welfare function provides the basis for making distribution-based judgments, it plays an important role in dealing with measurement issues particularly in inclusive development. Various types of social tension arise because of the misdistribution of welfare across people. Therefore, the social welfare function—which is sensitive to distribution—should be used to analyze social tension. This issue will be taken up in Chap. 3.

The social welfare functions derived in this chapter can be made operational using household surveys—in this context, they are called applied social welfare functions. This chapter has discussed two major classes of social welfare functions Atkinson's and Kakwani's. For Atkinson's social welfare function, the utility of an individual depends only on his own income (or consumption). In comparison, Kakwani's social welfare function accounts for interpersonal comparisons of utilities. Essentially, Kakwani's social welfare captures the idea of relative deprivation, experienced by individuals with different income levels. Sen's Gini social welfare function is a particular case of Kakwani's.

This chapter also presented empirical analysis for selected Asian countries including Bangladesh, Bhutan, India, Indonesia, Pakistan, Philippines, Sri Lanka, Tajikistan, and Vietnam. The results revealed that the countries with a higher (lower) social welfare have a higher (lower) absolute inequality: the higher the level of income for the country, the greater the absolute inequality. If this result generally holds, then a proposition is that absolute inequality increases with economic growth. The same cannot be said for the relative measure—economic growth shows little correlation with changes in relative inequality.

3

Measuring Social Tension

3.1 Introduction

Different types of social tension can lead to social unrest. Inequality and poverty, for instance, could cause social tension, given temporal fluctuations in living standards including both systemic and idiosyncratic sources of risk. Social tensions may also arise from immobility among social groups, polarization, and issues relating to middle class. This chapter provides a common methodology to model different sources of social tension.

Social tension has many dimensions shaped by economic, social, and political factors. Some of these dimensions are not quantifiable. This chapter deals with dimensions of social tension that can be quantified using available data from household surveys. The following aspects of social tension will be considered: (i) high inequality, (ii) existence of poverty, (iii) shrinking middle class and increased polarization, (iv) growth volatility, and (v) social immobility.

Measuring each of these dimensions will require normative judgments, which become explicit using a social welfare function. As noted in Chap.

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2, various social welfare functions have been proposed in the literature. A social welfare function is primarily used to identify policies that work and those that do not. From any public policy perspective, various policies affect individuals differently; some lose while others gain. Hence, it is inevitable to make some form of normative judgments in the assessment of policies using social welfare functions. Social welfare functions help specify judgments on the weights rendered to different individuals.

This chapter aims to derive social welfare functions that explicitly incorporate judgments about various types of social tension. Such social welfare functions provide the basis for the measurement of social tension. These social welfare functions are applied in Brazil's case with an empirical analysis of levels and trends of various types of social tension in the country from 1992 to 2012, using data from a national household survey called the *Pesquisa Nacional por Amostra de Domicílio* (PNAD).

3.2 A General Framework for Measuring Social Tension

Social welfare depends on mean income and its distribution. The mean income is generated through outputs produced by the economy, which in turn are generally measured by the gross domestic product (GDP). The maldistribution of income provides the measures of social tension. In this chapter, social tension is measured in income space. However, social tension also has non-income dimensions, which manifest for instance in a malfunctioning justice system, insecurity, and discrimination in the society. Chapters 6 and 7 will deal with these non-income dimensions.

Social tension in any dimension may be measured by the proportional loss of social welfare caused by it. The level of social welfare can be defined by

$$W = \mu(1-T) \tag{3.1}$$

where μ is the mean income of the society and T is a measure of social tension. If the percentage increase in mean income is greater than the percentage fall in $(1-T)$, then the net social welfare increases—such a growth process may be deemed inclusive in a given dimension of social tension. Inclusive growth is viewed as a multidimensional concept because it takes into account different dimensions of social tension.

The analysis presented in this chapter does not attempt to create a single index that merges the different dimensions of social tension. Since different dimensions are based on different normative judgments, it makes little sense to combine them into a single index. Each dimension is analyzed individually to identify the type of social tension that has an increasing or decreasing trend over time. An increasing social tension can become a source of social unrest, so it is imperative to measure trends in individual social tensions.

The trends in social tension can be analyzed by the following decomposition derived from (3.1):

$$\Delta ln(W) = \Delta ln(\mu) + \Delta ln(1 - T) \tag{3.2}$$

which shows that the growth rate of social welfare is the sum of two growth rates, mean income, and social tension. The growth rate of $(1 - T)$, denoted by $\tau = \Delta Ln(1 - T)$, informs whether social tension is increasing or decreasing overt time. A negative value of τ implies an increasing social tension, while a positive value indicates a decreasing social tension. Gains in the growth rate of social welfare signify decreasing social tension. In contrast, losses in the growth rate indicate increasing social tension. For example, if social tension (T) were hypothetically to decline to 50% from 60%, the gain in the growth rate of 22.3% in social welfare would be realized. In measuring T, a social welfare function linked to a type of social tension must therefore be specified. The subsequent section discusses this issue.

3.3 Social Tension Caused by Inequality

Inequality is one source of social tension. Social tension due to inequality can be measured using the Gini social welfare function, which gauges how much relative deprivation the society suffers. Chapter 2 has already defined the Gini social welfare function, proposed by Sen (1974), as the weighted average of individual incomes. An attractive feature of the Gini social welfare function is that it is interdependent and captures the idea of relative deprivations suffered by individuals across different levels of income.

This section derives the Gini social welfare function based on the idea that individuals lose their welfare when they find out that their income is lower than others. An individual with income x compares her income with all other individuals in the society. She selects other individuals one by one and makes all possible comparisons. Suppose she selects an individual with income y and feels deprived upon discovering her income x is lower than income y. She therefore suffers loss of welfare. There is no loss of welfare if her income is higher than the compared income. Her welfare is then given by:[1]

$$\begin{aligned} u(x, y) &= x && \text{if } x \geq y \\ &= x - (y - x) && \text{if } x < y \end{aligned}$$

Suppose the income x of an individual is a continuous random variable with mean μ and probability density function $f(x)$. Then, in all pair-wise comparisons, her expected welfare is obtained denoted by $u(x)$

$$u(x) = x - \mu\left[1 - F_1(x)\right] + x\left[1 - F(x)\right] \tag{3.3}$$

where $F(x)$ is the distribution function, which is interpreted as the proportion of population with income less than x. $F_1(x)$ is defined as

$$F_1(x) = \frac{1}{\mu}\int_0^{\infty} Xf(X)\,dX$$

which is the proportion of income enjoyed by individuals with income less than or equal to x.

Differentiating (3.3) twice gives

$$u'(x) = 2 - F(x)$$

[1] See Kakwani (1986).

$$u''(x) = -f(x)$$

which implies that the individual's (expected) welfare is an increasing function of income and is concave. This is the basic requirement of any utility function.

The average welfare of the society is then obtained from (3.3) as

$$W_G = \int_0^\infty u(x) f(x) dx = 2\int_0^\infty x\left[1 - F(x)\right] f(x) dx = \mu(1 - G) \tag{3.4}$$

where G is the Gini index and $\mu(1-G)$ is the Gini social welfare function.

The average deprivation suffered by the society is measured by the Gini index, which is the proportional loss of social welfare. Thus, the Gini index is a measure of social tension caused by inequality in the society.

3.4 Social Tension Caused by Poverty

Poverty is a major source of social tension and can trigger social unrest and, ultimately, the kind of sustained violence that reduces growth (Lustig et al. 2002). Poverty is viewed as income (or consumption) deprivation. It occurs when some sections of a society cannot meet their minimum basic needs as defined by the poverty line.

As discussed in the previous section, inequality creates social tension, measured by a loss of social welfare. The relationship between inequality and social welfare has been extensively discussed in the literature (see Chap. 2). Every inequality measure has an implicit social welfare function. Nevertheless, such a relationship has yet to be established between various poverty measures and social welfare functions. This section derives social welfare functions corresponding to the class of Foster et al. (1984) poverty measures, widely referred to as FGT measures.

The poverty line specifies the society's minimum standard of living. An individual suffers deprivation, which results in loss of welfare, when her income is less than the poverty line. The welfare of an individual with income x is given by

$$\begin{aligned} w(x) &= x - g(z,x) \quad \text{if } x < z \\ &= x \qquad\qquad\quad \text{if } x \geq z \end{aligned} \tag{3.5}$$

where z is the poverty line and

$$\begin{aligned} g(z,x) &> 0 \quad \text{if } x < z \\ &= 0 \quad \text{if } x \geq z \end{aligned}$$

is the deprivation suffered by the poor. The non-poor are assumed to not suffer any deprivation. Given (3.5), the average welfare of the society can be given by

$$W = \mu - \int_0^z g(z,x) f(x) dx \tag{3.6}$$

where μ is the mean income of the society. The second term on the right-hand side of (3.6) refers to social deprivation due to poverty. Social deprivation needs to be measured in money metric so that a society knows how much average income is lost because of poverty—that is, social deprivation should be invariant to a positive transformation of the deprivation function. Clark et al. (1981) introduced the idea of "equally distributed equivalent poverty gap", which is denoted by $\bar{g}$ and is defined as

$$\bar{g}^{\alpha} = \frac{1}{H} \int_0^z (z - x)^{\alpha} f(x) dx \tag{3.7}$$

where H is the headcount measure of poverty. The function $g(z, x)$ is the deprivation suffered by the poor, which can be measured in terms of equally distributed equivalent poverty gap:

$$\int_0^z g(z,x) f(x) dx = H\bar{g}. \tag{3.8}$$

Substituting (3.7) and (3.8) into (3.6) gives the social welfare (i.e., average welfare of the society) as

$$W_\alpha = \mu - Hz\left(\frac{\theta_\alpha}{H}\right)^{\frac{1}{\alpha}} \tag{3.9}$$

where θ^α is the FGT class of poverty measures defined as

$$\theta_\alpha = \int_0^z \left(\frac{z-x}{z}\right)^\alpha f(x)\,dx$$

where θ^α is the headcount ratio (H) if $\alpha = 0$, the poverty gap ratio if $\alpha = 1$, and the severity of poverty ration if $\alpha = 2$.

Sen (1976) considers the headcount ratio as a crude measure of poverty because it is completely insensitive to the depth and severity of poverty. The poverty gap ratio, meanwhile, takes into account the depth of poverty as measured by the average income gap of the poor from the poverty line. In addition, the severity of poverty accounts for inequality of income among the poor. Note that W^α is not defined for the headcount ratio when $\alpha = 0$.

W^α in (3.9) shows that like any inequality measure, there is an implicit social welfare function for each member of the FGT class of poverty measures, except the headcount ratio. The second term on the right-hand side of (3.9) is the welfare loss (measured in money metric) due to the existence of poverty. Given this, the proportional loss of social welfare due to poverty can be obtained from (3.9) as

$$P_\alpha = \frac{zH^{\frac{(\alpha-1)}{\alpha}}\left(\theta_\alpha\right)^{\frac{1}{\alpha}}}{\mu} \tag{3.10}$$

which is the proposed measure of social tension because of poverty. The measure of social tension for the poverty gap ratio is obtained by substituting $\alpha = 1$ in (3.10) as

$$P_1 = \frac{z\theta_1}{\mu} \tag{3.11}$$

where θ_1 is the poverty gap ratio. Differentiating (3.11) with respect to μ, while keeping distribution unchanged, gives[2]

$$\frac{\partial P_1}{\partial \mu} = -Hz < 0$$

which shows that social tension implied by the poverty gap ratio always declines when there is distribution-neutral economic growth (i.e., when economic growth does not change the relative inequality). Similarly, a measure of social tension for the severity of poverty is obtained by substituting $\alpha = 2$ in (3.10) as

$$P_2 = \frac{z\sqrt{H\theta_2}}{\mu} \tag{3.12}$$

where θ_2 is the severity of poverty ratio. Differentiating (3.12) with respect to μ, while keeping distribution constant, gives:

$$\frac{\partial P_2}{\partial \mu} = -\frac{z\left[zf(z)\theta_2 + 2H(\theta_1 + \theta_2)\right]}{2\mu^2\sqrt{H\theta_2}} < 0$$

which shows that social tension implied by the severity of poverty ratio also decreases when there is distribution-neutral economic growth. Similarly, the entire class of social tension measures caused by poverty will always decline when there is distribution-neutral growth rate. Note that inequality-neutral growth does not change the relative social tension measures caused by inequality in the society such as the Gini index. Thus, inequality-neutral growth reduces the poverty tension, but has no impact on the inequality tension.

A distribution-neutral growth increases incomes of all individuals by the same proportion when the relative distribution defined by the Lorenz curve does not change. If growth is not inequality-neutral, the following four scenarios are possible:

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[2] The distribution here is measured by the Lorenz curve.

(i) Inequality tension increases but poverty tension decreases;
(ii) Both inequality and poverty tensions increase;
(iii) Both inequality and poverty tensions decrease; and
(iv) Inequality tension decreases but poverty tension increases.

Ideally, society should aim at reducing both inequality and poverty tensions, but such a scenario is not very common in developing countries. Brazil has recently achieved reduction in both inequality and poverty tensions (scenario iii). However, scenario i, under which an increase in inequality tension is accompanied by a reduction in poverty tension, is most prevalent in developing countries, particularly in Asia and the Pacific. China offers a case in point: inequality has been increasing at the same time that poverty has been declining rapidly.

These observations have led to a belief that developing countries face a trade-off between inequality and poverty—if there is a reduction in poverty in society, this occurs at the cost of increasing inequality. Based on cross-country evidence, Ravallion (2005) did not find any systematic trade-off between measures of poverty and relative inequality. Hence, the trade-off between poverty and inequality may be quite sharp in China, but this is not found in other countries. Since both inequality and poverty have an intrinsic value to the society, any discussion of trade-off between the two is important.

3.5 Social Tension and Polarization

The role of the middle class in economic development has been examined in recent literature. An emerging consensus among economists is that an increase in the size of the middle class leads to a rise in per capita income and that increase in the middle income shares causes a rise in the growth rate (Easterly 2001). In addition, a greater income share of the middle class leads to better health and education outcomes. Birdsall (2007) even defined inclusive growth as growth which builds middle class. According to her, a small and weak middle class implies weak state institutions and, hence, unsustainable growth. Berkowitz and Jackson (2005) pointed out that a powerful middle class is conducive to lower inequality.

The phenomenon of "disappearing middle class" has become a concern among many economists (Wolfson 1994). In the United States, for instance, the share of households belonging to the middle income class declined from 53 % in 1967 to 43 % in 2013 (Gebeloff and Searcey 2015). Such phenomenon may take place as society becomes more polarized. Foster and Wolfson (2009) introduced the idea of bi-polarization that is directly linked to the disappearance of the middle class.

A society is said to be polarized when it is divided into groups with substantial intra-group homogeneity and inter-group heterogeneity. Based on this definition, Esteban and Ray (1994) identified two distinct notions of polarization. The first is alienation, which measures how far apart different groups are. The second is identification, which measures how closely the members of a group are aligned with each other, sharing common aspirations and values. Social conflicts may potentially arise due to the existence of such groups.

Suppose a society is divided into three groups: the poor, middle class, and the rich. A shrinking middle class and an increasing gap between the poor and the rich imply an increasing polarization in the society. A polarized society has a small middle class and sizable poor and rich classes, with large income gap between them. This is basically the idea of bi-polarization as articulated by Foster and Wolfson (2009).

The concept of polarization is directly linked to social tension. However, the link between social welfare and polarization has never been discussed in the literature. To measure social tension, this section derives a social welfare function that embodies the essential elements of social tension caused by polarization.

The notion of alienation is measured by the degree of spread from the middle position (median) to the tails of the income distribution. A larger spread from the median implies a smaller middle class and larger polarization, whereby the rich become richer and the poor become poorer. This causes social tension. The social welfare function that incorporates the idea of alienation is derived as follows.

A person is assumed to be alienated if her income spreads from the middle. Suppose m is the median income, then her alienation is given by the difference between the individual income and the median. The utility that takes account of alienation from the median may be defined as:

$$\begin{aligned} u(x) &= x - (m - x) \quad \text{if } x < m \\ &= x - (x - m) \quad \text{if } x > m \end{aligned} \tag{3.13}$$

Thus, the average welfare of the society from (3.13) is obtained as

$$W_A = \mu - \frac{(m_2 - m_1)}{2} \tag{3.14}$$

where m_1 and m_2 are the mean incomes of the population having income below and above the median income, respectively. W_A is the social welfare that accounts for alienation in the society. The proportional loss of social welfare due to alienation is given by

$$A = \frac{(m_2 - m_1)}{2\mu}. \tag{3.15}$$

The larger the A, the greater is the alienation in the society. A is the proposed measure of social alienation.

The second aspect of bi-polarization refers to the case where incomes below the median or above the median become closer to each other. Nissanov et al. (2011) called this situation as a "bunching of the two groups in the sense that the gaps between incomes below and above the median have been reduced." The polarization increases when the two groups become homogeneous.

The social welfare function defined in (3.14) gives equal weights to the income gaps from the median, which is why it is completely insensitive to any transfer of income on either side of the median. To make it sensitive to such transfers, different weights need to be given to different income gaps. How then should weights be determined?

Suppose $v(x)$ is the weight given to x. Since society is most concerned with the welfare of the middle income group, the weight $v(x)$ should be maximum at the median when $x = m$, which tapers off to 0 at the tails of the distribution. This means that $v(x)$ should be an increasing function of x until it reaches the maximum value at $x = m$ and then it should be decreasing with x until it becomes 0 as income reaches infinity. A simple weighting scheme is proposed by:

$$\begin{aligned} v(x) &= 4F(x) && \text{if } x < m \\ &= 4\left[1 - F(x)\right] && \text{if } x \geq m \end{aligned} \tag{3.16}$$

such that the sum of all weights becomes 1:

$$\int_0^\infty v(x) f(x) dx = 1.$$

Using (3.13) and (3.16), the average welfare of the society is then obtained as

$$W_B = \int_0^\infty u(x) v(x) f(x) dx = \mu - (m_2 - m_1) + 2\mu G \tag{3.17}$$

which is the social welfare that takes into account the polarization in the society. The proportional loss of social welfare due to polarization is given by

$$B = 2(A - G) \tag{3.18}$$

where A is the measure of social alienation derived in (3.15) and G is the Gini index. This measure can also be expressed as

$$B = 2(G_B - G_W) \tag{3.19}$$

where G_B and G_W are the between- and within-group inequalities when the two groups are formed by the populations having income less and greater than the median income, respectively. The polarization measure B in (3.18) is similar to the measure proposed by Foster and Wolfson (2009). This is a measure of social tension due to the existence of polarization in the society.

3.6 Growth Volatility and Social Tension

Growth rates inform the extent to which people have become better- or worse-off over time. The magnitude of growth rates, therefore, matter in discussing development strategies. Growth rates tend to be volatile; they can fluctuate widely from negative to positive. Such volatility can lead to social tension especially when it accompanies a decline in living standards. Fluctuation in growth rates causes uncertainty among economic agents, which in turn influences their business decisions for investments in physical and human capital. Government's policy making also becomes challenging during times of volatile growth. Volatile growth rates are thus deemed a cause of social tension. This section develops a model to measure a loss of social welfare attributed to volatility in growth rates.

Suppose μ_t is the per capita income of the society in period t and there are n time periods, then a simple inter-temporal social welfare function may be defined as

$$ln\left(\mu^*\right) = \frac{1}{n}\sum_{t=1}^{n} ln\left(\mu_t\right) \tag{3.20}$$

where μ^* is the money metric social welfare for the entire n periods. Let r_t be the growth rate of per capita income between $t-1$ and t, then the definition $\mu_t = \mu_{t-1}\left(1+r_t\right)$ must hold.

Substituting sequentially μ_t in terms of μ_1 gives

$$\mu_t = \mu_1\left(1+r_2\right)\left(1+r_3\right)\ldots\ldots\ldots\ldots\left(1+r_t\right)$$

which on taking on logarithm of both sides gives

$$ln\left(\mu_t\right) = ln\left(\mu_1\right) + \sum_{j=2}^{t} ln\left(1+r_j\right)$$

which on substituting in (3.20) gives

$$ln\left(\mu^*\right) = ln\left(\mu_1\right) + \frac{n-1}{2}\sum_{t=2}^{n} w_t\, ln\left(1+r_t\right) \tag{3.21}$$

where

$$w_t = \frac{2(n-t+1)}{n(n-1)}$$

such that $\sum_{t=2}^{n} w_t = 1$. Equation (3.21) provides the relationship between the aggregate welfare level measured by μ^* and the growth rates.[3]

When all growth rates are equal, it is reasonable to assume that there is no volatility in growth rates, in which case the social welfare must be maximized. Holding that assumption, the loss of social welfare from the maximum level of social welfare provides a welfare measure of growth volatility. To measure the impact of volatility on social welfare, a counter-factual would be that all growth rates are equal to the average growth rate given by

$$\bar{r} = \sum_{t=2}^{n} w_t r_t \tag{3.22}$$

which when substituted in (3.21) gives a new welfare function

$$ln\left(\mu_M^*\right) = ln\left(\mu_1\right) + \frac{n-1}{2} ln\left(1+\bar{r}\right) \tag{3.23}$$

Because of the concavity of the logarithmic function, the following relationship will always hold:

$$\sum_{t=2}^{n} w_t \, ln\left(1+r_t\right) \leq ln\left(\sum_{t=2}^{n} w_t \left(1+\bar{r}\right)\right)$$

which on using (3.22) immediately gives

$$\sum_{t=2}^{n} w_t \, ln\left(1+r_t\right) \leq ln\left(1+\bar{r}\right).$$

This equation holds for all values of growth rates r_t. Comparing (3.21) and (3.23) leads to

[3] This derivation is given by Kakwani (1995).

$$ln\left(\mu_M^*\right) \geq ln\left(\mu^*\right).$$

Thus, μ_M^* is the maximum value of money-metric social welfare when there is no growth volatility; that is, when all growth rates are equal. The loss of social welfare due to the volatility of growth rates is given by

$$V = \left(\mu_M^* - \mu^*\right) \tag{3.24}$$

which is the proposed measure of social tension caused by volatile growth rates. It can be easily verified that $V = 0$ when all growth rates are equal.

3.7 Social Mobility and Social Tension

Social mobility is the movement of individuals or groups in economic and social position. These social groups are classified by income, gender, race, age, caste, ethnicity, or religion. A society can be assumed to have low social mobility if some social groups are unable to improve their socio-economic status and stuck in low-paid jobs despite their efforts.

Social barriers generally contribute to immobility in the society. For instance, despite substantial expansion of educational opportunities around the globe, family background continues to play a pivotal role in determining one's economic success.

There is now a sizable literature on the measurement of income mobility. The measurement of income mobility is viewed as an extension of the measurement of inequality over time. The pioneering work in this area is the one by Shorrocks (1978) who developed a mobility index. The index informs the extent to which relative incomes of individuals have remained static or changed over time; the larger the change in relative incomes over time, the greater is the income mobility.

Income is deemed mobile if the ranking of individuals by their incomes changes between two periods. However, there is no income mobility in a society if the ranking of individuals remains the same between the two periods. King (1983) constructed an index that measures changes in the rank orders in income distribution over time. Similarly, Fields and Ok

(1996, 1999a, 1999b) and Mitra and Ok (1998) viewed mobility in terms of the distance between income distributions in two periods. The measures of income mobility proposed in the literature are largely based on the distance between income distributions in different periods. These measures can only be estimated from panel data for the same households that are seldom available.

In all these studies, income mobility is measured by the degree of volatility in individuals' incomes over time; the larger the volatility, the greater the mobility becomes. As discussed, volatility in growth rates causes social tension, resulting in a lower level of social welfare overtime. Unfortunately, such argument may not be applicable to the measurement of income mobility.

In this section, social mobility is analyzed in terms of the relative movement of social groups in their economic status. If the economic status of worse-off social groups improves at a faster rate than their better-off counterparts (i.e., there is a convergence in social welfare between the two groups), then the society may be defined as socially mobile. By the same token, a society lacks social mobility if the worse-off social groups never improve their relative economic status, which could be due to their family circumstances or other social barriers. This lack of social mobility may be considered as a source of social tension. The following methodology is proposed to measure social tension due to social immobility.

Suppose a population is divided into k mutually exclusive social groups and a_i is the population share of the ith group, then $\sum_{i=1}^{k} a_i = 1$ must hold. Further, if $f_i(x)$ is the density function of the ith group, then the average social welfare enjoyed by the ith group will be given by

$$W_i = \int_0^{\infty} u(x) f_i(x) dx \tag{3.25}$$

where $u(x)$ has been defined in (3.3) and $W_G = \mu(1-G)$, with G being the Gini index, is the average welfare enjoyed by the whole society. The average welfare enjoyed by any group can then be compared with that of the society as a whole. This will inform which group enjoys more (or less) welfare compared to the whole society.

It can be easily shown that

$$f(x)=\sum_{i=1}^{k} a_i f_i(x) \tag{3.26}$$

where $f(x)$ is the density function of the entire population. Substituting (3.26) into (3.3) and using (3.25) gives

$$W_G=\sum_{i=1}^{k} a_i W_i \tag{3.27}$$

which demonstrates that the social welfare enjoyed by the whole society is the weighted average of the welfare enjoyed by each social group, where the weight is the population share of the social group. The term $100\times a_i W_i$ is the percentage contribution of the ith social group to the total social welfare of the society.

Social mobility reflects the extent to which social groups who are deemed worse-off can economically progress relative to the whole society. In this context, the gap in economic status of different groups can be measured by the relative mean deviation:

$$RMD=\frac{1}{2W_G}\sum_{i=1}^{k} a_i \left|W_i-W_G\right| \tag{3.28}$$

The RMD is equal to 0 if all groups enjoy exactly the same welfare. Similarly, it is equal to 1 if only one group enjoys all the welfare and the remaining groups have welfare equal to 0. It is possible that the relative welfare of some groups is negative because their average income is less than the average deprivation suffered by them—in such a case, the RMD can exceed 1. The negative welfare of a group implies that the group is extremely worse-off in the society.

The society is defined as mobile if the worse-off groups improve their welfare more than the better-off ones (i.e., the gap in economic status measured by social welfare decreases over time). In addition, the degree of mobility may be measured by the rate at which the RMD declines over time. The increase in RMD over time implies that the worse-off groups are relatively becoming even worse.

3.8 Empirical Analysis of Social Tension in Brazil

The empirical analysis presented in this section is based on data from Brazil's national household survey called PNAD, covering the period 1992–2012. PNAD contains extensive information on personal and occupational characteristics of households and individuals. Per capita real household income is used as individuals' welfare measure.[4] Detailed information provided by the survey allows for calculating various dimensions of social tension and their trends for the given period. The trends are calculated for three periods: 1992–2001, 2001–12, and 1992–2012.

3.8.1 Social Tension Due to Inequality

The debate on inequality in Brazil mainly revolves around the Gini index, which is the most widely used measure of inequality. As such, social tension caused by inequality is measured based on the Gini social welfare function.

Table 3.1 presents the estimates of social welfare—the per capita real income adjusted for the social tension caused by inequality as measured by the Gini index. The estimates do not provide the values of social welfare for 1994, 2000, and 2010 because of the unavailability of PNADs in these three years. For trends, however, appropriate adjustments were made for 1994, 2000, and 2010. The trend growth rates were accordingly estimated by the trend-regression technique.

Between 1992 and 2012, the per capita real household income has increased at an annual rate of 2.13 %, while the social welfare has increased at a higher rate of 3.04 %. This indicates a gain in the growth rate of 0.91 % per annum in the social welfare because the Gini index has declined at an annual rate of 0.69 % during the same period. This result indicates that a 1 % fall in the Gini index has led to a gain of 1.32 %

[4] Per capita real household income is defined as per capita nominal household income adjusted for prices. Adjustments are made using the consumer price indices corresponding to the PNAD survey periods.

Table 3.1 Social tension due to inequality in Brazil, 1992–2012

Year	Social welfare	Per capita household income	Social tension
1992	199.1	474.7	58.05
1993	198.6	499.5	60.23
1995	248.5	619.2	59.86
1996	251.8	629.9	60.02
1997	251.5	628.9	60.02
1998	255.3	635.7	59.84
1999	244.6	599.6	59.21
2001	247.2	608.8	59.39
2002	251.5	609.4	58.73
2003	240.4	573.7	58.10
2004	255.6	592.8	56.89
2005	272.9	629.2	56.63
2006	303.2	688.2	55.95
2007	316.1	705.7	55.20
2008	338.1	739.4	54.27
2009	350.5	759.6	53.86
2011	381.8	807.4	52.72
2012	413.6	872.0	52.57
Growth rate			
1992–2001	2.67	2.77	0.08
2001–2012	5.12	3.65	–1.16
1992–2012	3.04	2.13	–0.69

Source: Authors' calculations

in the growth rate of social welfare. Hence, the reduction in inequality results in a substantial gain in social welfare.

Figure 3.1 illustrates the trends in inequality for the period 2001–12. A sustained decline in inequality over the decade can be observed. During the period, social welfare has increased at an annual rate of 5.12 %, while per capita real household income has increased 3.65 % annually. This suggests a gain of the growth rate in social welfare by 1.47 % per annum during 2001–12 because the Gini index has fallen at an annual rate of 1.16 % over the years. The sharp decline in Brazil's inequality has resulted in an increase in the growth rate of social welfare. After decades of stubbornly high inequality in the country, tides finally turned with inequality beginning to fall from 2001.

The increase (decrease) in social tension leads to loss (gain) in the growth rate of social welfare. The gain in the growth rate fluctuates during the

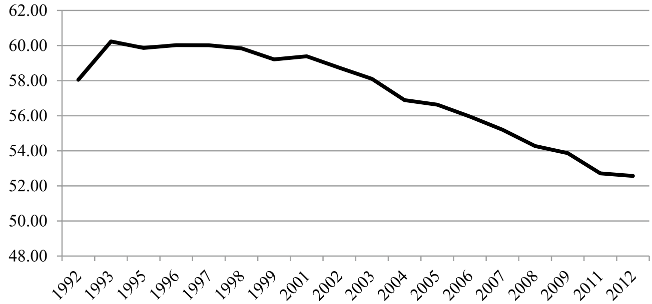

Fig. 3.1 Social tension due to inequality in Brazil from 1992 to 2012 (*Source*: Authors' calculations)

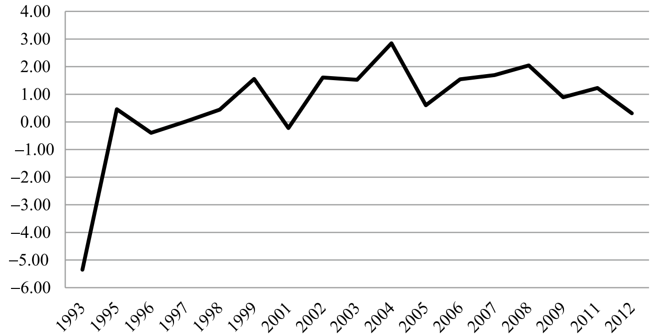

Fig. 3.2 Gains/losses in the growth rate of social welfare in Brazil from 1993 to 2012 (*Source*: Authors' calculations)

1992–2001 period, but this is observed every year during 2001–12, albeit it has slowed down since 2008 (Fig. 3.2). The trend growth rate for the latter period is 1.47 % per annum. Overall, the growth process for Brazil in the 2000s has benefited lower-income groups proportionally more than upper-income groups, thereby reducing social tension caused by inequality.

3.8.2 Social Tension Due to Poverty

Poverty estimates for the headcount ratio, poverty gap ratio, and severity of poverty are presented in Table 3.2. The estimates are based on two

Table 3.2 Poverty in Brazil, 1992–2012

Year	$1.25-a-day poverty line			$2.50-a-day poverty line		
	% of poor	Poverty gap ratio	Severity of poverty	% of poor	Poverty gap ratio	Severity of poverty
1992	12.3	5.6	3.6	29	13.2	8.2
1993	12.2	5.4	3.5	29.1	13.2	8.1
1995	8.6	3.8	2.5	22.7	9.8	5.9
1996	9.4	4.3	3.0	23.3	10.4	6.4
1997	9.2	4.1	2.8	23.2	10.2	6.2
1998	8.5	3.6	2.4	22.2	9.6	5.7
1999	8.4	3.7	2.4	22.9	9.8	5.8
2001	8.7	4.1	2.9	23.0	10.0	6.1
2002	7.6	3.3	2.2	22.3	9.0	5.3
2003	8.4	3.8	2.6	23.3	9.7	5.8
2004	6.8	3.0	2.1	20.4	8.2	4.8
2005	5.7	2.6	1.8	17.5	7.2	4.2
2006	5.2	2.2	1.5	15.4	5.9	3.5
2007	5.1	2.6	1.9	14.4	5.9	3.7
2008	4.2	2.1	1.5	12.4	5.0	3.1
2009	4.2	2.1	1.5	11.6	4.8	3.0
2011	3.9	2.2	1.7	9.1	4.3	2.9
2012	3.3	1.9	1.5	7.9	3.6	2.5
Growth rate						
1992–2001	−4.3	−4.1	−3.4	−2.9	−3.5	−3.8
2001–2012	−8.9	−6.6	−5.4	−10.3	−9.5	−8.3
1992–2012	−6.2	−5.1	−4.4	−5.7	−6.0	−5.7

Source: Authors' calculations

poverty lines: (i) extreme poverty as measured by the $1.25-a-day poverty line in 2005 purchasing power parity (PPP) and (ii) poverty as measured by the $2.50-a-day poverty line in 2005 PPP. All measures show that poverty in Brazil has decreased sharply over the period of 1992–2012, with the rate of poverty reduction accelerating especially during 2001–12. Figure 3.3 presents the percentage of the extreme poor and poor. Brazil achieved notable poverty reduction in 2003–04 when it introduced its well-known conditional cash transfer program, called *Bolsa Família*.

In 2001–12, the percentage of extreme poor has declined at 8.9 % annually, while the percentage of poor has declined at a higher rate of 10.3 % per annum. Thus, poverty reduction among the extreme poor has been slower than that among the poor. Since deprivation tends to

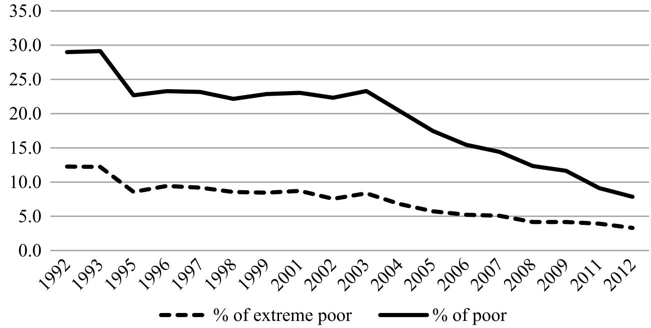

Fig. 3.3 Percentage of extreme poor and poor in Brazil from 1992 to 2012 (*Source*: Authors' calculations)

be greater for the extreme poor than for the poor, government policies should be designed to its efforts to address extreme poverty.

The poverty gap and severity of poverty generally decline at a faster rate than the percentage of poor. Nevertheless, this is not observed in the case of Brazil. What would be the implication of such observation? In 2001–12, the poverty gap for the extreme poor has fallen at an annual rate of 6.6 %. This suggests that the income gap of the extreme poor from the poverty line has widened at 2.3 % annually during the period. Given this, the extreme poor, who were unable to cross the poverty line, have suffered the most from the fall in income. Poverty alleviation programs in Brazil should target the extreme poor to help them lift them out of poverty.

Social tension depends on the poverty measure that is used. Table 3.3 presents the estimates of social tension for the poverty gap ratio and the severity of poverty. Social tension caused by extreme poverty decreased sharply between 1992 and 1995, but its reduction slowed considerably during 1995–2003 and then accelerated after 2003 (Fig. 3.4).

The magnitude of social tension due to poverty is much smaller than that of social tension caused by inequality. Nevertheless, the reduction in social tension has been greater for poverty than for inequality. For 2001–12, the social tension measured by the severity of poverty has reduced by 10.79 % annually; the corresponding rate for inequality is about 1.16 %.

The results reveal that the social tension due to poverty is much higher than that due to extreme poverty. Moreover, the former has declined at

Table 3.3 Social tension due to poverty in Brazil, 1992–2012

	$1.25-a-day poverty line		$2.50-a-day poverty line	
Year	Poverty gap ratio	Severity of poverty	Poverty gap ratio	Severity of poverty
1992	0.83	0.98	1.95	2.27
1993	0.76	0.91	1.84	2.15
1995	0.43	0.53	1.11	1.31
1996	0.48	0.59	1.15	1.36
1997	0.46	0.56	1.13	1.34
1998	0.40	0.50	1.05	1.24
1999	0.43	0.53	1.14	1.35
2001	0.47	0.58	1.15	1.37
2002	0.38	0.47	1.03	1.25
2003	0.46	0.57	1.18	1.42
2004	0.36	0.44	0.97	1.17
2005	0.29	0.35	0.80	0.95
2006	0.23	0.28	0.60	0.74
2007	0.26	0.31	0.59	0.72
2008	0.20	0.24	0.47	0.58
2009	0.20	0.23	0.44	0.55
2011	0.19	0.22	0.37	0.44
2012	0.15	0.18	0.29	0.35
Growth rate				
1992–2001	−6.92	−6.61	−6.30	−6.11
2001–2012	−10.21	−10.79	−13.16	−12.97
1992–2012	−7.26	−7.44	−8.10	−7.82

Source: Authors' calculations

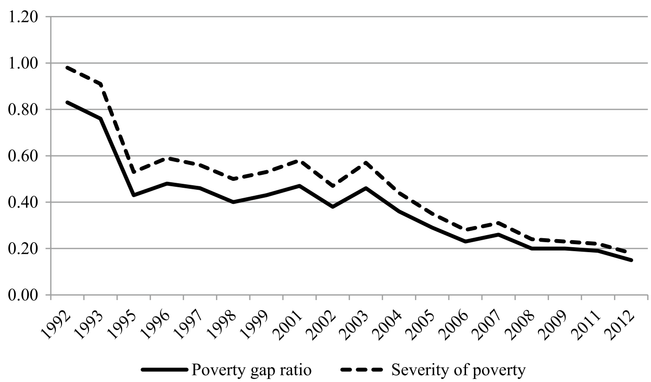

Fig. 3.4 Social tension due to extreme poverty in Brazil from 1992 to 2012 (*Source*: Authors' calculations)

a faster rate than the latter (Fig. 3.5). The social tension captured by the poor living below the poverty threshold could be expected to be greater than the poorest of the poor living far below the poverty line because the latter group represents a much smaller section of the population compared to the former.

3.8.3 Social Tension Due to Alienation and Polarization

Social tension caused by alienation and polarization may have a close relationship with a shrinking middle class in a society. The middle class can shrink as the society becomes more polarized. The size of the middle class can also be adversely affected by the phenomenon of alienation. Alienation is primarily concerned with the spread of income distribution from the median; the greater the spread, the smaller is the size of the middle class. In addition, polarization indicates the degree of homogeneity within the two groups.

For the empirical analysis, we have looked at the case of Brazil. Utilizing the country's household surveys, the measures outlined in Sect. 3.5 have been applied and the results are accordingly presented in Table 3.4. The estimates show that the social tension caused by polarization and alien-

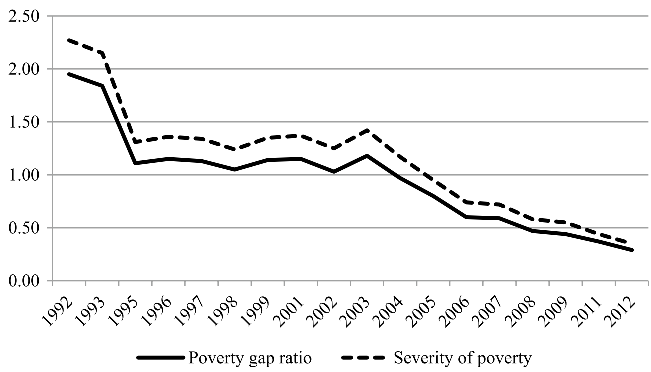

Fig. 3.5 Social tension due to poverty in Brazil from 1992 to 2012 (*Source*: Authors' calculations)

Table 3.4 Social tension due to alienation and polarization in Brazil, 1992–2012

Year	Alienation	Polarization	Size of the middle class	Share of the middle class
1992	73.62	31.16	39.54	19.62
1993	75.16	29.85	40.25	18.60
1995	76.92	34.11	41.24	18.48
1996	75.88	31.71	37.78	17.21
1997	77.04	34.04	39.03	17.28
1998	75.20	30.73	39.54	18.01
1999	74.44	30.46	39.79	18.54
2001	75.07	31.36	39.88	18.49
2002	73.85	30.24	40.68	19.46
2003	73.56	30.92	41.13	20.08
2004	72.02	30.26	41.63	20.79
2005	71.84	30.44	42.65	21.40
2006	71.19	30.47	43.68	22.57
2007	70.10	29.80	43.14	23.08
2008	69.24	29.93	44.54	24.35
2009	68.51	29.30	44.76	24.86
2011	67.32	29.20	45.90	26.69
2012	66.78	28.43	46.67	27.16
Growth rate				
1992–2001	0.06	0.03	−0.08	−0.52
2001–2012	−1.07	−0.71	1.40	3.53
1992–2012	−0.65	−0.51	0.87	2.12

Source: Authors' calculations

ation has increased at an annual rate of 0.03 % and 0.06 %, respectively, during the 1992–2001 period. However, their corresponding rates have declined at 0.71 % and 1.07 % in the subsequent period, 2001–12.

For this sub-section, the population in Brazil is divided into three mutually exclusive groups:

(i) The poor whose per capita income is less 50 % of the median;
(ii) The middle class whose per capita income is above the 50 % of the median and below the 150 % of the median; and
(iii) The rich whose per capita income is above the 150 % of the median.

In classifying social groups, the median is used as the reference point. The definition of middle class is rather arbitrary. There is no consensus on what range around the median should be used to define the middle class. The selection of the range is crucial in deciding the size and share of the middle class. As such, there are numerous alternatives to the definition of the middle class available in this field.

In identifying the middle class, this sub-section follows the definition given in (ii) above. Given this, defining the middle class would involve two components: (i) the size of the middle class and (ii) the income share of the middle class. Figures 3.6 and 3.7 illustrate an inverse relationship between the size and income share of the middle class, and alienation and polarization.

When alienation and polarization increased during 1992–2001, the size and the income share of the middle class has declined. As expected, the opposite has happened in the subsequent period, 2001–12; while alien-

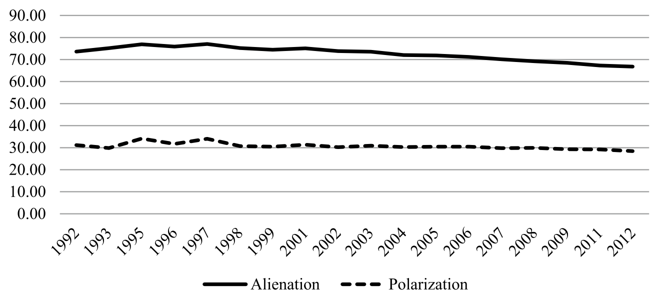

Fig. 3.6 Social tension due to alienation and polarization in Brazil from 1992 to 2012 (*Source*: Authors' calculations)

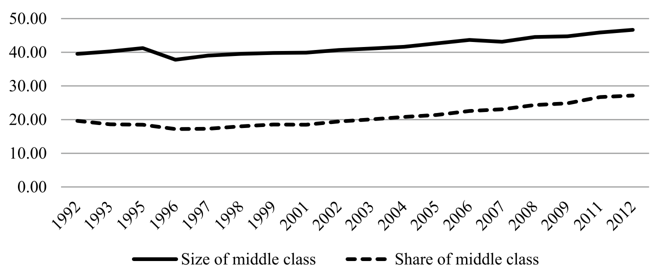

Fig. 3.7 Size and share of the middle class in Brazil from 1992 to 2012 (*Source*: Author's calculations)

ation and polarization fell, the size and the income share of the middle class have risen at 1.40 % and 3.53 % per annum, respectively. The share of the middle class has increased at a much faster rate than the size of the middle class. This suggests that in relative terms, per capita income of the middle class grows at a faster rate than the average income of the society.

As pointed out previously, alienation and polarization are closely related to the middle class. To see how closely they are related, this subsection has fitted the following regressions using PNADs for the period 1992–2012:

ln(size of the middle class) = 9.1–1.25 *ln*(alienation)	$R^2 = 0.86$
(29.6) (–10.1)	
ln(share of the middle class) = 16.9–3.2 *ln*(alienation)	$R^2 = 0.97$
(28.5) (–23.3)	
ln(size of the middle class) = 6.62–0.85 *ln*(polarization)	$R^2 = 0.43$
(8.0) (–3.5)	
ln(share of the middle class) = 11.0–2.3 *ln*(polarization)	$R^2 = 0.55$
(6.1) (–4.4)	

The findings show a strong relationship between the size and income share of the middle class, and alienation. Given this, it can be concluded that a decrease (increase) in alienation leads to an increase (decrease) in the size and income share of the middle class. Although this relationship is established in terms of the specific range of 50–150 % of the median, simulations using alternative ranges around the median have also been performed. The conclusions emerging from these simulation exercises were found to be robust for alternative ranges. The findings also suggest that there is no need to arbitrarily specify the range of the middle class to determine whether the middle class is increasing (declining). While this analysis does not inform the size and the income share of the middle class, it indicates whether the social tension due to shrinking the middle class rises or falls for all alternative ranges around the median.

3.8.4 Growth Volatility and Social Tension

Social tension due to volatile growth is measured by the loss of social welfare in a temporal social welfare function. There are year-to-year variations in growth rates between per capita income from PNADs and per capita GDP from the national accounts. As shown in Fig. 3.8, volatility in growth rates is greater for per capita income from PNADs than for per capita GDP. The results are also consistent with the findings in Table 3.5, where the growth rates for per capita GDP, per capita household income, and per capita household income of the bottom 40 % are presented. In addition, the table shows the volatility index for three periods: 1992–2001, 2001–12, and 1992–2012. The following summarizes the main conclusions.

(i) Per capita GDP has a lower volatility than the per capita household income.
(ii) The bottom 40 % of the population experiences higher volatility in per capita household income than the entire population. This important observation reveals that the poor have not only lower incomes, but their incomes are also more volatile.
(iii) Growth rates are more volatile in 1992–2001 compared to the subsequent period, 2001–12.
(iv) The social welfare in the 2000s has not only improved, but has also become less volatile.

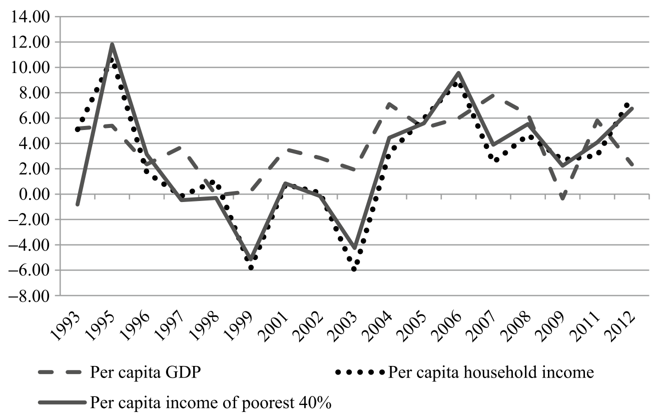

Fig. 3.8 Growth rates of per capita GDP, per capita household income, and per capita household income of bottom 40 % in Brazil from 1993 to 2012 (*Source*: Authors' calculations)

Table 3.5 Growth rates of per capita GDP, per capita household income, and per capita household income of bottom 40 % in Brazil, 1992–2012

Year	Per capita GDP	Per capita household income	Per capita income of poorest 40 %
1992–93	5.17	5.10	−0.82
1994–95	5.39	10.74	11.82
1995–96	2.35	1.71	3.14
1996–97	3.71	−0.16	−0.47
1997–98	−0.09	1.06	−0.30
1998–99	0.22	−5.84	−5.15
1999–2001	3.53	0.76	0.85
2001–02	2.86	0.11	−0.15
2002–03	1.92	−6.04	−4.25
2003–04	7.10	3.27	4.45
2004–05	5.21	5.97	5.59
2005–06	5.99	8.97	9.56
2006–07	7.79	2.50	3.90
2007–08	6.30	4.67	5.53
2008–09	−0.35	2.70	2.24
2009–11	5.81	3.05	4.08
2011–12	2.34	7.69	6.75
Volatility			
1992–2001	1.82	2.96	3.32
2001–2012	1.02	0.56	0.73
1992–2012	1.21	1.12	1.28

Source: Authors' calculations

Note: *GDP* gross domestic product

3.8.5 Social Immobility

Social mobility is measured by using three social groups that are classified (i) by income (the poor, middle class, and the rich); (ii) by age (children, adults, and the elderly); and (iii) by race (white Caucasians, black Africans/mixed, and others).

Table 3.6 and Fig. 3.9 present the estimates of RMD for the three social groups identified above. The RMDs for the social groups by income are mostly greater than 1, which indicates a large gap in the social welfare among the poor, the middle class, and the rich. In comparison, the corresponding estimates for the other groups by age and race suggest relatively smaller gaps in their social welfare. Moreover, the

Table 3.6 Relative mean deviations by social groups in Brazil, 1992–2012

Year	Social groups by income	Social groups by age	Social groups by race
1992	1.22	0.29	0.53
1993	1.32	0.30	0.58
1995	1.31	0.31	0.58
1996	1.33	0.30	0.58
1997	1.32	0.30	0.59
1998	1.31	0.31	0.59
1999	1.28	0.30	0.57
2001	1.28	0.31	0.58
2002	1.25	0.30	0.54
2003	1.23	0.30	0.55
2004	1.17	0.28	0.50
2005	1.15	0.28	0.50
2006	1.12	0.27	0.48
2007	1.09	0.27	0.47
2008	1.05	0.25	0.43
2009	1.03	0.25	0.42
2011	0.98	0.23	0.38
2012	0.97	0.23	0.40
Growth rate			
1992–2001	0.19	0.68	0.52
2001–2012	–2.63	–3.04	–3.61
1992–2012	–1.56	–1.32	–2.05

Source: Authors' calculations

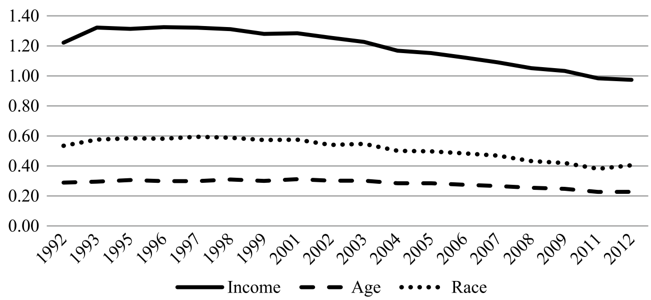

Fig. 3.9 Relative mean deviations for social groups by income, age, and race in Brazil from 1992 to 2012 (*Source*: Authors' calculations)

results on the growth rates of RMDs present a positive indication of improving the social mobility in Brazil that has occurred particularly in the 2000s.

3.9 Concluding Remarks

This chapter has modeled and measured various dimensions of social tensions using a social welfare function framework. This approach allows for making explicit assumptions and normative values associated with each dimension of social tension used in the chapter.

The empirical analysis in this chapter gauged how different social tensions in Brazil evolved over the period 1992–2012. The approach proved to be useful in understanding possible relationships between these social tensions. In particular, the sharp decline in inequality observed in Brazil during 2001–12 has provided different implications for trends in social welfare and tension. The main conclusions that emerged from the analysis are the following:

- *Social Welfare*: In1992–2012, social welfare in Brazil increased at an annual rate of 5.12 %, while the per capita real household income increased 3.65 % annually. This implies a gain in the growth rate of 1.47 % annually in social welfare.
- *Poverty*: The magnitude of the social tension due to poverty was much smaller than that observed for the social tension due to inequality. However, the rate of decline was much sharper for the social tension caused by poverty than by inequality. For the period 2001–12, the trend growth rate shows that the decline in the social tension caused by the severity of poverty was 10.79 %, while the decline in the social tension due to inequality was 1.16 %.
- *Middle Class:* One major contribution of this chapter is to derive the social tension caused by alienation and polarization using particular forms of social welfare function, as well as establish their relationship with the size and share of the middle class. The findings revealed that alienation, which does not require specific income brackets, has been particularly useful in predicting changes in the size and the share of the middle class. In Brazil, the social tension caused by alienation and polarization has fallen substantially in the 2000s. This result is also consistent with expanding the middle class in the country.
- *Aggregate Risk*: The bottom 40 % of Brazil's population has experienced a greater volatility in their per capita household income as compared to the population as a whole. Not only do the poor have lower

incomes, but their incomes are also more volatile. Social welfare in Brazil has generally improved in the 2000s and has become less volatile.

- *Social Mobility*: An immobile society is one in which some groups are never able to improve their economic status relative to the whole society. Social mobility, measured in this repeated cross-sectional environment, is interpreted as how the relative welfare of disadvantaged groups such as children and afro-descendent progresses with respect to the overall changes in the social welfare. Social mobility in Brazil has begun to improve since 2001; relatively worse-off social groups have improved their welfare more than the society as a whole.

4

Relative Deprivation and Social Groups

4.1 Introduction

The concept of deprivation originated from Runciman's theory of relative deprivation which was proposed in 1966. This theory defines relative deprivation as the degree of deprivation inherent in not having X as an increasing function of the proportion of persons in society who have X. It implies that people make comparisons of their economic status with others', and they feel some sense of deprivation when they find that they are worse off than others in income (or consumption) or other possessions such as assets. Other than income (or consumption), deprivation can also be measured in terms of different dimensions of living standards, such as lack of access to education, health, and other basic services.

Sen's (1973b, 1976) approach to measuring deprivation is based on all possible pair-wise comparisons between individuals. The idea is that a person with lower income suffers deprivation by finding out that his or her income is lower than others'. Under the assumption that the deprivation suffered by individuals is proportional to the difference between the incomes compared, the average of all such deprivations in all pair-wise

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comparisons becomes μG—where μ is the mean income of the society and G represents the Gini index. Formally derived by Yitzhaki (1979) and Hey and Lambert (1980), μG is the absolute deprivation suffered by the society.

A relative measure of deprivation, proposed by Kakwani (1984), can be derived from all pair-wise comparisons when the deprivation suffered by individuals is the proportional difference in income shares rather than the absolute income difference. The deprivation aggregated over the society is the Gini index or the average deprivation suffered by the society.

Let us look at the case of Brazil. After suffering decades of stubbornly high inequality, the country's Gini index began to decline in 2001 and reached its lowest level in 2012, which indicates a likewise declining average deprivation. Moreover, inequality in Brazil—still high by global standards—suggests deprivation across social groups; that is, some social groups might be suffering greater deprivation than others. This leads us to deepen our analysis by disaggregating deprivation by social groups.

As Sen (1992) pointed out, human beings are diverse in terms of their characteristics. They differ by age, gender, education level, occupation, and ethnicity, among others. Given these differences, a population can be classified into various social groups. These differences in individual characteristics should therefore be accounted for in the analysis of inequality.

In this chapter, we attempt to measure individual characteristics based on information provided in available household surveys. A methodology is developed to estimate the average deprivation by various social groups and to identify particular groups with greater deprivation. Identifying such groups is important and especially useful in addressing inequality for the society as a whole.

4.2 Relative Deprivation Function

Suppose income x of an individual is a continuous random variable with mean μ and probability density function $f(x)$. An individual with income x compares his income with other individuals in the society. He selects other individuals one by one and makes all possible comparisons. Suppose he selects an individual with income y and feels deprived upon discovering that his income x is lower than income y. If it is assumed that the degree of deprivation is given by the function $g(x, y)$, then the expected deprivation suffered by the person with income x in all pair-wise comparisons is given by

$$E(\text{deprivation} \mid x) = \int_0^\infty g(x,y) f(y) dy. \tag{4.1}$$

Consider that the probability of selecting an individual with income y from the population is $f(y)dy$ and $g(x, y) = 0$ if $y < x$. The following restrictions can be imposed on the function $g(x, y)$:

$$\frac{\partial g(x,y)}{\partial y} > 0 \text{ and } \frac{\partial g(x,y)}{\partial x} < 0$$

which are intuitively reasonable because as income y relative to x increases, deprivation should likewise increase. To make this idea empirically operational, we need to specify the function $g(x, y)$. While there could be many alternative functional forms, a functional form adopted from Kakwani (1984) captures the sense of deprivation:

$$\begin{aligned} g(x, y) &= y - x \quad \textit{if } y \geq x \\ &= 0 \quad \textit{if } y < x \end{aligned} \tag{4.2}$$

which implies that in any pair-wise comparisons, the deprivation suffered by an individual with lower income is the difference in income.

The proportion of individuals who have income less than or equal to x is given by

$$F(x) = \int_0^x f(x) dx \tag{4.3}$$

which is called the probability distribution function. From this function, the first moment probability distribution function is derived:

$$F_1(x) = \frac{1}{\mu}\int_0^x Xf(X)\,dX \tag{4.4}$$

where μ is the mean income of the society which is interpreted as the proportion of income enjoyed by individuals with income less than or equal to x. Substituting (4.2) into (4.1), and using (4.3) and (4.4),the expected deprivation suffered by the individual with income x is given as

$$E(deprivation \mid x) = \mu\left[1 - F_1(x)\right] + x\left[1 - F(x)\right]. \tag{4.5}$$

The expected deprivation must be at maximum when the individual has no income because this will place him at the bottom of the income distribution. Substituting $x = 0$ in (4.5) gives the maximum deprivation equal to μ. Thus, dividing (4.5) by μ provides the relative deprivation function

$$d(x) = \left[1 - F_1(x)\right] - \frac{x}{\mu}\left[1 - F(x)\right] \tag{4.6}$$

which is the deprivation suffered by an individual with income x, as derived by Kakwani (1984).

Differentiating (4.6) with respect to x gives

$$d'(x) = -\frac{1}{\mu}\left[1 - F(x)\right] < 0$$

which shows that the relative deprivation suffered by an individual with income x declines as his income increases while keeping incomes of other individuals in the society constant.

Given the function $d(x)$, the average deprivation suffered by the society can be obtained by integrating $d(x)$ over the whole income range.

According to Kakwani (1984), the average deprivation suffered by the society is equal to the Gini index:

$$G = \int_0^\infty d(x) f(x) dx \tag{4.7}$$

The next section presents a methodology for computing the deprivation suffered by any social group.

4.3 Relative Deprivation Suffered by Social Groups

Suppose a population is divided into k mutually exclusive social groups and a_i is the population share of the ith group, then $\sum_{i=1}^{k} a_i = 1$ must hold. Further, if $f_i(x)$ is the density function of the ith group, the average deprivation suffered by the ith group is given as follows:

$$D_i = \int_0^\infty d(x) f_i(x) dx. \tag{4.8}$$

The average deprivation suffered by any group can be compared with that of the whole society. This will indicate which group suffers more (or less) compared to the society in general.

It can be easily shown that

$$f(x) = \sum_{i=1}^{k} a_i f_i(x) \tag{4.9}$$

where $f(x)$ is the density function of the entire population. Substituting (4.9) into (4.7) and using (4.8) gives

$$G = \sum_{i=1}^{k} a_i D_i \tag{4.10}$$

which demonstrates that the social deprivation suffered by the whole society—as measured by the Gini index—is the weighted average of the deprivations suffered by each social group, using the respective population share of the social group as weights. Multiplying $a_i D_i$ by 100 will yield the percentage contribution of the ith social group to the total social deprivation.

From (4.10), the change in Gini can be explained by two factors: (1) change in population share and (2) change in average deprivation. Let us define G_t as the Gini index in period t, a_{it} as the population share of the ith group in period t, and D_{it} as the average deprivation suffered by the ith group in period t. Following Kakwani (1994), the proposed dynamic decomposition is:

$$\Delta G_t = \sum_{i=1}^{k} \left(\frac{D_{it} + D_{i(t-1)}}{2} \right) \Delta a_{it} + \sum_{i=1}^{k} \left(\frac{a_{it} + a_{i(t-1)}}{2} \right) \Delta D_{it} \tag{4.11}$$

which shows the contribution of the two factors in the change in the Gini index. The first factor in the right-hand side of (4.11) is the change in population share, and the second factor of the equation is the change in average deprivation. This equation explains the extent to which different social groups affect changes in the Gini index.

4.4 Empirical Analysis: Case Study for Brazil, 2001–12

This section presents the average relative deprivation in Brazil. The empirical analysis uses data from national household surveys in the country called *Pesquisa Nacional por Amostra de Domicilios* (PNAD), covering the period 1992–2012. PNAD provides detailed information at both household and individual levels. The rich information contained in the surveys allows us to identify various social groups which this study is interested in.

As presented in the previous section, the Gini index is the most widely used measure of inequality. It is also a measure of per capita relative deprivation suffered by the population. Figure 4.1 depicts the trend in Gini for Brazil from 1992 to 2012. The trend growth rate in Gini has been computed for three periods: 1992–2001, 2001–12, and 1992–2012.

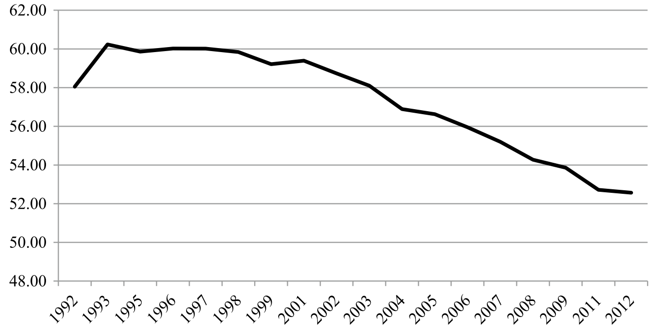

Fig. 4.1 Gini index in Brazil for the period 1992–2012 (*Source*: Authors' estimates)

The estimates in Fig. 4.1 show that the Gini index in Brazil has declined at an annual rate of 0.39 percentage points during 1992–2012, and that the decline has not been monotonic. For 1992–2001, the Gini index rose at an annual rate of 0.04 percentage points. However, Gini has fallen monotonically and rather sharply at 0.65 percentage points annually during 2001–12. With inequality falling overall in Brazil, we investigate whether different social groups across the population have benefited from the decline in inequality in the 2000s and, also, the extent to which social groups have contributed to total inequality.

4.5 Age and Inequality

In modern and technologically-advanced societies, both the young and the old tend to be relatively disadvantaged, with the young as the most disadvantaged. This is true in the case of Brazil where, based on our estimates, deprivation among children under 15 is greater than deprivation among people aged 60 and older. Sometimes, the elderly have had the opportunity to build their wealth through their lives, while younger people have the disadvantage of recently entering into or having not yet entered into the economic sphere. Moreover, the social security benefits received by the elderly in the country contributed significantly to reduction in this disparity.

As with other countries, numerous social policies that aim to improve the welfare of children and the elderly have been implemented in Brazil. For instance, Brazil has implemented two major social programs: *Beneficio de Prestacao Continuada* (BPC) and *Bolsa Familia Programa* (BFP). The BPC targets individuals of any age with severe disabilities, as well as the elderly over 65 years. Meanwhile, the targeted beneficiaries of BFP are poor families with children. Since children and the elderly are not part of the labor force, they are deemed as the dependent segment of the population. This section therefore looks into deprivation by three major age groups: (i) children less than 15 years; (ii) adults 15 years and older but less than 60 years; and (iii) elderly 60 years and over.

Table 4.1 provides the share of population for these three age groups during 1992–2012. In 1992, Brazilian population was composed of 33.9%

Table 4.1 Population share and growth rates by age group in Brazil, 1992–2012

Year	Children (below 15)	Adults (15–59)	Elderly (60 and older)
Population share (%)			
1992	33.9	58.2	7.9
1993	33.7	58.4	7.9
1995	32.4	59.3	8.4
1996	31.4	60.0	8.6
1997	31.0	60.3	8.6
1998	30.3	61.0	8.8
1999	29.7	61.3	9.0
2001	28.8	62.2	9.0
2002	28.1	62.6	9.3
2003	27.4	63.1	9.6
2004	27.1	63.2	9.7
2005	26.5	63.6	9.9
2006	26.0	63.8	10.2
2007	25.5	64.0	10.5
2008	24.8	64.2	11.0
2009	24.2	64.5	11.3
2011	23.3	64.6	12.1
2012	22.9	64.5	12.7
Growth rates			
1992–2001	–0.60	0.47	0.14
2001–2012	–0.54	0.21	0.32
1992–2012	–0.56	0.35	0.22

Source: Authors' estimates

children, 58.2 % adults, and 7.9 % elderly. Over the two-decade period, this age composition has substantially changed. The share of children in the population fell to 22.9 % in 2012, while the population shares for adults and elderly rose to 64.5 % and 12.7 %, respectively. Looking at the trend growth rates for 1992–2012, population share of children has dropped by 0.56 percentage points annually, while the corresponding shares of adults and elderly have increased annually by 0.35 and 0.22 percentage points, respectively. As with most developed countries, the population in Brazil is aging rather rapidly. Albeit changes in the demographic structure in many parts of the globe including Brazil have been documented, their impact on inequality is hardly explored in the literature. This issue is tackled in this section.

Based on estimates, the relative deprivation among children is highest in Brazil (see Table 4.2 and Fig. 4.2). The results also reveal that the elderly

Table 4.2 Average deprivation by children, adults, and elderly in Brazil, 1992–2012

Year	Children (below 15)	Adults (15–59)	Elderly (60 & older)	Total population
1992	64.9	55.2	49.7	58.0
1993	66.8	57.6	52.0	60.2
1995	66.8	57.1	53.1	59.9
1996	67.0	57.2	54.0	60.0
1997	67.1	57.3	53.7	60.0
1998	67.4	57.2	52.5	59.8
1999	66.8	56.6	51.7	59.2
2001	67.7	56.9	50.2	59.4
2002	67.1	56.3	49.8	58.7
2003	67.0	55.7	48.2	58.1
2004	65.8	54.6	47.0	56.9
2005	65.8	54.4	46.2	56.6
2006	65.3	53.8	45.5	56.0
2007	64.8	53.0	45.1	55.2
2008	64.1	52.2	44.1	54.3
2009	63.9	51.9	43.4	53.9
2011	62.7	50.9	43.1	52.7
2012	62.6	50.9	43.0	52.6
Growth rates				
1992–2001	0.22	0.07	0.01	0.04
2001–2012	–0.48	–0.57	–0.69	–0.65
1992–2012	–0.19	–0.33	–0.57	–0.39

Source: Authors' estimates

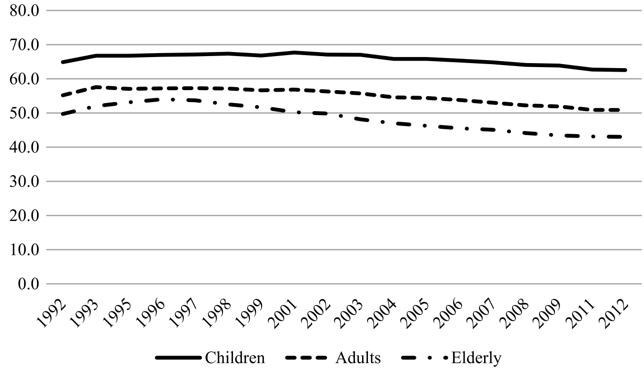

Fig. 4.2 Average deprivation by children, adults, and elderly in Brazil for the period 1992–2012 (*Source*: Authors' estimates)

fare better compared to other age groups in terms of relative deprivation. In 2012, children suffered 20 % more deprivation than the national average, while the elderly experienced 18 % less deprivation than the national average. In terms of overall trends, the decline in deprivation is most rapid for the elderly group over the period, and this has consequently widened the gap in deprivation between elderly and children over time.

The decline in deprivation among the elderly group is largely attributed to two major pension programs—the BPC and the social security benefits. The BPC is a non-contributory program and thus means-tested. It is a temporary social benefit for the disabled and the elderly above 65 with per capita family income of less than 25 % of minimum wage. This large non-contributory pension system coexists with a large contributory system in Brazil—the general regime of social security for private-sector workers (RGPS) and the pension regime for government workers (RJU). The social security benefits largely refer to pensions from RGPS and RJU, as well as from the private insurance scheme which is complementary for some elderly.

Currently, around 64 % of the total population—particularly workers in the household economy scheme in rural areas—receive social security benefits equivalent to the minimum wage. This reflects the pay-as-you-go nature of social security policy in Brazil. It also characterizes the importance of the real appreciation of the minimum wage in the last decade, since its value acts as a floor for the benefits of almost two-thirds of the workers currently covered by social security. In addition, the increase in coverage, along with the appreciation in the real value of benefits, has led to the increase in the scheme's total expenditure, which went from 5.3 % of GDP in 2000 to 6.1 % in 2010. Both programs—RGPS and RJU—are facing financing problems, with the public servant regime worse than the private-sector workers regime.

The BFP, as widely known, is the conditional cash transfer program in Brazil that aims to reduce poverty among beneficiary households. However, the results suggest that the program alone may not be adequate to reduce the relative deprivation among children. As shown in Table 4.2 and Fig. 4.2, children are the most deprived compared to their adults and elderly counterparts.

As explained in Sect. 4.3, there are two main factors explaining changes in Gini—changes in the population share and average deprivation. Applying (4.11), results show that the social deprivation as measured by the Gini index has declined by 0.65 percentage points annually during 2001–12 (Table 4.3). The decline is attributed to the reduction by 0.47 percentage points among children and 0.25 percentage points among adults. The deprivation among elderly contributed to an increase in the Gini index by 0.07 percentage points annually during the same period. Moreover, the declining population share of the children group largely explains the reduction in inequality by 0.35 percentage points. This suggests that demographic

Table 4.3 Factors explaining changes in the Gini index in Brazil, 1992–2012

	Population share	Relative deprivation	Total change
1992–2001			
Children	−0.41	0.06	−0.35
Adults	0.27	0.02	0.29
Elderly	0.07	−0.01	0.07
Total change	−0.07	0.07	0.04
2001–2012			
Children	−0.35	−0.12	−0.47
Adults	0.12	−0.37	−0.25
Elderly	0.14	−0.07	0.07
Total change	−0.09	−0.56	−0.65
1992–2012			
Children	−0.37	−0.05	−0.42
Adults	0.19	−0.22	−0.02
Elderly	0.10	−0.06	0.05
Total change	−0.08	−0.32	−0.40

Source: Authors' estimates

changes play an important role in declining inequality in Brazil. As noted previously, the average deprivation among children has slowly declined over time, which reduced the Gini index by only 0.12 percentage points.

The declining share of children in the population could be explained by falling fertility rate in the country. The total fertility rate in Brazil was 5.8 children per woman in the late 1960s, and it declined rapidly to 1.9 in 2010. However, it is interesting to note that such demographic change alone has led to the reduction in Gini by 0.35percentage points annually. This suggests that policies aimed at reducing deprivation among children are effective in addressing overall inequality in the country. In contrast, an aging population exacerbates inequality, increasing the Gini index by 0.14 % annually during 2001–12.

4.6 Gender and Inequality

Poverty is often seen as a gender issue since women are disproportionately affected. In many countries, women and girls face problems such as lack of access to education, which limits their opportunities to succeed and further constrains their ability to contribute economically to their society. Although women's participation in work has been increasing globally, women still earn less compared to men. Given the patterns in gender, it is reasonable to hypothesize that female-headed households are more likely to have lower income and higher incidence of poverty compared to their male-headed counterparts. This section investigates whether female-headed households are more deprived relative to male-headed ones, and quantifies how much.

Table 4.4 shows that in 1992, 15.52 % of the Brazilian population belonged to female-headed households and this figure increased to about 35 % in 2012. Notice that while the proportion of people living in female-headed households has increased by one percentage point annually during 1992–2012, the corresponding figure for those in male-headed households has fallen at the same rate. During 2001–12, it is surprising that the share of the population living in female-headed households increased at 1.38 percentage points annually. Given such a social change taking place in the country, its implications for inequality may not be negligible.

Table 4.5 presents the average deprivation suffered by male- and female-headed households. The difference in the deprivation by the two

Table 4.4 Population share by male- and female-headed households in Brazil, 1992–2012

Year	Male-headed	Female-headed
1992	84.48	15.52
1993	84.39	15.61
1995	83.84	16.16
1996	82.34	17.66
1997	82.02	17.98
1998	80.92	19.08
1999	80.70	19.30
2001	79.45	20.55
2002	78.20	21.80
2003	77.86	22.14
2004	77.11	22.89
2005	75.64	24.36
2006	74.41	25.59
2007	71.94	28.06
2008	69.39	30.61
2009	69.20	30.80
2011	66.16	33.84
2012	65.21	34.79
Growth rates		
1992–2001	−0.60	0.60
2001–2012	−1.38	1.38
1992–2012	−0.99	0.99

Source: Authors' estimates

groups is rather small. While Fig. 4.3 depicts that the gap is widening over time, the declining trend in deprivation is consistent: While the deprivation in male-headed households has declined at 0.42 percentage points annually during 1992–2012, the corresponding figure for female-headed households is 0.33 percentage points annually.

How did gender affect the reduction in Gini in Brazil? The results in Table 4.6 show that in the period 2001–12, the overall Gini index has declined by 0.65 percentage points annually. Male-headed households contributed to such a decline in Gini by 1.29 percentage points. Meanwhile, female-headed households led to an increase in the Gini index by 0.64 percentage points, which is largely explained by the increasing share of population living in households headed by a female. In summary, there are no significant differences in the deprivation suffered by male- and female-headed households. Female-headed

Table 4.5 Average deprivation by male- and female-headed households in Brazil, 1992–2012

Year	Male-headed	Female-headed
1992	58.04	58.05
1993	60.19	60.44
1995	59.78	60.28
1996	59.93	60.46
1997	60.00	60.08
1998	59.90	59.60
1999	59.19	59.31
2001	59.36	59.52
2002	58.70	58.84
2003	58.02	58.36
2004	56.73	57.42
2005	56.70	56.40
2006	55.78	56.44
2007	54.92	55.91
2008	53.93	55.06
2009	53.60	54.45
2011	51.93	54.25
2012	51.76	54.08
Growth rates		
1992–2001	0.05	0.03
2001–2012	−0.72	−0.52
1992–2012	−0.42	−0.33

Source: Authors' estimates

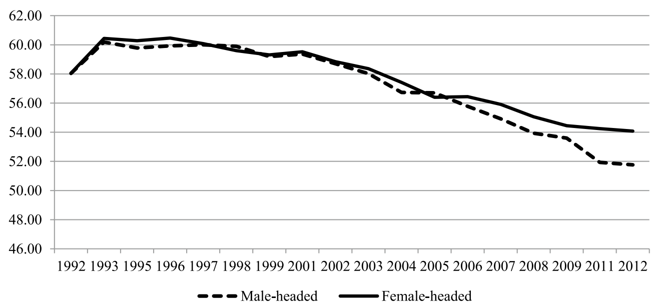

Fig. 4.3 Average deprivation suffered by male- and female-headed households in Brazil for the period 1992–2012 (*Source*: Authors' estimates)

households contribute to the increase in inequality largely because their population share has sharply increased. Such an increase also signifies that women are enjoying greater economic and social freedom. As confirmed by Table 4.7 and Fig. 4.4, those who belong in female-headed

Table 4.6 Factors explaining changes in the Gini index for Brazil, 1992–2012

	Population share	Relative deprivation	Change in Gini
1992–2001			
Male-headed	–0.37	0.01	–0.36
Female-headed	0.37	–0.01	0.36
Total population	0.00	0.01	0.01
2001–2012			
Male-headed	–0.76	–0.53	–1.29
Female-headed	0.78	–0.14	0.64
Total population	0.01	–0.66	–0.65
1992–2012			
Male-headed	–0.57	–0.32	–0.89
Female-headed	0.57	–0.08	0.49
Total population	0.01	–0.40	–0.40

Source: Authors' estimates

Table 4.7 Completed years of schooling by male- and female-headed households in Brazil, 1992–2012

Year	Male-headed	Female-headed	Total population
1992	4.91	4.79	4.89
1993	4.99	4.96	4.98
1995	5.16	5.09	5.15
1996	4.26	4.49	4.30
1997	4.32	4.60	4.37
1998	4.49	4.77	4.54
1999	4.62	4.92	4.68
2001	4.88	5.11	4.93
2002	5.06	5.29	5.11
2003	5.23	5.45	5.28
2004	5.36	5.57	5.41
2005	5.50	5.74	5.55
2006	5.69	5.84	5.73
2007	5.79	5.95	5.84
2008	5.96	6.10	6.00
2009	6.08	6.22	6.12
2011	6.29	6.28	6.28
2012	6.49	6.42	6.47
Growth rates			
1992–2001	–0.04	0.01	–0.03
2001–2012	0.14	0.12	0.14
1992–2012	0.09	0.09	0.09

Source: Authors' estimates

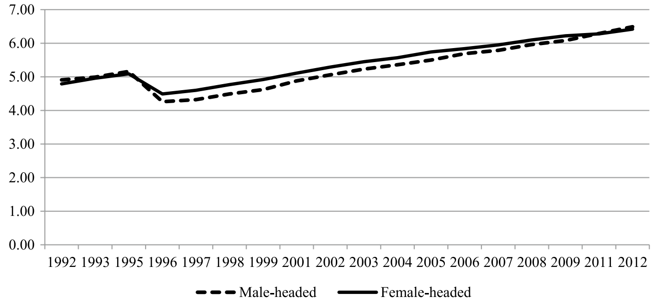

Fig. 4.4 Completed years of schooling by male- and female-headed households in Brazil for the period 1992–2012 (*Source*: Authors' estimates)

households are not deprived of acquiring education. In fact, there is no significant difference in the average years of education completed between the two groups.

4.7 Geographical Location and Inequality

Geographical locations can have a sizeable effect on inequality. Residents of large metropolitan areas may have a wider range of industries, and therefore may have more opportunities in jobs, than those who reside in smaller towns and rural areas where jobs may be restricted to family farms. This section analyzes the deprivation suffered by the populations living in metropolitan, non-metropolitan, and rural areas. What is the relationship between inequality and deprivations among people in different areas? Additionally, this section explores how migration among the three areas has influenced inequality in Brazil.

Since the publication of Kuznets' seminal paper in 1955, the relationship between migration from rural to urban sector and income inequality has attracted much attention in the literature. Kuznets' dualistic model of development entails a continuous shift of population from traditional rural areas to modern urban sector, leading to the hypothesis called inverted U-shaped pattern of inequality. This section does not attempt to prove or disprove the Kuznets' hypothesis. Rather, it tries to quantify the impact of migration among metropolitan, non-metropolitan, and rural areas in falling inequality in Brazil.

Table 4.8 presents the population shares of metropolitan, non-metropolitan, and rural areas. It shows that the share of rural population declined from 20.48 % in 1992 to 13.19 % in 2012. This decline in rural population is expected because people migrate from traditional rural sector to modern urban sector as the economy develops. Unexpectedly, population is shifting to non-metropolitan areas rather than to metropolitan areas. Over the period 1992–2012 the population share in metropolitan areas has been mostly steady.

Figures in Table 4.9 and Fig. 4.5 show that the rural population suffers the highest deprivation, followed by non-metropolitan and metropolitan areas. The gap in the deprivation between metropolitan and rural areas is quite large. Metropolitan areas suffer the lowest deprivation, but the gap

Table 4.8 Population share by areas in Brazil, 1992–2012

Year	Metropolitan	Non-metropolitan	Rural
1992	30.86	48.65	20.48
1993	30.78	48.81	20.41
1995	30.59	49.42	19.98
1996	30.43	50.09	19.47
1997	30.50	50.07	19.43
1998	30.19	50.41	19.41
1999	30.47	50.34	19.19
2001	31.16	53.72	15.11
2002	31.14	53.93	14.93
2003	31.13	54.08	14.79
2004	30.85	54.51	14.64
2005	31.08	54.11	14.81
2006	30.89	54.69	14.43
2007	30.55	55.06	14.40
2008	30.88	55.10	14.02
2009	30.68	55.45	13.87
2011	30.71	56.15	13.14
2012	30.60	56.21	13.19
Growth rates			
1992–2001	0.00	0.46	−0.46
2001–2012	−0.05	0.23	−0.18
1992–2012	0.01	0.42	−0.43

Source: Authors' estimates

Table 4.9 Average deprivation by areas in Brazil, 1992–2012

Year	Metropolitan	Non-metropolitan	Rural
1992	49.31	57.03	73.63
1993	52.41	59.26	74.34
1995	50.58	59.22	75.68
1996	50.59	59.50	76.11
1997	51.03	59.25	76.11
1998	51.20	58.96	75.56
1999	51.39	58.20	74.28
2001	52.43	59.08	74.84
2002	51.94	58.41	74.07
2003	52.23	57.57	72.38
2004	51.13	56.30	71.19
2005	50.56	56.09	71.33
2006	50.14	55.33	70.77
2007	49.39	54.64	69.66
2008	48.62	53.67	69.09
2009	48.48	53.30	68.02
2011	47.03	52.43	67.22
2012	47.16	52.13	66.96
Growth rates			
1992–2001	0.18	0.09	0.09
2001–2012	–0.53	–0.65	–0.71
1992–2012	–0.17	–0.37	–0.46

Source: Authors' estimates

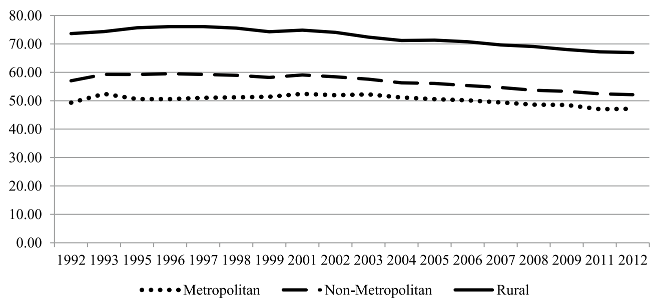

Fig. 4.5 Average deprivation by metropolitan, non-metropolitan, and rural areas in Brazil for the period 1992–2012 (*Source*: Authors' estimates)

between non-metropolitan and metropolitan areas is narrower compared to the one between non-metropolitan and rural areas.

During 1992–2001, the average deprivation increased across areas, with the metropolitan area experiencing worse deprivation. It started

Table 4.10 Regional contributions to total inequality in Brazil, 2001–12

Area	Change in population share	Average deprivation	Change in Gini
Metropolitan	−0.03	−0.17	−0.19
Non-metropolitan	0.13	−0.36	−0.23
Rural	−0.13	−0.10	−0.23
Total population	−0.03	−0.62	−0.65

Source: Authors' estimates

to decline across areas in the subsequent decade, 2001–12, suggesting that the decline in inequality was consistent in all three areas. This trend implies that growth in Brazil is broad-based and is not limited only to the metropolitan area. It is even more encouraging to note that the largest decline in deprivation has taken place among rural population, and thus the disparity in deprivation is closing in among the three areas.

Inequality in Brazil has continuously declined during the period 2001–12, as noted earlier. Table 4.10 indicates that the Gini index declined at an annual rate of 0.65 percentage points within the decade, of which 0.03 percentage points was due to migration from one area to another and the remaining 0.62 percentage points was due to the reduction in deprivation within each of the three areas. While the overall impact of migration on inequality was rather small, migration from rural to non-metropolitan areas led to quite a large reduction in inequality by 0.13 percentage points. Kuznets' dualistic model of development is not applicable to Brazil because it is assumed that during the course of economic development, the traditional rural sector remains underdeveloped whereas the modern urban sector grows rapidly. For Brazil, however, it is the rural sector that has experienced the most rapid reduction in deprivation, as observed in this chapter.

4.8 Middle Class and Inequality

The literature on the role of the middle class in economic development has been growing recently. The emerging consensus is that an increase in the size of middle class leads to rising per capita income and that an increase in the middle income share causes a rise in the growth rate (Easterly 2001). In addition, a greater income share of the middle class is associated with better health and education outcomes. Birdsall (2007) articulated the role of middle class in terms of inclusive growth by defining inclusive growth as growth that builds the middle class. According to her, a small and weak middle class implies weak state institutions, and hence unsustainable growth. In addition, Berkowitz and Jackson (2005) viewed that a powerful middle class is conducive to lower inequality. These studies are mostly derived from cross-country regressions that fail to provide a robust link between the rise of the middle class and economic development. This section explores to what extent the increasing size of the middle class contributes to changes in inequality. It is accomplished in the Brazilian context using its household surveys covering the period 1992–2012.

Definitions of the middle class vary and a widely accepted, unified one has yet to emerge. Thurow (1984) defined the middle class as the group whose income ranges from 75 % to 125 % of the median income. Later, Blackburn and Bloom (1985) broadened the range from 60 % to 225 % of the median. Another range proposed is 50 % to 150 % of the median (Davis and Huston 1992). Such methods of defining the middle class are called the relative approach which uses the median income as the reference point. Since the relative approach is based on individuals' income, Foster and Wolfson (1992) referred to the middle class in "income space". Meanwhile, Levy (1987) defined it in "people-space", whereby the middle class ranges from the 20th to the 80th percentile.

Following the classification in Chap. 3, assume that the population in Brazil is divided into three mutually exclusive groups:

(i) The poor whose per capita income is less than 50 % of the median;
(ii) The middle class whose per capita income is above the 50 % of the median and below the 150 % of the median; and
(iii) The rich whose per capita income is above the 150 % of the median.

In this approach, the median income is the reference point. Although analysis is carried out in the range 50–150 %, simulation exercise is performed with alternative ranges around the median. The conclusions

Table 4.11 Population share of social classes in Brazil, 1992–2012

Year	Poor class	Middle class	Rich class
1992	25.85	39.54	34.61
1993	25.51	40.25	34.24
1995	23.96	41.24	34.80
1996	26.57	37.78	35.64
1997	24.91	39.03	36.06
1998	25.47	39.54	34.99
1999	25.46	39.79	34.74
2001	25.10	39.88	35.02
2002	25.36	40.68	33.96
2003	25.01	41.13	33.86
2004	24.43	41.63	33.94
2005	23.67	42.65	33.68
2006	23.51	43.68	32.81
2007	24.03	43.14	32.84
2008	23.30	44.54	32.16
2009	23.24	44.76	32.00
2011	23.17	45.90	30.92
2012	22.72	46.67	30.61
Growth rates			
1992–2001	–0.03	–0.03	0.07
2001–2012	–0.23	0.60	–0.37
1992–2012	–0.15	0.37	–0.22

Source: Authors' estimates

emerging from this analysis were found to be robust for alternative ranges.[1]

Table 4.11 shows that the share of middle class rose from 39.54 % in 1992 to 46.67 % in 2012, increasing at 0.37 percentage points annually. By contrast, the corresponding shares for the poor and the rich fell annually at 0.15 and 0.22 percentage points, respectively. The middle class increased more sharply at 0.6 percentage points annually in the 2000s, when the shares for the poor and the rich shrank at an annual rate of 0.23 and 0.37 percentage points, respectively. These figures suggest that there

[1] In Chap. 3, the analysis of middle class was presented in terms of social tension caused by social alienation and polarization. In comparison, this chapter discusses the issue of middle class from the perspective of group deprivation.

has been a significant shift across social classes and the middle class, in particular, has been expanding rapidly over time.

Table 4.12 and Fig. 4.6 present the average deprivation by social classes. As expected, the poor class suffers the highest level of deprivation, followed by the middle class and the rich class. The disparity in deprivation among the three groups is quite large, indicating a high level of inequality in Brazil. Deprivation has declined across all three classes; the average deprivation by the middle class has declined at 0.90 percentage points annually during 2001–12, while the corresponding rates for the poor and rich classes fell at 0.38 and 0.69 percentage points, respectively. The middle class has performed very well; while its size is increasing, its relative deprivation is rapidly declining. A faster decline in relative deprivation implies that the middle class has become better-off over time at a faster rate.

Table 4.12 Average deprivation by social classes in Brazil, 1992–2012

Year	Poor class	Middle class	Rich class
1992	86.46	62.91	31.27
1993	87.19	65.33	34.16
1995	87.50	66.12	33.42
1996	87.34	65.87	33.45
1997	87.70	66.56	33.81
1998	87.02	65.67	33.47
1999	86.51	64.82	32.78
2001	87.05	65.00	33.18
2002	85.96	63.90	32.21
2003	86.01	63.18	31.32
2004	85.02	61.95	30.43
2005	84.92	61.69	30.33
2006	84.46	60.55	29.41
2007	84.31	59.34	28.46
2008	83.70	58.26	27.42
2009	83.59	57.60	27.05
2011	82.89	55.68	25.70
2012	82.55	55.45	25.91
Growth rates			
1992–2001	0.01	0.12	0.07
2001–2012	–0.38	–0.90	–0.69
1992–2012	–0.25	–0.53	–0.41

Source: Authors' estimates

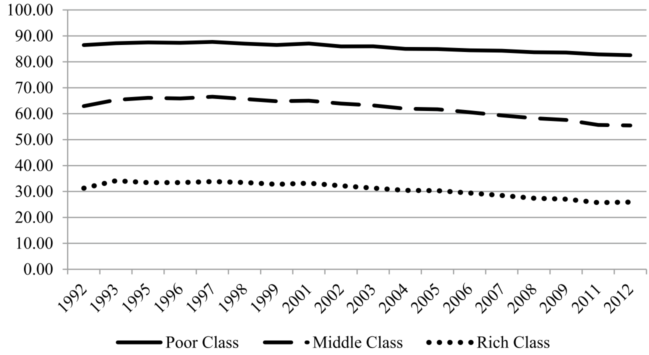

Fig. 4.6 Average deprivation by social classes in Brazil for the period 1992–2012 (*Source*: Authors' estimates)

Table 4.13 Social classes' contributions to reduction in inequality in Brazil, 2001–12

	Change in population share	Average deprivation	Change in Gini
Poor class	−0.03	−0.17	−0.19
Middle class	0.13	−0.36	−0.23
Rich class	−0.13	−0.10	−0.23
Total population	−0.03	−0.62	−0.65

Source: Authors' estimates

The literature largely suggests that the expanding middle class should have been a driving force for declining inequality in Brazil. This claim, surprisingly, is not confirmed by our estimates in Table 4.13, where the results suggest that the enlarging middle class in Brazil is not a dominant factor in the reduction in inequality in the 2000s. The increase in the size of middle class contributes to an increase in inequality, while the decrease in deprivation among the middle class reduces inequality. The net impact of middle class to inequality is the sum of the two effects. Of the reduction in Gini by 0.65 percentage points annually during 2001–12, the middle class accounts for 0.23 percentage points, while the poor and rich classes contribute to the reduction in Gini by 0.19 and 0.23 percentage points, respectively. This suggests that the middle class is not the only factor that explains the reduction of inequality. The reduction in inequality is broad-based—that is, improvements in deprivation among all three classes have contributed to the reduction in Gini in the 2000s in Brazil.

4.9 Race and Inequality

Understanding the relationship between race and inequality has been a subject of intense debate. For instance, black Africans in the U.S. earn 24 % less and tend to have a shorter life expectancy compared to white Caucasians. While the majority of barometers of economic and social progress have increased substantially over time, large disparities between racial groups have been and continue to be an everyday part of people's lives around the globe. It is thus important to look into the relationship between inequality and racial groups in the country context like Brazil.

This section looks into deprivation by racial groups. It also discusses the relative contribution of deprivation experienced by racial groups to inequality in Brazil. The racial groups identified by household surveys are: (i) white Caucasians, (ii) black Africans, (iii) mixed, and (iv) others. As the results show that deprivation by black Africans and mixed is similar in magnitude, we have combined (ii) and (iii) into black Africans/mixed.

Majority of the population in Brazil is white Caucasians, followed by black Africans/mixed, as shown in Table 4.14. The figures also indicate how racial composition has changed over the period 1992–2012. While the white Caucasians population has declined at 0.42 percentage points annually during 1992–2012, the black Africans/mixed population has increased at 0.41 percentage points annually. Furthermore, the decline in the white Caucasians population has accelerated in the 2000s. Such a shift in the racial composition may have implications on inequality.

Table 4.15 and Fig. 4.7 show that the black Africans/mixed population suffers much greater deprivation than the white Caucasians population. The disparity between the two racial groups has remained constant during 1992–2001, but narrowed rapidly in the 2000s. The average deprivation among black Africans/mixed has declined at 0.85 percentage points annually, whereas the corresponding figure for white Caucasians is 0.62

Table 4.14 Population share by race in Brazil, 1992–2012

Year	White Caucasians	Black Africans/mixed	Others
1992	54.42	45.08	0.50
1993	54.55	44.80	0.65
1995	54.58	44.84	0.58
1996	55.50	43.91	0.59
1997	54.41	45.08	0.51
1998	54.08	45.17	0.75
1999	54.10	45.29	0.61
2001	53.23	46.19	0.58
2002	53.09	46.30	0.61
2003	51.86	47.53	0.62
2004	51.84	47.58	0.57
2005	50.28	49.07	0.66
2006	50.00	49.24	0.76
2007	49.64	49.59	0.77
2008	48.91	50.19	0.90
2009	48.63	50.69	0.67
2011	48.21	50.91	0.88
2012	46.61	52.66	0.73
Growth rates			
1992–2001	−0.12	0.12	0.01
2001–2012	−0.57	0.55	0.02
1992–2012	−0.42	0.41	0.01

Source: Authors' estimates

percentage points per annum. The average deprivation among other racial groups has risen at 0.09 percentage points annually during 2001–12.

Changing racial composition has led to an increase in Gini by 0.08 % annually, but the reduction in deprivation was responsible for a reduction in Gini by 0.73 % annually. Taken together, the net impact of these two factors is the reduction of Gini by 0.65 % per annum during 2001–12 (see Table 4.16).

The rapid reduction in Gini in the 2000s is mainly due to the white Caucasians population. There are two factors that explain this reduction. First, the share of white Caucasians population has fallen in the recent decade, thereby reducing Gini by 0.28 percentage points. Second, the average deprivation has declined over the period, which led to a reduction in Gini by 0.31 percentage points. The total effect is, thus, a reduction in the Gini index by 0.58 percentage points.

Table 4.15 Average deprivation by race in Brazil, 1992–2012

Year	White Caucasians	Black Africans/ mixed	Others	Total population
1992	51.06	66.69	39.25	58.05
1993	53.40	68.78	44.47	60.23
1995	52.80	68.69	42.32	59.86
1996	53.03	69.01	49.39	60.02
1997	52.73	68.99	45.22	60.02
1998	52.76	68.58	43.93	59.84
1999	52.07	67.93	45.43	59.21
2001	52.22	67.82	45.60	59.39
2002	51.91	66.72	46.51	58.73
2003	50.77	66.24	47.05	58.10
2004	49.83	64.72	44.76	56.89
2005	49.61	63.99	43.84	56.63
2006	48.84	63.31	46.87	55.95
2007	47.97	62.52	49.56	55.20
2008	47.35	61.12	48.81	54.27
2009	46.98	60.59	44.33	53.86
2011	46.12	59.04	48.54	52.72
2012	45.64	58.81	44.97	52.57
Growth rates				
1992–2001	0.01	0.04	0.49	0.04
2001–2012	–0.62	–0.85	0.09	–0.65
1992–2012	–0.38	–0.53	0.21	–0.39

Source: Authors' estimates

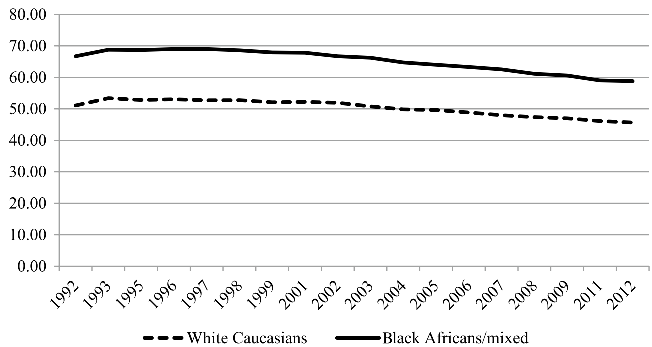

Fig. 4.7 Average deprivation by white Caucasians and black Africans/mixed race in Brazil for the period 1992–2012 (*Source*: Authors' estimates)

Table 4.16 Contribution of race to reduction in inequality in Brazil, 2001–12

Race	Change in population share	Average deprivation	Change in Gini
White Caucasians	–0.28	–0.31	–0.58
Black Africans/mixed	0.34	–0.42	–0.08
Others	0.01	0.00	0.01
Total population	0.08	–0.73	–0.65

Source: Authors' estimates

In comparison, the black Africans/mixed population has contributed to the reduction in Gini by 0.08 percentage points in the 2000s. Of the reduction, 0.34 percentage points accounts for rising share of this racial group in total population, and the remaining was due to falling deprivation among black Africans/mixed. Overall, the net contribution of black Africans/mixed to the reduction in Gini during 2001–12 was relatively small.

4.10 Education and Inequality

Does better education reduce income inequality? Our empirical analysis for Brazil illustrates that improving education does in fact help increase the position of those at the bottom and thus reduce overall inequality in the country.

Based on information provided by PNADs, persons aged 15 years and over are categorized into six groups based on their level of educational attainment: no schooling (level 1), incomplete primary (level 2), complete primary (level 3), incomplete secondary (level 4), complete secondary (level 5), and tertiary (level 6). Table 4.17 presents the share of these educational groups in the population. As shown, the population with no schooling has halved from 18.8 % in 1992 to 9.8 % in 2012.

More than half of the Brazilian population was educated at level 2 in 1992, but the share of the population with the same level of education was only 31.1 % in 2012. This trend suggests that the labor force in Brazil has become more educated over time. There is also an increasing share of those with higher levels of education in the past two decades.

Table 4.17 Population shares by levels of education for 15 years and over in Brazil, 1992–2012

Year	No schooling	Incomplete primary	Complete primary	Incomplete secondary	Complete secondary	Tertiary
1992	18.8	51.2	8.5	4.8	9.8	6.9
1993	17.7	51.6	8.7	5.1	10.0	6.9
1995	16.9	50.8	8.9	5.4	10.7	7.3
1996	16.7	48.8	9.8	5.9	11.4	7.4
1997	16.0	48.9	9.5	5.9	11.8	7.8
1998	15.1	47.7	9.9	6.6	12.7	8.0
1999	14.6	46.8	10.0	6.9	13.7	8.1
2001	14.0	44.0	10.2	7.3	15.8	8.7
2002	13.2	43.0	10.2	7.3	17.2	9.2
2003	12.8	41.2	10.4	7.7	18.1	9.7
2004	12.5	39.8	10.5	7.9	19.3	10.1
2005	11.9	39.0	10.3	8.0	20.3	10.6
2006	11.2	37.9	10.3	8.1	21.2	11.3
2007	11.0	36.4	11.0	7.7	21.8	12.0
2008	11.1	34.4	10.6	8.4	22.8	12.7
2009	10.5	34.3	10.1	8.2	23.5	13.4
2011	12.6	29.5	11.1	8.0	24.8	14.1
2012	9.8	31.1	11.0	7.9	24.7	15.3
Growth rates						
1992–2001	−0.53	−0.81	0.20	0.29	0.65	0.21
2001–2012	−0.27	−1.28	0.07	0.06	0.83	0.59
1992–2012	−0.42	−1.15	0.11	0.18	0.86	0.42

Source: Authors' estimates

Table 4.18 and Fig. 4.8 illustrate the average deprivation by different levels of education. The results reveal that the greater the deprivation, the lower the level of education. In addition, Fig. 4.9 presents the growth rates of deprivation by educational levels over two periods, 1992–2001 and 2001–12.

Negative (positive) growth rates in deprivation indicate increasing (declining) returns to education. As depicted in Fig. 4.9, the two trend lines have dramatically changed over the last two decades. In the 1990s, the education returns fell at all levels except in the tertiary level. In the 2000s, however, the returns increased at lower levels (levels 1–3) and declined at higher levels (levels 4–6). As opportunities in education expand over time, the distribution of educational returns has become more favorable to those at lower level of education. This suggests that for less educated

Table 4.18 Average deprivation by levels of education for 15 years and over in Brazil, 1992–2012

Year	No schooling	Incomplete primary	Complete primary	Incomplete secondary	Complete secondary	Tertiary
1992	67.7	59.0	47.9	44.8	38.0	24.1
1993	70.1	61.4	50.7	49.1	41.2	26.1
1995	70.7	61.8	50.7	48.2	40.4	23.9
1996	71.5	62.4	51.3	48.6	41.4	24.7
1997	71.6	62.9	51.2	48.9	41.4	25.0
1998	71.1	63.0	52.3	49.9	42.0	24.7
1999	70.1	62.6	52.6	50.9	42.3	23.9
2001	69.2	63.2	54.2	52.8	43.9	25.0
2002	68.4	62.8	54.7	53.4	44.7	24.7
2003	67.1	62.2	55.0	54.3	44.9	24.9
2004	65.9	61.0	54.3	53.8	44.6	25.0
2005	65.0	61.0	54.7	54.3	45.1	25.3
2006	64.3	60.4	54.5	54.7	45.5	25.4
2007	63.2	59.6	54.0	54.3	45.4	26.2
2008	62.2	58.7	53.8	53.7	45.2	26.8
2009	61.3	58.5	53.2	53.9	45.5	27.4
2011	60.2	56.6	53.1	54.1	45.3	27.9
2012	59.3	56.9	53.0	54.9	45.9	29.0
Growth rates						
1992–2001	0.11	0.39	0.56	0.68	0.50	–0.03
2001–2012	–0.91	–0.62	–0.16	0.10	0.13	0.38
1992–2012	–0.60	–0.22	0.22	0.44	0.35	0.18

Source: Authors' estimates

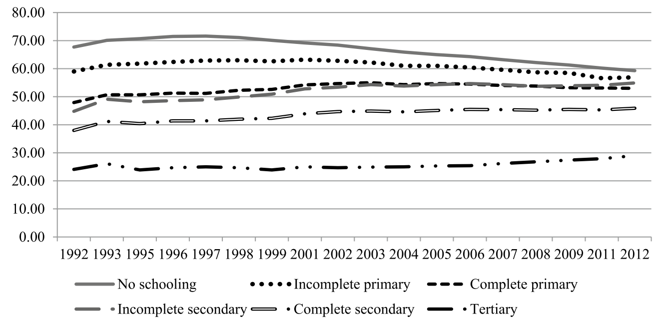

Fig. 4.8 Average deprivation by education level for 15 years and over in Brazil for the period 1992–2012 (*Source*: Authors' estimates)

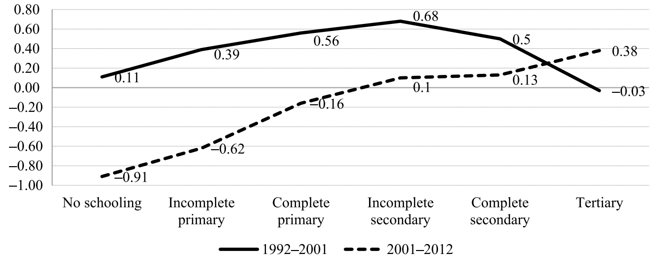

Fig. 4.9 Trend growth rates of deprivation by education level in Brazil for the period 1992–2001 and 2001–12 (*Source*: Authors' estimates)

Table 4.19 Impact of education on inequality in Brazil, 2001–12

Educational attainment	Change in population share	Average deprivation	Change in Gini
No schooling	–0.17	–0.11	–0.27
Incomplete primary	–0.78	–0.23	–1.01
Completed primary	0.03	–0.02	0.02
Incomplete secondary	0.03	0.01	0.04
Completed secondary	0.38	0.03	0.40
Tertiary education	0.15	0.05	0.20
Total population (15 years and over)	–0.34	–0.27	–0.62

Source: Authors' estimates

workers and those who earn a lower wage, additional education can still be especially important. Increasing the rate of educational attainment at lower levels might have the effect of reducing income inequality among median- and low-wage earners because it can boost the lower end of the earnings distribution toward median incomes. This could have led to falling inequality during 2001–12 in Brazil.

Education has played a key role in the reduction of inequality in Brazil in the recent decade. Table 4.19 notes that inequality among 15 years and over has declined at 0.62 percentage points annually. That can be explained in terms of two factors: (i) changes in the population composition by educational level and (ii) changes in deprivation among the corresponding groups. The population composition by level of education is constantly changing toward higher level of education. Such upward trend in educational level among the labor force has contributed to the reduction in inequality by 0.34 percentage points in the 2000s. Additionally, the change in deprivation was responsible for the reduction in inequality by 0.27 percentage points in the same period.

The results also reveal that the labor force with almost no education—that is, those with no schooling and had incomplete primary—has played a pivotal role in reducing inequality in Brazil during 2001–12. This group led to the reduction in inequality by 1.28 percentage points, as compared to 0.66 percentage points by the other levels of education altogether. This finding suggests that to address inequality, policy options should aim to reduce the share of the population with no education or to improve the deprivation among those with no education, or a combination of both.

4.11 Concluding Remarks

This chapter developed a methodology to estimate the average deprivation experienced by various social groups. It helped identify particular social groups with greater deprivation in society. Identifying such groups is important because reducing inequality can be more effective through policies directly targeting these social groups rather than specific individuals.

After experiencing stubbornly high inequality, Brazil has witnessed a sustained decline in Gini since 2001. With inequality falling, the average deprivation for the society as a whole is on the decline. Yet, this may not be true for all social groups. Given that inequality in Brazil may still be deemed high by global standards, deprivation could be more severe in one group than in another. To this end, this chapter analyzed relative deprivation by various social groups. Moreover, it provided detailed analysis on why inequality has fallen in the 2000s in terms of the relative deprivation by social groups. The key findings are summarized below.

Children in Brazil are found to be most deprived, and the elderly are shown to have the lowest deprivation. While deprivation among children has declined over time, its rate of reduction has been rather slower in comparison with other age groups. This has led to the trend where the disparity between the most deprived and least deprived groups is increasing over time.

The demographic structure in Brazil has changed rapidly in the last two decades. Like many other countries, the aging population is a major challenge that Brazil needs to tackle. Our findings suggest that despite their greater deprivation, the falling share of children in the population has led to the reduction in inequality by 0.35 % annually. This suggests that policies aimed at improving deprivation among children could be a way to address inequality in Brazil.

This chapter also explored how migration from rural areas impacts inequality in Brazil. Like other emerging economies, Brazil's urbanization has taken place rapidly over time. The population has migrated across rural, non-metropolitan, and metropolitan areas. Such a shift in the population from rural to other areas has shown to have a positive effect on inequality in Brazil particularly during the period 2001–12. In the 2000s, the average deprivation has declined across areas. The pattern of growth in Brazil has been broad-based and not limited to metropolitan areas. In fact, the rural areas have experienced the largest decline in deprivation. Moreover, the gap in deprivation among areas has reduced over time.

There has been a significant shift in the composition of social classes. The middle class in Brazil has enlarged and become better-off, which had a negligible impact on the reduction in inequality in Brazil. While it is commonly perceived in the literature that the expansion of middle class reduces inequality, findings presented in this chapter do not support this claim.

The relationship between inequality and racial groups was also explored in this chapter. Results indicated that the change in racial composition over time led to an increase in Gini by 0.08 % annually, while the reduction in deprivation among racial groups resulted in the reduction in Gini by 0.73 percentage points annually. Taken these two factors together, the net impact was an overall reduction in Gini by 0.65 % annually during 2001–12.

Of the racial groups, the white Caucasians population was most responsible for the reduction in Gini in the 2000s and this could be explained by two factors. First, the share of white Caucasians population has declined over the period, which led to the reduction in Gini by

0.28 percentage points. Second, the average deprivation among the white Caucasians population has also declined in the recent decade, leading to a further reduction in Gini by 0.31 percentage points. Therefore, the total effect of the white Caucasians race on inequality was the reduction in Gini by 0.58 percentage points. By contrast, the net impact of black Africans/mixed population on inequality was rather small, reducing Gini only by 0.08 percentage points.

Education has played a key role in reducing inequality in Brazil in the 2000s. In this chapter, Gini was estimated for those aged 15 years and over. The estimates showed that the Gini index has fallen at 0.62 percentage points annually. There are two factors behind the decline—one is changves in the population composition by educational levels and the other is changes in deprivation among those educational groups. As expected, the proportion of population with higher education has increased over time in Brazil. This has contributed to the reduction in inequality by 0.34 percentage points. In addition, the decline in deprivation among educational groups also led to the reduction in inequality by another 0.27 percentage points. These findings call for policies that aim to improve the educational level of the labor force and, consequently, to address inequality in Brazil.

5

Growth and Shared Prosperity

5.1 Introduction

The World Bank has recently proposed a new development model that focuses on the bottom 40 % of the population. This new paradigm aims to (i) lower extreme or absolute poverty in the globe to 3 % by 2030, and (ii) foster economic growth that benefits the bottom 40 % of the population (Rosenblatt and McGavock 2013). The second goal that targets the bottom 40 % of the population is built on the concept of shared prosperity. The basic idea is that growth fosters shared prosperity if the bottom 40 % of the population could benefit from economic growth.

The idea of shared prosperity appeals to various stakeholders because it has a well-defined but simple social welfare function. It is closely related to the notion of inclusive growth because it ensures that a sizable bottom part of the population can participate in and benefit from growth. The idea of shared prosperity is also related to one of the Sustainable Development Goals (SDGs)—that is, inequality within and between countries.

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DOI 10.1057/978-1-137-58325-3_5

This chapter extends the idea of shared prosperity by exploring linkages between four dimensions: growth patterns, inequality, labor market performance, and social policies. It demonstrates that the simple idea of shared prosperity could be a powerful tool to answer many policy questions relating to labor market and social policies. The distinction is made between average prosperity (AP) and shared prosperity (SP), which are linked by an inequity component on top of the average prosperity measure. Following Kolm (1976a, b), two measures of inequity are thus proposed: (i) relative or rightist measure of inequity, and (ii) absolute or leftist measure of inequity. A related idea of shared growth is developed through measuring gains or losses in growth rates due to increasing (decreasing) equity in shared prosperity; that is, the larger the gain, the greater the shared growth.

The main contribution of this chapter is the new decomposition method that quantifies the contributions of social policies and labor market performance to shared growth. The chapter also extends the idea of shared prosperity to shared opportunities, leading to a new measure of inequity in opportunities. This new measure can be calculated from household surveys to analyze individuals' access to various basic services in education, health, and living conditions.

The proposed methodologies are applied to Brazil, covering the period 2001–12. Many policy questions relating to labor market performance and social policies will shed light on how Brazil has achieved shared growth during the past decade or so.

5.2 A Simple Indicator of Shared Prosperity

Suppose x is the income of an individual that is a random variable with density function $f(x)$, then the mean income of the population is defined as

$$\mu = \int_0^\infty x f(x)\,dx. \tag{5.1}$$

This is a simple measure of average standards of living. Although per capita gross domestic product (GDP) is widely used as a measure of country's prosperity, it has many limitations in measuring average welfare adequately. In the book *Mismeasuring Our Lives: Why GDP Doesn't Add up,* Stiglitz et al. (2010) explained why GDP may be a misleading measure of welfare. GDP measures an economic average, masking inequalities in the way GDP is distributed. Much of the public discussion about living standards focuses on indicators for the entire economy, but in the end, it is individuals whose economic situation should be assessed when talking about the standard of living. Given such limitations of GDP, the mean household income defined in (5.1) can be suggested as a measure of average prosperity (AP) of the society.

The World Bank is now promoting the idea of shared prosperity (SP), which is based on the mean income of the bottom 40 % of the population. More formally, suppose the poverty line z is the income defined by

$$0.4 = \int_0^z f(x)dx$$

then the indicator of shared prosperity can be defined by

$$\mu_s = \frac{\int_0^z xf(x)dx}{\int_0^z f(x)dx} \tag{5.2}$$

which shows that the measure of shared prosperity is the weighted average of individual incomes. In fact, this is similar to the welfare measure proposed by Basu (2001), which focuses on the bottom 20 % of the population. It is fundamentally different because the idea of shared prosperity focuses on the bottom 40 % of the population instead of the bottom 20 %. Shared prosperity is built upon the notion that a large proportion of the population should take part in and benefit from the growth process.

Similar to Atkinson's and Sen's social welfare, the SP indicator is defined using individual incomes. As such, the indicator has an implicit inequality measure, which can be defined as

$$I = 1 - \frac{\mu_s}{\mu}. \tag{5.3}$$

Given this, the SP indicator can be expressed as

$$\mu_s = \mu(1 - I) \tag{5.4}$$

which is similar to the social welfare function defined for Atkinson's and Sen's indices. Note that I is not a usual measure of inequality, like the Gini index, because it does not satisfy the weak transfer axiom. Rather, I will be referred to as a measure of inequity in shared prosperity, and thus $(1 - I)$ is a measure of equity in shared prosperity.

I is a mean-independent measure of equity—that is, the value of the measure remains unchanged if each income is altered by the same proportion. Such measures are called the relative or rightist measures of inequality, according to Kolm (1976a, b). Moreover, Kolm has also proposed the absolute or leftists measures of inequality, which do not indicate any changes in inequality when each income is increased or decreased by the same amount. The absolute measure of inequity that is implicit in the social welfare function for shared prosperity is defined as

$$A = \mu - \mu_s. \tag{5.5}$$

The absolute inequity measure A reflects the absolute, rather than relative, difference in levels of living standard.

5.3 Shared Growth

The idea of shared growth can also be developed. To do so, (5.4) can be written as

$$ln(\mu_s) = ln(\mu) + ln(1 - I)$$

which, on taking the first difference, gives

$$\gamma^{*} = \gamma + g \tag{5.6}$$

where $\gamma^{*} = \Delta ln(\mu_s)$ is the growth rate of shared prosperity, $\gamma = \Delta ln(\mu)$ is the growth rate of average prosperity, and $g = \Delta ln(1 - I)$ is the growth rate of equity in shared prosperity. Note that g will be positive (negative) if equity in shared prosperity increases (decreases). There will be gains (losses) in growth rates when equity improves (deteriorates). For instance, if $\gamma^* = 6\,\%$ and $\gamma = 4\,\%$, this means that there is a gain of 2 % in the growth rate of shared prosperity largely due to improvement in equity. The gain in the growth rate suggests that economic growth provides greater benefits to the bottom 40 % population than to the average gain to the society. This motivates the idea of shared growth, which can be measured by the gain in the growth rate due to increased equity in shared prosperity. This means that shared growth increases as the gain in growth rate becomes larger.

5.4 Patterns of Shared Prosperity in Brazil

This section provides trends in average and shared prosperity in Brazil from 2001 to 2012. For empirical analysis, various rounds of *Pesquisa Nacional por Amostra de Domicilios* (PNADs) are used. Per capita real household income is used as a measure of individuals' welfare. Per capita real income is obtained by per capita nominal income adjusted for prices. The consumer price indices (CPIs) corresponding to the PNAD survey years are used for price adjustments.

Table 5.1 presents the estimates of average and shared prosperity in Brazil. Both AP and SP are measured in money metric R$ (annual) in 2012 prices. The trends show that both AP and SP have increased consistently but the absolute gap between the two has widened at the same time. The trend growth rates indicate that AP has increased at an annual rate of R$309 per person while the corresponding figure for SP is only R$131. In terms of absolute living standards, the bottom 40 % of the

Table 5.1 Average and shared prosperity in Brazil, 2001–12 (*Real* annual)

Year	Average prosperity	Shared prosperity	Absolute inequality	Relative inequality
2001	7305	1496	5809	79.5
2002	7313	1556	5757	78.7
2003	6884	1493	5391	78.3
2004	7113	1644	5470	76.9
2005	7551	1770	5780	76.6
2006	8259	2000	6258	75.8
2007	8468	2081	6387	75.4
2008	8873	2277	6596	74.3
2009	9116	2348	6768	74.2
2011	9689	2642	7047	72.7
2012	10464	2904	7560	72.2
Trend 2001–12	309	131	177	–0.66

Source: Authors' calculation

population has thus performed worse than the average population; the gap between the two has increased at an annual rate of R$177 per person. The findings suggest that while the average standards of living have improved during 2001–12, the poorest 40 % of the population are left behind in the process by R$177 per person annually. As a result, absolute inequality—defined as the difference between AP and SP—has worsened in Brazil in the 2000s.

Conversely, the trend of the inequality measure developed in (5.3) shows that relative inequality in Brazil has declined from 79.5 % in 2001 to 72.2 % in 2012, falling by 0.66 percentage points annually. This result is consistent with the declining Gini index during the same periods. Thus, while absolute inequality has risen in Brazil, relative inequality has fallen.

The concept of absolute inequality may be more appealing, as noted in Chap. 2, but inequality in public debates is mostly understood in relative terms. Brazil is no exception in this regard. Indeed, when inequality is discussed in the political or the public arena, it always points to Gini, a measure of relative inequality. Meanwhile, the public often talks about the increasing gap between the rich and the poor, which actually means the absolute difference between the two. Which of the two concepts should be adopted to evaluate alternative policies? As Ravallion (2004) points out, there is no economic theory that can guide us on whether inequality ought to be relative rather than absolute. The debate is not about whether one concept is right and the other is wrong, as the two are conceptually different. Rather, preference on which concept to use reflects a value judgment on what is considered a fair division of gains from growth.

5.5 Shared Growth in Brazil

Table 5.2 presents the annual growth rates of AP and SP in Brazil from 2001 to 2012. The trend shows that the growth rate of SP is higher than that of AP throughout the years. This implies that the bottom 40 % of the population has performed consistently better than the entire population. The last column of Table 5.2, which is obtained by subtracting the growth rate of AP from that of SP, reveals the gains in the growth rate that measure the extent to which growth in the mean income is shared. The larger the gains are, the greater the shared growth becomes. Substantial gains in the growth rates are noticeable throughout the decade.

The last row in Table 5.2 provides the trend growth rates for 2001–12. AP and SP have increased at 3.64 and 6.37 % per annum, respectively. As a result, the annual gain in the growth rate is 2.73 % during the period. This growth pattern signifies an unprecedented reduction in inequality in the 2000s. Thus, not only has average prosperity in Brazil increased during

Table 5.2 Annual growth rates of average and shared prosperity in Brazil, 2001–12 (%)

Year	Average prosperity	Shared prosperity	Equity gains/losses
2001–02	0.11	3.93	3.82
2002–03	–6.04	–4.13	1.91
2003–04	3.27	9.59	6.32
2004–05	5.97	7.43	1.46
2005–06	8.97	12.21	3.25
2006–07	2.50	3.93	1.43
2007–08	4.67	9.01	4.34
2008–09	2.70	3.09	0.39
2009–11	3.05	5.90	2.85
2011–12	7.69	9.45	1.76
Trend 2001–12	3.64	6.37	2.73

Source: Authors' calculation

2001–12, more importantly, its increase has been higher among the bottom 40 % of the population. Moreover, since the SP increases at a faster rate than AP, it can be concluded that growth in Brazil has been sustained and shared among population. Since growth rates are measured in relative terms, the shared prosperity achieved is the relative prosperity. This story changes, however, when the absolute concept is used to measure shared prosperity.

5.6 Determinants of Shared Prosperity

Brazil has been able to achieve substantial improvements in both average and shared prosperity. To sustain these improvements, it is important to identify the factors that contribute to them. One of the main factors could be various sources of household income, such as labor income, public and private transfers, interests, and dividends, among others. This section investigates the impacts and contributions of these different sources of household income to shared prosperity.

Suppose households draw their income from k sources. Further, suppose that there are k mutually exclusive income components and $v_i(x)$ is the income from the ith source of a household with a per capita income x such that

$$x = \sum_{i=1}^{k} v_i(x). \tag{5.7}$$

Given this, the mean income from the ith source is given by

$$\mu_i = \int_0^{\infty} v_i(x) f(x) dx. \tag{5.8}$$

Substituting (5.7) into (5.8) gives

$$\mu = \sum_{i=1}^{k} \mu_i. \tag{5.9}$$

This equation can be used to estimate the contribution of each income source (component) to average prosperity. The term $100 \times \mu_i / \mu$ is the percentage contribution of the *i*th income source to the total average prosperity.

Similarly, the mean income of the *i*th component for the bottom 40 % of the population is calculated by

$$\mu_{is} = \frac{\int_0^z v_i(x) f(x) dx}{\int_0^z f(x) dx}. \tag{5.10}$$

Substituting (5.7) into (5.10) gives

$$\mu_s = \sum_{i=1}^{k} \mu_{is} \tag{5.11}$$

This equation provides the contribution of each income component to total shared prosperity. Thus, the term $100 \times \mu_{is} / \mu_s$ is the percent contribution of the *i*th income source to total shared prosperity.

For policy making, it will be helpful to identify income sources that contribute to shared prosperity and by how much. An income source can promote shared prosperity if it contributes more to the per capita income of the bottom 40 % than to the per capita income of the whole society. This leads to a new indicator or the shared prosperity index:

$$\varphi_i = \frac{\mu_{is} \mu}{\mu_s \mu_i} \tag{5.12}$$

If φ_i is greater than 1, this implies that the *i*th income source contributes more to the per capita income of the bottom 40 % of the population. The value denoted by φ_i indicates whether a particular income source contributes more or less to the bottom 40 % of the population.

We now turn to identifying factors that can explain inequity in SP. To tackle this issue, two decomposition methods have been proposed as follows:

$$I_i = \sum_{i=1}^{k} \left(\mu_i - \mu_{is}\right) / \mu \tag{5.13}$$

for relative inequity and

$$A_i = \sum_{i=1}^{k} \left(\mu_i - \mu_{is}\right) \tag{5.14}$$

for absolute inequity. The term $100 \times \left(\mu_i - \mu_{is}\right) / \mu$ is the percent contribution of the *i*th income source to total relative inequity. Similarly, $100 \times \left(\mu_i - \mu_{is}\right)$ is the percent contribution of the *i*th income source to total absolute inequity.

5.7 Determinants of Shared Prosperity in Brazil from 2001 to 2012

To illustrate shared prosperity in the Brazilian context, this section considers income sources that include (i) labor income, (ii) *Bolsa Familia* Program (BFP), (iii) continuous cash benefit called *Beneficio de Prestação Continuada* (BPC), (iv) social security, and (v) other incomes. Labor income includes all earnings from employed members of the household. A household's labor income depends on two main factors—the number of household members employed and the level of earnings of working individuals.

Bolsa Familia Program took shape in 2003, early in the first term of Brazilian President Luiz Inácio Lula da Silva. It was established out of a merger of four major cash transfer programs: (i) *Bolsa Escola* which was an income grant for primary education, (ii) *Fome Zero* and (iii) *Bolsa Alimentação* which provided income grants related to food security, and (iv) *Vale Gás* which were subsidies to poor housheolds to buy cooking gas. It has now become a popular program benefiting more than 45 million people.

The BPC, meanwhile, is an unconditional disability and old-age grant targeted for the poor. It is a non-contributory social assistance program that is entirely comprised of a subsidy to the beneficiaries.

Social security is the main component of social income in Brazil. It is only second to labor earnings among all other sources listed above. The major portion of benefits is made up of transfers that are to some degree linked with past contributions. Still, the beneficiaries of social security do get public subsidies because the volume of transfers exceeds the volume of contributions.

Other incomes include various types of non-social incomes to which the government does not make any contribution. They include private transfers from other families and non-government organizations, private pensions, rents, and other earnings from assets such as interests and dividends.

Table 5.3 presents the percentage contributions of different income sources to total shared prosperity. Labor income is the most dominant factor impacting shared prosperity. In 2001, labor income alone contributed 79.23 % to SP but fell to 72.77 % in 2012, declining at a rate of 0.53 percentage points per annum. Meanwhile, the contribution of non-labor incomes has risen at 0.47 percentage points annually. For instance, the contribution of BFP to the total SP increased from 0.67 % in 2001 to 7.08 % in 2012, indicating an annual increase of 0.52 percentage points. The contribution of BPC has also increased by 0.16 percentage points annually, whereas that of social security has remained stable at about 15 %. While the contributions of social income have increased during the period, contributions of non-social incomes have seen a declining trend.

As noted earlier, relative inequity in Brazil has declined sharply over the 2001–12 period. Total inequity was 79.52 % in 2001 and 72.25 % in 2012, declining at 0.66 percentage points annually. Table 5.4 quantifies the decline by income components. The labor income is the most dominant factor, reducing relative inequity by 0.40 percentage points annually. In contrast, BFP, which is the major social program in Brazil, has contributed to the reduction in inequity by only 0.08 percentage points. The contribution of BPC is even smaller at only 0.01 percentage points.

Table 5.3 Contributions of income sources to total shared prosperity in Brazil, 2001–12 (%)

Year	Labor income	*Bolsa Familia* program	*Beneficio de Prestação Continuada*	Social security	Other incomes
2001	79.23	0.67	0.35	15.09	4.66
2002	78.30	1.89	0.57	14.91	4.32
2003	77.53	2.53	0.53	15.48	3.93
2004	75.98	4.50	1.45	14.02	4.04
2005	76.64	3.82	1.65	13.82	4.06
2006	74.83	4.86	2.20	13.37	4.74
2007	75.43	4.28	1.93	14.41	3.95
2008	75.90	5.15	1.83	13.44	3.67
2009	74.68	5.70	1.99	13.99	3.65
2011	73.22	6.55	1.84	15.52	2.87
2012	72.77	7.08	2.26	14.93	2.97
Trend 2001–12	–0.53	0.52	0.16	–0.01	–0.14

Source: Authors' calculation

Table 5.4 Contributions of income sources to inequity in shared prosperity in Brazil, 2001–12 (%)

Year	Labor income	*Bolsa Familia* program	*Beneficio de Prestação Continuada*	Social security	Other incomes	Total income
2001	61.71	–0.06	0.01	14.03	3.82	79.52
2002	60.70	–0.17	0.57	14.05	3.56	78.72
2003	59.84	–0.23	0.01	15.13	3.55	78.31
2004	58.77	–0.50	0.02	14.90	3.71	76.89
2005	57.92	–0.44	0.32	14.94	3.81	76.55
2006	57.78	–0.58	0.12	14.75	3.71	75.78
2007	58.42	–0.55	0.04	14.44	3.08	75.43
2008	57.05	–0.68	0.08	14.76	3.13	74.34
2009	56.94	–0.77	0.09	15.20	2.77	74.24
2011	57.38	–0.92	0.09	13.95	2.23	72.73
2012	56.88	–0.97	0.07	13.73	2.53	72.25
Trend 2001–12	–0.40	–0.08	–0.01	–0.03	–0.14	–0.66

Source: Authors' calculation

Similarly, social security has had a relatively small impact on inequity. It is interesting to note that other non-social incomes have contributed to a reduction in inequity by 0.14 percentage points. Thus, the sharp reduction in relative inequity that has happened in Brazil could largely be due to non-social incomes, which include labor and other incomes

Results indicate that social programs do not have large impacts on inequality reduction. This is because these programs are relatively small compared to labor and other incomes. However, this does not mean that these programs are poorly targeted. To measure their targeting efficiency, the shared prosperity index φ_i derived in (5.12) is calculated for each income component. Table 5.5 presents the estimates.

The indicator for the total income is 1. An index value greater than 1 implies that the particular income source benefits the bottom 40 % more than the average. The larger the value of the index, the greater will be the targeting efficiency. As indicated in Table 5.5, the corresponding indicator for the labor income was 1.02 in 2001 and 0.94 in 2012. The estimated value for BFP is around 8, indicating that the program has been highly effective in targeting the bottom 40 % of the population and thus promoting shared prosperity. The indicator for the BPC, on the other hand, has been over 3 in most years. This suggests that the program promotes shared prosperity but is less effective than BFP. Social security cannot be deemed to have promoted shared prosperity given that its indicator is below 1 throughout the years.

In summary, while social programs in Brazil are well targeted, their impacts on inequality are rather small. This suggests that the decline in

Table 5.5 Shared prosperity index by income sources in Brazil, 2001–12

Year	Labor income	*Bolsa Familia program*	*Beneficio de Prestação Continuada*	Social security	Other incomes	Total income
2001	1.02	8.38	4.08	0.88	0.97	1.00
2002	1.01	7.97	0.82	0.87	0.96	1.00
2003	1.01	8.03	4.09	0.84	0.89	1.00
2004	1.00	8.34	4.11	0.77	0.87	1.00
2005	1.01	8.32	2.34	0.76	0.85	1.00
2006	0.99	8.15	3.37	0.74	0.98	1.00
2007	0.98	8.59	3.75	0.80	0.98	1.00
2008	0.99	7.96	3.36	0.74	0.90	1.00
2009	0.98	8.15	3.29	0.74	0.98	1.00
2011	0.95	7.52	3.13	0.85	0.95	1.00
2012	0.94	7.09	3.25	0.84	0.88	1.00
Trend 2001–12	–0.01	–0.08	0.02	0.00	0.00	1.00

Source: Authors' calculation

inequality in Brazil in the 2000s has been largely due to labor income. There have been various structural changes in the labor market that might have contributed to the reduction in inequality. The next section is devoted to identifying these changes in the labor market and how these changes contributed in shared growth.

5.8 The Role of Labor Market in Explaining Shared Growth

Brazil has experienced shared growth during 2001–12 largely due to incomes generated in the labor market. To extend our analysis, we will look at potential factors in the labor market that determine the shared growth. Using information available from PNADs, we have identified the following variables that directly impact the growth rate of labor income:

(i) Employment rate (e), defined as the employed persons as share of the labor force;
(ii) Hours worked per employed person (h);
(iii) Labor force participation rate (l), defined as the employed and unemployed persons as share of the population; and
(iv) Labor productivity ($p = y/h$), defined as labor income earned per hour of work.

The linkage between the growth rate of per capita labor income and the growth rates of the four characteristics of labor force identified above is provided through the following identity:

$$ln(y) = ln(e) + ln(h) + ln(l) + ln(p).$$

where y is the per capita labor income. Taking the first differences of this identity gives the growth rate of per capita labor income, denoted by $\gamma(y)$. This is the sum of the growth rates of the four characteristics:

$$\gamma(y) = \gamma(e) + \gamma(h) + \gamma(l) + \gamma(p) \tag{5.15}$$

where $\gamma(e)$ is the growth rate of the employment rate, $\gamma(h)$ is the growth rate of hours worked per employed person, $\gamma(l)$ is the growth rate of the labor force participation rate, and $\gamma(p)$ is the growth rate of labor productivity. If any of these growth rates is positive (negative), it will contribute positively (negatively) to the growth rate of labor income per employed person.

Schooling is a major factor that influences labor productivity. It is generally true that the higher the level of schooling an individual possesses, the greater is his productivity. Thus, an increase in years of schooling should lead to an increase in labor productivity. However, the relationship between the two is not that simple. Changes in years of schooling are also accompanied by changes in returns to schooling. The average hourly return of one year of schooling is given by

$$r = \frac{y}{h \times S}$$

where S is the mean years of schooling. Given this, growth rate in productivity ($p = y/h$) can be written as

$$\gamma(p) = \gamma(r) + \gamma(S)$$

which shows that the growth rate in labor productivity can be decomposed into two components. The first component is the growth rate of average hourly rate of return from schooling and the second is the growth rate of average years of schooling. The growth rate of per capita labor income is thus equal to the growth rates of five components given by

$$\gamma(y) = \gamma(e) + \gamma(h) + \gamma(l) + \gamma(S) + \gamma(r) \tag{5.16}$$

which provides a method of calculating the contributions of each of the five labor force characteristics to the growth rate of average labor income. While (5.16) has been derived for the whole population, a similar equation can be derived for the bottom 40 % of the population as

$$\gamma(y_s) = \gamma(e_s) + \gamma(h_s) + \gamma(l_s) + \gamma(S_s) + \gamma(r_s) \tag{5.17}$$

where y_s, e_s, h_s, l_s, S_s, and r_s are per capita labor income, employment rate, average hours of work, labor force participation rate, average years of schooling, and average rate of return from schooling of the bottom 40 % of the population, respectively. The shared growth in per capita labor income is given by $\gamma(y_s)$, which can be written as the sum of growth rates of five labor force characteristics:

$$\begin{aligned}\gamma(y_s) - \gamma(y) = {} & \left[\gamma(e_s) - \gamma(e)\right] + \left[\gamma(h_s) - \gamma(h)\right] \\ & + \left[\gamma(l_s) - \gamma(l)\right] + \left[\gamma(S_s) - \gamma(S)\right] + \left[\gamma(r_s) - \gamma(r)\right].\end{aligned}$$

This equation quantifies the contributions of each of the labor force components to the shared growth in the labor income.

Table 5.6 presents the contributions of each of the labor force components to the trend growth rates in per capita labor income. Labor income has increased at an annual rate of 3.61 % during 2001–12. Of this trend growth rate, an increase in employment has contributed 0.31 % to AP—not very large but positive nonetheless. The labor force participation rate has also increased, contributing 0.39 % to the growth in labor income.

The hours worked by employed persons have fallen, leading to a decline in the growth rate of labor income by 0.27 %. The declining hours of work may be due to changes in the nature of employment, which is becoming more productive over time. It is the increase in hourly productivity that has contributed 3.18 % to growth in labor income. The increased productivity is explained by two factors—expansion of education and increase in the rate of return from additional year of schooling. The completed years of schooling alone has contributed 2.30 % to the growth in productivity. It is interesting to note that the expansion of education is accompanied by an increase in the average return from every year of schooling, which has contributed 0.88 % to the growth in total labor income.

Labor income for the bottom 40 % of the population grew at an annual rate of 5.68 %, which is predominantly explained by the productivity growth of 6.06 %. Growth in productivity is explained by expansion of education and the increase in returns from education. The completed years of schooling for the bottom 40 % of the population increased at an annual rate of 4.26 %, and, at the same time, their average rate of return from schooling increased at 1.80 % annually. Therefore, it can be concluded that education has played the key role in promoting shared prosperity in Brazil. The increase in rates of return from schooling might have been partly due to the increases in the minimum wage during 2001–12.

The last column of Table 5.6 provides the contributions to shared growth due to labor income. Employment and labor force participation rates have negatively contributed to the shared growth. The shared growth seen in the 2000s has been largely because of the increase in labor productivity, which is contributed by years of education among the labor force, as well as increased returns to education, albeit to a lesser degree.

Table 5.7 provides the contributions of all factors to the shared growth in per capita total household income. The results show that both social programs and labor market influence the shared growth in per capita household income. Specifically, the shared growth was 2.74 % per annum during 2001–12, of which 1.47 % is explained by the overall expansion of education among the labor force, 0.67 % by the increase in the returns from schooling, and 0.73 % by *Bolsa Família* Program. Contributions of

Table 5.6 Contributions of labor force characteristics to growth in labor income in Brazil, 2001–12 (%)

Labor force component	Average prosperity	Shared prosperity	Equity gains/losses
Employment rate	0.31	0.18	−0.13
Labor force participation rate	0.39	−0.30	−0.70
Hours worked per employed person (monthly)	−0.27	−0.26	0.01
Labor productivity per hour	3.18	6.06	2.88
Per capita years of schooling	2.30	4.26	1.96
Average returns per school year (hourly)	0.88	1.80	0.93
Per capita labor income	3.61	5.68	2.07

Source: Authors' calculation

BPC and social security are relatively small at 0.22 % and 0.16 %, respectively. Increases in the employment rate and the labor force participation rate have negative impacts on the shared growth.

5.9 Shared Opportunities

Apart from expanding output, economic growth also creates opportunities in the economy that enhance well-being. For instance, growth generates employment, allowing people to earn income to be able to consume goods and services. However, these economic opportunities are not always equally shared by all. The poor generally benefit less from growth due to circumstances or market failures that prevent them from availing of these economic opportunities.

Economic growth can directly create opportunities through market operations. More importantly, however, it generates resources in the form of tax revenues, fees, and fines that governments use to create opportunities, particularly in education, health, housing, and so on. Governments can formulate policies and programs that facilitate the full participation of those who are less well-off, ensuring that opportunities created by

Table 5.7 Contributions of factors to shared growth in per capita household income in Brazil, 2001–12 (%)

Factors	Average prosperity	Shared prosperity	Equity gains/losses
Employment rate	0.24	0.13	−0.10
Labor force participation rate	0.30	−0.21	−0.51
Hours worked	−0.21	−0.20	0.00
Labor productivity per hour	2.42	4.56	2.14
Years of schooling	1.76	3.23	1.47
Returns from education	0.66	1.33	0.67
Bolsa Familia Program (BFP)	0.10	0.83	0.73
Beneficio de Prestação Continuada (BPC)	0.06	0.28	0.22
Social security benefits	0.73	0.89	0.16
Other incomes	0.00	0.11	0.11
Per capita household income	3.64	6.39	2.74

Source: Authors' calculation

growth are equitably availed across the population. As such, governments play a key role in determining the pattern of growth that can result in equitable opportunities.

Suppose $O(x)$ is an opportunity enjoyed by a person with income x, then the average opportunity (AO) by the society is given by

$$\vartheta = \int_0^\infty O(x) f(x) dx.$$

This is the average opportunity available, but it does not provide information on how it is shared by the population. Similar to the idea of shared prosperity, shared opportunity (SO) is defined as

$$\vartheta_s = \frac{\int_0^z o(x) f(x) dx}{\int_0^z f(x) dx}$$

which is the average opportunity enjoyed by the bottom 40 % of the population. The inequity in opportunity can be defined as

$$I_o = 1 - \frac{\vartheta_s}{\vartheta}.$$

Thus, the shared opportunity can be expressed as

$$\vartheta_s = \vartheta(1 - I_o)$$

which is similar to Atkinson's and Sen's social welfare functions but defined over opportunity space. The value denoted by I_o measures the proportional loss (gain) in opportunity due to inequity (equity) and therefore can be an indicator of inequity (equity) in opportunity. Note that unlike the inequity measure I in (5.3) with range $0 \le I \le 1$, this inequity measure

I_o lies in the range $-1 \le I_o \le 1$. The negative (positive) value implies that opportunity is inequitable (equitable). Using this new measure, we look into inequality in opportunities such as (i) employment, (ii) productive employment, (iii) education attainment, and (iv) school attendance.

5.9.1 Employment Opportunities

Labor income is generated through employment in the labor market. People who do not have employment opportunities earn lower income and are likely to have lower standards of living compared to their counterparts who do. Employment itself has an intrinsic value because aside from monetary rewards, employment provides people with satisfaction in their lives.

The employment rate is defined as the share of employed persons in the labor force. This informs us whether those able and willing to work are able or unable to get a job. The AO in employment is the employment rate for the whole society whereas the SO in employment is the average employment rate for the bottom 40 % of the population. The estimates for AO and SO are presented in Table 5.8.

The average employment rate has increased from 90.57 % in 2001 to 93.61 % in 2012, resulting in improvement in the employment rate at an annual rate of 0.28 percentage points. The employment rate for the bottom 40 % of the population is consistently lower than the average, which suggests that employment opportunities are not equitable. As shown in Table 5.8, inequality in employment has increased from 5.93 % in 2001 to 7.05 % in 2012, increasing by 0.12 percentage points annually.

5.9.2 Productive Employment

International organizations such as the World Bank argue that the inclusiveness of growth hinges on poverty reduction policies particularly geared toward creating full and productive employment. Although pro-

Table 5.8 Average and shared opportunity in the employment rate in Brazil, 2001–12 (%)

Year	Average opportunity	Shared opportunity	Inequity
2001	90.57	85.20	5.93
2002	90.77	85.78	5.50
2003	90.22	84.19	6.68
2004	90.91	85.25	6.22
2005	90.51	84.87	6.23
2006	91.43	85.65	6.32
2007	91.69	85.82	6.41
2008	92.72	87.37	5.77
2009	91.50	84.79	7.33
2011	93.09	86.39	7.20
2012	93.61	87.01	7.05
Trend 2001–12	0.28	0.16	0.12

Source: Authors' calculation

ductive employment generation has been widely discussed among governments, international organizations, and other stakeholders in recent years, policies to create productive employment have yet to be clearly articulated. To ensure the generation of productive employment, Brazil has developed a system of formal contracts that provides considerable protection to employees, particularly those with low earnings. Still a large number of employees, especially those in the informal sector, do not enjoy the opportunity of securing contractual employment. Large inequity still exists, as Table 5.9 shows.

The percentage of employees with formal contracts has been low in Brazil at 56.55 % in 2001 and 67.93 % in 2012, increasing 1.1 percentage points annually during the period. In 2001, only 38.38 % of employees among the bottom 40 % of the population had formal contracts, indicating a high degree of inequity. Fortunately, inequity in contractual employment has declined sharply at 1.11 percentage points annually. In 2012, 50.20 % of employees among the bottom 40 % worked with a formal contract. The inequity index declined from 37.43 % in 2001 to 26.11 % in 2012. Thus, Brazil has made an impressive progress in enhancing productive employment, which has been broad-based

Table 5.9 Average and shared opportunity in employment with formal contracts in Brazil, 2001–12 (%)

Year	Average opportunity	Shared opportunity	Inequity
2001	56.55	35.38	37.43
2002	56.39	35.62	36.83
2003	57.67	36.50	36.72
2004	57.75	36.42	36.93
2005	58.79	38.30	34.85
2006	59.46	39.14	34.18
2007	61.11	41.35	32.34
2008	62.27	43.33	30.42
2009	62.92	43.71	30.53
2011	67.69	49.60	26.73
2012	67.93	50.20	26.11
Trend 2001–12	1.11	1.44	–1.11

Source: Authors' calculation

with benefits going proportionally more to the poorest 40 % of the population.

5.9.3 Opportunity in Educational Attainment

Educational attainment for a family can be defined as the average years of schooling of employed members of the household. As pointed out earlier, educational attainment largely contributes to the household's per capita labor income; hence, education is an opportunity everyone should avail. This section analyzes inequity in educational attainment.

Due to many changes in the Brazilian education system, a systematic increase in the schooling population occurred as the number of the locations of public schools increased, compulsory school attendance for the school-age population rose, and the initial age of compulsory education was reduced. As presented in Table 5.10, educational attainment in Brazil has expanded rapidly between 2001 and 2012. Completed years of schooling of the employed have, on average, increased from 6.64 years in 2001 to 8.59 years in 2012. This number is still low when compared to educational attainment in developed countries (e.g., 12.4 years in the U.S. and 11.6 years in Japan in 2011) or even the level of schooling

Table 5.10 Average and shared opportunity in educational attainment in Brazil, 2001–12 (%)

Year	Average opportunity	Shared opportunity	Inequity
2001	6.64	3.84	42.14
2002	6.82	4.05	40.60
2003	7.02	4.33	38.35
2004	7.21	4.54	36.97
2005	7.34	4.70	35.99
2006	7.57	4.96	34.40
2007	7.72	5.15	33.33
2008	7.93	5.45	31.26
2009	8.10	5.58	31.11
2011	8.35	5.89	29.40
2012	8.59	6.24	27.33
Trend 2001–12	0.17	0.21	−1.29

Source: Authors' calculation

obtained in other Latin American countries such as Chile (9.7 years in 2011). The average level of schooling of the poorest 40 % was only 3.84 years in 2001 but increased to 6.24 years in 2012. This low educational attainment among the poorest 40 % reflects limited access to education among adults with lower education and unfavorable socio-economic conditions that cause high repetition and dropout rates. As expected, there is large inequity in educational attainment between the average and the poorest 40 % of the population. The results show that the inequity was 42.14 % in 2001 but reduced to 27.33 % in 2012.

Although the improvement in educational attainment has contributed to a large reduction in inequality in Brazil, high inequity in education continues to exist. Nevertheless, Brazil has achieved commendable improvement in broadening its educational opportunities, which the poorest 40 % have taken up much more than the average population.

5.9.4 School Attendance

Brazil's *Bolsa Familia* has become the renowned conditional cash transfer program around the globe. It has dual objectives of immediate poverty reduction through direct cash transfers to the poorest population, and breaking the poverty cycle through investments in human capital, thus,

Table 5.11 Children 6–14 years old attending school in Brazil, 2001–12 (%)

Year	Average opportunity	Shared opportunity	Inequity
2001	95.33	93.33	2.10
2002	95.81	94.14	1.75
2003	96.11	94.60	1.58
2004	96.30	94.79	1.57
2005	96.70	95.55	1.20
2006	97.09	95.96	1.16
2007	97.14	96.20	0.98
2008	97.55	96.79	0.78
2009	97.65	96.97	0.69
2011	98.31	97.87	0.45
2012	98.28	97.79	0.50
Trend 2001–12	0.27	0.41	–0.15

Source: Authors' calculation

reducing poverty in the long run. Given that Brazil's *Bolsa Familia* was launched in 2003, it would be interesting to find out whether or not inequity in school attendance still exists. Empirical results for this inquiry are presented in Table 5.11.

In 2012, 98.28 % of the children aged 6–14 years attended school. Only 1.72 % of the children in that age group did not attend school due to reasons such as illness or disability. Even among the poorest 40 % of the population, 97.79 % of the children in this age group attended school in 2012. The gap in school attendance has narrowed over time, and there is hardly any inequity in school attendance especially in 2011–12. The conclusion that emerges from this analysis is that today, Brazil offers opportunity to almost all children to access school and to avail such opportunity. That is, the country has achieved almost universal education for the school-age children. As many impact evaluations have already shown, the CCT program has played a role in that achievement. Notably, Soares, Ribas, and Osorio (2007) argue that the *Bolsa Familia* program led to increased school attendance and declining dropout rates among the school-age children.

5.10 Concluding Remarks

In recent years, inclusive growth has become the new development paradigm. Related to this, the World Bank has proposed the idea of shared prosperity that focuses on the bottom 40 % of the population. This chapter extended the concept of shared prosperity to explore linkages between mean income, inequality, and social welfare on one hand, and different labor market characteristics and social policies, on the other. It demonstrated that the idea of shared prosperity can be a useful tool to answer many policy-related questions. This chapter emphasized the distinction between average prosperity and shared prosperity, both of which are linked by inequity. The chapter also developed the concept of shared growth and measured it in terms of gains (losses) in growth rates due to increased (decreased) equity in shared prosperity.

To explain the pattern of shared growth, a decomposition method was proposed. The method identifies the factors that contribute to the shared growth, including labor market characteristics and social policies. Finally, the idea of share prosperity was further extended to shared opportunities, leading to a new measure of inequality in opportunities.

The main findings that emerged from the empirical analysis are as follows:

- Trends in shared and average prosperity indicated that the poorest 40 % has performed consistently better than the average population in Brazil during 2001–12. While average prosperity has increased at 3.64 % annually, the corresponding figure for shared prosperity was 6.37 %. These led to an annual gain of the growth rate of 2.73 % for the period.
- In identifying contributions of shared prosperity by income components, labor income has played a dominant role in shared prosperity. Nevertheless, the contribution by the labor income has declined at 0.53 percentage points annually during 2001–12.
- For the contributions of non-labor income components, *Bolsa Família* Program led to an increase in shared prosperity by 0.67 % in 2001 and 7.08 % in 2012. This suggests that the program's contribution has

risen at 0.52 percentage points annually during the period. By contrast, the contribution of BPC has also increased but at a slower annual rate of 0.16 percentage points. Similarly, the corresponding contribution for social security has remained stable at about 15 %. Overall, while incomes from social programs have become more important for shared prosperity over time, labor incomes have become less so.

- Relative inequity in Brazil sharply declined during 2001–12. Once again, labor income has been the most dominant factor for this decline, contributing to an annual reduction of 0.40 percentage points. In contrast, BPC has contributed to the reduction in inequity by only 0.01 annual percentage points. The sharp reduction in relative inequity has been contributed largely by labor income.
- Labor income for the bottom 40 % of the population grew at an annual rate of 5.68 %, which is predominantly explained by the productivity growth of 6.06 %. The completed years of schooling for the bottom 40 % increased at an annual rate of 4.26 %, while the average returns from schooling increased at 1.80 % annually. Thus, it can be concluded that education has played the key role in promoting shared prosperity in Brazil. While employment and labor force participation rates have negatively impacted the shared growth, factors such as increased productivity, years of schooling, and returns from education, have positively contributed to the shared growth.
- Shared growth of per capita household income was 2.74 % per annum in 2001–12, of which 1.47 % is explained by the expansion of education and 0.67 % by the increase in the returns from schooling. Contributions of BPC and social security are relatively small, while increases in the employment rate and the labor force participation rate have negative impacts in shared growth.
- The employment rate increased at 0.28 percentage points annually during 2001–12. It improved among the poorest 40 %, but at the slower rate of 0.15 percentage points. These results indicate that employment opportunities are not equitable across population, and have even worsened over time.
- The percentage of employees with a formal contract increased at 1 percentage point annually, with the increase better among the bottom 40 % at 1.45 percentage points annually. Thus, inequity in contrac-

tual employment has sharply declined at 1.17 percentage points annually. Brazil has made an impressive progress in generating productive employment, especially for the poorest 40 % of the population.

- Completed years of schooling for the employed increased by 0.17 years annually. Educational attainment for the poorest 40 % was only 3.84 years in 2001, indicating a large inequity of 42.14 %. Fortunately, educational attainment for the bottom 40 % increased overall in the 2000s, reaching 6.37 years in 2012. Such an increase in educational attainment led to a decline in educational inequity across population at 1.26 percentage points annually. While high inequity in educational attainment continues to exist, Brazil has expanded its educational opportunities relatively more to the poorest 40 % of the population.
- Brazil has almost achieved universal education among the children 6–14 years old. In 2012, 98.03 % of children among the poorest 40 % attended school. The results revealed that there is little inequity in school attendance among school-age children.

6

Income Inequality and Social Well-Being

6.1 Introduction

That inequality matters is gaining ground in development affairs. Reducing income disparities across the population is on top of the agenda of many governments today. High inequality may imply a large concentration of people either at the top or at the bottom of the distribution, thereby hollowing out the middle-income group. This can create social tension in society that may result in political instability and social conflicts.

The widening disparity between the top 1 % and the remaining 99 % of a population is a persistent topic in recent public debates. A number of books dealing with various aspects of inequality have sparked interest in the impacts of uneven distribution of income on growth and development. These include *The Price of Inequality* (2012) by Joseph Stiglitz, *Capital in the Twenty-First Century* (2014) by Thomas Piketty, *Inequality: What Can Be Done?* (2015) by Anthony Atkinson, and *The Globalization of Inequality* (2015) by François Bourguignon.

Inequality comes at the expense of a less stable and less efficient economic system, Stiglitz argues in his book. Piketty's book emphasizes the

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linkage between inequality in income and wealth while Bourguignon's focuses on globalization and inequality. Atkinson's book sets out concrete policy proposals that could bring about a shift in the distribution of income towards less inequality. These publications underscore that high inequality is undesirable in a society and thus requires appropriate policy actions.

Inequality matters for two reasons: (i) rising inequality slows down poverty reduction; and (ii) high inequality could weaken the basis of growth. Changes in poverty depend on both the growth rates in mean income and inequality in the distribution of benefits from growth. While an increase in mean income reduces poverty, rising inequality exacerbates poverty; hence, the net effect on poverty reduction will be slower with increasing inequality.[1] Higher initial inequality tends to reduce the impact of growth on absolute poverty, as Ravallion (1997) found in a study that examined the relationship between initial inequality and the rate of poverty reduction using cross-country data with 41 spells for 23 countries.

The impacts of income inequality on growth have been extensively discussed in the literature, but empirical findings point to different directions. While some suggest that inequality hurts growth, some argue that it actually enhances growth. A recent study by Dabla-Norris, Kochhar, Suphaphiphat, Ricka and Tsounta (2015) suggested a significant linkage between inequality and growth of gross domestic product (GDP). Using cross-country data from 159 advanced and developing economies, the study found that if the Gini index increases by one percentage point, the growth rate of GDP slows down by 0.07 percentage points. The study also found that when the income share of the richest 20 % increased by one percentage point, growth in GDP was 0.08 percentage points lower in the following five years, which suggests that the benefits do not "trickle down". In contrast, Mirrlees (1971) and Lazear and Rosen (1981) found that high inequality may increase growth if it provides incentives for people to work harder, invest, and innovate. Kaldor (1955) and Bourguignon (1981) also found a positive relationship between inequality and growth,

[1] Kakwani (2000) developed a decomposition method that explains changes in poverty in terms of growth and inequality effects.

as higher inequality encourages aggregate savings and capital accumulation given the rich's lower propensity to consume.

Per capita GDP and related inequality measures are widely used to appraise the economic welfare of different countries. However, these measures have been subject to many criticisms because of their failure to give any indication of how the total output of an economy is distributed among the population.[2] Many researchers in this field, most notably Sen (1984, 1985), have raised concerns whether these income measures adequately reflect the well-being of people. In 2010, Stiglitz, Sen, and Fitoussi identified the limitations of GDP as an indicator of economic performance and social progress. In *Mismeasuring Our Lives: Why GDP Does Not Add Up*, the authors stressed that GDP and its related measures are inappropriate as the sole measures of living standards or well-being. While GDP gives an indication of a society's economic success, it masks inequalities within societies and does not take into account the negative effects of economic progress such as the pollution of the environment. As an alternative to GDP as a measure of well-being, Sen (1985) introduced a conceptual framework for defining and measuring well-being in terms of functionings and capabilities. This framework will be the basis for measuring well-being in this chapter.

There is scant literature pointing to the conclusion that income inequality may impede growth in well-being. For instance, Deaton and Paxson (2001) compared the experiences of the U.S.A. and Britain on the evolution of incomes and income inequality on mortality rates and found no evidence that links income inequality and mortality rates. This chapter primarily aims to measure the impact of income inequality on well-being. It will explore whether inequality hurts well-being, and if so, to what extent. This chapter argues that the price of income inequality is far higher than predicted in the literature. Findings reveal that income inequality significantly hurts various dimensions of well-being.

Although the debate on inequality is largely dominated by income inequality, non-income disparities also exist. As Sen (1995) pointed out, society should also be concerned with inequality in different dimensions

[2] Kakwani (1981, 1986) developed welfare measures that account for the income distribution of the population.

of well-being such as health, education, employment, and living conditions, among others. This chapter examines inequality in different dimensions of well-being, with the empirical analysis carried out in the context of Brazil.[3]

This chapter uses data from the recently released 2013 Atlas of Human Development in Brazil, which was developed by the Brazilian Research Institute for Applied Economics, the United Nations Development Program, and *Fundação João Pinheiro* of Minas Gerais. The Atlas provides the human development index for more than 5000 municipalities in Brazil and over 1000 socio-economic indicators for these localities based on census data for 1991, 2000, and 2010.[4] Using these data, this chapter analyzes levels and distribution in well-being in Brazil, and explores the extent to which inequality affects well-being.

6.2 What is Well-Being?

Well-being used to be solely assessed by per capita GDP and related income measures but as dissatisfaction with these measures became widespread in the 1970s, the emphasis shifted to finding alternative measures of development. Social indicators, quality of life, and basic needs were accordingly suggested as new approaches in some of the most influential studies that include those by Hicks and Streeten (1979), Hicks (1979), Drenowski (1974), Morris (1979), Sen (1973), Streeten (1979), Sheehan and Hopkins (1979), and Dasgupta (1990). These approaches were evidently related to the concept of well-being, but lacked a unifying conceptual framework for defining and measuring well-being. Such a framework was formally developed only in the 1980s by Sen (1984, 1985, 1987) who conceptualized well-being in terms of functionings and capabilities. Following Kakwani and Subbarao (1994), this framework is briefly discussed below.

[3] Using the idea of equivalent length of life, Silber (1983) developed an inequality measure in the distribution of number of years lived by individuals. This is an innovative approach, accounting for the distribution of length of life enjoyed by individuals in a society.

[4] The Atlas is available on the site http://www.atlasbrasil.org.br/2013/

Income is the primary currency by which people consume commodities and services. The higher the income, the greater the command people have over commodities or services, which in turn provide people with the means to lead a better life. Thus, the possession of commodities or opulence is closely related to the quality of life people lead. However, it is merely a means to an end. As Sen (1985) writes, "ultimately, the focus has to be on what life we lead and what we can or cannot do, or can be or cannot be". Using this logic, Sen's ideas of functionings and capabilities were born. While functioning is an achievement, capability is the ability to achieve. Functionings are directly related to the kind of life people actually lead, whereas capabilities are associated with the freedom people have in choosing their lives or functionings that they value. According to Sen's conceptualization, well-being should be evaluated according to the extent of freedom people have to achieve the functionings that they value. Therefore, it is a multidimensional concept defined in terms of a set of capabilities that reflect the extent of freedom people have in leading their lives.

6.3 Selection of Capabilities

After defining well-being, the next step is to select appropriate capabilities that people value. Ideally, the measurement of well-being should incorporate all capabilities that enhance well-being, but this may not be feasible from an empirical perspective.

The United Nations Research Institute for Social Development (UNRISD) in Geneva has been concerned with the construction of a standard of living index. It initially compiled a set of 100 indicators of well-being but the list was reduced to 73 by eliminating some indicators that had insufficient data or obvious defects. After applying several other selection criteria, the number of indicators was reduced to nine.

One of the criteria used for selection was correlation. Indicators showing relatively low average correlations with the mass of other development indicators were not selected. This uses a purely statistical method of selecting an indicator and has no economic rationale. One can also argue that indicators with high correlation should not be selected because they have little additional information. According to Alkire (2007), one distinct feature of the capability approach is the emphasis it places on identifying freedom that people value. The choice of relevant capabilities requires making a value judgment rather than undertaking a technical exercise. The purely statistical method of selecting the domain of capabilities, therefore, has no link with what freedom people value because this approach is completely devoid of any value judgment.

Using various research and concrete initiatives developed around the globe, Stiglitz, Sen and Fitoussi's 2010 report identifies several key dimensions that should be considered in measuring well-being. These dimensions are: (i) material living standards such as income, consumption, or wealth; (ii) health; (iii) education; (iv) personal activities including work; (v) political voice and governance; (vi) social connections and relationships; (vii) environment, both present and future conditions; and (viii) insecurity of economic as well as physical nature. These represent a comprehensive list of dimensions that shape well-being. Nevertheless, the report does not recommend measurable indicators corresponding to each of these dimensions. The next section discusses indicators of well-being based on this framework.[5]

6.4 Indicators of Well-Being

According to Sen, individual achievements—not the means that individuals possess—should be the focus of the conceptualization of well-being. Variables that reflect results rather than inputs should therefore be selected as indicators. In Sen's view, income is merely a means to an end. But the means cannot be undermined in any evaluation of well-being. If the means is highly unequally distributed, or if a large proportion of the population suffers from income deprivation, the well-being of society would surely be lower. Hence, the indicators of material well-being can be based on income or non-income dimensions. In measuring mate-

[5] Deutsch et al. (2015) have used the questionnaire and data from the Afrobarometer survey to develop indicators for different dimensions of well-being.

rial well-being, the possession of wealth cannot be ignored because it provides people with means to consume goods and services they value and enhances their living standards. This study does not deal with wealth mainly due to unavailability of information on wealth in the data used for the study.

There is a distinction to be made between material and non-material well-being. While material well-being includes indicators that are measured in income (or consumption) space, non-material well-being includes indicators in non-income space such as health, education, living conditions, and personal activities including work. However, indicators reflecting certain dimensions are not considered in this study. These are political voice and governance, social connections and relationships, environment, and insecurity of economic as well as physical nature.

Box 6.1 presents a set of well-being indicators identified in this chapter. Our analysis does not incorporate many other social and psychological characteristics suggested by the term "quality of life" such as security, justice, freedom of choice, and human rights. In this context, the analysis may be deemed rather limited, which is mainly due to non-availability of the appropriate data. While the analysis may appear narrow, the chapter uses a set of indicators that covers a wide range of important capabilities influencing human well-being.

Box 6.1 Indicators of Well-Being

(a) Material well-being
- (i) Per capita income
- (ii) Gini index of per capita income
- (iii) Income share of 1st quintile
- (iv) Income share of 2nd quintile
- (v) Income share of 3rd quintile
- (vi) Income share of 4th quintile
- (vii) Income share of 5th quintile
- (viii) Percentage of poor
- (ix) Percentage of extremely poor

(continued)

(b) Health
- (i) Life expectancy at birth
- (ii) Infant survival rate
- (iii) Child survival rate

(c) Education
- (i) Adult literacy rate among people ages 15 and above
- (ii) Expected number of years of schooling for 18 year-olds
- (iii) Proportion of people ages 18 and above who completed high school
- (iv) Proportion of people ages 25 and above who completed higher education
- (v) Proportion of children ages 11–14 attending school
- (vi) Proportion of children ages 15–17 attending school
- (vii) Proportion of youth ages 18–24 attending school

(d) Living Conditions
- (i) Proportion of population living in households with piped water
- (ii) Proportion of population living in households with a toilet
- (iii) Proportion of population living in households with garbage collection
- (iv) Proportion of population living in households with electricity
- (v) Proportion of population living in households with adequate sanitation

(e) Labor Market Activities
- (i) Employment rate among people ages 18 and above
- (ii) Employment rate among people ages 18 and above with formal contracts
- (vi) Employment rate among people ages 18 and above with at least one minimum wage
- (vii) Labor force participation rate among people ages 18 and above

As noted earlier, this study utilizes Brazil's census data at the municipal level available for 1991, 2000, and 2010. It thus uses the panel data for 5565 municipalities in the years indicated. For per capita income, this study uses information on the average income of each municipality in the dataset. To calculate per capita income, incomes of all residents are added up by municipality, the sum of which is then divided by the number of people living in the municipality. Population census does not generally contain information on income, but in Brazil there is a sample in the census population for which income information is collected. Population weights are used to extend this information to the total population of the municipality and that of the entire country. The Gini index and quintile shares are calculated from the sample. The percentage of poor and extremely poor are identified based on the poverty lines of R$140 and R$70 per month at 2010 prices, respectively.

Another indicator of well-being is life expectancy at birth, which indicates the number of years a newborn infant would live if patterns of mortality prevailing for all people at the time of birth were to stay the same throughout his life. It is an index of long life, which can be influenced by several input variables such as nutrition, clean water supply, sanitation, and access to medical services. Those who live longer lives suffer less from morbidity, ill health, and hunger. Hence, life expectancy at birth can be regarded as an indicator of achievement and therefore, becomes eligible as an indicator of well-being.

Calculating life expectancy at birth is complex and involves several phases. Computing life expectancy at the regional level is not an easy task and it is even more challenging at the municipal level. This is partly because of the migration taking place within the country which makes civil records inadequate. To calculate life expectancy at birth per municipality, indirect methods were used to get estimates of mortality. Information is based on self-reported number of live births and the number of living children at the time when the census was conducted. This information was obtained after relevant questions were asked to women in reproductive age from a sample of the population census. From this information, it is possible to calculate the proportion of deaths. Some modeling is required to turn these estimated proportions into likelihood ratios of death. The next step is to apply these odds ratios to life tables, from which the life expectancy at birth is extracted.

Infant and child mortality rates are also indicators of well-being as survival among infants and children is important for the well-being of the society. The infant mortality rate is the number of infants per one thousand live births in a given year who die before reaching their first birthday. Similarly, the child mortality rate is the probability per 1000 that a child will die before her fifth birthday. Poor sanitation, contaminated drinking water due to susceptibility to water-borne diseases, and poor nutrition are some of the causes of high mortality rates among infants and children. Poor nutrition reduces resistance to infection of infants and children, and various infections in turn reduce the absorption capacity of the body. Consequently, a child who is seriously malnourished faces reduced chances of survival. High infant and child mortality rates thus reflect critical aspects of well-being.

Unlike other indicators, infant and child mortality rates are negatively associated with well-being. To be consistent with other positive indicators, the infant and child mortality rates were converted to infant and child survival rates. These indicators now represent the probabilities of survival for infants and children. Although infant or child survival rates are the main determinants of life expectancy at birth, they should be included as separate well-being indicators because they are more sensitive to poor hygienic conditions and more susceptible to water-borne diseases and malnutrition.

Educational attainment is another important factor that affects well-being. Education has long been dubbed as "the great equalizer", given the perception that higher education may enable an individual to get higher paying jobs. Higher paying jobs, of course, raise a person's standard of living. Thus, it is generally believed that highly educated persons have higher standards of living than their poorly educated counterparts.

Among the educational indicators, the adult literacy rate can be considered as the ultimate achievement of a society. Clearly, if a person is literate, he is open to a large number of other capabilities such as communicating more effectively with others, reading and writing, and participating in political processes, to name a few. This study also finds that there is a significant positive correlation between literacy rate and life expectancy at birth. The municipalities with a higher literacy rate have a significantly higher life expectancy at birth, as well as lower infant and child mortality rates. This study uses two additional indicators of educational attainment: (i) proportion of people aged 18 years and above who have completed high school and (ii) proportion of people aged 25 years and over who have completed a higher education. In addition, three indicators related to school attendance among children at school-age group are also included in the analysis. Attendance is an important factor in the academic performance of students. For instance, 22 % of students' academic performance in 398 secondary schools in Delta State, Nigeria was influenced by attendance (Oghuvbu 2010).

Living conditions greatly matter in maintaining healthy lives and, ultimately, in achieving well-being. Poor sanitation and contaminated drinking water can cause contraction of many infectious diseases, contributing to poor health. Kakwani and Son (2015) point out that severe malnutrition among children is prevalent in India, but this may not be solely because of food deprivation. As rightly stated in The Economist (2015), "one reason Indians are less well-nourished than Africans is that more Indians defecate outdoors so more contract diarrhea and other diseases that makes it harder for children, specially, to absorb the nutrients they consume". A population deprived of piped water, toilet, and adequate sanitation is highly susceptible to infectious diseases, resulting in lower well-being.

Well-being is also influenced by income generated through employment in the labor market. As discussed, income serves as a means to improve well-being by allowing people to consume goods and services that enable them to lead better lives. Those unemployed are likely to have lower standards of living compared to their employed counterparts. Moreover, employment itself has an intrinsic value. Besides material reward, jobs provide people with satisfaction in life. Unemployed people express lower happiness and life satisfaction than employed individuals (World Bank 2013). In improving well-being, the quality of jobs should also be noted. For instance, those employed in the informal sector work long hours under poor working conditions, but with subsistence level of earnings. In developing countries, about 60 % of workers are engaged in some form of activities in the informal sector (International Labor Organization and World Trade Organization 2009). For instance, nearly one fourth of the labor force in Brazil is employed in the informal economy, more than

50% in Sri Lanka, and almost 75% in the Philippines (ILO 2012a). As such, this study includes the proportion of those employed in a formal sector or with a formal contract as an indicator of well-being.

Similarly, the rate of productive employment is included as an indicator of well-being in this study. The productive employment rate is defined as the proportion of those employed who are earning at least one minimum wage. Productive employment ensures that a worker and his dependents have a consumption level above the poverty line (ILO 2012b). As such, productive employment generation is an integral component of inclusive growth efforts, as put forward by organizations like the International Labor Organization and the World Bank. Although productive employment generation has been widely discussed among governments, international organizations, and other stakeholders in recent years, policies to create productive employment have yet to be clearly articulated. For instance, Brazil has a system of minimum wage that helps workers escape from poverty. Those earning less than the minimum wage may be deemed low-paid workers who are likely to suffer from relative or even absolute deprivation.

Finally, participation in the labor market is an important source of freedom people ought to have. Labor force participation shapes well-being given the returns from work—in terms of wages and accumulation of human capital—that increase labor productivity. Labor force participation is particularly an important indicator of women's well-being for several reasons. First, the number of female-headed families and single-woman households is on the rise which means that the segment of the female population whose economic well-being greatly hinges on work and earnings is also becoming larger. Second, women's work and earnings in married-couple families are likely to affect the distribution of resources and the processes of household decision making. Third, participation increases the level of labor market experience of women, which is an important determinant of the gender pay gap (Spain and Bianchi 1996). Thus, this study also includes the labor participation rate as an indicator of well-being.

This study does not attempt to aggregate different dimensions of well-being into a single index, although several attempts have been made in that direction (Morris 1979; United Nations Development Program

1990; UNRISD 1972). While a single index of well-being allows us to rank countries, constructing the index has many pitfalls. Major drawbacks of arriving at such an index stem from a method of aggregating different dimensions of well-being and resulting weights that should be given to different dimensions of well-being in the aggregation. Morris (1979) constructed a single index by taking a simple average of three dimensions: life expectancy at birth, infant mortality rate, and literacy rate. While his index is simple to construct, it is too arbitrary because there is no economic rationale for assigning different dimensions of well-being an equal weight.

An alternative approach suggested in the literature is to use a method of principal components in which weights of indicators are determined as proportional to the leading principal components of the correlation matrix. The rationale behind this approach is that the data determine the "optimal" weights that capture the largest variation in indicators. There is also no economic justification for maximizing the variation in the component indicators. Weighing different dimensions of well-being requires making a normative judgment about the relative importance of different dimensions. For example, is health more important than education or vice versa? The weights determined by purely statistical techniques do not reflect our relative valuation of different dimensions.

In this regard, Sen (1989) has argued that it is not necessary to convert a vector of capabilities into one index reflected by one real number. According to Sen, well-being is inherently plural and should not be seen as a one-dimensional measure like that of weight or height. Thus, this chapter adopts a partial ordering approach in which the overall well-being is evaluated according to each of the capabilities. This approach is applied in assessing the well-being of Brazil, as discussed in the next section.

6.5 Levels and Performance of Well-Being in Brazil

Brazil is the largest and most populous country in Latin America with some 190 million people. It led Latin America in growth from the 1960s to the early 1980s. However, growth was accompanied by rising inequality and deteriorating social development. As economic growth slowed in the mid-1980s to mid-1990s, the 1980s and 1990s have been described as the *lost decades* of development (Todaro and Smith 2003). Brazil's economy rebounded in the 2000s, with growth picking up, inequality starting to decline, and poverty falling sharply. Health, education, and living conditions have also improved markedly. Table 6.1 depicts overall well-being in Brazil in 1991, 2000, and 2010 based on the indicators derived from 5565 municipalities.

Per capita household income in the local currency was converted to U.S. dollars at 2011 purchasing power parity (PPP). The average per capita income in 1991 was \$10.75 per day, which increased to \$14.21 per day in 2000 and further to \$19.05 per day in 2010. Thus, the average standard of living per person increased by \$3.46 daily in 1991–2000, and further by \$5.24 daily in 2000–10. The absolute increase in the average standard of living was higher in 2000–10 than in 1991–2000. In relative terms, per capita income increased by3.10 % annually in 1991–2000 and 3.25 % annually in 2000–10.

Inequality, as measured by the Gini index, increased from 54.61 % in 1991 to 56.77 % in 2000, but dropped to 53.23 % in 2010. Thus the Gini index increased at an annual rate of 0.24 percentage points in 1991–2000, but then decreased sharply at an annual rate of 0.35 percentage points in 2000–10. This study's estimates using Brazilian national household surveys (PNADs) show that inequality continued to decline monotonically in 2001–12.

Inequality can also be assessed by the income shares of the poorest and richest quintiles. The income share of the poorest quintile declined from 3.55 % in 1991 to 2.96 % in 2000, but then increased to 3.52 % in 2010. Meanwhile, the income share of the richest quintile rose from 59.57 % in 1991 to 61.19 % in 2000, but then fell sharply to 57.98 % in 2010. The changes in income shares of the poorest and richest quintiles suggest that inequality worsened in 1991–2000 but improved during 2000–10.

The incidence of poverty has decreased from 1991 to 2000 and through 2010, albeit its decline was sharper during 2000–10. Brazil implemented the conditional cash transfer program known as *Bolsa Familia* in 2003 and the program is deemed to have contributed to poverty reduction during the 2000–10 period. *Bolsa Familia* contributed a 12 % reduction

Table 6.1 Average well-being indicators in Brazil, 1991–2010

	Actual values			Annual change	
Indicators	1991	2000	2010	1991–2000	2000–10
Material well-being					
Per capita income in 2011 PPP	10.75	14.21	19.05	0.38	0.52
Income share of 1st quintile (%)	3.55	2.96	3.52	–0.07	0.06
Income share of 2nd quintile (%)	7.15	6.65	7.56	–0.05	0.09
Income share of 3rd quintile (%)	11.25	10.88	11.93	–0.04	0.11
Income share of 4th quintile (%)	18.48	18.31	19.01	–0.02	0.07
Income share of 5th quintile (%)	59.57	61.19	57.98	0.18	–0.32
Average Gini index (%)	54.61	56.77	53.23	0.24	–0.35
% of poor	38.11	27.87	15.19	–1.14	–1.27
% of extremely poor	18.63	12.45	6.62	–0.69	–0.58
Health					
Life expectancy at birth (years)	65.55	69.95	74.39	0.49	0.44
Infant survival rate (%)	95.89	97.22	98.35	0.15	0.11
Child survival rate (%)	94.92	96.69	98.17	0.20	0.15
Education					
Adult literacy rate (% of people ages 15 and above)	79.48	86.47	90.04	0.78	0.36
Expected years of schooling for 18 year-olds	8.26	8.97	9.63	0.08	0.07
High school completion (% of people ages 18 and above)	17.06	23.86	37.24	0.76	1.34
Higher education completion (% of people ages 25 and above)	5.28	6.34	10.83	0.12	0.45
Children 11–14 years old attending school (%)	79.54	94.44	96.24	1.66	0.18
Children 15–17 years old attending school (%)	55.21	77.79	83.58	2.51	0.58
Youth 18–24 years old attending school (%)	19.68	31.03	30.62	1.26	–0.04
Living conditions					
Population with piped water (%)	71.38	79.60	92.06	0.91	1.25
Population with toilet (%)	67.05	76.73	87.17	1.08	1.04
Population with garbage collection (%)	70.85	88.19	96.17	1.93	0.80
Population with electricity (%)	84.89	93.45	98.58	0.95	0.51
Population with adequate sanitation (%)	89.67	91.08	93.88	0.16	0.28
Labor market activities					
Employment rate (% of people ages 18 and above)		56.48	61.45		0.50

(*continued*)

Table 6.1 (continued)

Indicators	Actual values			Annual change	
	1991	2000	2010	1991–2000	2000–10
Employment rate with formal contracts (% of people ages 18 and above)		28.46	35.88		0.74
Productive employment rate (% of people ages 18 and above)		30.83	47.40		1.66
Labor force participation rate (% of people ages 18 and above)		65.48	66.32		0.08

Source: Authors' calculations
Note: *ppp* purchasing power parity

in poverty based on the poverty gap measure and 19 % when the poverty severity measure is used (Zepeda 2006).

Brazil's case offers an example of a country having growth without development (Todaro and Smith 2003). In the 1980s and early 1990s, its human development lagged behind many other middle-income countries. For instance, Brazil's life expectancy at birth was 69.55 years in 1991, which was of similar magnitude as in many low-income developing countries like Sri Lanka. But there has been a marked improvement in the next two decades. The life expectancy at birth increased to 74.39 years in 2010, although it still compares unfavorably with 79 years in South Korea.

The infant and child survival rates have improved markedly during the past two decades. These rates exceeded 98 % in 2010, while their corresponding rates are lower in countries like South Korea (over 99 %). In education, Brazil's adult literacy rate was 79.48 % in 1991, increased to 86.47 % in 2000, and further to 90.04 % in 2010. While the literacy rate in Brazil has improved remarkably over the two decades, it still lags behind countries at similar income level such as Costa Rica (96 %).

This chapter explores the impact of income inequality on human development in Brazil. The findings demonstrate that Brazil's stubbornly high inequality in the 1980s and 1990s might have been the main cause of sluggish human development the country experienced at the time.

Table 6.1 presents the well-being indicators selected for this study. Marked improvement in education, health, living conditions, employment, and poverty reduction during the past two decades in Brazil can be observed. Even though growth has slowed in recent years, Brazil can no longer be considered as a country without development. Since 2001, inequality in Brazil has been sharply falling. This decline in inequality has in turn improved the country's growth prospect in the long run. According to a study by the International Monetary Fund in 2015, a reduction of one percentage point in the Gini index leads to an increase of 0.07 percentage points in the growth rate of GDP.

6.6 Inequality of Well-Being

In the previous section, we have assessed the levels and performance of well-being in Brazil based on aggregate indicators. Ideally, we should be concerned with well-being indicators at individual or group level rather than aggregate, particularly if there is an uneven distribution of well-being across social and economic groups. Dasgupta (1990) correctly points out that we should be interested in the distribution of well-being across gender, caste, race, and income, among others. This section discusses the study's framework for measuring inequality of well-being.

Inequality measured in income space is derived from a social welfare function. Once the social welfare function is specified, an inequality measure is precisely known. A social welfare function in income space can be defined as

$$W = W\left(x_1, x_{2,\ldots\ldots\ldots\ldots,} x_n\right)$$

where n is the total number of persons in society. Following Atkinson (1970), the relationship between social welfare function and inequality is given by

$$W = \mu\left(1 - I\right) \tag{6.1}$$

where μ is the mean income and I is the inequality measure that is interpreted as the percentage loss of social welfare because of inequality

Assuming that x is a random variable with density function (x), then Sen's (1974) social welfare function is defined as

$$S = 2\int_0^\infty \left[1 - F(x)\right] xf(x)\,dx \tag{6.2}$$

which is the weighted average of individual incomes, where weights on income x depend on the percentage of individuals in the society who are richer than the person with income x. Sen's social welfare function is thus written as

$$S = \mu\left(1 - G\right) \tag{6.3}$$

where G is the Gini index. Sen's social welfare function is also referred to as the Gini social welfare function.

To measure inequality of well-being, we need to extend the idea of social welfare function to social well-being function. As discussed in the previous section, well-being is a multidimensional concept and there is no economic rationale to combine all dimensions into a single index. Given this, we define a social well-being function for each dimension separately:

$$SWF = SWF\left(y(x_1), y(x_2) \ldots\ldots\ldots\ldots y(x_n)\right) \tag{6.4}$$

where $y(x_i)$ is the well-being of an ith individual with income x_i.

Similar to Sen's social welfare function, we can have a social well-being function:

$$SWF\left(\tilde{y}\right) = 2\int_0^\infty y(x)\left[1 - F\left(y(x)\right)\right] f(x)\,dx \tag{6.5}$$

where $F(y(x))$ is the probability distribution function of $y(x)$ when individuals are arranged in ascending order of their well-being. The social well-being function in (6.5) is the weighted average of individual well-being, where weights on well-being $y(x)$ depend on the proportion of people in society who have a higher well-being than the person with well-being $y(x)$. In this formulation, the person with the lowest well-being is the most deprived in the society and thus given the highest weight; weights decrease as well-being increases. This social well-being function can be written as

$$SWF\left(\tilde{y}\right) = \mu_y\left(1 - G_y\right) \tag{6.6}$$

where μ_y is the average well-being of the society and G_y is the Gini index of well-being.

G_y in (6.6) can be interpreted as the percentage loss of social well-being due to the unequal distribution of well-being in society. Like the Gini index of income, G_y takes the value 0 when everyone in the society enjoys the same degree of well-being and 1 when there is extreme inequality in well-being. The larger the value of G_y, the greater the disparity in well-being in society is. Inequality in the literature has largely concentrated on income inequality. But Sen (1995) has emphasized that society should also be concerned with inequality in non-income dimensions of well-being such as health, education, employment, and living conditions. While the Gini index G in (6.3) measures inequality of means, G_y measures inequality of ends. Both means and ends are important in assessing social disparities.

The social well-being function in (6.4) is defined in terms of individuals' achievement or attainment therefore our social objective is to maximize this function. Since well-being is measured by bounded indicators such as health status, educational attainment, or nutritional intake, one can focus on attainments or shortfalls of attainments from the maximum possible level of attainment (Sen 1992). The shortfall is a negative indicator of well-being. For instance, infant survival rate is an indicator of attainment whereas the infant mortality rate is an indicator of shortfall. Like social well-being defined over the space of attainment, we can define a social ill-being function in the space of shortfall. Our social objective then is to minimize the social ill-being function. If the upper bound of attainment is the same for all individuals, then a society will achieve the same objective either by maximizing a social well-being function or minimizing a social ill-being function. Thus, social well-being and ill-being functions are a mirror image of each other; as the social well-being function ranks attainment distributions, the social ill-being function ranks shortfall distributions. This requirement will be called rank consistency:

Rank consistency: Suppose $\tilde{y}$ and $\tilde{y}^*$ are any two distributions of attainment, and $\left(a-\tilde{y}\right)$ and $\left(a-\tilde{y}^*\right)$ are the corresponding distributions of shortfall, respectively. Given this, we can write

$$SWF\left(\tilde{y}\right) \geq SWF\left(\tilde{y}^*\right) \text{ if and only if } SIF\left(a-\tilde{y}\right) \leq SIF\left(a-\tilde{y}^*\right) \quad (6.7)$$

where a is the maximum possible attainment assumed to be the same for all individuals, $SWF\left(\tilde{y}\right)$ is the social well-being function defined over the distribution of attainments, and the $SIF\left(a-\tilde{y}\right)$ is the social ill-being function defined over the distribution of shortfalls.

In the derivation of *SWF* in (6.5), the person with the lowest attainment was given the highest weight as weights decrease monotonically as individuals' attainments increase. But in deriving *SIF*, the person with the lowest shortfall receives the lowest weight, as weights increase monotonically as individuals' shortfalls increase. Therefore, the social ill-being function can be defined as

$$SIF\left(a-\tilde{y}\right) = 2\int_0^\infty \left(a-y(x)\right)F\left(a-y(x)\right)f(x)\,dx \quad (6.8)$$

where $F\left(a-y(x)\right)$ is the probability distribution function of shortfalls when individuals are arranged in ascending order of their shortfalls. Integrating (6.8) by parts, we obtain

$$SIF\left(a-\tilde{y}\right) = \mu_{a-y}\left(1+G_{a-y}\right) \quad (6.9)$$

where μ_{a-y} is the average shortfall of the society and G_{a-y} is the Gini index of shortfalls, which from (6.9) can be interpreted as the proportional gain in social ill-being. It is easy to verify that

$$\mu_y G_y = \mu_{a-y} G_{a-y}. \tag{6.10}$$

Substituting (6.10) into (6.6) and (6.9) and using $\mu_{a-y} = a - \mu_y$, we obtain

$$SWF\left(\tilde{y}\right) + SIF\left(a - \tilde{y}\right) = a. \tag{6.11}$$

If the upper bound of attainment is the same for all individuals, equation (6.11) demonstrates that the social well-being function will rank distributions in the same way as the social ill-being function. Thus, the social well-being and social ill-being functions both satisfy the rank consistency requirement, as stated in equation (6.7).

It is noted from (6.10) that the Gini index of attainments is not equal to the Gini index of shortfalls. Moreover, the two Gini indices will not rank any distribution in the same way unless the means for the distributions of attainments and shortfalls are equal. The divergence in rankings by the two Gini indices has attracted much attention in the literature. Studies by Lambert and Zheng (2011), Bosmans (2013), Erreygers (2009), Lasso de la Vega and Aristondo (2012), and Permanyer (2015) have explored if there exists any reasonable measure of relative inequality that can rank distributions consistently. A consensus emerging from the literature is that all relative measures of inequality fail to provide consistent rankings. Attainment inequality and shortfall inequality do not necessarily mirror one another. This is expected because the Gini index of attainments has a different interpretation from the Gini index of shortfalls. The Gini index of attainments is interpreted as the proportional loss of social well-being, whereas the Gini index of shortfalls refers to the proportional gain in social ill-being. Although the two social functions rank all distributions consistently, their implicit Gini indices are not rank-consistent.

Attainment inequality and shortfall inequality are two sides of the same issue and thus both should be examined. If the two inequalities result in different rankings, a question arises as to which one should be selected in assessing inequality in well-being. Considering inequality of shortfalls, our concern would be about people's sufferings; accordingly, the social objective would be to equalize sufferings. But it makes sense to equalize people's attainments or achievements rather than sufferings. Given this, this study focuses on inequality in achievements.

6.7 Linkage Between Ends and Means

An alternative social well-being function can be derived by combining both means and ends. In deriving the social well-being function defined in (6.5), an individual's deprivation is captured by weighing the well-being of the individual by the percentage of individuals who have a higher well-being than his. Instead of capturing deprivation in well-being space, we can also define deprivation in income space. Suppose $F(x)$ is the probability distribution function of x when individuals are arranged in ascending order of their income. The following social well-being function can then be proposed:

$$SWF\left(\tilde{y}/\tilde{x}\right) = 2\int_0^\infty y\left(x\right)\left[1 - F\left(x\right)\right] f\left(x\right) dx. \tag{6.12}$$

This social well-being function differs from the one defined in (6.5) in terms of weights given to individual well-being $y(x)$.

The linkage between means and ends can be operationalized using concentration indices. Following Kakwani (1980), the concentration index of well-being $y(x)$ can be written as

$$C_y = 2\int_0^\infty y\left(x\right)\left[F\left(x\right) - \frac{1}{2}\right] f\left(x\right) dx, \tag{6.13}$$

which when substituted into (6.12) gives

$$SWF\left(\tilde{y}/\tilde{x}\right) = \mu_y\left(1 - C_y\right) \tag{6.14}$$

which shows that the concentration index C_y is the percentage loss of social well-being as defined in (6.12).

Both G_y and C_y measure the percentage loss of well-being based on social well-being functions (6.5) and (6.12), respectively. They both measure inequality in well-being but answer different questions. The relationship between the two can be given by

$$C_y = \frac{R\left[y(x), r(x)\right]}{R\left[y(x), r\left(y(x)\right)\right]} G_y \tag{6.15}$$

where $R(a, b)$ is the coefficient of correlation between a and b, $r(x)$ stands for rank of x, and $r(y(x))$ is the rank of $y(x)$. If income and well-being have the same ranking in their distributions, $C_y = G_y$. But if they have completely opposite rankings, $C_y = -G_y$. This implies that $-G_y \le C_y \le G_y$.

$R[y(x), r(y(x))]$ will always be positive, but $R[y(x), r(x)]$ can either be negative or positive. A negative value means that well-being decreases as income increases; that is, the poorer the person, the greater the well-being is. Similarly, a positive value implies that the richer the person, the greater the well-being is. Since G_y is always positive, it follows from (6.15) that the negative (positive) value of the concentration index implies the greater (smaller) well-being for the poor (non-poor). Thus, the concentration index measures equity (or inequity) in well-being; the smaller (larger) its value, the greater the concentration of well-being among the poor (non-poor).

Thus, G_y measures the overall disparity of well-being in the population while C_y measures the disparity of well-being across income groups. Both of these types of inequalities are important in understanding disparity of well-being in society. The concentration index is particularly useful in assessing the extent to which individual incomes matter for individual well-being.

6.8 Magnitude of Inequality in Well-Being in Brazil

While income inequality in Brazil has declined since early 2000s, the Gini index of per capita household income still remains high by global standards at 53 % in 2010. Table 6.2 presents the Gini indices for various well-being indicators. The results show that inequalities in well-being indicators are quite small. For instance, the Gini index of life expectancy at birth was only 3.59 % in 1991, declined to 2.78 % in 2000, and further declined to 1.74 % in 2010. A similar finding emerges for the infant and child survival rates. Not only has Brazil made impressive progress in health outcomes over time, but it has also succeeded in reducing inequality in those outcome indicators.

Inequality in educational well-being is much higher than that in health well-being. The Gini index of adult literacy rate was 10.55 % in 1991, which declined to 6.66 % in 2000 and further to 4.98 % in 2010. Our findings reveal that inequality in educational well-being has continued to decline as a greater proportion of population becomes increasingly more educated. In the past two decades, Brazil has experienced a rapid expansion of educational opportunities among the population that translated to the reduction of inequality in school attendance over time.

Brazil's education finance equalization programs and a conditional cash transfer scheme have contributed to such expansion in educational opportunities. For instance, the Fund for Maintenance and Development of the Fundamental Education and Valorization of Teaching was created in 1996 to finance sub-national spending on primary and lower secondary education. The fund entails a per student spending floor for the whole country. The federal government is required to make up for spending in those states and municipalities that fail to meet the national spending floor. Transfers from the fund were found to have a positive effect on actual enrolment rates (Mello and Hoppe 2005). Brazil's conditional cash transfer to students, called *Bolsa Escola*, also had a positive impact on school attendance. Implemented in 2001–03, *Bolsa Escola* gave local authorities at the municipal level the tasks to identify and select

Table 6.2 Gini index of well-being indicators in Brazil, 1991–2010

	Actual value			Annual change	
Indicators	1991	2000	2010	1991–2000	2000–10
Health					
Life expectancy at birth (years)	3.59	2.78	1.74	–0.09	–0.10
Infant survival rate (%)	1.13	0.69	0.30	–0.05	–0.04
Child survival rate (%)	1.54	0.89	0.31	–0.07	–0.06
Education					
Adult literacy rate (% of people ages 15 and above)	10.55	6.66	4.98	–0.43	–0.17
Expected years of schooling for 18 year-olds	11.90	9.34	4.83	–0.28	–0.45
High school completion (% of people ages 18 and above)	35.52	29.08	20.11	–0.72	–0.90
Higher education completion (% of people ages 25 and above)	49.42	46.10	35.85	–0.37	–1.03
Children 11–14 years old attending school (%)	8.17	1.90	0.94	–0.70	–0.10
Children 15–17 years old attending school (%)	14.22	5.62	2.95	–0.96	–0.27
Youth 18–24 years old attending school (%)	20.75	12.26	12.63	–0.94	0.04
Living conditions					
Population with piped water (%)	21.77	15.52	5.57	–0.69	–0.99
Population with toilet (%)	23.86	17.73	9.23	–0.68	–0.85
Population with garbage collection (%)	21.64	8.91	2.83	–1.42	–0.61
Population with electricity (%)	12.43	5.52	1.21	–0.77	–0.43
Population with adequate sanitation (%)	8.62	6.54	4.77	–0.23	–0.18
Labor market activities					
Employment rate (% of people ages 18 and above)		5.78	6.27		0.05
Employment rate with formal contracts (% of people ages 18 and above)		22.23	20.90		–0.13
Productive employment rate (% of people ages 18 and above)		26.55	17.22		–0.93
Labor force participation rate (% of people ages 18 and above)		4.80	5.34		0.05

Source: Authors' calculations

beneficiaries and to implement the program. The program had a notable impact on continuity in school attendance, inducing a 7.8 percentage points decline in school drop-out rate (Janvry et al. 2006).

Along with education and health, the overall living conditions in Brazil have improved markedly over time. Furthermore, disparities in living conditions across the population have declined, as indicated by the Gini indices of various indicators pertaining to living conditions presented in Table 6.2. Such gains in living conditions may be accounted for by government initiatives. In water and sanitation, for instance, Brazil implemented technical and financial innovations to improve access to water and sanitation among poor households. The government introduced the *Programa Despoluição de Bacias Hidrográficas* or Basin Restoration Program in 2001, under which the federal government pays water and sanitation companies, mostly public, for treating wastewater based on certified outputs. Brazil has also pioneered the use of low-cost appropriate technology such as condominial sewers to enhance the access of poor urban households to water and sanitation. In electricity, the government's grid extension efforts mainly contributed to increased electrification rate. As of 2012, 99.5 % of households in Brazil have access to electricity (World Bank 2015).

All labor market indicators have also shown substantial improvements. Both formal and productive employment rates have improved. More importantly, their inequalities are also on the decline, suggesting that working conditions in the labor market in Brazil are improving overall. A number of factors contributed to such gains in the labor market. Formal employment opportunities in Brazil expanded. The share of formal jobs (as a percentage of the workforce) has increased by more than 13 percentage points since 2002. The share of poor individuals who secured formal employment increased from 10.5 % in 2008 to 16 % in 2011 (considering only the beneficiaries of Brazil's *Bolsa Família*). Moreover, structural transformation paved the way for shifts in sectoral employment. Since 2002, retail and construction output has increased, but agriculture and manufacturing output has decreased. Labor productivity also improved, with the workforce becoming more skilled. Between 1995 and 2010, the average educational level of the labor force increased by more than 50 %, given the rapid expansion of secondary education (Silva et al. 2015).

Table 6.3 presents the concentration indices of well-being indicators. The concentration index captures inequity in well-being of a particular indicator across income. The index indicates the extent to which income contributes to the particular dimension of well-being. Given the case of Brazil, this index will help answer the question as to whether better-off municipalities have higher or lower well-being. As the values of concentration indices are mostly positive, better-off municipalities are likely to enjoy higher well-being than their worse-off counterparts. Moreover, the magnitude of concentration index suggests that the degree of disparity in well-being across poor and non-poor municipalities is rather small.

As shown in Table 6.3, the concentration index has declined mostly for all indicators of well-being except for those relating to living conditions. It is interesting to note that the concentration indices for health indicators are rather small, suggesting that income differences among municipalities matter less in achieving health outcomes relative to other dimensions of well-being. Compared to health, living conditions are more directly influenced by income. A number of studies reveal that a household's access to basic infrastructure–such as piped water, electricity, and sanitation, among others–is highly and significantly correlated with a lower probability of being poor.

Inequity in educational attainment is relatively high, particularly at higher level of education. However, the trend shows that this inequity is on the decline. Similarly, the formal and productive employment rates also have high inequities, but their inequities are declining over time. This suggests that working conditions in poorer municipalities are improving at a faster rate than their non-poor counterparts.

6.9 Income Inequality Elasticity of Well-Being

Income provides people with means to lead a better life, but it varies across households and individuals. Deprivation in a society arises when there are differences in incomes across the population. The Gini index is equal to the average relative deprivation suffered by the society (Kakwani 1977). This study postulates that average income and inequality are the two main determinants of well-being. Well-being increases with average

Table 6.3 Concentration index of well-being indicators in Brazil, 1991–2010

	Actual value			Growth rate	
Indicators	1991	2000	2010	1991–2000	2000–10
Health					
Life expectancy at birth (years)	2.98	2.19	1.46	–0.09	–0.07
Infant survival rate (%)	0.92	0.54	0.25	–0.37	–0.03
Child survival rate (%)	1.26	0.70	0.26	–0.56	–0.04
Education					
Adult literacy rate (% of people ages 15 and above)	9.83	6.24	–0.06	–3.60	–0.63
Expected years of schooling for 18 year-olds	9.61	7.71	0.18	–1.90	–0.75
High school completion (% people ages 18 and above)	31.57	26.83	18.12	–4.74	–0.87
Higher education completion (% people ages 25 and above)	45.38	43.32	34.23	–2.05	–0.91
Children 11–14 years old attending school (%)	6.89	1.25	0.20	–5.64	–0.11
Children 15–17 years old attending school (%)	9.80	3.37	1.30	–6.43	–0.21
Youth 18–24 years old attending school (%)	11.95	2.97	6.66	–8.98	0.37
Living conditions					
Population with piped water (%)	–0.06	0.46	4.73	0.52	0.43
Population with toilet (%)	–0.30	0.68	8.07	0.98	0.74
Population with garbage collection (%)	–0.06	0.23	2.33	0.29	0.21
Population with electricity (%)	–0.05	0.08	1.04	0.13	0.10
Population with adequate sanitation (%)	–0.13	0.27	4.14	0.40	0.39
Labor market activities					
Employment rate (% of people ages 18 and above)		2.14	4.00		0.19
Employment rate with formal contracts (% of people ages 18 and above)		19.76	18.26		–0.15
Productive employment rate (% of people ages 18 and above)		24.55	15.43		–0.91
Labor force participation rate (% of people ages 18 and above)		2.96	3.62		0.07

Source: Authors' calculations

income, but at a decreasing rate. Moreover, the impact of inequality on well-being can either be negative or positive. With this in mind, we estimated income inequality elasticities of well-being using three regression models: one is based on the Gini index, second on the income share of the poorest 40 %, and third on the richest 60 % of the population.

Well-being indicators, such as life expectancy at birth, infant survival rate, child survival rate, literacy rate, and completed years of schooling, have lower and upper limits reflecting physical and biological maxima. This means that like income, they cannot go on increasing indefinitely. Moreover, as well-being reaches progressively higher limits, incremental improvement would represent much higher levels of achievement than similar incremental improvements from a lower base. For instance, an increase in longevity from 70 to 75 years will be much harder to achieve than an increase from 50 to 55 years. It becomes increasingly more difficult to increase life expectancy as life expectancy rises.[6]

Given the nature of well-being indicators, estimating elasticities using a linear regression model will be inadequate. The dependent variable varies in a narrow range, which implies a limited variation in the error term giving rise to perverse econometric problems (Kmenta 1990). To this end, a non-linear specification may be more appropriate. A popular approach used in the literature is the logistic curve that corresponds to what is known as the logit model. Suppose *wel* denotes a well-being indicator with lower and upper bounds as m and M, respectively, then a transformed variable given by

$$\pi = \frac{wel - m}{M - m} \tag{6.16}$$

lies in the range between 0 and 1. Following this, we can then introduce the idea of an achievement function:

$$\varphi = \frac{\pi}{(1 - \pi)} = \frac{wel - m}{M - wel} \tag{6.17}$$

[6] See Kakwani (1993).

which varies from 0 to ∞. Differentiating this equation twice, we obtain

$$\frac{\partial \varphi}{\partial wel} = \frac{M - m}{\left(M - wel\right)^2} > 0$$

and

$$\frac{\partial^2 \varphi}{\partial wel^2} = \frac{2\left(M - m\right)}{\left(M - wel\right)^2} > 0.$$

These equations imply that the achievement function increases with *wel* but at an increasing rate. As well-being reaches progressively a higher limit, an incremental improvement reflects a higher level of achievement than a similar incremental improvement from a lower base. To account for the non-linear characteristic of well-being, achievement is used as a dependent variable rather than well-being itself. While achievement is not restricted to a finite range, well-being is restricted.

The regression model based on the Gini index is defined as:

$$\text{Model 1: } ln\left(\varphi\right) = \alpha_0 + \alpha_1\, ln\left(x\right) + \alpha_2\, ln\left(Gini\right) + u_1$$

where x is the average per capita income of a municipality and *Gini* is the municipality Gini index. Note that α_1 is positive and α_2 can either be positive or negative. The error term u_1 is the aggregate impact of all the omitted variables, which is assumed to be distributed randomly with zero mean and constant variance.

The second regression model based on the income share of the poorest 40 % of the population is given by:

$$\text{Model 2: } ln\left(\varphi\right) = \beta_0 + \beta_1\, ln\left(x\right) + \beta_2\, ln\left(share1\right) + u_2$$

where *share*1 is the income share of the poorest 40 %. While β_1 is positive, β_2 can either be positive or negative. If the income share of the poorest

40 % increases by 1 %, the achievement function changes by β_2 percent. Again, the error term u_2 is the aggregate impact of all the omitted variables, assumed to be distributed randomly with zero mean and constant variance.

The third regression model based on the income share of the richest 60 % of the population is given by:

$$\text{Model 3: } ln(\varphi) = \gamma_0 + \gamma_1\, ln(x) + \gamma_2\, ln(share2) + u_3$$

where *share*2 is the income share of the richest 60 %.

Differentiating the three models, we obtain inequality elasticities of well-being:

$$e(Gini) = \frac{dln(wel)}{dln(Gini)} = \frac{\alpha_2 (wel - m)(M - wel)}{(wel)(M - m)} \tag{6.18}$$

$$e(share1) = \frac{dln(wel)}{dln(share1)} = \frac{\beta_2 (wel - m)(M - wel)}{(wel)(M - m)} \tag{6.19}$$

$$e(share2) = \frac{dln(wel)}{dln(share2)} = \frac{\gamma_2 (wel - m)(M - wel)}{(wel)(M - m)} \tag{6.20}$$

These three elasticities measure the percentage change in well-being with respect to the change in inequality by 1 %. If $e(Gini)$ is negative (positive) and statistically significant, then the increase in inequality reduces (increases) well-being. Similarly, if $e(share1)$ is negative (positive), the increase in the share of the poorest 40 % reduces (increases) well-being. A similar interpretation applies to $e(share2)$ as the share of the richest 60 % changes.

In the three regression models, average income and inequality are the means, whereas well-being indicators are the ends. The means can be assumed to be exogenous variables, but the ends are endogenous variables. There are 19 well-being indicators. Models 1, 2, and 3 were estimated for each of the 19 indicators based on municipal panel data for 1991, 2000, and 2010. Hence, 155 regressions were estimated in total, with each regression based on 5,565 observations. The estimated regressions are presented in Tables A6.1–A6.19 in the Appendix; each table provides estimated coefficients along with respective t values and R^2. Given the size of the sample, the estimated R-squares are quite high, ranging from 0.40 to 0.90. This indicates that the unexplained variations in regressions are relatively small.

The hypothesis that income inequality impedes growth in well-being is tested using the three regression models. The inequality elasticities of well-being calculated from the regression models provide the answer to this hypothesis. Tables 6.4–6.6 present the estimated inequality elasticities of well-being, along with their t values from the regressions.

The significance of a coefficient is normally assessed at the 5 % level of significance. Assuming that the error in the regression model is normally distributed with zero mean, the regression coefficient is significant at the 5 % level of significance if its t value is greater than 1.96. All t values reported are greater than 2.34, most ranging between 5 and 21.89. Therefore, we can conclude that the relationship between inequality and well-being is highly significant.

In 16 out of 19 indicators from Table 6.4, the Gini elasticity of well-being is negative. For instance, if the Gini index were to be increased by 1 %, the life expectancy at birth would be 0.07 percent lower in 2010. The t value for this coefficient is −14.27, which is highly significant, suggesting that a higher Gini index is associated with a significantly lower life expectancy at birth. Thus, a higher Gini index lowers overall well-being.

There are three indicators suggesting that a higher Gini index is associated with a higher well-being. These are: (i) percentage of youth aged 18–24 years attending school, (ii) percentage of population 18 years and over who completed high school, and (iii) percentage of population 25 years and over who completed a higher education. These indicators relate to educational attainment and are closely associated with human capital development. Thus, a higher Gini index is likely to be associated with a higher human capital. One conjecture is that if human capital is an engine of growth, higher inequality may be good for growth. As the growth process is highly complex, it is difficult to disentangle the extent to which human capital accumulation enhances growth.

Table 6.4 Elasticity of well-being with respect to Gini index in Brazil, 1991–2010

	1991		2000		2010	
Indicators	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Health						
Life expectancy at birth (years)	–0.08	–7.35	–0.13	–9.71	–0.07	–14.27
Infant survival rate (%)	–0.04	–8.84	–0.04	–13.17	–0.01	–18.23
Child survival rate (%)	–0.05	–9.35	–0.05	–12.58	–0.01	–7.17
Education						
Adult literacy rate (% of people ages 15 and above)	–0.18	–7.66	–0.20	–10.62	–0.12	–9.14
Expected years of schooling for 18 year-olds	–0.27	–7.47	–0.38	–12.35	–0.20	–8.32
High school completion (% people ages 18 and above)	1.21	11.53	0.40	3.90	0.23	2.77
Higher education completion (% people ages 25 and above)	1.87	15.20	1.20	8.83	0.97	12.02
Children 11–14 years old attending school (%)	–0.04	–1.75	–0.06	–8.08	–0.05	–8.04
Children 15–17 years old attending school (%)	–0.15	–2.89	–0.20	–6.95	–0.24	–8.34
Youth 18–24 years old attending school (%)	0.98	10.62	0.87	11.53	0.91	20.11
Living conditions						
Population with piped water (%)	–0.98	–15.22	–1.02	–17.92	–0.15	–5.26
Population with toilet (%)	–0.84	–12.78	–1.21	–22.50	–0.68	–21.60

(*continued*)

Table 6.4 (continued)

	1991		2000		2010	
Indicators	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Population with garbage collection (%)	–0.69	–6.55	–0.43	–10.36	–0.15	–8.20
Population with electricity (%)	–0.65	–7.99	–0.32	–9.89	–0.05	–10.62
Population with adequate sanitation (%)	–0.38	–9.65	–0.42	–11.05	–0.32	–15.17
Labor market activities						
Employment rate (% of people ages 18 and above)			–0.20	–6.31	–0.32	–11.29
Employment rate with formal contracts (% of people ages 18 and above)			–1.18	–15.61	–1.27	–20.88
Productive employment rate (% of people ages 18 and above)			–1.15	–18.18	–0.94	–17.64
Labor force participation rate (% of people ages 18 and above)			–0.15	–5.81	–0.24	–8.26

Source: Authors' calculations
Note: No data available for labor market activities in 1991

Table 6.5 Elasticity of well-being with respect to the share of poorest 40 % in Brazil, 1991–2010

	1991		2000		2010	
Indicators	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Health						
Life expectancy at birth (years)	0.04	7.11	0.04	7.42	0.03	10.62
Infant survival rate (%)	0.02	8.77	0.01	9.25	0.01	17.48

Table 6.5 (continued)

Indicators	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Child survival rate (%)	0.03	9.30	0.02	9.20	0.00	7.06
Education						
Adult literacy rate (% of people ages 15 and above)	0.07	5.37	0.05	7.22	0.05	7.98
Expected years of schooling for 18 year-olds	0.15	7.83	0.13	9.89	0.10	9.07
High school completion (% people ages 18 and above)	–0.62	–11.85	–0.13	–3.78	–0.09	–2.31
Higher education completion (% people ages 25 and above)	–0.90	–13.96	–0.33	–5.95	–0.42	–10.16
Children 11–14 years old attending school (%)	0.00	–0.06	0.01	5.01	0.02	8.74
Children 15–17 years old attending school (%)	0.09	3.55	0.07	6.21	0.11	7.48
Youth 18–24 years old attending school (%)	–0.51	–10.85	–0.32	–9.91	–0.42	–18.48
Living conditions						
Population with piped water (%)	0.52	15.44	0.33	11.63	0.07	5.11
Population with toilet (%)	0.46	12.67	0.40	13.17	0.32	24.77
Population with garbage collection (%)	0.39	7.40	0.13	9.07	0.07	7.98
Population with electricity (%)	0.27	5.44	0.08	6.73	0.02	9.49

(*continued*)

Table 6.5 (continued)

	1991		2000		2010	
Indicators	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Population with adequate sanitation (%)	0.21	10.35	0.11	6.54	0.13	14.17
Labor market activities						
Employment rate (% of people ages 18 and above)			0.08	6.39	0.15	10.32
Employment rate with formal contracts (% of people ages 18 and above)			0.41	11.39	0.61	23.28
Productive employment rate (% of people ages 18 and above)			0.37	10.40	0.46	19.85
Labor force participation rate (% of people ages 18 and above)			0.05	5.05	0.12	7.95

Source: Authors' calculations
Note: No data available for labor market activities in 1991

Table 6.6 Elasticity of well-being with respect to the share of the richest 60 % in Brazil, 1991–2010

	1991		2000		2010	
Indicators	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Health						
Life expectancy at birth (years)	–0.36	–7.18	–0.51	–8.58	–0.26	–12.43
Infant survival rate (%)	–0.16	–8.75	–0.14	–11.23	–0.05	–19.13
Child survival rate (%)	–0.24	–9.34	–0.18	–11.11	–0.04	–7.62

Table 6.6 (continued)

Indicators	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Education						
Adult literacy rate (% of people ages 15 and above)	–0.61	–5.68	–0.65	–8.87	–0.44	–9.42
Expected years of schooling for 18 year-olds	–1.21	–7.43	–1.41	–9.51	–0.76	–8.35
High school completion (% people ages 18 and above)	5.69	13.50	1.82	4.91	0.88	2.62
Higher education completion (% people ages 25 and above)	8.42	16.44	4.52	8.34	3.69	10.60
Children 11–14 years old attending school (%)	0.01	0.11	–0.16	–5.52	–0.17	–7.82
Children 15–17 years old attending school (%)	–0.73	–3.26	–0.82	–6.32	–0.94	–7.98
Youth 18–24 years old attending school (%)	4.61	11.77	3.83	11.79	3.51	18.79
Living conditions						
Population with piped water (%)	–4.51	–15.55	–3.94	–13.25	–0.56	–5.17
Population with toilet (%)	–3.91	–12.78	–4.71	–15.05	–2.65	–25.79
Population with garbage collection (%)	–3.36	–7.50	–1.57	–9.78	–0.56	–7.87

(*continued*)

Table 6.6 (continued)

	1991		2000		2010	
Indicators	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Population with electricity (%)	−2.56	−6.73	−1.03	−7.52	−0.20	−9.62
Population with adequate sanitation (%)	−1.78	−10.19	−1.43	−8.63	−1.16	−15.49
Labor market activities						
Employment rate (% of people ages 18 and above)			−0.88	−6.52	−1.30	−11.70
Employment rate with formal contracts (% of people ages 18 and above)			−4.73	−11.96	−5.09	−24.94
Productive employment rate (% of people ages 18 and above)			−4.44	−12.75	−3.88	−21.65
Labor force participation rate (% of people ages 18 and above)			−0.61	−5.05	−0.98	−8.81

Source: Authors' calculations

Note: No data available for labor market activities in 1991

Model 2 is built upon the World Bank's idea of shared prosperity which focuses on the welfare of the bottom 40 % in the population (see Chap. 5). As discussed earlier, this model examines how the income share of the bottom 40 % matters in well-being. Table 6.5 presents the coefficients for the variable of the income share in Model 2. The positive coefficient implies that an increase in the share of the poorest 40 % is associated with an increase in well-being. For instance, if the income share of the bottom 40 % had increased by 1 %, the life expectancy at birth would have been 0.03 percent higher in 2010. The *t* value for this coefficient, 10.62, indicates that increased shared prosperity is significantly associated with a higher life expectancy at birth.

Of the 19 well-being indicators, 16 have positive elasticities for all three years and all of these are highly significant. The results suggest that the overall well-being in Brazil would have been significantly higher if the income share of the poorest 40 % had increased. Only in three indicators relating to human capital, would well-being have been lower. Thus, improving the welfare of the poorest 40 % will significantly increase overall well-being in Brazil. Moreover, the findings also provide evidence that widening income disparities matter for well-being. This chapter has demonstrated that income disparities impede well-being. As such, inequality needs to be addressed to improve overall well-being of society.

Table 6.6 presents the percentage change in well-being in response to the percentage change in the income share of the richest 60 % of the population. Out of 19 indicators, 16 have negative elasticities. This means that keeping other things constant, making the rich richer will lower overall well-being for society.

6.10 Concluding Remarks

Inequality is one of today's foremost development challenges. While the literature has extensively examined the impact of income disparities on growth and poverty, the relationship between inequality and well-being has yet to be comprehensively explored. This chapter provides evidence that inequality matters for well-being. It defines well-being through a set of capabilities that indicate an individual's freedom to lead their lives. It examines income and non-income dimensions of well-being through indicators in the areas of material well-being, health, education, living conditions, and labor market activities.

Like income inequality, it is also important to be concerned with inequality in different dimensions of well-being such as health, education, employment, and living conditions, among others. This chapter examined inequality in different dimensions of well-being, with the empirical analysis carried out in the context of Brazil. To measure inequality in well-being, the idea of social welfare function was extended to a social well-being function. The Gini index of well-being is then derived as the percentage loss of social well-being. The chapter also used a concentration index to measure disparities in well-being across income.

The findings revealed that inequalities in well-being indicators are small. For instance, Brazil improved health outcomes and reduced the inequality in outcome indicators, including life expectancy at birth and infant and child survival rates. The Gini index of life expectancy at birth, for example, decreased from 3.59 % in 1991 to 1.74 % in 2010. Disparities in education well-being have also been reduced, albeit they remain higher than inequalities in health well-being. For instance, the Gini index of adult literacy rate dropped from 10.55 % in 1991 to 4.98 % in 2010. Similarly, declining disparities in living conditions and labor market activities were noted. Findings also indicated that better-off municipalities are likely to have higher well-being than their worse-off counterparts, with the concentration index declining for all indicators except for those dealing with living conditions.

Do changes in income inequality impede growth in well-being? An answer to this question was sought through estimating inequality elasticities of 19 well-being indicators. Empirical analysis in this chapter revealed that a higher Gini index is associated with lower overall well-being. Negative elasticities of well-being were found for 16 of the 19 indicators examined. For instance, a 1 % increase in the Gini index would lower life expectancy at birth by 0.07 % in 2010. For three indicators, all closely associated with education and human capital development, a higher Gini index increases well-being. While this may indicate that high inequality is good for human capital development, it is difficult to prove that high inequality leads to a higher growth. The findings also revealed that increasing the income share of the poorest 40 % is linked with a rise in well-being, while a corresponding increase in the share of the richest 60 % is associated with a drop in well-being.

This chapter showed that various dimensions of well-being are affected adversely by inequality. The evidence presented in this chapter suggests that inequality should be addressed to improve a society's well-being. To enable people to lead better lives, policies need to help those at the bottom of the distribution and improve their access to economic opportunities such as education, health, and basic infrastructure.

Appendix

Regression Estimates

Table A6.1 Dependent variable = achievement in life expectancy at birth

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	0.71	22.59	0.63	19.95	0.76	41.23
Log(Gini)	−0.71	−7.35	−1.34	−9.71	−1.12	−14.27
Constant	−4.55	−26.45	−3.96	−27.13	−4.10	−39.22
R-square	0.66		0.68		0.73	
Model 2						
Log(per capita income)	0.72	22.65	0.59	17.19	0.70	33.40
Log(share of poorest 40 %)	0.37	7.11	0.44	7.42	0.48	10.62
Constant	−3.30	−15.56	−1.90	−6.07	−1.91	−9.25
R-square	0.68		0.71		0.77	
Model 3						
Log(per capita income)	0.72	23.68	0.61	19.30	0.70	33.85
Log(share of richest 60 %)	−3.19	−7.18	−5.31	−8.58	−4.17	−12.43
Constant	−4.52	−27.54	−3.57	−25.38	−3.50	−32.45
R-square	0.68		0.71		0.77	

Source: Authors' calculations

Table A6.2 Dependent variable = achievement in infant survival rate

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	0.53	26.67	0.51	31.99	0.45	43.76
Log(Gini)	−0.88	−8.84	−1.33	−13.17	−0.81	−18.23
Constant	−0.37	−3.32	−0.25	−3.02	0.67	11.65
R-square	0.63		0.71		0.72	

(*continued*)

Table A6.2 (continued)

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 2						
Log(per capita income)	0.53	26.98	0.47	26.37	0.41	39.12
Log(share of poorest 40 %)	0.46	8.77	0.42	9.25	0.36	17.48
Constant	1.17	7.27	1.76	9.69	2.29	23.69
R-square	0.66		0.70		0.74	
Model 3						
Log(per capita income)	0.53	28.88	0.48	31.30	0.41	40.49
Log(share of richest 60 %)	–3.88	–8.75	–5.06	–11.23	–3.08	–19.13
Constant	–0.32	–3.01	0.16	2.30	1.09	20.04
R-square	0.67		0.71		0.74	

Source: Authors' calculations

Table A6.3 Dependent variable = achievement in child survival rate

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	0.59	31.79	0.55	35.19	0.42	31.14
Log(Gini)	–1.07	–9.35	–1.45	–12.58	–0.55	–7.17
Constant	–1.07	–9.54	–0.72	–8.48	0.93	13.35
R-square	0.67		0.71		0.74	
Model 2						
Log(per capita income)	0.60	32.08	0.50	28.59	0.39	25.67
Log(share of poorest 40 %)	0.56	9.30	0.46	9.20	0.25	7.06
Constant	0.80	4.78	1.47	7.75	2.04	12.70
R-square	0.66		0.70		0.74	
Model 3						
Log(per capita income)	0.60	34.88	0.52	34.60	0.39	26.36
Log(share of richest 60 %)	–4.70	–9.34	–5.54	–11.11	–2.16	–7.62
Constant	–1.00	–9.60	–0.28	–3.98	1.21	17.42
R-square	0.69		0.69		0.70	

Source: Authors' calculations

Table A6.4 Dependent variable = achievement in adult literacy rate among people ages 15 and above

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	1.21	24.86	1.23	72.34	1.44	79.53
Log(Gini)	–0.89	–7.66	–1.51	–10.62	–1.23	–9.14
Constant	–6.05	–21.96	–6.31	–57.94	–7.61	–59.52
R-square	0.85		0.88		0.86	
Model 2						
Log(per capita income)	1.21	24.08	1.19	55.14	1.37	63.48
Log(share of poorest 40 %)	0.34	5.37	0.38	7.22	0.49	7.98
Constant	–4.71	–16.64	–4.30	–20.28	–5.30	–22.15
R-square	0.84		0.86		0.85	
Model 3						
Log(per capita income)	1.21	25.01	1.20	63.89	1.37	68.52
Log(share of richest 60 %)	–2.96	–5.68	–4.79	–8.87	–4.39	–9.42
Constant	–5.83	–21.72	–5.75	–60.46	–6.93	–67.10
R-square	0.85		0.84		0.87	

Source: Authors' calculations

Table A6.5 Dependent variable = achievement in expected years of schooling for 18 year-olds

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	0.56	20.65	0.53	28.09	0.26	17.39
Log(Gini)	–0.60	–7.47	–0.94	–12.35	–0.55	–8.32
Constant	–3.45	–23.22	–3.41	–38.79	–1.45	–18.72
R-square	0.64		0.71		0.48	
Model 2						
Log(per capita income)	0.57	20.52	0.50	25.00	0.23	14.58
Log(share of poorest 40 %)	0.34	7.83	0.31	9.89	0.28	9.07

(*continued*)

Table A6.5 (continued)

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Constant	−2.35	−13.42	−1.94	−11.07	−0.27	−1.80
R-square	0.65		0.73		0.48	
Model 3						
Log(per capita income)	0.57	21.43	0.51	27.47	0.23	13.90
Log(share of richest 60 %)	−2.70	−7.43	−3.50	−9.51	−2.12	−8.35
Constant	−3.42	−23.83	−3.11	−36.03	−1.16	−13.86
R-square	0.85		0.84		0.87	

Source: Authors' calculations

Table A6.6 Dependent variable = achievement in percentage of population ages 18 and above who completed high school

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	1.09	26.10	1.08	46.61	0.91	31.29
Log(Gini)	1.46	11.53	0.52	3.90	0.37	2.77
Constant	−7.34	−30.30	−7.69	−63.60	−6.30	−49.97
R-square	0.80		0.84		0.81	
Model 2						
Log(per capita income)	1.08	27.26	1.09	43.69	0.94	27.08
Log(share of poorest 40 %)	−0.74	−11.85	−0.17	−3.78	−0.14	−2.31
Constant	−9.86	−42.92	−8.49	−38.02	−6.99	−20.74
R-square	0.81		0.83		0.82	
Model 3						
Log(per capita income)	1.07	26.15	1.09	42.59	0.93	26.42
Log(share of richest 60 %)	6.86	13.50	2.39	4.91	1.41	2.62
Constant	−7.36	−31.43	−7.81	−64.23	−6.50	−40.19
R-square	0.83		0.80		0.84	

Source: Authors' calculations

Table A6.7 Dependent variable = achievement in percentage of population ages 25 and above who completed higher education

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	1.59	34.18	1.64	54.36	1.22	56.58
Log(Gini)	1.97	15.20	1.28	8.83	1.08	12.02
Constant	−11.58	−42.11	−12.59	−79.80	−9.59	−92.04
R-square	0.84		0.85		0.87	
Model 2						
Log(per capita income)	1.57	35.80	1.67	55.17	1.28	49.81
Log(share of poorest 40 %)	−0.95	−13.96	−0.35	−5.95	−0.47	−10.16
Constant	−14.85	−60.19	−14.37	−52.95	−11.72	−47.35
R-square	0.85		0.86		0.89	
Model 3						
Log(per capita income)	1.56	33.80	1.66	51.45	1.27	48.05
Log(share of richest 60 %)	8.89	16.44	4.83	8.34	4.14	10.60
Constant	−11.65	−43.07	−12.97	−79.66	−10.16	−79.31
R-square	0.82		0.85		0.89	

Source: Authors' calculations

Table A6.8 Dependent variable = achievement in percentage of children ages 11–14 attending school

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	0.81	23.25	0.53	19.57	0.15	4.40
Log(Gini)	−0.18	−1.75	−1.00	−8.08	−1.20	−8.04
Constant	−3.34	−16.88	−0.84	−6.06	1.62	10.11
R-square	0.72		0.62		0.51	
Model 2						
Log(per capita income)	0.80	23.11	0.50	16.01	0.08	2.12
Log(share of poorest 40 %)	0.00	−0.06	0.24	5.01	0.60	8.74

(*continued*)

Table A6.8 (continued)

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Constant	–3.20	–15.18	0.48	1.81	4.16	11.40
R-square	0.71		0.60		0.53	
Model 3						
Log(per capita income)	0.80	23.42	0.51	17.26	0.08	2.23
Log(share of richest 60 %)	0.05	0.11	–2.86	–5.52	–4.56	–7.82
Constant	–3.18	–16.61	–0.44	–3.03	2.25	12.25
R-square	0.75		0.65		0.58	

Source: Authors' calculations

Table A6.9 Dependent variable = achievement in percentage of children ages 15–17 attending school

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	0.36	16.55	0.54	17.93	0.42	9.75
Log(Gini)	–0.33	–2.89	–0.88	–6.95	–1.48	–8.34
Constant	–2.21	–15.07	–3.43	–24.23	–2.68	–15.48
R-square	0.64		0.60		0.50	
Model 2						
Log(per capita income)	0.37	16.48	0.52	16.27	0.33	6.88
Log(share of poorest 40 %)	0.21	3.55	0.32	6.21	0.68	7.48
Constant	–1.57	–9.12	–2.00	–7.05	0.32	0.66
R-square	0.68		0.61		0.51	
Model 3						
Log(per capita income)	0.37	16.85	0.53	17.49	0.34	6.72
Log(share of richest 60 %)	–1.63	–3.26	–3.68	–6.32	–5.75	–7.98
Constant	–2.22	–15.66	–3.20	–22.91	–1.90	–8.21
R-square	0.69		0.60		0.55	

Source: Authors' calculations

Table A6.10 Dependent variable = achievement in percentage of youth ages 18–24 attending school

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	0.34	24.40	0.07	3.32	0.19	12.34
Log(Gini)	1.22	10.62	1.26	11.53	1.31	20.11
Constant	−2.74	−25.90	−0.52	−5.29	−1.22	−13.89
R-square	0.60		0.52		0.60	
Model 2						
Log(per capita income)	0.33	27.95	0.11	5.08	0.26	14.91
Log(share of poorest 40 %)	−0.63	−10.85	−0.46	−9.91	−0.60	−18.48
Constant	−4.87	−35.66	−2.58	−12.74	−3.87	−23.89
R-square	0.62		0.57		0.68	
Model 3						
Log(per capita income)	0.33	25.91	0.09	4.39	0.25	14.14
Log(share of richest 60 %)	5.74	11.77	5.56	11.79	5.06	18.79
Constant	−2.76	−28.71	−0.83	−8.46	−1.90	−20.45
R-square	0.63		0.60		0.65	

Source: Authors' calculations

Table A6.11 Dependent variable = achievement in percentage of population with access to piped water

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	2.46	62.15	2.35	49.10	2.24	31.88
Log(Gini)	−3.42	−15.22	−5.00	−17.92	−1.89	−5.26
Constant	−15.05	−67.69	−15.27	−56.66	−12.42	−31.06
R-square	0.79		0.78		0.59	
Model 2						
Log(per capita income)	2.48	71.40	2.20	48.10	2.13	27.41
Log(share of poorest 40 %)	1.83	15.44	1.62	11.63	0.84	5.11

(*continued*)

Table A6.11 (continued)

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Constant	−8.96	−24.59	−7.65	−15.36	−8.66	−11.21
R-square	0.79		0.80		0.59	
Model 3						
Log(per capita income)	2.49	70.55	2.25	52.68	2.14	27.01
Log(share of richest 60 %)	−15.75	−15.55	−19.29	−13.25	−7.10	−5.17
Constant	−14.95	−78.45	−13.77	−62.14	−11.41	−29.25
R-square	0.82		0.80		0.85	

Source: Authors' calculations

Table A6.12 Dependent variable = achievement in percentage of population with access to sanitary toilet

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	2.22	42.50	2.38	57.03	2.22	49.57
Log(Gini)	−2.54	−12.78	−5.21	−22.50	−5.27	−21.60
Constant	−13.57	−47.41	−15.89	−66.08	−15.12	−59.22
R-square	0.81		0.81		0.74	
Model 2						
Log(per capita income)	2.24	40.92	2.23	58.19	1.93	42.97
Log(share of poorest 40 %)	1.39	12.67	1.71	13.17	2.48	24.77
Constant	−8.99	−21.74	−7.88	−18.37	−4.31	−9.73
R-square	0.81		0.83		0.77	
Model 3						
Log(per capita income)	2.24	44.35	2.28	67.09	1.94	47.33
Log(share of richest 60 %)	−11.85	−12.78	−20.26	−15.05	−20.67	−25.79
Constant	−13.52	−50.81	−14.34	−74.30	−12.40	−58.77
R-square	0.83		0.85		0.80	

Source: Authors' calculations

Table A6.13 Dependent variable = achievement in percentage of population with access to garbage collection

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	2.05	22.47	2.10	36.02	2.14	21.87
Log(Gini)	−2.35	−6.55	−3.60	−10.36	−3.88	−8.20
Constant	−12.00	−22.64	−12.06	−34.62	−12.08	−24.95
R-square	0.61		0.50		0.43	
Model 2						
Log(per capita income)	2.08	24.13	2.00	34.68	1.93	17.60
Log(share of poorest 40 %)	1.33	7.40	1.08	9.07	1.73	7.98
Constant	−7.73	−12.63	−6.79	−13.27	−4.35	−4.03
R-square	0.61		0.51		0.45	
Model 3						
Log(per capita income)	2.08	23.30	2.03	34.12	1.94	17.03
Log(share of richest 60 %)	−11.52	−7.50	−13.32	−9.78	−14.51	−7.87
Constant	−12.08	−23.61	−10.92	−34.74	−10.00	−18.48
R-square	0.71		0.61		0.50	

Source: Authors' calculations

Table A6.14 Dependent variable = achievement in percentage of population with access to electricity

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	3.17	32.44	2.93	39.98	2.67	33.94
Log(Gini)	−4.27	−7.99	−4.83	−9.89	−3.85	−10.62
Constant	−17.84	−31.15	−16.24	−42.91	−13.76	−33.63
R-square	0.66		0.53		0.43	
Model 2						
Log(per capita income)	3.16	33.59	2.79	34.87	2.46	27.58
Log(share of poorest 40 %)	1.82	5.44	1.25	6.73	1.65	9.49

(*continued*)

Table A6.14 (continued)

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Constant	–11.07	–11.51	–9.69	–11.96	–6.23	–7.12
R-square	0.66		0.55		0.44	
Model 3						
Log(per capita income)	3.18	32.95	2.83	36.17	2.47	27.77
Log(share of richest 60 %)	–16.93	–6.73	–15.77	–7.52	–13.92	–9.62
Constant	–17.24	–32.16	–14.50	–41.08	–11.64	–26.74
R-square	0.70		0.65		0.56	

Source: Authors' calculations

Table A6.15 Dependent variable = achievement in percentage of population with access to adequate sanitation

	1991		2000		2010	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Model 1						
Log(per capita income)	2.35	31.83	2.11	22.77	2.73	44.40
Log(Gini)	–3.64	–9.65	–4.72	–11.05	–5.17	–15.17
Constant	–12.39	–28.14	–12.31	–27.42	–17.00	–43.62
R-square	0.51		0.47		0.58	
Model 2						
Log(per capita income)	2.38	32.51	1.98	21.65	2.45	35.31
Log(share of poorest 40 %)	2.04	10.35	1.19	6.54	2.17	14.17
Constant	–5.76	–9.61	–6.00	–7.15	–7.00	–10.43
R-square	0.51		0.46		0.59	
Model 3						
Log(per capita income)	2.39	34.51	2.02	21.13	2.47	37.80
Log(share of richest 60 %)	–17.27	–10.19	–16.01	–8.63	–19.02	–15.49
Constant	–12.36	–30.49	–10.67	–23.50	–14.19	–41.16
R-square	0.60		0.62		0.60	

Source: Authors' calculations

Table A6.16 Dependent variable = achievement in employment rate among people ages 18 and above

	2000		2010	
	Coefficient	t-value	Coefficient	t-value
Model 1				
Log(per capita income)	0.13	9.67	0.36	21.13
Log(Gini)	−0.47	−6.31	−0.84	−11.29
Constant	−0.83	−11.35	−2.42	−29.95
R-square	0.46		0.52	
Model 2				
Log(per capita income)	0.12	8.08	0.31	16.54
Log(share of poorest 40 %)	0.18	6.39	0.39	10.32
Constant	−0.05	−0.39	−0.7	−3.63
R-square	0.47		0.54	
Model 3				
Log(per capita income)	0.12	9.01	0.32	16.64
Log(share of richest 60 %)	−2.01	−6.52	−3.36	−11.7
Constant	−0.71	−10.71	−1.99	−21.71
R-square	0.42		0.45	

Source: Authors' calculations
Note: No data available for 1991

Table A6.17 Dependent variable = achievement in employment rate with formal contracts among people ages 18 and above

	2000		2010	
	Coefficient	t-value	Coefficient	t-value
Model 1				
Log(per capita income)	0.94	32.84	1.17	53.56
Log(Gini)	−1.65	−15.61	−1.98	−20.88
Constant	−7.76	−59.66	−9.57	−92.81
R-square	0.85		0.88	
Model 2				
Log(per capita income)	0.89	29.2	1.06	52.57
Log(share of poorest 40 %)	0.57	11.39	0.95	23.28
Constant	−5.15	−19.67	−5.47	−27.39
R-square	0.85		0.89	
Model 3				
Log(per capita income)	0.9	33.65	1.07	51.25
Log(share of richest 60 %)	−6.62	−11.96	−7.95	−24.94
Constant	−7.29	−57.16	−8.57	−84.58
R-square	0.83		0.85	

Source: Authors' calculations
Note: No data available for 1991

Table A6.18 Dependent variable = achievement in productive employment rate among people ages 18 and above

	2000		2010	
	Coefficient	t-value	Coefficient	t-value
Model 1				
Log(per capita income)	1.18	52.64	1.13	46.61
Log(Gini)	–1.66	–18.18	–1.79	–17.64
Constant	–9.16	–85.8	–8.65	–78.13
R-square	0.91		0.89	
Model 2				
Log(per capita income)	1.13	49.49	1.03	44.93
Log(share of poorest 40 %)	0.53	10.4	0.87	19.85
Constant	–6.64	–30.49	–4.91	–21.87
R-square	0.90		0.91	
Model 3				
Log(per capita income)	1.14	55.51	1.04	44.79
Log(share of richest 60 %)	–6.42	–12.75	–7.37	–21.65
Constant	–8.66	–88.61	–7.77	–69.74
R-square	0.89		0.90	

Source: Authors' calculations
Note: No data available for 1991

Table A6.19 Dependent variable = achievement in labor force participation rate among people ages 18 and above

	2000		2010	
	Coefficient	t-value	Coefficient	t-value
Model 1				
Log(per capita income)	0.23	12.95	0.36	18.36
Log(Gini)	–0.45	–5.81	–0.70	–8.26
Constant	–1.02	–12.59	–2.12	–24.77
R-square	0.41		0.55	
Model 2				
Log(per capita income)	0.22	11.23	0.32	14.68
Log(share of poorest 40 %)	0.16	5.05	0.35	7.95
Constant	–0.31	–1.78	–0.65	–2.89
R-square	0.41		0.56	
Model 3				
Log(per capita income)	0.22	12.15	0.33	14.72
Log(share of richest 60 %)	–1.78	–5.05	–2.89	–8.81
Constant	–0.90	–11.16	–1.78	–17.25
R-square	0.43		0.54	

Source: Authors' calculations
Note: No data available for 1991

7

Measuring Equity in Opportunity Using Social Opportunity Function

7.1 Introduction

Inequality poses significant threats to growth and development of economies. It is usually measured in terms of income or consumption, but the concept can be extended to cover many other dimensions of well-being. In Chap. 6, we examined inequality in different dimensions of well-being across Brazilian municipalities. Findings revealed that Brazil has improved outcomes related to material well-being, health, education, living conditions, and labor market activities, and has reduced disparities in these areas. Although a society's ultimate objective should be to eliminate or reduce inequality of outcomes, the *2006 World Development Report* has argued that it is equally important to focus on reducing inequalities that arise from unequal opportunity.

Economic growth creates opportunities that enhance well-being. For instance, growth generates employment, which provides people with means to consume goods and services. Every individual is endowed with a bundle of resources, which he or she can exchange for goods and services produced in the economy. A person's entitlements depend on what

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she owns initially and what she can acquire through exchange. If, for any person, the entitlement set is not sufficient to access basic services in health, education, nutrition and infrastructure, he or she is deprived of basic human opportunities. This, according to Sen (1989), is an entitlement failure.

An entitlement failure can occur for many reasons. For instance, if prices of basic services go up sharply, the entitlements of some individuals may cease to ensure their access to basic services. Similarly, people can suffer entitlement failure due to sickness, unemployment, or death of a bread-earner. People can lose entitlement to basic services even in rich counties. In the United States, for instance, if a person loses her job, she also loses her entitlement to health insurance.

Economic growth can directly create opportunities through market operations, but more importantly it generates resources in the form of tax revenues. Governments use these revenues to create opportunities in education, health, nutrition, and living conditions, such as provision of clean water, electricity, sanitation, and so on. Growth that expands opportunities and, more importantly, makes these opportunities accessible to all—that is, inclusive growth—has recently become an important development goal of many governments (Ali and Zhuang 2007). A fair society is one that provides equal opportunity to all (Son 2013). How equitably people can avail themselves of these opportunities is an important policy question and is the focus of this chapter.

In this chapter, we develop an index of equity of opportunity which we can use to examine the extent to which opportunities in an economy are equally availed by people, particularly those who are less well off. We formulate this index using the concept of social opportunity function akin to a social welfare function. The social opportunity function depends on two factors: (i) average opportunity available to population and (ii) how opportunities are shared or distributed among the population.

Inequity (or equity) is measured with respect to family per capita income or per capita consumption as circumstance variable. People can also be denied of opportunity because of their affiliation to a particular socioeconomic and demographic group. Thus any analysis of inequity in opportunity cannot ignore the diversity of such social groups. In this chapter, we also provide a methodology to measure social opportunity enjoyed by different social groups. This analysis informs the extent to which a particular social group is denied access to opportunities available in an economy. Equal opportunity is a basic human right; it is unethical to treat different social groups differently in access to opportunities. Identifying social groups that are unable to enjoy basic opportunities is important so that the government can formulate policies and programs that facilitate the participation of all social groups in the growth process.

This chapter analyzes equity of opportunity in basic education, health, and social infrastructure services in seven developing counties: Bangladesh, Bhutan, Indonesia, Pakistan, the Philippines, Sri Lanka, and Vietnam. The analysis is based on unit record household income and expenditure surveys from these countries.

7.2 Inequality of Opportunities

Inequality is usually measured in income or consumption space, called inequality of outcomes, which is often distinguished from the concept of inequality of opportunity. The two concepts differ with respect to how inequality is generated. Inequality is caused by several complex factors. A distinction is made between circumstance and effort factors. Circumstance factors are exogenous—that is, variables which individuals have no control over. Examples of circumstance variables that have an impact on the person's income are gender, race, place of birth, and family circumstances including father's and mother's education and father's occupation (Bourguinon et al. 2007). Effort factors are in turn outcome determinants, which can be affected by individual's choice or efforts.

Roemer (1998) developed the conceptual framework of the inequality of opportunity, which influenced the World Bank's view of the concept. The basic idea of Roemer's framework is that total inequality of outcome can be partitioned into two components: (i) inequality caused by individuals' circumstances and (ii) inequality caused by individuals' efforts. The idea is that inequalities caused by circumstances are unjust and those caused by efforts are just. Suppose it is possible to exactly identify circumstance variables denoted by vector C and efforts variables denoted by vector E. Then, the total inequality of outcome, denoted by I, can be partitioned as

$$I = I(C) + I(E). \tag{7.1}$$

In equation (7.1), $I(C)$ is the inequality for which individuals cannot be held responsible and is therefore unjust or illegitimate. $I(E)$ is created due to individuals' efforts and is therefore just; hence, a society should always encourage individuals' efforts that would yield greater prosperity for all. It is a very pursuable argument to focus only on inequality caused by individuals' circumstances. In this formulation, I is the inequality of outcome and $I(C)$ is called the inequality of opportunity. According to the 2006 *World Development Report*, public policies need not necessarily eliminate or reduce all inequality of outcomes. They may instead focus on reducing inequality that arises from individuals' circumstances.

Kanbur and Wagstaff (2014) have raised two concerns with this approach. First, it is not possible to develop a consensus on the sets of circumstance and efforts variables. Second, inequality—as partitioned in (7.1)—is not credible and meaningful in practical applications. The inequality of outcome I in (7.1) can be estimated accurately from household surveys if per capita household welfare is known. The inequality of opportunity $I(C)$ on the right hand side of (7.1) is the predicted value of inequality based on a limited number of circumstance variables. There are numerous circumstance variables that have both direct and indirect effects on outcome, but many of which cannot be measured. This means that $I(C)$ is systematically underestimated due to omitted variables. In addition, $I(C)$ will also be subjected to prediction error depending on the model used to forecast individuals' income. Thus, we have no way of knowing the true value of inequality of opportunity. In this context, Kanbur and Wagstaff (2014) point out that cross-country comparisons of inequality of opportunity are not possible: a country's estimated value could presumably fall over time without its true value falling, and this makes the measure highly misleading.

Another conceptual problem stems from the fact that inequality is usually measured based on per capita household welfare and that individuals in households pool their incomes and share the total available resources. Hence, circumstance and efforts variables need to be related to all household members. However, circumstance variables will vary across individuals comprising a household. Some circumstance variables can be defined for a household as a whole—for instance, race, location, religion, gender or age of household head—but variables such as educational attainment of mother and father are not easily identifiable to all household members.

Effort variables, however, are more difficult to interpret at the household level. How do we define efforts that are under the control of household as a whole? Individuals within a household are not a homogeneous group; they vary with respect to age, gender, education, occupation, and health status, among others. As household members exert different efforts, how do we arrive at a composite index of efforts for a household? Efforts of some household members are circumstance variables for others. For instance, if parents create the conditions that allow children to flourish in life, efforts exerted by parents become circumstance for children, in which case the children get unfair advantage compared to their counterpart children who do not have such caring parents. These differences within households make it extremely difficult to identify circumstance and efforts variables.

The idea of inequality of opportunity can also be applied to poverty, which can be determined by circumstance and effort variables. Applying the same argument of bad and good inequality, is poverty caused by circumstance variables bad and that caused by effort variables good? Inequality itself contributes to poverty. If inequality caused by efforts is good, then poverty contributed by inequality will also be deemed good. This line of argument leads us to conclude that as long as individuals exert sufficient efforts, society should not be concerned with poverty. This conclusion seems at odds with social values that most of us hold. Poverty should always be of concern to the society irrespective of its causes. Thus, the idea of inequality of opportunity leads to an erroneous conclusion when applied to poverty.

7.3 A New Method of Measuring Contribution of Circumstance Variables to Inequality

For our empirical illustration, we apply our proposed method to India's 2007–08 household expenditure survey, called the National Sample Survey (NSS). To measure inequality, we need to define household welfare. Widely used in empirical studies, per capita household consumption expenditure is used as a measure of household welfare in this chapter. We have also made some refinement to this measure by adjusting for the urban-rural costs of living, but keeping the mean the same. The calculated Gini index of per capita household expenditure is equal to 34.27 %. Adjusting for urban-rural costs of living reduced the Gini index to 30.48 %, which implies that the difference in urban-rural costs of living led to a reduction in the Gini index by about 12 %.

This chapter examines three circumstance variables: (i) urban-rural sector, (ii) male-female head of household, and (iii) schedule tribe-schedule caste-other social groups. The union of these three variables can be partitioned into eight groups or cells. While differences in the means of per capita household welfare of these cells are attributed to inequality of opportunity, differences within cells are ascribed to inequality due to efforts. To separate these two inequalities, we eliminate the differences in the means keeping inequality within each cell the same. Suppose $\tilde{x}$ is the vector of the distribution of per capita household welfare, then inequality of outcome can be measured by the Gini index, $G(\tilde{x})$.

To establish a counterfactual that there is no inequality of opportunity, we construct a new distribution vector that eliminates all differences in per capita mean household welfare in all eight cells. Denoting this vector by $\tilde{x}(A \cup B \cup C)$, we can obtain the joint percentage contribution of three circumstance variables to the total inequality of outcome by

$$C(ABC) = \frac{100\left[G(\tilde{x}) - G\left(\tilde{x}(A \cup B \cup C)\right)\right]}{G(\tilde{x})}. \tag{7.2}$$

Using the Indian NSS for 2007–08, we have estimated $G(\tilde{x}) = 30.48\%$ and $\tilde{x}(A \cup B \cup C) = 29.03\%$, which gives the joint contribution of three circumstance variables equal to 4.75 %.

The contribution of each circumstance variable to the joint contribution of three circumstance variables would be beneficial to policymaking. This task can be accomplished using the Shapley decomposition:

$$C(A) = \frac{100}{3G(\tilde{x})}\Big[\big\{(G(\tilde{x}) - G(\tilde{x}(A))\big\} + \frac{1}{2}\big\{G(\tilde{x}(B)) - G(\tilde{x}(B \cup A)) + G(\tilde{x}(C)) - G(\tilde{x}(C \cup A)) + G(\tilde{x}(B \cup C))\big\} + \big\{G(\tilde{x}(B \cup C)) - G(\tilde{x}(A \cup B \cup C))\big\}\Big]$$

$$C(B) = \frac{100}{3G(\tilde{x})}\Big[\big\{(G(\tilde{x}) - G(\tilde{x}(B))\big\} + \frac{1}{2}\big\{G(\tilde{x}(A)) - G(\tilde{x}(B \cup A)) + G(\tilde{x}(C)) - G(\tilde{x}(C \cup B)) + G(\tilde{x}(C \cup B))\big\} + \big\{G(\tilde{x}(C \cup A)) - G(\tilde{x}(A \cup B \cup C))\big\}\Big]$$

$$C(C) = \frac{100}{3G(\tilde{x})}\Big[\big\{G(\tilde{x}) - G\tilde{x}(C)\big\}\Big] + \frac{1}{2}\big\{G(\tilde{x}(A)) - G(\tilde{x}(C \cup A)) + G(\tilde{x}(B)) - G(\tilde{x}(B \cup C)) + G(\tilde{x}(B \cup C))\big\} + \big\{G(\tilde{x}(A \cup B)) - G(\tilde{x}(A \cup B \cup C))\big\}\Big]$$

Based on the 2007–08 NSS data, we have also estimated the following: $G(\tilde{x}(A)) = 29.83\%$; $G(\tilde{x}(B)) = 30.46\%$; $G(\tilde{x}(A)) = 29.54\%$; $G(\tilde{x}(AB)) = 29.80\%$; $G(\tilde{x}(AC)) = 29.06\%$; and $G(\tilde{x}(BC)) = 29.52\%$. Given these estimates and using the Shapley decomposition described above, we can obtain $C(A) = 1.87\%$, $C(B) = 0.08\%$, and $C(C) = 2.81\%$, of which the sum is equal to 4.75 %. While rural–urban difference contributes 1.87 % of total inequality and gender of household head contributes 0.08 %, the social group defined by schedule tribe/schedule caste makes the largest contribution of 2.81 % to total inequality. Although the circumstance variables selected for this study influence standards of living at the household level, their contributions to inequality seem rather small.

As noted earlier, adjustments to living costs between urban and rural areas led to a reduction in the inequality in outcome by as much as 12 %. In comparison, the impact of the circumstance variables on inequality is relatively small. The idea of inequality in opportunity redefines the measurement of inequality by focusing only on inequality that is contributed by circumstance variables. If the contribution of circumstance variables to total inequality is indeed small, as suggested by our findings on India, a pertinent concern would be whether the issue of inequality is in fact being downplayed.

7.4 Human Opportunity Index

The previous sections discussed the inequality of income, which in the recent literature is also called inequality of outcome. Inequality of opportunity was defined as the part of inequality in income that is contributed by circumstance variables. Inequality of opportunity can also be defined in terms of inequality in access to basic services such as education, health, water, and sanitation, among others. Inequality arises when some people are denied access to these basic services because of their family circumstances. When a child is unable to get proper education because her family belongs to a low-income group, it is deemed as gross injustice. The World Bank (2006) has developed the Human Opportunity Index (HOI), which is an overall measure of inequality of opportunity in access to basic services.

To explain the HOI briefly, let us define a variable z_i, which takes a value of 1 if the ith individual has an access to an opportunity (such as education) and 0 if the ith individual lacks access to that opportunity. It can be easily seen that $E(z_i) = \pi_i$, where π_i is the probability that the ith individual has an access to a given opportunity. The term π_i is estimated using a set of k circumstance variables x_{i1}, x_{i2}, ..., x_{ik} by a logit model:

$$ln\left(\frac{\pi_i}{1-\pi_i}\right) = \sum_{j=1}^{k} \beta_j x_{ij} + \epsilon_i$$

The model is estimated using the maximum likelihood method. The term $\hat{\pi}_i$ is the estimated probability of access to a given opportunity that is explained by the circumstance variables. The HOI is the inequality of $\hat{\pi}_i$, which is measured by the dissimilarity index

$$D = \frac{1}{2\bar{\pi}} \sum_{i=1}^{n} w_i \mid \hat{\pi}_i - \bar{\pi} \mid$$

where n is the number of sample households, w_i is the population weight attached to the ith sample household, and $\bar{\pi}$ is the weighted mean of $\hat{\pi}_i$ across all households. D measures the degree of inequality of opportunity that is explained by the individuals' circumstances. $D = 0$ implies that every individual in a society enjoys the same opportunities irrespective of their circumstances. The larger the D, the greater the inequality of opportunity will be.

D measures the total contribution of all circumstance variables to inequality of opportunity. Son (2013) devised a method of isolating the contribution of each circumstance variable to total inequality. The individual contributions indicate the circumstance variables that have the most impact on inequality of opportunity. Among the several circumstance variables, Son (2013) found that inequality of opportunity is largely driven by per capita household expenditure. This suggests that household poverty plays a crucial role in determining equitable access to basic services.

7.5 Equity in Opportunity Based on Social Opportunity Function

The World Bank's view of inequality in opportunity is based on the contribution of circumstance variables to inequality in income or inequality in access to basic services. This concept is closely related to fairness. Circumstances can provide undue advantage to certain individuals only, which is deemed unjust or unfair. If all individuals have the same playing field, then inequality in outcomes is not an issue for a society.

In this chapter, we take a different view and define opportunity as an access to basic services in education, health, nutrition, clean water, electricity, and sanitary toilets. These are the real opportunities that enhance individuals' well-being. If many individuals in a society are denied adequate access to these basic services, then it has an inequity in opportunity. A social objective should be to expand these opportunities and make them accessible to all. Our definition of equity (or inequity) in opportunity is closely related to well-being, whereas the World Bank's definition is aligned with fairness. The two definitions can go in opposite directions.

As pointed out, if the entitlement set for any person is not sufficient to obtain access to basic services in health, educations, nutrition, and basic infrastructure, she is deprived of basic human opportunities. Sen (1989) identifies this as an entitlement failure. There may not always be direct linkage between an individual's entitlement failure and her circumstance variables. For instance, the father or mother's educational attainment does not always contribute to entitlement failure. However, factors such as unemployment, sickness, or death of bread-earners can have a more immediate and direct impact.

According to Barry (2005), circumstances are past variables, while access to opportunities depends on the families' current economic situation. Family income, if not perfect, is a good indicator of a household's economic situation, which directly determines access to opportunities. Families are generally unable to access opportunities because they cannot afford them. For instance, if a family cannot buy health insurance, members cannot access health services when needed. Access to opportunity is an outcome variable, while per capita family income is a means to access basic services and is, thus, a circumstance variable. Circumstance variables can impact access to basic services, but only through income. Policy makers have no control over individuals' circumstances; they cannot change the choices parents made that might have provided their children with advantage over others. Policy makers, however, understand current economic situation of families better than their non-income circumstances such as the mother or father's education. Given this, safety nets programs can be employed to help disadvantaged families avail themselves of opportunities that they cannot access due to their economic conditions.

Following Son (2013), this section derives a social opportunity index which is the product of average opportunity available to the population and equity of opportunity. The equity of opportunity informs the extent to which opportunities are distributed across individuals' incomes. To measure the equity of opportunity, we need to extend the idea of social welfare function to social opportunity function. We define a social opportunity function in each dimension separately:

$$SOF = SOF\left(O\left(x_1\right), O\left(x_2\right), \ldots\ldots\ldots\ldots, O\left(x_n\right)\right) = SOF\left(\mu_O, E_O\right) \quad (7.3)$$

where $O(x_1)$ is the opportunity enjoyed by the ith individual with income x_i, in which case i varies from 0 to n, with n being the total number of persons in a society. This equation implies that a social opportunity function is a function of two factors: (i) average opportunity available to the society, and (ii) equity of opportunity (i.e., how opportunity is distributed across incomes).

The social opportunity function in (7.3) should be an increasing function of its arguments. If the opportunity of one individual increases without reducing opportunities of others, then the social opportunity function should also increase. This requirement is similar to the Pareto optimality requirement in the case of social welfare function: *A situation is a Pareto improvement if it makes no one worse off and someone better off.* This implies that the social opportunity function in (7.3) will be an increasing function of μ_O: if we expand the average opportunity available to the society without changing the distribution, the social opportunity must increase. To bring equity into consideration, we require a social opportunity function to satisfy the transfer principle: any transfer of opportunity from a poorer (richer) person to a richer (poorer) must decrease (increase) the social opportunity function. This requirement also implies that the social opportunity function must be at least quasi-concave.[1]

As the social opportunity function in (7.3) is still too general, we need to specify the function to operationalize it empirically. Suppose $F(x)$

[1] Quasi-concavity is a mathematical property of a function. $u(x)$ is quasi-concave if and only if $min\left(u(x), u(y)\right) \leq u\left(\rho x + (1-\rho)y\right)$ for any ρ with $0 < \rho < 1$ and for any vectors x and y. See Kakwani (1980) for detailed explanations.

is the probability distribution function of income x when individuals are arranged in ascending order of their income. Then, similar to Sen's (1973) social welfare function, the following social opportunity function can be proposed:

$$SOF\left(\tilde{O}\right) = 2\int_0^\infty O\left(x\right)\left[1 - F\left(x\right)\right] f\left(x\right) dx. \tag{7.4}$$

where $O(x)$ is the opportunity enjoyed by the individual with income x. This social opportunity function is interdependent, which means that an individual's deprivation is captured by weighing the opportunity of the individual by the percentage of individuals who have a higher income than her.

The linkage between opportunity as outcome and income as means can be operationalized using concentration indices. Following Kakwani (1980), the concentration index of opportunity $O(x)$ with respect to income x can be written as

$$C_O = 2\int_0^\infty O\left(x\right)\left[F\left(x\right) - \frac{1}{2}\right] f\left(x\right) dx, \tag{7.5}$$

which when substituted into (7.4) gives

$$SOF\left(\tilde{O}\right) = \mu_O\left(1 - C_O\right) = \mu_O E_O \tag{7.6}$$

where μ_O is the average opportunity in the population. This equation shows that the concentration index C_O is the percentage loss of social opportunity as defined in (7.4).

If $C_O = 0$, it implies that all individuals in the society are enjoying equal opportunity. The negative (positive) value of the concentration index implies the greater (smaller) opportunity for the poor (non-poor). Thus, the concentration index measures inequity in opportunity: the larger its value, the greater is the concentration of opportunity among the non-poor. $E_O = (1 - C_O)$ is a measure of equity of opportunity. If $C_O = 0$, then $E_O = 1$, in which case all individuals enjoy the same opportunity irrespective of their family income. If $C_O < 0$, then $E_O > 1$, in which case opportunities are said to be equitable because the poor persons enjoy more opportunity than the rich. If $C_O > 0$, then $E_O < 1$ and this implies that opportunities are inequitable because the rich enjoy more opportunities than the poor.

The social opportunity index defined in (7.6) is a product of two factors: (i) average opportunity available to the society and (ii) equity of opportunity (i.e., how opportunity is distributed). The social objective is to maximize the social opportunity function (SOF) by increasing μ_O (expanding opportunities) or by increasing E_O (making opportunity more equitable) or by increasing both simultaneously. However, if there is a trade-off between the two, then both cannot be increased simultaneously.

For instance, a government in partnership with the private sector makes a large investment in higher education, which provides on average greater opportunity for the population to enhance its human capital. Consequently, average opportunity in the economy has increased, but at the same time the poor cannot access these opportunity because of the high cost of tertiary education. In this case, equity has become lower and there is a trade-off between equity and efficiency. Efficiency relates to an increase in average opportunity, while equity relates to how opportunity is distributed.

The SOF can be utilized to assess whether such government policy on huge investment in education, in partnership with the private sector, is justified. For instance, if this policy increases the access of population to higher education from % 10 to 20 %, but at the same time reduces equity index from 0.3 to 0.1, then the net effect of this policy will be a reduction in the index defined in (7.6) from 3 % to 2 %. Hence, the adoption of this policy is deemed socially undesirable. Thus, the SOF is key to assessing policies particularly when there is a trade-off between expanding opportunity and equity of opportunity. This trade-off may not always be assumed. There may be situations where an expansion of opportunity is also accompanied by improving equity. Thus, the social opportunity index defined in (7.6) can be employed as a useful tool in the cost-benefit analysis of projects and programs.

7.6 Access of Opportunity by Social Groups

In the previous section, inequity (or equity) was measured based on family income or consumption as a circumstance variable. Some people can be also denied of opportunity because of their affiliation to a particular socioeconomic and demographic group. Any analysis of inequity in opportunity cannot ignore the diversity of such social groups. This section provides a methodology to measure social opportunity by social groups.

Suppose a population is divided into k mutually exclusive social groups and a_i is the population share of the ith group such that $\sum_{i=1}^{k} a_i = 1$. If $f_i(x)$ is the density function of the distribution of income in the ith group, then we have the relation

$$f(x) = \sum_{i=1}^{k} a_i f_i(x) \tag{7.7}$$

where $f(x)$, the density function of the distribution of income in the entire population, will always hold. The social opportunity function (SOF) for the ith social group can be derived from (7.4) as

$$(SOF)_i = 2\int_0^\infty v(x)\left[1 - F(x)\right] f_i(x)\,dx. \tag{7.8}$$

Substituting (7.7) into (7.4) and utilizing (7.8) gives

$$SOF = \sum_{i=1}^{k} a_i (SOF)_i \tag{7.9}$$

which demonstrate that the SOF for the whole population is the weighted average of social opportunity index for each group, where the weight is the population share for the each social group. $100 \times a_i (SOF)_i$ is the percentage contribution of the ith group to the SOF for the whole population. These contributions inform how social opportunities in the population are explained by the opportunities enjoyed by various social groups.

For the population as a whole, we can obtain from (7.6): $SOF = \mu_O E_O$. The same relationship must hold for the *i*th group. As such, we have $SOF_i = \mu_{Oi} E_{Oi}$, where μ_{Oi} is the average opportunity enjoyed by the *i*th group and E_{Oi} is the equity of opportunity in the *i*th group, which upon substituting in (7.9) gives

$$E = \sum_{i=1}^{k} s_i E_i \tag{7.10}$$

where $s_i = \frac{a_i \mu_{Oi}}{\mu_O}$ is the share of opportunities enjoyed by the *i*th social group. This equation demonstrates that the equity index in the population is the weighted average of equity index for each social group, where the weight is the share of opportunity enjoyed by each social group.

The policy-makers' main objective should be to maximize the social opportunity index as defined in (7.6). To achieve this, opportunities available to different social groups must be expanded. Different social groups will have varying impact on the social opportunity index. Given the resource constraints, policy-makers will need to prioritize certain social groups over others to expand their opportunities. The impact of an expansion of opportunity of the *i*th social group can be measured from (7.9) by

$$\frac{\partial (SOF)}{\partial \mu_{Oi}} = a_i E_{Oi} \tag{7.11}$$

which indicates that if average opportunity of the *i*th social group is expanded by one percentage point, the social opportunity function will increase by $a_i E_{Oi}$ percentage points.

A government can incur some costs in providing opportunities to the population. For instance, to increase access to schooling, schools have to be built and teachers have to be deployed. The cost can vary across social groups. Since information on cost is not readily available, as a first approximation, the per person cost of providing opportunity is assumed the same for all groups, in which case the cost of expanding opportunity for the *i*th social group will be related by $dC_i = a_i d\mu_{Oi}$. Substituting this in (7.11) yields

$$\frac{\partial(SOF)}{\partial C_i} = E_{Oi} \tag{7.12}$$

which informs that \$1 expenditure in expanding opportunity for the *i*th social group will lead to E_{Oi} percentage points increase in social opportunity function. The most cost-effective policy to expand social opportunity will be to enhance opportunity in the social groups to yield the maximum value of equity index, which provides a practical method of formulating policies relating to expanding opportunity in the society.

7.7 Empirical Analysis for Selected Countries in Asia

One of the social objectives of inclusive development is to expand economic opportunities and enable all segment of population to equally partake of these opportunities. The previous section developed a social opportunity function, which is the product of average opportunity available to the population and equity of opportunity. The equity of opportunity informs how equitably opportunities are enjoyed by the population. The government's social objective should be to enhance the social opportunity function.

There are various opportunities that enhance a society's well-being. In the analysis of inclusive development, it is not realistic to analyze all the opportunities that people are often faced with. It is, however, important to identify some basic opportunities that are critical to human development. For instance, the United Nations Development Program's human development index focuses mainly on opportunities in health and education. Opportunities may also be defined in terms of access to basic infrastructure such as electricity, clean drinking water, and sanitation. In this section, an analysis of opportunity is presented for education and health.

7.7.1 Opportunities in Education

Equitable access to education is inextricably linked with alleviating poverty and reducing inequality. Education helps lift people out of poverty by developing skills necessary to improve their employability and productivity. To address inequality, equitable learning is crucial in improving the lives of the poor and marginalized so that the benefits of growth are fairly shared.

All children in the school-age groups must attend school, irrespective of their family circumstances. If, somehow, children belonging to poor households are unable to attend school, then there is inequity in the education system. This section presents equity indices for school attendance for two age groups: primary age 6–11 years and secondary age 12–17 years.

Indonesia

In 2000, there were 24.97 million children in the primary age group in Indonesia. The government's objective would be to provide primary education to all these children irrespective of their economic circumstances. As can be seen from Table 7.1, 87.03 % of children aged 6–11 years attended school in 2000. This implies that 3.24 million children in the primary school age group were deprived of their opportunity to attend school.

The number of children in the primary age group increased to 26.57 million in 2009. Hence, the government needed to provide schooling at primary level to an additional 1.6 million children. Despite this increase, 94.29 % of children in this age group were attending primary school in 2009. This suggests that opportunity for primary-aged children has expanded over the period of nine years. In 2009, there were only 1.25 million children who were deprived of their basic opportunity in education.

The percentage of children attending school increases monotonically from the poorest quintile to the richest quintile in both years. This means that children from rich households have greater opportunity to attend school than those from poor households. This finding suggests that opportunities are not equitable. This is also indicated by the equity

Table 7.1 Percentage of children aged 6–11 attending school in Indonesia

Indicators	2000	2009	Growth rate
Number of children 6–11 years (million)	24.97	26.57	0.69
% children attending school (average opportunity)	87.03	94.29	0.89
% children from quintile 1 (poorest) attending school	82.87	91.14	1.06
% children from quintile 2 attending school	85.82	93.50	0.96
% children from quintile 3 attending school	87.86	95.25	0.90
% children from quintile 4 attending school	89.77	96.04	0.75
% children from quintile 5 (richest) attending school	91.67	97.25	0.66
Equity index	0.98	0.99	0.09
Social opportunity function	85.18	93.00	0.98
Number of children deprived of opportunity (million)	3.24	1.52	–8.08

Source: Authors' calculations

indices. Opportunity is said to be equitable (inequitable) if the equity index is greater (less) than 1. Since the equity indices are less than 1, it can be concluded that opportunities are inequitable. However, the degree of inequity is not high because the values of the equity index are close to 1. Moreover, equity in opportunities has improved over time, as indicated by positive growth rates in the equity index during 2000–09.

The opportunity function, which accounts for level and equity of opportunity, has increased at an annual rate of about 0.98 %. This increase is due to the fact that both level and equity of opportunities increased between 2000 and 2009.

School attendance among children aged 12–17 years increased from 74.72 % in 2000 to 80.58 % in 2009 (see Table 7.2), which represents a significant improvement. The equity index was only 0.93 in 2000, holding steady in 2009. While the equity in opportunity has not changed substantially between 2000 and 2009, there has been a significant increase in the coverage of opportunity. In 2000, 6.62 million children in the secondary school age group were deprived of opportunity in school attendance, but this number decreased to 4.92 million in 2009.

In 2014, there were 24.6 million children in the primary age group, and of which 12.54 were males and 12.06 were females (Table 7.3). The

Table 7.2 Percentage of children aged 12–17 attending school in Indonesia

Indicators	2000	2009	Growth rate
Number of children 12–17 years (million)	26.20	25.35	–0.36
% children attending school (average opportunity)	74.72	80.58	0.84
% children from quintile 1 (poorest) attending school	62.50	66.68	0.72
% children from quintile 2 attending school	69.93	77.02	1.08
% children from quintile 3 attending school	75.19	83.14	1.12
% children from quintile 4 attending school	82.02	87.73	0.75
% children from quintile 5 (richest) attending school	88.26	91.02	0.34
Equity index	0.93	0.94	0.10
Social opportunity function	69.46	75.57	0.94
Number of children deprived of opportunity (million)	6.62	4.92	–3.24

Source: Authors' calculations

Table 7.3 Percentage of children attending school in Indonesia in 2014

	Male	Female	Urban	Rural	Total
	Primary school: 6–11 years				
Number of children (million)	12.54	12.05	11.79	12.81	24.60
Average opportunity (%)	99.47	99.76	99.68	99.55	99.61
Equity index	1.09	1.08	0.92	1.24	1.09
Social opportunity function (%)	108.20	108.10	91.89	123.13	108.15
Children deprived of opportunity (million)	0.07	0.03	0.04	0.06	0.10
Elasticity	0.55	0.53	0.44	0.64	1.09
	Secondary school: 12–17 years				
Number of children (million)	14.02	13.27	13.14	14.15	27.29
Average opportunity function (%)	86.71	89.71	91.00	85.54	88.17
Equity index	1.02	1.03	0.88	1.17	1.02
Social opportunity function (%)	88.70	91.99	80.17	99.70	90.30
Children deprived of opportunity (million)	1.86	1.37	1.18	2.05	3.23
Elasticity	0.53	0.50	0.42	0.60	1.02

Source: Authors' calculations

government's objective would be to provide universal primary education irrespective of the children's economic status (family income) and gender. Some 99.47 % of male children and 99.76 % female children aged 6–11 years attended school in 2014. This means that only 0.39 % of children in the primary school age group were deprived of their opportunity to attend school. This small fraction of children who did not attend the school is not significant. Their absence from school could be due to some unavoidable reasons such as disability or sickness.

The average opportunity in primary school age 6–11 years old is not different in rural and urban areas but equity in rural areas is much higher than in urban areas. Consequently, the value of social opportunity function in rural areas is also higher than in urban areas. It seems that a greater proportion of students from poorer families in rural are able to attend school compared to that in the urban areas. Similar conclusion emerges for the children in the secondary age group 12–17 years old. These are surprising results because we expect that there will be greater opportunities for poorer children in urban areas.

Given these findings, government policies in Indonesia have contributed to improvements in the availability of opportunities among primary and secondary school age children. However, a large number of children in secondary age group are still deprived of basic education opportunities.

Bangladesh

In Bangladesh, 5.23 million children in the primary school age group were deprived of opportunity to attend school in 2000 (Table 7.4). Only 75.59 % of children in this age group attended school in 2000. This is notably lower compared to Indonesia where 87.03 % of such children attended school in the same year. The opportunity for children belonging to the poorest quintile is much lower; only 64.21 % of them attended school. In contrast, 86.82 % of primary school age children from the richest quintile attended school in the same year. Thus, there is a considerable inequity in school attendance in the primary level in Bangladesh. This is also indicated by the value of equity index of 0.93 in Bangladesh, compared to 0.98 for Indonesia.

Table 7.4 Percentage of children attending school in Bangladesh in 2000

Indicators	6–11 years	12–17 years
Number of children (million)	21.41	17.93
% children attending school (average opportunity)	75.59	58.25
% children from quintile 1 (poorest) attending school	64.21	41.92
% children from quintile 2 attending school	72.33	47.87
% children from quintile 3 attending school	77.96	53.41
% children from quintile 4 attending school	84.86	68.14
% children from quintile 5 (richest) attending school	86.82	74.41
Equity index	0.93	0.88
Social opportunity function	70.60	51.24
Number of children deprived of opportunity (million)	5.23	7.49

Source: Authors' calculations

In the secondary school age group, the percentage of children attending school is only 58.25 % in 2000, which varies from 41.92 % in the poorest quintile to 74.87 % in the richest quintile. This means that some 7.49 million secondary school age children in Bangladesh are deprived of opportunity to attend school.

In summary, education opportunities available to children in Bangladesh are low and largely determined by the economic circumstance of their parents. This conclusion is based only on data for 2000 so it is not possible to see how much progress Bangladesh has made in improving basic education opportunities for children since then.

Pakistan

Like Bangladesh, education opportunities available to children in Pakistan are limited and heavily influenced by the economic circumstance of their parents (see Table 7.5). The two countries have almost similar profiles of school attendance, but data used for Pakistan are from the 2007–08 period, whereas Bangladesh's data are for the year 2000. Hence, it is difficult to make comparisons of the two. Assuming that Bangladesh would have made some progress in educational attainment between 2000 and 2007–08, it can then be said that Pakistan has fewer education opportunities than Bangladesh.

Table 7.5 Percentage of children attending school in Pakistan in 2007–08

Indicators	6–11 years	12–17 years
Number of children (million)	21.68	19.40
% children attending school (average opportunity)	74.57	56.15
% children from quintile 1 (poorest) attending school	57.36	34.13
% children from quintile 2 attending school	70.36	45.27
% children from quintile 3 attending school	78.86	55.64
% children from quintile 4 attending school	87.40	66.91
% children from quintile 5 (richest) attending school	93.17	83.17
Equity index	0.90	0.83
Social opportunity function	66.91	46.44
Number of children deprived of opportunity (million)	5.51	8.51

Source: Authors' calculations

Table 7.6 Percentage of children aged 6–11 attending school in Sri Lanka

Indicators	2006–07	2009–10	Growth rate
Number of children 6–11 years (million)	2.45	2.10	–4.98
% children attending school (average opportunity)	98.74	99.39	0.22
% children from quintile 1 (poorest) attending school	97.37	98.95	0.54
% children from quintile 2 attending school	98.99	99.60	0.21
% children from quintile 3 attending school	99.38	99.25	–0.04
% children from quintile 4 attending school	99.13	99.50	0.12
% children from quintile 5 (richest) attending school	99.70	99.81	0.04
Equity index	0.99	1.00	0.14
Social opportunity function	98.21	99.27	0.36
Number of children deprived of opportunity (million)	0.03	0.01	–25.27

Source: Authors' calculations

Sri Lanka

In contrast to Pakistan and Bangladesh, almost all children in the primary school age group in Sri Lanka are attending school. The percentage of these children attending school was 99.39 % in 2009–10 so there were hardly any children who did not attend school (Table 7.6). The value of equity index is 1.0, which means that all children irrespective of their economic circumstances have an opportunity to attend primary school in Sri Lanka.

The percentage of children in the secondary school age group attending school was 86.38 % in 2009–10 (see Table 7.7); this figure is relatively high compared to that in its neighboring countries in Asia. This outcome also compares favorably with secondary school attendance in developed countries. The percentage of secondary school age children attending school increases monotonically from the poorest quintile to the richest quintile in 2006–07 and 2009–10. Hence, children from wealthier families have greater opportunities to attend school compared to their poorer counterparts. While opportunities to attend secondary school are not equitable, the variation in attendance across quintiles is not large. The value of equity index is 0.97 in 2009–10, which is high for secondary school children even when compared with developed countries.

In conclusion, Sri Lanka is clearly an outlier in its achievement of educational opportunities among low-income countries. No other low-income country has ever achieved such a high level of educational attainment.

Table 7.7 Percentage of children in aged 12–17 attending school in Sri Lanka

Indicators	2006–07	2009–10	Growth rate
Number of children 12–17 years (million)	2.65	2.08	−7.69
% children attending school (average opportunity)	83.54	86.38	1.12
% children from quintile 1 (poorest) attending school	76.04	78.68	1.14
% children from quintile 2 attending school	79.39	84.70	2.18
% children from quintile 3 attending school	88.83	87.86	−0.37
% children from quintile 4 attending school	86.63	91.23	1.74
% children from quintile 5 (richest) attending school	95.17	92.63	−0.90
Equity index	0.96	0.97	0.37
Social opportunity function	79.79	83.43	1.50
Number of children deprived of opportunity (million)	0.44	0.28	−13.34

Source: Authors' calculations

Vietnam

Vietnam has achieved notable progress in poverty reduction, with the percentage of extreme poor down to around 2.5 %. The country's performance in providing basic education opportunities is also commendable. In 2008, almost 96.31 % of children aged 6–11 years and 81.97 % of children aged 12–17 years attended primary and secondary school, respectively (refer to Tables 7.8 and 7.9). The number of children deprived of opportunity to attend school is low at 0.28 million in the 6–11 age group and 2.08 million in the 12–17 age group.

The percentage of children attending school increases monotonically from the poorest to the richest quintile in 2002 and 2008, suggesting that children from poorer households have fewer opportunities to attend school compared to children from their richer counterparts. However, the difference across quintiles is rather small, and the equity index is 0.98 for the 6–11 age group and 0.95 for the 12–17 age group. This suggests that the opportunities in primary and secondary education are also equitable.

Vietnam's government policies have almost eliminated extreme poverty and significantly improved education opportunities for both primary and secondary school age children. With the number of children deprived of

Table 7.8 Percentage of children aged 6–11 attending school in Vietnam

Indicators	2002	2008	Growth rate
Number of children 6–11 years (million)	10.17	7.57	−7.10
% children attending school (average opportunity)	94.17	96.31	0.56
% children from quintile 1 (poorest) attending school	89.54	92.72	0.88
% children from quintile 2 attending school	94.50	96.90	0.63
% children from quintile 3 attending school	95.10	96.89	0.47
% children from quintile 4 attending school	96.71	98.25	0.40
% children from quintile 5 (richest) attending school	98.25	99.80	0.39
Equity index	0.98	0.98	0.10
Social opportunity function	92.32	94.80	0.66
Number of children deprived of opportunity (million)	0.59	0.28	−17.15

Source: Authors' calculations

Table 7.9 Percentage of children aged 12–17 attending school in Vietnam

Indicators	2002	2008	Growth rate
Number of children 12–17 years (million)	11.78	11.56	–0.47
% children attending school (average opportunity)	75.68	81.97	2.02
% children from quintile 1 (poorest) attending school	64.37	69.73	2.02
% children from quintile 2 attending school	73.01	80.97	2.62
% children from quintile 3 attending school	75.26	84.63	2.98
% children from quintile 4 attending school	80.87	85.99	1.55
% children from quintile 5 (richest) attending school	88.5	93.28	1.33
Equity index	0.94	0.95	0.11
Social opportunity function	71.23	77.49	2.13
Number of children deprived of opportunity (million)	2.86	2.08	–7.64

Source: Authors' calculations

attending school very low, Vietnam provides a good example of successfully achieving the social objective of education for all.

Philippines

The Philippines and Vietnam are similar in terms of population, but Vietnam has charted a better performance in poverty reduction than the Philippines. Extreme poverty in the Philippines is around 15 %, compared to around 2.5 % in Vietnam, based on their national poverty lines. The Philippines also has slightly higher inequality than Vietnam. Interestingly, educational opportunities available to children in the primary school age group in the two countries are similar in magnitude (Table 7.10).

In contrast, the opportunities for secondary school age children in the Philippines have declined significantly and have also become less equitable. Although growth in the Philippines has improved considerably, it still lags behind in achieving poverty reduction. Its educational attainments in the secondary level have declined (Table 7.11). As such, the pattern of growth in the Philippines cannot be considered as inclusive.

Table 7.10 Percentage of children aged 6–11 attending school in the Philippines

Indicators	2002	2007	Growth rate
Number of children 6–11 years (million)	11.76	13.04	2.60
% children attending school (average opportunity)	93.92	94.38	0.12
% children from quintile 1 (poorest) attending school	88.59	88.80	0.06
% children from quintile 2 attending school	93.38	94.25	0.23
% children from quintile 3 attending school	95.81	96.43	0.16
% children from quintile 4 attending school	97.66	98.03	0.09
% children from quintile 5 (richest) attending school	99.30	98.98	–0.08
Equity index	0.98	0.98	0.02
Social opportunity function	91.58	92.11	0.14
Number of children deprived of opportunity (million)	0.72	0.73	0.59

Source: Authors' calculations

Table 7.11 Percentage of children aged 12–17 attending school in the Philippines

Indicators	2002	2007	Growth rate
Number of children 12–17 years (million)	10.49	13.17	5.84
% children attending school (average opportunity)	83.09	79.53	–1.09
% children from quintile 1 (poorest) attending school	73.09	68.75	–1.52
% children from quintile 2 attending school	78.95	74.91	–1.30
% children from quintile 3 attending school	83.64	79.60	–1.23
% children from quintile 4 attending school	89.02	86.37	–0.75
% children from quintile 5 (richest) attending school	95.29	94.22	–0.28
Equity index	0.95	0.94	–0.27
Social opportunity function	78.63	74.43	–1.36
Number of children deprived of opportunity (million)	1.77	2.70	11.03

Source: Authors' calculations

Bhutan

Bhutan is a relatively small kingdom within Himalaya with a population of only 750,000. Extreme poverty is low, with only 3.5 % of the population deemed as extreme poor. The Gini index is calculated at 38 %, which is high given the size of the country.

In 2003, there were 81,480 children in the primary school age group. The government's objective would be to provide primary education to all children irrespective of their economic circumstance. Nevertheless, only 70.2 % of children aged 6–11 years attended school in 2003 (Table 7.12). Hence, 24,280 children in the primary school age group were deprived of opportunity to attend school. The number of children deprived of the educational opportunity, however, declined to 14,420 in 2007. The equity index had also risen during 2003–07, but inequity still exists. The percentage of children attending school increases monotonically from 70 % among children in the poorest quintile to 96.57 % among children in the richest quintile. Thus, education opportunities available to children in Bhutan are largely determined by the economic circumstance of their parents.

Although the educational opportunities available to secondary school age group are low in Bhutan, improvement in opportunity is significant (Table 7.13). The number of children deprived of opportunities in secondary education has declined from 33,950 to 26,390. The educational opportunities have become equitable over time, but inequity is still severe. The family's economic circumstances play an important role in determining educational opportunities available to children.

Table 7.12 Percentage of children aged 6–11 attending school in Bhutan

Indicators	2003	2007	Growth rate
Number of children 6–11 years (thousand)	81.48	85.06	1.08
% children attending school (average opportunity)	70.20	83.05	4.29
% children from quintile 1 (poorest) attending school	56.68	70.00	5.42
% children from quintile 2 attending school	65.11	81.61	5.81
% children from quintile 3 attending school	72.09	88.61	5.29
% children from quintile 4 attending school	82.31	93.76	3.31
% children from quintile 5 (richest) attending school	90.85	96.57	1.54
Equity index	0.91	0.93	0.66
Social opportunity function	63.55	77.20	4.98
Number of children deprived of opportunity (thousand)	24.28	14.42	−12.22

Source: Authors' calculations

Table 7.13 Percentage of children aged 12–17 attending school in Bhutan

Indicators	2003	2007	Growth rate
Number of children 12–17 years (thousand)	85.53	94.41	2.50
% children attending school (average opportunity)	60.31	72.04	4.55
% children from quintile 1 (poorest) attending school	45.55	53.47	4.09
% children from quintile 2 attending school	52.11	69.39	7.42
% children from quintile 3 attending school	65.16	79.41	5.07
% children from quintile 4 attending school	75.02	84.21	2.93
% children from quintile 5 (richest) attending school	78.62	83.66	1.57
Equity index	0.87	0.90	0.85
Social opportunity function	52.72	65.14	5.43
Number of children deprived of opportunity (thousand)	33.95	26.39	–6.10

Source: Authors' calculations

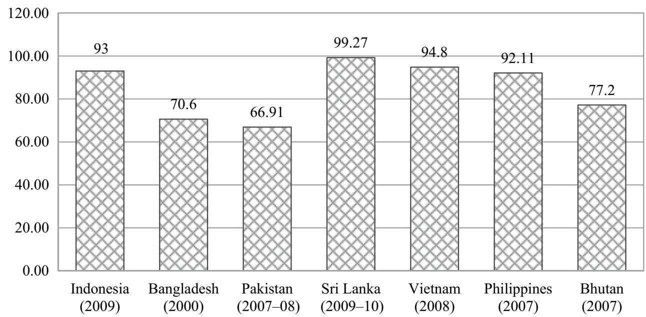

Fig. 7.1 Opportunity index for the children in the primary school age group in selected Asian countries

A Summary of Opportunities Across Selected Countries

Figures 7.1 and 7.2 present the social opportunity function for children having opportunities to attend primary and secondary school in Bangladesh, Bhutan, Indonesia, Pakistan, Philippines, Sri Lanka,

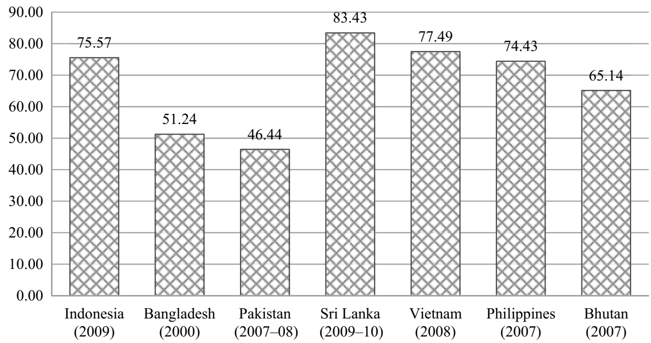

Fig. 7.2 Opportunity index for the children in the secondary school age group in selected Asian countries

and Vietnam. Basic education opportunities lay the foundation for an educated work force. If children are deprived of opportunities to attend school, a society's efforts to promote human capital development—a crucial component of inclusive development—will be jeopardized. Among the countries examined, Sri Lanka charts the best performance in providing opportunities for basic education, followed by Vietnam, Indonesia, and the Philippines. In contrast, Pakistan has the worst performance followed by Bangladesh.

7.7.2 Opportunities in Health

Inadequate access to health services is both a cause and consequence of poverty and inequality. Poverty is associated with poor health outcomes since it forces people to live in environments with limited clean water and sanitation or no decent shelter. Similarly, poor health outcomes such as life expectancy or infant mortality are linked with inequality. The consequences of poor health outcomes for an economy are significant such as reduced productivity of the workforce or greater public investments in health. This section examines the opportunities in health in selected Asian countries.

Indonesia

In many developing countries, a lack of qualified health personnel during childbirth is linked with maternal and infant death, as well as infant deformities. In Indonesia, only 18.7 % of babies were delivered by qualified doctors in 2014 (Table 7.14). A large proportion of babies were delivered by midwives or other unqualified health personals. Among the poorest 20 % population, child birth by doctors is only 7.8 %, compared to 40 % for the richest 20 % population. The equity index for childbirth assisted by doctors is only 0.76. This indicates that a large proportion of poor women in Indonesia are deprived of this basic health service critical for the health of both mother and newly born.

Access to immunization is also critical for the health and survival of infants and children. Children who have been deprived of appropriate doses of vaccination can suffer serious health issues or even death. For instance, 90.7 % of children in Indonesia received polio vaccination in 2014 (see Table 7.15), which means that 9.3 % children had no protection from polio. The value of equity index for polio is equal to 0.99, which implies that children from both poor and non-poor households have more or less equal probability of getting polio vaccination. Hence, the government should make effort in expanding the polio vaccination program so that no child is subject to the risk of acquiring polio. Meanwhile, the coverage of measles vaccination is only 78.5 %, which is quite low and needs to be improved.

Table 7.14 Opportunity in access to trained health personnel during delivery in Indonesia in 2014

Indicators	Doctors	Midwife	Others
Average opportunity (%)	18.7	65.1	16.2
% of child birth from quintile 1 (poorest)	7.8	56.4	35.8
% of child birth from quintile 2	11.0	64.6	24.3
% of child birth from quintile 3	14.4	66.8	18.9
% of child birth from quintile 4	20.7	65.5	13.7
% of child birth from quintile 5 (richest)	40.2	52.8	7.0
Equity in opportunity	0.76	1.12	1.36
Social opportunity Function	30.6	58.9	9.5

Source: Authors' calculations

The provision of vaccination to all children is one of the least expensive health interventions that governments can support. In Indonesia, much more needs to be done to expand the coverage of child vaccination, especially since family circumstances do not play a key role in protecting the children from serious diseases.

Health care is provided by private and public service providers. Private health care is generally of high quality, but may be unaffordable to a large proportion of people forcing them to seek treatment in public health facilities. In Table 7.15, utilization of health care is measured by the average number of visits by the population during the last six months of the survey year. For instance, the Indonesian population on average made 2.88 visits to government hospitals and 1.77 visits to private hospitals in 2014. Thus, government hospitals are utilized more than the private hospitals.

The equity index for the private hospitals is only 0.54, which implies that the poor do not have much opportunity to utilize private hospitals that have higher quality of health care compared with government hospitals (Table 7.16). It is striking to note that the equity index for the government hospitals is only 0.78, suggesting that the poor enjoy less opportunity than the non-poor even in the utilization of government hospitals. Since government hospitals are largely funded by the government,

Table 7.15 Opportunity in child vaccination in Indonesia in 2014

Indicators	BCG	DPT	Polio	Measles	Hepatitis B
Average opportunity (%)	93.4	90.7	90.7	78.5	87.5
Coverage in quintile 1 (poorest)	91.2	89.4	88.9	77.1	84.7
Coverage in quintile 2	92.0	89.2	89.7	77.3	85.7
Coverage in quintile 3	94.1	91.5	91.5	78.7	88.9
Coverage in quintile 4	94.9	91.7	91.7	79.1	88.6
Coverage in quintile 5 (richest)	95.9	92.5	92.9	81.2	91.2
Equity in opportunity	0.99	0.99	0.99	0.99	0.98
Social opportunity function	92.31	89.91	89.86	77.67	86.14

Source: Authors' calculations

Note: *BCG* stands for bacillus calmette guérin which is a vaccine against tuberculosis; DPT is a class of combination vaccines against three infectious diseases: diphtheria, pertussis, and tetanus

Table 7.16 Utilization and equity in health care in Indonesia in 2014

Indicators	Government hospital	Private hospital	Community health center
Average opportunity (%)	2.88	1.77	0.45
Utilization from quintile 1 (poorest)	3.17	0.66	0.86
Utilization from quintile 2	3.01	1.11	0.70
Utilization from quintile 3	3.52	0.94	0.51
Utilization from quintile 4	3.58	1.47	0.37
Utilization from quintile 5 (richest)	3.42	2.55	0.17
Equity in opportunity	0.78	0.54	1.17
Social opportunity function	2.25	0.95	0.53

Source: Authors' calculations
Note: Utilization and equity in health care are measured by visits made in the past six months in 2014

it is critical to ensure that poor people can more readily access them than their non-poor counterparts. However, the richer population is currently utilizing more of both private and public hospitals.

People at the lower end of the income distribution are the main users of community health centers. This is evident in the value of equity index at 1.17. Community health centers are not as well equipped as hospitals to deal with serious illnesses. These centers are supposedly to provide preventive health care and treatment for minor illnesses. Thus, the poor have fewer opportunities for treatment when confronted with serious illnesses.

Indonesia's health care system is inequitable, favoring the rich more than the poor. Even government hospitals provide greater opportunity for treatment to richer population. While Indonesia has recently performed well on the growth front, inequities in the provision health care remain.

Philippines

The Philippines has an extensive network of both public and private health facilities, which include government hospitals, private hospitals, private clinics, rural health centers (RHCs), barangay health stations (BHSs), and other miscellaneous facilities. Table 7.17 presents the

Table 7.17 Utilization and equity in health care in the Philippines in 2007

Indicators	Government hospital	Private hospital	Private clinic	Rural health unit	Barangay health station	Other health care
Average opportunity (%)	29.04	19.23	21.82	20.18	15.55	1.75
Utilization among quintile 1 (poorest)	26.67	4.92	7.39	33.74	30.10	3.31
Utilization among quintile 2	32.51	8.94	12.41	27.86	23.22	1.79
Utilization among quintile 3	35.78	12.94	17.48	23.56	15.74	2.08
Utilization among quintile 4	29.68	18.74	26.06	19.18	12.55	1.26
Utilization among quintile 5 (richest)	23.17	37.11	34.36	7.29	5.83	1.10
Equity in opportunity	0.91	0.51	0.59	1.12	1.18	1.10
Social opportunity function	26.28	9.79	12.91	22.64	18.33	1.92

Source: Authors' calculations

percentage of the population utilizing such facilities and the equity index that informs the extent to which facilities are utilized by poor and non-poor populations.

About 29.04 % of the Philippine population utilized government hospitals in the past six months of the survey year, but the rate of utilization was 26.67 % among the poorest 20 % of population, which increased to 35.78 % among those belonging to the third quintile. The utilization rate among the richest 20 % population was the lowest at 23.17 %. Nevertheless, the equity index of 0.91 suggests that there is inequity in the utilization of government hospitals. The degree of inequity is, however, relatively smaller than that observed in Indonesia. The inequity is expectedly much higher in the utilization of private hospitals and clinics.

The equity index is found to be significantly greater than 1 for RHCs, BHSs, and other miscellaneous facilities. This implies that the poor population tends to depend largely on the health services provided by these health care facilities. To achieve inclusive growth, the government should therefore improve the quality health care facilities, particularly the RHUs and BHSs.

A good health care system allows people with ill health to get treatment from a qualified medical professional. If any person is unable to seek such a treatment when ill, he is deprived of such health opportunity, which can have a potential long term impact. In 2007, only 33.37 % of the population could get treatment when ill from a medical professional in the Philippines (Table 7.18). The value of equity index is 0.84, which implies that there is a large degree of inequity in getting treatment from professional medical personnel among the income groups. The poorer population when ill is either unable to get any treatment or depend on

Table 7.18 Types of treatment sought by ill people in the Philippines in 2007

Indicators	No treatment	Self treatment	Medical professional	Traditional
Average opportunity (%)	5.37	55.29	33.37	5.85
% of people seeking treatment from quintile 1 (poorest)	7.41	61.51	20.25	10.74
% of people seeking treatment from quintile 2	6.14	59.64	26.25	7.72
% of people seeking treatment from quintile 3	5.05	57.34	32.11	5.47
% of people seeking treatment from quintile 4	4.32	52.62	39.87	3.04
% of people seeking treatment from quintile 5 (richest)	3.59	43.78	51.13	1.41
Equity in opportunity	1.18	1.09	0.84	1.36
Social opportunity function	6.31	60.52	28.04	7.98

Source: Authors' calculations

self treatment or traditional treatment. These results indicate that the Philippines has serious inequities in access to basic health services.

Vietnam

The utilization of health facilities in Vietnam is measured by the average number of visits to these facilities. Figure 7.3 presents the population's utilization of 13 types of medical facilities, most of which are run by the government.

The health facilities most intensively utilized by the population are community health clinics, district hospitals, provincial hospitals, and central hospitals, which are government facilities. With the exception of private clinics, the private facilities are not much utilized. Thus, the government plays the key role in providing health services to the Vietnamese population.

To see how equitably various health facilities are utilized, the equity index is presented in Fig. 7.4. The equity index of most of the government facilities has a value equal or greater than 1. The exceptions are provincial hospitals and other state-owned hospitals. Access to these facilities is not equitable because they are largely utilized by the urban population. Private hospitals are largely located in urban areas and generally utilized by the richer population.

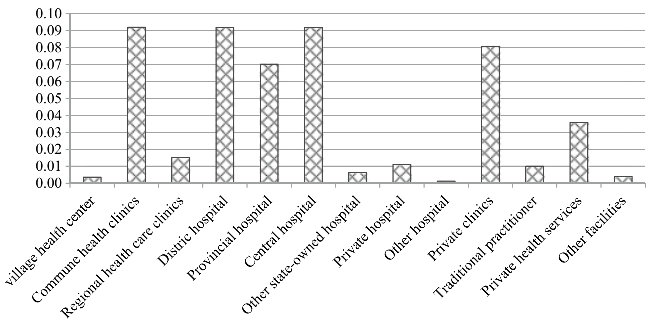

Fig. 7.3 Average utilization of various health facilities in Vietnam in 2008 (*Source*: Authors' calculations)

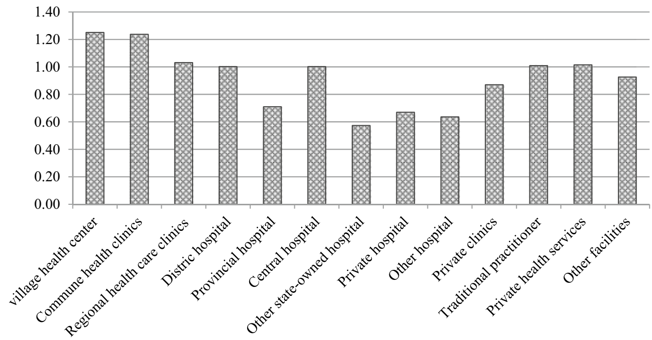

Fig. 7.4 Equity index of utilization of various health care services in Vietnam in 2008 (*Source*: Authors' calculations)

Overall, public health facilities are equitably utilized in Vietnam. Family circumstances do not play a key role in the overall access to health services in the country.

7.8 Concluding Remarks

Inequality is one of the defining challenges facing many economies today. While inequality is often examined in terms of outcomes such as income or consumption, improving how equitably people can access opportunities such as education or health services is also equally important in improving welfare.

This chapter analyzed the equity of opportunity in basic education and health in Bangladesh, Bhutan, Indonesia, Pakistan, Philippines, Sri Lanka, and Vietnam. It defined opportunity as access to basic services such as education, health, nutrition, clean water, electricity, and sanitary toilets, which enhances individuals' well-being. This study developed an index of equity of opportunity based on the concept of social opportunity function. The index measures the extent to which opportunities are equitably available to a population, particularly the poor. Meanwhile, the social opportunity function is useful in assessing policies that involve a trade-off between expanding opportunity and equity of opportunity.

In basic education, Sri Lanka, Vietnam, and Indonesia charted progress in expanding opportunities, improving equity in these opportunities or both. In Sri Lanka, the equity index for primary education is 1.0 in 2009–10, implying that all children have an opportunity to attend primary school regardless of their economic circumstances. Meanwhile, the corresponding value for secondary level is 0.97 in the same year. Similarly, in Vietnam, the number of children deprived of attending primary and secondary school is low—reaching 0.28 million and 2.08 million, respectively, in 2008.

Opportunities to attend primary school in Indonesia expanded between 2000 and 2009. Some 3.24 million children aged 6–11 were deprived of their opportunity to attend primary school in 2000, but this number decreased to 1.25 million in 2009. The opportunity function rose at an annual rate of about 0.98 % given that both level and equity of opportunities increased in 2000–09. At the secondary level, equity in opportunity has not changed significantly in the given period. However, a notable increase in the coverage of opportunities is observed; the number of children in the secondary school age group deprived of the opportunity to attend secondary school decreased from 6.62 million in 2000 to 4.92 million children in 2009.

While notable improvement in education opportunities was seen in Sri Lanka, Vietnam, and Indonesia, Philippines, Bangladesh, Bhutan, and Pakistan have encountered challenges in this area. While opportunities to attend primary school in the Philippines has held steady in 2000–08, opportunities for secondary school age children have declined significantly and became less equitable. In Bhutan, Bangladesh, and Pakistan, economic circumstance of parents largely determined the availability of basic education opportunities to children. For instance, the percentage of children attending primary school in Bhutan is 70 % among the bottom quintile, compared to 96.57 % in the richest quintile. Similarly in Bangladesh, the percentage of children attending secondary school varies from 41.92 % in the bottom quintile to 74.87 % in the top quintile in 2000. The equity indices for primary and secondary level in Pakistan were 0.90 and 0.83, respectively, in 2007–08, indicating that inequity exists.

Providing opportunities for basic health services appear more challenging for some Asian economies than for basic education. For instance, in Indonesia, the equity index for doctor-assisted child birth is only 0.76, which means that a large proportion of poor women do not have access to services of qualified health personals during child delivery. Immunization is one of the least expensive health interventions. In Indonesia, family circumstances do not influence access to vaccination, but the coverage for child vaccination needs to be expanded.

In the utilization of health facilities, the poor have less opportunity than the non-poor in utilizing government hospitals in Indonesia—given that the equity index for the government hospitals is only 0.78. Similarly, the equity index for the private hospitals is only 0.54, which means that the poor have fewer opportunities to utilize private hospitals compared to the non-poor. Poor households are the main users of community health centers, with an equity index of 1.17. Since these centers focus on preventive health care and treatment for minor illnesses, the poor do not have much opportunity to seek treatment for serious illnesses.

In the Philippines, the equity index in the utilization of the government hospitals is 0.91, which is relatively smaller than in Indonesia. Poor people depend largely on RHCs, BHSs and other miscellaneous facilities given that the equity index is greater than 1 for these facilities. In Vietnam, government-run community health clinics, district hospitals, provincial hospitals and central hospitals are most intensively utilized by the population. Hence, public health investments are crucial in improving health opportunities in Vietnam.

8

Global Poverty Counts

8.1 Introduction

How many people are considered poor in the world? This question may seem simple, but drawing a global poverty line demands an intricate analysis of subsistence needs, relative prices, and purchasing power that vary across countries over time. In 2015, the World Bank refined its estimates of the purchasing power parity (PPP), which is a currency conversion for comparing the size and price levels of economies, by updating the base year from 2005 to 2011. The release of the 2011 PPP has sparked debates about how a new global poverty threshold should be established. This chapter aims to determine a new global poverty threshold based on the 2011 PPP.

The change in PPPs should not sharply shift poverty counts, but the World Bank's calculations have shown otherwise. With the modification of 1993 PPP to the 2005 PPP, the World Bank estimates that the number of poor in the world increased by about 500 million. Given the same absolute poverty line and distributions, such change in PPP conversions should not substantially increase the number of poor in the world.

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A large increase in poverty counts of about 500 million can only happen when the real poverty line has been adjusted upward. Nonetheless, updating PPP conversions can alter the poverty profiles across countries. Since countries have different sizes of population, global poverty counts can also change. For instance, if the change in PPPs increases the percentage of poor in large countries, the total number of poor in the world can increase. The new 2011 PPP conversion rates cover more countries and are based on an improved methodology and a more detailed coverage of price data. This provides an opportunity to improve the calculations of global poverty counts.

A 2015 paper by the World Bank stressed that the new poverty line should preserve the real purchasing power of the earlier poverty line of \$1.25 in 2005 PPP.[1] Based on its most recent estimates, the World Bank increased the poverty line from \$1.25 in 2005 PPP to \$1.90 in 2011 PPP. The revised poverty line—albeit seemingly very high—leads to a relatively small change in global poverty incidence with only a moderate increase in the number of poor in 2011.

The poverty line of \$1.25 per person per day in 2005 PPP has been widely used by the international development community as a basis for poverty reduction efforts. The poverty counts based on this poverty line have been the key indicator for assessing progress in the Millennium Development Goals (MDGs). The United Nations' more recent Sustainable Development Goals, adopted in 2015, have also used global poverty rates as a key indicator to assess economic development in the post-MDG era. The World Bank in 2013 announced a new goal of reducing the share of the world's population living in extreme poverty to no more than 3% by 2030. Given this wide adaptation, the poverty line of \$1.25 will continue to be used as a benchmark for calculating global poverty rates.

With the release of the 2011 PPP conversion rates, determining the poverty line in 2011 PPP that is equivalent to the poverty line of \$1.25 in 2005 PPP becomes pertinent. To calculate a single international poverty line based on 2011 PPP, this chapter proposes a new methodology of equivalent poverty lines. This method is different from the World Bank's approach that establishes a single poverty line for all countries based on

[1] See Ferreira et al. (2015).

the national poverty lines found in the 15 poorest countries. This idea of equivalent poverty lines was initially developed by the authors in an earlier version of this chapter. The World Bank has now applied this new method to the poverty lines of 15 poorest countries to arrive at its official poverty line of $1.90 in 2011 PPP.[2]

8.2 Establishing Global Poverty Lines

The first serious attempt to calculate global poverty estimates based on an international poverty threshold dates back to 1990. Using a sample of national poverty lines from 33 countries and 1985 PPP exchange rates, the World Bank derived the $1-a-day poverty line. Since then, the $1-a-day threshold has been regarded the absolute minimum standard of living and below this, basic needs cannot possibly be met.

The World Bank initially attempted to derive the $1-a-day[3] poverty line by fitting a cross-country semi-logarithmic function that related a country's poverty line with its mean private consumption, both of which are expressed in 1985 PPP dollars. However, the World Bank eventually decided to eye-ball the scatter plot of that equation after its econometric analysis failed to produce a reasonable yardstick. Using this eye-balling method, the poverty line of $31 per month (or $1 a day) was selected because the (duly converted) national poverty lines of eight of the poorer countries in the sample were very close to $1 a day, and was thus considered to be reflective of a poverty line that was *most typical* for poor countries.

Moreover, the sample of national poverty lines from 33 countries was gathered from various sources within and outside the World Bank. Many of them were estimates from independent researchers and could not be considered official. The sample also included wealthy countries such as Australia, Belgium, Canada, Germany, Japan, and the United States (U.S.A.) where absolute poverty is of little concern. Further, some countries had separate poverty lines for urban and rural areas. In these

[2] An earlier version of this chapter discussing the equivalent poverty lines was shared with some economists at the World Bank in early 2015.

[3] To be precise, it was actually $1.02 a day.

cases, the World Bank selected the lower poverty line, whereas the correct procedure would have been to compute the weighted average of the two lines with weights proportional to the total population in each area.

In the late 1990s, the World Bank released the 1993 PPP exchange rates, which accounted for a much broader coverage of countries than the previous PPP. However, critics noted that the change in the base year from 1985 to 1993 lowered the international poverty line in real terms. The World Bank updated the international poverty line by calculating the median of the ten lowest poverty lines in its original sample of 33 countries based on the 1993 PPP. The resulting poverty line was \$1.08 a day in 1993 PPP, which replaced the previous threshold of \$1 a day. The ten countries with the lowest poverty lines were not necessarily countries with low incomes. Indonesia and Thailand, as well as Tunisia—a relatively better-off country with per capita consumption of \$8 in 1993 PPP—were included in the ten countries.

The World Bank again updated the PPP estimates in 2008, producing the 2005 PPP conversion factor. However, instead of converting the previous poverty line of \$1.08 to 2005 prices, it redrew the global poverty line. The World Bank found that national poverty lines do not increase with per capita consumption until they reach about \$60 per month, after which they rise notably. As a result, the World Bank set the new international poverty line of \$1.25 a day in 2005 PPP which is now regarded as the extreme poverty line. The \$1.25-a-day poverty line is based on the mean of the poverty lines among the 15 poorest countries in terms of their per capita consumption. Those poorest countries were Mali, Malawi, Ethiopia, Sierra Leone, Niger, Uganda, Gambia, Rwanda, Guinea-Bissau, Tanzania, Tajikistan, Mozambique, Chad, Nepal, and Ghana. Table 8.1 presents the calculations of the new poverty lines for these 15 poorest countries.

Critics, however, have raised concerns with this approach of redrawing the poverty line based on new data. Regarding the \$1.25-a-day threshold based on 2005 PPP, they note that the group of countries changed with a new sample of national lines, which resulted in "graduation effects" when specific countries were taken out of the reference group (Bluhm et al. 2014). For instance, if Guinea-Bissau was left out of the reference group, the international poverty line would decrease and global poverty counts would thus be reduced by more than 20

Table 8.1 Re-estimating $1.25-line using the 2011 PPPs

Country	Poverty line year(s)	2005 PPP	2011 PPP	CPI 2011 (2005 = 100)	Poverty line in 2005 PPP	Poverty line in 2011 PPP
Chad	1995–96	327.57	251.30	112.4	0.87	1.28
Ethiopia	1999–2000	2.75	5.44	297.1	1.35	2.03
Gambia, The	1998	10.34	10.83	129.3	1.48	1.82
Ghana	1998–99	0.45	0.79	295.2	1.83	3.07
Guinea-Bissau	1991	284.28	248.24	124.8	1.51	2.16
Malawi	2004–05	56.92	78.02	214.6	0.86	1.34
Mali	1988–89	289.68	221.87	119.8	1.38	2.15
Mozambique	2002–03	11.63	15.53	173.5	0.97	1.26
Nepal	2003–04	26.47	25.76	164.8	0.87	1.47
Niger	1993	267.33	228.75	116.3	1.10	1.49
Rwanda	1999–2001	236.75	246.83	157.8	0.99	1.50
Sierra Leone	2003–04	1396.21	1767.19	203.9	1.69	2.73
Tajikistan	1999	0.93	1.88	334.2	1.93	3.18
Tanzania	2000–01	482.45	585.52	169.9	0.63	0.88
Uganda	1993–98	744.62	946.89	178.0	1.27	1.77
Mean					1.25	1.88

Source: Ferreira et al. (2015)

Note: *PPP* purchasing power parity, *CPI* consumer price index

times than the population of Guinea-Bissau. In contrast, both the international poverty line and the global poverty headcount increased due to India being dropped out of the average. India was originally part of the previous rounds of PPP estimation, but was taken out of the reference group as the country's average consumption crossed the threshold of $60 (Deaton 2010).

Using the national poverty lines as presented allows the global poverty line to reflect how the world's poorest countries estimate a minimum threshold that meets basic needs. However, this is contradicted by the fact that the countries included in the reference group are not the poorest in the world. Of the 15 countries in the group, 13 are in Sub-Saharan Africa and the remaining two, Nepal and Tajikistan, are in Asia. Tajikistan cannot be deemed one of the poorest countries with only 6.04 % of its population considered as poor.

A strong critique of this approach based on the 15-country reference group was laid out by Deaton (2010). It correctly pointed out that these countries provide weak support for representing the world's poor. The national poverty lines of the 15 countries were gathered from various sources within and outside the World Bank that used different methodologies. In fact, many estimates were from independent researchers and thus cannot be considered official. The methodology for constructing a minimum threshold for living standards is complex, and many countries often adopt such thresholds on an ad hoc basis. Moreover, poverty lines for some countries in the reference group were constructed more than two decades ago and may no longer reflect the current level of living standards appropriately.

In essence, the PPP conversion factors are exchange rates used in order to maintain the real value of the poverty line (Jolliffe and Prydz 2015). Of the 15 countries, Tanzania has the lowest poverty line of $0.88 in 2011 PPP, while Ghana has the highest at $3.44 in 2011 PPP (see Table 8.1). This implies that the basic needs in Ghana are about four times greater than those in Tanzania. If those poverty lines had appropriately reflected the cost of absolute basic needs, they should not have varied widely from one country to another. The basic needs, as indicated by the poverty lines, differ across countries. Thus, the large variation in the real poverty lines suggests that there are other country-specific factors affecting the national poverty lines. Given this, the World Bank's assumption that the national poverty lines measure the cost of absolute basic needs may be implausible.

Aside from the PPP conversion factors, the global poverty line also depends crucially on the inflation rates between the survey year and 2011 in each of the 15 countries. To illustrate, the inflation rate in Ghana would have an impact on the number of poor in China through the poverty line constructed globally. Thus, it can be said that the global poverty line has been heavily influenced by a few small countries in Sub-Saharan Africa. This is the main reason why a methodology of drawing the global poverty line can lead to peculiar results. A case in point is the increase in the number of poor in the world by 500 million when the 1993 PPP was modified to 2005 PPP.

8.3 Producing Global Poverty Estimates

In the development community, the World Bank's PovcalNet is widely used to calculate global poverty estimates based on any global poverty line. Global poverty lines are determined using PPPs. The International Comparison

Program, which was established in the early 1970s, calculates PPP estimates by gathering data on prices and expenditures for a wide range of final goods and services used in the compilation of gross domestic product.

PPP conversion factors have undergone many rounds of revisions, with estimates released for the base years 1985, 1993, 2005, and 2011. While the 2005 round covered 146 countries, the 2011 round expanded to 177 countries. The International Comparison Program included data from 150 developing countries in its 2011 round, compared to 100 countries from the previous round in 2005. With broader country coverage, the 2011 PPP conversion factors are better suited for estimating and comparing poverty across countries.

The current benchmark of $1.25 a day in 2005 PPP is the most-widely used poverty line. To use the 2005 PPP conversion rates, one would need to calculate the local currency equivalent of the $1.25 benchmark in 2005 prices, and then adjust for inflation between 2005 and the year in which the latest household survey was conducted in a particular country. Individual poverty rates can then be estimated for the years when household surveys were conducted. These poverty rates are comparable across countries because the poverty line in these calculations implies the same minimum standards of living across countries. The resulting poverty counts for individual countries can be aggregated to produce estimates for the number of poor around the globe in that particular year.

8.4 The Poverty Line in 2011 Purchasing Power Parity: World Bank's Method

Global poverty counts depend on both PPP exchange rates and national consumer price indices (CPIs). The PovcalNet calculates poverty estimates based on 2005 PPP. With the release of the 2011 PPP, new global poverty estimates will be produced to account for changes in the cost of living of the world's poor. It is important to determine the poverty line in 2011 PPP that is equivalent to the current poverty line of $1.25 in 2005 PPP. Given the World Bank's new development agenda to eliminate extreme poverty by 2030, updating poverty estimates based on 2011 PPP would be crucial.

Despite many criticisms, the World Bank continues to use the average of the national poverty lines of the15 poorest countries to estimate the equivalent poverty line in 2011 PPP (see Table 8.1). The mean value of these poverty lines is $1.25 in 2005 PPP. The World Bank has recently released the new poverty line of $1.90 in 2011 PPP. This is derived from the unweighted mean of equivalent poverty lines in 2011 PPP of the 15 countries presented in Table 8.1. Given this, the World Bank has set its new global poverty line at $1.90 in 2011 PPP, which allows one to buy the same bundle of goods in 2011 as those purchased with $1.25 in 2005 PPP. This approach sounds intuitive, but the problem lies with the bundle itself, which fails to reflect the cost of absolute basic needs.

The simple mean value of poverty lines used in calculating the global poverty line is presented in Table 8.1. Hence, all countries are given an equal weight irrespective of the size of their populations. For instance, Mozambique, with a population of 1.41 million, is given exactly the same weight as Ethiopia, with a population of 89.39 million. However, the correct method would be to calculate the weighted average of national poverty lines with weights proportional to each country's population. The weighted average method is normally used in aggregating poverty counts. This subsequently raises the question: why are poverty lines aggregated by merely taking a simple average? The weighted average method would have led to a different poverty line by the World Bank. It is difficult to find a plausible explanation why the World Bank measured the global poverty line by taking the simple average for the national poverty lines of 15 selected countries.

Among the 15 poorest countries, the equivalent poverty lines for Tajikistan and Ghana are $3.18 and $3.44 in 2011 PPP, respectively. If these small countries were omitted from the sample of 15, the World Bank's poverty line would have been reduced from $1.90 to $1.68, which could have substantially reduced the number of poor by hundreds of millions in the globe. This suggests that global poverty counts based on the World Bank's method can be highly sensitive to the countries included in or excluded from the sample. For the World Bank to arrive at a robust global poverty line, it should therefore move away from updating the poverty line based on the national poverty lines of 15 countries, which were largely selected on an ad hoc basis.

To calculate a single global poverty line based on 2011 PPP, this chapter proposes a new methodology of equivalent poverty lines, which differs from the World Bank's. The next section discusses this new method.

8.5 Equivalent Poverty Lines: An Alternative Method

The World Bank's approach of drawing a single global poverty line for all countries is anchored on national poverty lines of the poorest 15 economies, 13 of which are in Sub-Saharan Africa. However, critics stress that this method does not provide a reliable indicator of what constitutes poverty for poor people around the world (Pogge 2010). In updating the global poverty line in 2011 PPP, this chapter uses a new methodology of equivalent poverty lines instead of the national poverty lines of the 15 countries.

The poverty lines based on 2005 and 2011 PPP are said to be equivalent if they produce exactly the same poverty rates. The methodology of estimating equivalent poverty lines is explained in Appendix 1. The calculations can be performed using CPIs and PPP conversions rates for 2005 and 2011. This chapter utilizes the same CPIs the World Bank used in estimating the new \$1.90 poverty line.[4] Moreover, this chapter uses the PPP conversion rates based on consumption PPPs instead of gross domestic product PPPs.

Table A8.1 in Appendix 2 provides estimates of equivalent poverty lines for 101 countries. While the PovcalNet provides poverty counts for 126 countries, our analysis only selects 101 countries; 25 countries are omitted because their CPIs are imputed based on regressions. Updating the PPP from 2005 to 2011 should be based on real prices rather than imputed figures. These estimates show that the equivalent poverty line in 2011 PPP, which supposedly corresponds to \$1.25 in 2005 PPP, is not unique to all countries; each country has its own

[4] We are grateful to Espen Beer Prydz of the World Bank for providing us with consumer price indices for 101 countries. We would also like to acknowledge that Mr. Prydz helped clarify many issues relating to the new global poverty line of \$1.90.

equivalent poverty line depending on the country's 2011 PPP conversion and inflation rates.

The idea of an equivalent poverty line can be illustrated as follows. The equivalent poverty line for Bangladesh is calculated equal to $2.64 in 2011 PPP and the new PPP conversion rate in 2011 is 24.85 Taka per dollar, thereby resulting in a poverty line of 65.60 Taka per person per day in the local currency. After adjusting for inflation of 206 % between 2005 and 2011, this poverty line is estimated to be equal to 31.85 Taka per person per day in 2005. The PPP exchange rate for Bangladesh in 2005 was 25.49 Taka per dollar. Dividing the poverty line in the local currency in 2005 by the 2005 PPP exchange rate produces an international poverty line of $1.25 in 2005 PPP. Therefore, the poverty line of $2.64 in 2011 PPP is equivalent to the poverty line of $1.25 in 2005 PPP.

The estimates in Table A8.1 in Appendix 2 show that the equivalent poverty line is not the same for all countries. The World Bank has recently announced a single poverty line of $1.90 in 2011 PPP for all countries, but this is not equivalent to the $1.25 poverty line in 2005 PPP; hence, the rankings of countries by their poverty estimates based on the two PPPs will change accordingly.

There is a suggestion to calculate equivalent poverty line based on the inflation rate of the U.S.A. The U.S. inflation rate averaged 15.2 % during 2005–11, which gives a single equivalent poverty line of $1.44 in 2011 PPP. However, Appendix 1 demonstrates that this method is problematic because it estimates poverty counts only if the 2011 PPP conversion rates are equal to the 2005 PPP when adjusted for the relative inflation rates of comparator countries to the U.S.A. Thus, a single poverty line of $1.44 cannot be adopted in 2011 PPP.

8.6 Global Poverty Counts Based on Equivalent Poverty Lines

There is no single poverty line from the new 2011 PPP that is equivalent to $1.25 in 2005 PPP. If a single poverty line is required, it should be calculated using the weighted average of equivalent poverty lines for all 101 countries, with weights proportional to their population. This results in a poverty line of $1.93 in 2011 PPP.

Interestingly, a simple average of equivalent poverty lines for 101countries happens to yield $1.90. It was merely a coincidence rather than being robust, as claimed by the World Bank. In fact, there is no linkage between the poverty lines averaged across 15 countries and the poverty lines averaged across 101 countries. The same figure for the two averages is a mere coincidence.

Having decided on how poverty lines are calculated, the next step is to calculate poverty rates and the number of poor. We calculate the poverty rates and the number of poor for 126 countries using the PovcalNet. Table 8.2 presents the aggregate poverty rates for six regions with the regional poverty rates calculated by using weighted means. The global poverty rates are then obtained using weighted means with weights proportional to each region's population.

The poverty line of $1.25 in 2005 PPP has been adopted as the goalpost to monitor progress in international targets such as the Sustainable Development Goals and the World Bank's agenda of reducing the global

Table 8.2 Percentage and number of poor by region for alternative poverty lines

		Percentage of poor (%)			Number of poor (million)		
All countries	Population in 2011 (million)	$1.25 (2005 PPP)	$1.90 (2011 PPP)	$1.93 (2011 PPP)	$1.25 (2005 PPP)	$1.90 (2011 PPP)	$1.93 (2011 PPP)
East Asia and Pacific	1896.37	7.93	8.54	8.97	150.30	161.96	170.16
Europe and Central Asia	447.98	0.49	0.49	0.53	2.21	2.21	2.37
Latin America and Caribbean	585.22	4.63	5.90	6.03	27.12	34.52	35.28
Middle East and North Africa	125.18	1.06	0.85	0.91	1.33	1.07	1.14
South Asia	1599.28	24.49	22.20	23.24	391.69	355.10	371.74
Sub-Saharan Africa	847.84	46.85	44.35	45.14	397.20	376.02	382.74
Total	5501.87	17.63	16.92	17.51	969.85	930.88	963.43

Source: Authors' calculations

Note: PPP purchasing power parity

poverty incidence to less than 3 % by 2030. To maintain these targets, poverty rates based on new PPPs should be equivalent to those based on $1.25 in 2005 PPP. The exact equivalence, however, is implausible.

This chapter discusses two poverty lines: $1.90 a day proposed by the World Bank and $1.93 a day calculated by the study. While the two are seemingly close, one may need a criterion to choose one over the other. One possible criterion is discussed below.

For each poverty line, there is a vector of poverty rates for 126 countries. The equivalence of any two poverty lines can be measured by the absolute distance between their corresponding vectors of poverty rates. The relative mean deviation (RMD) is widely used to measure the distance between any two vectors. It lies between 0 and 1; the lower the value, the greater the equivalence will be. The RMD, which is expressed in percentage, is 6.9 % for the $1.90-a-day poverty line and 6.2 % for the $1.93-a-day poverty line. Based on this criterion, the $1.93 poverty line performs better than the $1.90 poverty line.

Many interesting findings emerge from comparing poverty estimates at the country level, as presented in Table A8.2 in Appendix 2. One striking result involves the comparison of poverty incidence in India and China. Based on the poverty line of $1.25 in 2005 PPP, 24.67 % of India's population lived in poverty in 2011 (with the number of poor equal to 301 million), while in China only 6.26 % were poor in the same year (with the number of poor equal to 84.14 million). When the calculations are performed using the $1.93 poverty line in 2011 PPP, India's poverty decreased to 23.63 % (with the number of poor equal to about 288.56 million), while poverty in China increased to 8.27 % (with the number of poor equal to 111.16 million). Although the gap in poverty incidence between India and China has narrowed, India has a long way to go to catch up with China's progress. The change in PPP has appeared to favor India and disfavor China.

Based on the poverty line of $1.93 in 2011 PPP, the total number of poor in South Asia and Sub-Saharan Africa is 754.48 million, while the total number of poor in the world based on the same poverty line is 963.85 million. About 79 % of the world's poor are concentrated in the two regions. The incidence of extreme poverty outside these two regions is almost negligible.

The proposed global poverty line of $1.93 in 2011 PPP has led to a reduction in the number of poor by 6.42 million. The reduction has largely occurred in South Asia (19.95 million) and Sub-Saharan Africa (14.46 million). This large reduction in the number of poor in these two poorest regions has been offset by an increase in the number of poor in richer regions, thereby resulting in the net reduction of the poor by 6.42million. South Asia and Sub-Saharan Africa have experienced such a large reduction in poverty counts because prices in these two regions have fallen relative to their richer counterparts.

8.7 Concluding Remarks

The release of 2011 PPP exchange rates should give a better picture of the extent of global poverty by accounting for changes in the poor's cost of living. The refined estimates of the PPP provide a window of opportunity to update the global poverty line.

This chapter provided an alternative to the World Bank's method of anchoring a single global poverty line on the national poverty lines of the poorest countries. The World Bank's method assumes that national poverty lines measure the cost of absolute basic needs, but the basic needs as reflected by the national poverty lines are different for each country. Other country-specific factors that determine national poverty lines cause variation in real poverty lines.

We have proposed the use of equivalent poverty lines to calculate a new global poverty line based on 2011 PPP. Findings suggest that there is no single poverty line in 2011 PPP that is equivalent to $1.25 in 2005 PPP. Single poverty lines vary for each region since countries have experienced different inflation rates and have different PPP conversion rates between 2005 and 2011. To measure a single poverty line, this chapter calculated the weighted average of equivalent poverty lines of 101 countries with weights proportional to their populations. The corresponding poverty line was estimated at $1.93 in 2011 PPP.

Based on the proposed poverty line of $1.93 in 2011 PPP, the decline in the number of poor is estimated at 6.42 million. South Asia and Sub-Saharan Africa accounted for much of the reduction, where 19.95 million and 14.46 million people, respectively, were lifted out of poverty. Such gains in poverty reduction in these two poorest regions are due to lower prices relative to their richer counterparts. However, the notable decrease in the number of poor in South Asia and Sub-Saharan Africa is offset by an increase in the poor in richer regions, bringing about the net reduction of the world's poor by 6.42 million.

The incidence of poverty and the number of poor vary across countries when the PPP's base year changes from 2005 to 2011, as estimated in this study. Based on the poverty line of $1.25 in 2005 PPP, 24.67 % of the Indian population—equivalent to 301 million people—lived in poverty in 2011. The corresponding figure in 2011 for China was 6.26 %, which is equivalent to 84.14 million people. Using the study's proposed $1.93 poverty line in 2011 PPP, poverty in India declined to 23.63 % (equivalent to 288.56 million people), but poverty in China increased to 8.27 % (equivalent to 111.16 million people). Despite the narrowed gap in poverty incidence between the two countries, India needs to significantly scale up its poverty reduction efforts before it can pull alongside China. The change in PPP from 2005 to 2011 appears to be favorable to India, but unfavorable to China.

More importantly, this chapter showed that the change in PPP conversions should not drastically alter world poverty estimates given the same absolute poverty line and the same income distributions. Had the World Bank used equivalent poverty lines, the dramatic increase in world poverty count by 500 million upon the change in the PPP base year from 1993 to 2005 would not have occurred.

Appendix 1

The equivalent poverty lines based on 2005 and 2011 PPP are derived in this section. If the extreme poverty line in 2005 at 2005 PPP was $1.25 per person per day, then what would be the equivalent poverty line in 2011 at 2011 PPP? The following definitions are presented below:

- PPP(2005): Purchasing power parity in 2005
- PPP(2011): Purchasing power parity in 2011

- $PL_{LOCAL}(2005)$: Poverty line in local currency in 2005
- PL_{LOCAL} (2011): Poverty line in local currency in 2011
- CPI(2005): Consumer price index in 2005
- CPI(2011): Consumer price index in 2011
- PL_{US} (2005, 2005 PPP): Poverty line in U.S. dollars in 2005 PPP
- PL_{US}(2011, 2011 PPP): Poverty line in U.S. dollars in 2011 PPP

The following relationships will hold:

$$PL_{LOCAL}(2005) = PL_{US}(2005, 2005\ PPP) \times PPP(2005) \quad \text{(A8.1)}$$

$$PL_{LOCAL}(2011) = PL_{US}(2011, 2011\ PPP) \times PPP(2011) \quad \text{(A8.2)}$$

Adjusting the poverty lines in local currency for inflation in the country gives:

$$PL_{LOCAL}(2011) = PL_{LOCAL}(2005) \times \frac{CPI(2011)}{CPI(2005)} \quad \text{(A8.3)}$$

Substituting (A8.1) and (A8.2) into (A8.3) gives:

$$\begin{aligned} &PL_{US}(2011, 2011\ PPP) \\ &= PL_{US}(2005, 2005\ PPP) \times \left[\frac{PPP(2005)}{PPP(2011)}\right] \times \left[\frac{CPI(2011)}{CPI(2005)}\right] \end{aligned}$$

This equation gives the two poverty lines, PL_{US}(2005, 2005 *PPP*) and PL_{US}(2011, 2011 *PPP*), which are equivalent because they imply the same real poverty lines in local currency in 2005 and 2011. If PL_{US}(2005, 2005 *PPP*) is set equal to $1.25, then the equivalent poverty line in 2011 in 2011 PPP will be given by

$$PL(2011) = 1.25 \times \left[\frac{PPP(2005)}{PPP(2011)}\right] \times \left[\frac{CPI(2011)}{CPI(2005)}\right] \quad \text{(A8.4)}$$

PL(2011) is the international poverty line in 2011, which provides the same poverty rates as $1.25 a day in 2005. It is noted from (A8.4) that *PL*(2011) is not unique for all countries, and varies with inflation rates in the country between 2005 and 2011, as well as PPP rates in 2005 and 2011. A country with a high inflation rate will give a higher poverty line in 2011. Similarly, if the PPP exchange rate for the country appreciates in 2011 relative to that in 2005, the poverty line will also be higher. Therefore, there exists no single equivalent poverty line in 2011 PPP as is generally implied.

PPP(2011) is the PPP exchange rate in 2011, which has recently been estimated by the International Comparison Program. If *PPP*(2011) were not available, then one could still calculate the exchange rates using the 2005 PPP as

$$EX\left(2011, 2005\,PPP\right) = PPP\left(2005\right) \times \left[\frac{CPI\left(2011\right)CPI_R\left(2005\right)}{CPI\left(2005\right)CPI_R\left(2011\right)}\right] \quad (A8.5)$$

where $CPI_R(2005)$ and $CPI_R(2011)$ are the consumer price indices for the reference country (U.S.) in 2005 and 2011, respectively. The exchange rate in 2011 in a country is determined by the relative inflation rates in the country to that of U.S. Equating this exchange rate to *PPP*(2011) equations (A8.4) and (A8.5) yield

$$PL\left(2011\right) = 1.25 \times \left[\frac{CPI_R\left(2011\right)}{CPI_R\left(2005\right)}\right]$$

which shows that the poverty line in 2011 that is equivalent to the poverty line of $1.25 depends on the inflation rate in the U.S.: the larger the inflation rate, the greater the poverty line in 2011 will be. There has been a suggestion to calculate the equivalent poverty line based on the rate of inflation in the U.S.A. But this method is problematic because it estimates poverty counts only under the highly restricted assumption that the 2011 PPP conversion rates are equal to the 2005 PPP rates when adjusted for the relative inflation rates of comparator countries to the U.S.

Appendix 2

Table A8.1 Equivalent poverty lines in 2011 PPP corresponding to $1.25 in 2005 PPP

Country	Population in 2011 (million)	CPI in 2011	2005 PPP	2011 PPP	Equivalent poverty line
Cambodia	14.61	1.76	1615.30	1527.56	2.33
China	1344.13	1.22	4.09	3.70	1.69
Fiji	0.87	1.38	1.55	1.22	2.19
Indonesia	243.80	1.61	4192.83	4091.94	2.06
Lao PDR	6.52	1.51	3741.62	2914.85	2.42
Malaysia	28.76	1.18	2.11	1.59	1.96
Philippines	95.05	1.33	24.18	18.87	2.13
Thailand	66.58	1.20	17.47	12.84	2.04
Vietnam	87.84	2.07	5919.89	7624.97	2.01
Albania	3.15	1.19	60.41	58.17	1.54
Armenia	2.96	1.41	196.19	183.78	1.88
Azerbaijan	9.17	1.76	0.35	0.33	2.33
Belarus	9.47	2.48	759.62	1832.44	1.29
Bosnia and Herzegovina	3.84	1.22	0.87	0.87	1.53
Bulgaria	7.35	1.43	0.74	0.77	1.72
Croatia	4.28	1.19	4.46	4.36	1.52
Czech Rep.	10.5	1.17	15.20	14.90	1.49
Estonia	1.33	1.38	0.56	0.61	1.58
Georgia	4.48	1.55	0.78	0.84	1.80
Hungary	9.97	1.35	137.52	137.88	1.68
Kazakhstan	16.56	1.75	64.96	83.61	1.70
Kyrgyz Rep.	5.51	1.95	13.00	17.54	1.81
Latvia	2.06	1.45	0.35	0.40	1.59
Lithuania	3.03	1.34	1.66	1.79	1.55
Macedonia	2.10	1.20	23.58	22.94	1.54
Moldova	3.56	1.65	4.83	5.45	1.83
Montenegro	0.62	1.26	0.50	0.45	1.75
Poland	38.53	1.20	2.15	1.94	1.66
Romania	20.15	1.43	1.72	2.00	1.54
Russian Federation	142.96	1.76	13.39	16.77	1.76
Serbia	7.26	1.70	34.31	45.37	1.61
Slovak Rep.	5.40	1.20	0.62	0.57	1.63
Tajikistan	7.81	3.34	0.93	1.88	2.07
Turkey	73.06	1.62	1.00	1.16	1.75
Ukraine	45.71	2.11	1.71	3.31	1.36
Bolivia	10.32	1.48	2.57	2.91	1.63
Brazil	196.94	1.33	1.57	1.66	1.57

(*continued*)

Table A8.1 (continued)

Country	Population in 2011 (million)	CPI in 2011	2005 PPP	2011 PPP	Equivalent poverty line
Chile	17.31	1.23	387.36	391.64	1.52
Colombia	47.08	1.3	1191.74	1196.96	1.62
Ecuador	15.25	1.29	0.50	0.55	1.47
Mexico	119.36	1.28	7.65	8.94	1.37
Paraguay	6.57	1.45	2127.80	2309.43	1.67
Peru	29.61	1.19	1.65	1.57	1.56
Uruguay	3.38	1.58	15.31	16.42	1.84
Djibouti	0.85	1.35	107.81	101.48	1.79
Egypt	79.39	1.91	2.02	1.80	2.68
Iran	75.42	2.51	2714.82	5001.36	1.70
Iraq	31.76	2.65	639.87	573.42	3.70
Jordan	6.18	1.42	0.49	0.32	2.72
Morocco	32.06	1.13	5.51	4.19	1.86
Tunisia	10.67	1.27	0.70	0.70	1.59
Yemen, Rep.	23.30	1.99	91.06	82.09	2.76
Bangladesh	152.86	2.06	25.49	24.85	2.64
Bhutan	0.73	1.45	18.46	16.96	1.97
India	1221.16	1.65	15.60	14.98	2.15
Maldives	0.33	1.56	9.74	10.68	1.78
Nepal	27.16	1.65	26.47	25.76	2.12
Pakistan	176.17	2.02	20.71	25.41	2.06
Sri Lanka	20.87	1.83	40.04	42.22	2.17
Angola	20.18	2.11	70.50	73.83	2.52
Benin	9.78	1.22	275.19	224.92	1.87
Botswana	1.99	1.69	3.38	4.44	1.61
Burkina Faso	16.00	1.18	242.42	222.24	1.61
Burundi	9.54	1.79	447.04	487.33	2.05
Cabo Verde	0.49	1.27	78.17	47.57	2.61
Cameroon	21.16	1.20	294.50	230.38	1.92
Central African Rep.	4.44	1.25	307.47	267.87	1.79
Chad	12.08	1.12	327.57	251.30	1.82
Comoros	0.70	1.21	294.41	220.57	2.02
Congo, Dem. Rep.	63.93	1.97	316.23	537.73	1.45
Congo, Rep.	4.23	1.32	375.57	296.50	2.09
Cote d'Ivoire	19.39	1.20	325.81	235.69	2.07
Ethiopia	89.39	2.97	2.75	5.44	1.88

Table A8.1 (continued)

Country	Population in 2011 (million)	CPI in 2011	2005 PPP	2011 PPP	Equivalent poverty line
Gabon	1.59	1.14	443.75	359.22	1.76
Gambia, The	1.73	1.29	10.34	10.83	1.54
Ghana	24.82	2.95	0.45	0.79	2.10
Guinea	11.16	2.87	1479.57	2572.34	2.06
Guinea-Bissau	1.62	1.25	284.28	248.24	1.79
Kenya	42.03	2.05	32.68	35.43	2.36
Lesotho	2.03	1.48	3.43	3.86	1.64
Liberia	4.08	1.76	0.51	0.57	1.97
Madagascar	21.68	1.74	756.38	704.91	2.33
Malawi	15.46	2.15	56.92	78.02	1.96
Mali	14.42	1.21	289.68	221.87	1.97
Mauritania	3.70	1.40	125.67	112.81	1.95
Mauritius	1.29	1.46	17.73	18.29	1.77
Mozambique	24.58	1.75	11.63	15.53	1.64
Namibia	2.22	1.47	5.06	5.13	1.81
Niger	16.51	1.16	267.33	228.75	1.69
Nigeria	164.19	1.79	78.58	79.53	2.21
Rwanda	11.14	1.60	236.75	246.83	1.92
Sao Tome and Principe	0.18	2.91	6363.13	10,194.79	2.27
Senegal	13.33	1.18	298.24	246.11	1.79
Sierra Leone	5.87	2.04	1396.21	1767.19	2.01
South Africa	51.58	1.55	4.57	5.07	1.75
Sudan	36.43	2.04	1.24	1.49	2.12
Swaziland	1.21	1.53	3.73	4.05	1.76
Tanzania	46.35	1.77	482.45	585.52	1.82
Togo	6.47	1.22	282.26	232.22	1.85
Uganda	35.15	1.84	744.62	946.89	1.81
Zambia	13.63	1.78	2830.33	2505.34	2.51
Total	5481.46				
Simple average					*1.90*
Weighted average					*1.93*

Source: Authors' calculations
Note: *CPI* consumer price index, *PPP* purchasing power parity

Table A8.2 The percentage and number of poor in developing world in 2011

Country	Population in 2011 (million)	Poverty rate (%) $1.25 in 2005 PPP	$1.90 in 2011 PPP	$1.93 in 2011 PPP	Number of poor (million) $1.25 in 2005 PPP	$1.90 in 2011 PPP	$1.93 in 2011 PPP
East Asia and Pacific	*1896.37*	*7.93*	*8.54*	*8.97*	*150.30*	*161.96*	*170.16*
Cambodia	14.61	10.05	8.94	9.78	1.47	1.31	1.43
China	1344.13	6.26	7.90	8.27	84.14	106.19	111.16
Fiji	0.87	3.26	3.07	3.31	0.03	0.03	0.03
Indonesia	243.80	16.20	13.58	14.46	39.50	33.11	35.25
Lao PDR	6.52	31.15	31.78	32.97	2.03	2.07	2.15
Malaysia	28.76	0.00	0.15	0.16	0.00	0.04	0.05
Micronesia (urban)	0.02	17.50	48.26	48.63	0.00	0.01	0.01
Papua New Guinea	7.01	7.27	36.30	36.73	0.51	2.54	2.57
Philippines	95.05	18.60	13.36	14.00	17.68	12.70	13.31
Thailand	66.58	0.29	0.04	0.05	0.19	0.03	0.03
Timor-Leste	1.18	33.16	36.71	38.67	0.39	0.43	0.46
Vietnam	87.84	4.96	3.99	4.23	4.36	3.50	3.72
Europe and Central Asia	*447.98*	*0.49*	*0.49*	*0.53*	*2.21*	*2.21*	*2.37*
Albania	3.15	0.32	0.90	0.94	0.01	0.03	0.03
Armenia	2.96	2.45	2.70	2.88	0.07	0.08	0.09
Azerbaijan	9.17	0.31	0.00	0.00	0.03	0.00	0.00
Belarus	9.47	0.00	0.00	0.00	0.00	0.00	0.00
Bosnia and Herzegovina	3.84	0.04	0.06	0.06	0.00	0.00	0.00
Bulgaria	7.35	1.90	2.19	2.27	0.14	0.16	0.17
Croatia	4.28	0.00	0.00	0.00	0.00	0.00	0.00
Czech Rep.	10.50	0.03	0.05	0.05	0.00	0.01	0.01
Estonia	1.33	0.98	1.21	1.21	0.01	0.02	0.02
Georgia	4.48	16.05	17.79	18.22	0.72	0.80	0.82
Hungary	9.97	0.05	0.13	0.13	0.00	0.01	0.01
Kazakhstan	16.56	0.03	0.03	0.04	0.00	0.00	0.01
Kyrgyz Rep.	5.51	5.11	1.80	1.99	0.28	0.10	0.11
Latvia	2.06	1.07	1.31	1.37	0.02	0.03	0.03
Lithuania	3.03	0.83	0.87	0.87	0.03	0.03	0.03
Macedonia	2.10	0.22	1.33	1.85	0.00	0.03	0.04
Moldova	3.56	0.23	0.28	0.30	0.01	0.01	0.01
Montenegro	0.62	0.21	0.21	0.21	0.00	0.00	0.00
Poland	38.53	0.00	0.02	0.02	0.00	0.01	0.01
Romania	20.15	0.00	0.00	0.00	0.00	0.00	0.00

Table A8.2 (continued)

Country	Population in 2011 (million)	Poverty rate (%) $1.25 in 2005 PPP	$1.90 in 2011 PPP	$1.93 in 2011 PPP	Number of poor (million) $1.25 in 2005 PPP	$1.90 in 2011 PPP	$1.93 in 2011 PPP
Russian Federation	142.96	0.02	0.08	0.08	0.03	0.11	0.11
Serbia	7.26	0.05	0.10	0.10	0.00	0.01	0.01
Slovak Rep.	5.40	0.30	0.36	0.36	0.02	0.02	0.02
Slovenia	2.05	0.00	0.00	0.00	0.00	0.00	0.00
Tajikistan	7.81	6.04	3.98	4.26	0.47	0.31	0.33
Turkey	73.06	0.08	0.28	0.37	0.06	0.20	0.27
Turkmenistan	5.11	5.73	4.80	5.14	0.29	0.25	0.26
Ukraine	45.71	0.00	0.00	0.00	0.00	0.00	0.00
Latin America and Caribbean	*585.22*	*4.63*	*5.90*	*6.03*	*27.12*	*34.52*	*35.28*
Argentina (urban)	40.73	1.41	1.53	1.56	0.57	0.62	0.64
Belize	0.32	11.29	12.59	13.66	0.04	0.04	0.04
Bolivia	10.32	6.97	7.96	8.05	0.72	0.82	0.83
Brazil	196.94	4.53	5.50	5.58	8.92	10.83	10.99
Chile	17.31	0.83	1.30	1.32	0.14	0.23	0.23
Colombia	47.08	4.95	6.58	6.75	2.33	3.10	3.18
Costa Rica	4.74	1.36	1.75	1.83	0.06	0.08	0.09
Dominican Rep.	10.15	2.54	2.90	3.03	0.26	0.29	0.31
Ecuador	15.25	4.04	5.86	5.99	0.62	0.89	0.91
El Salvador	6.26	2.82	4.53	4.76	0.18	0.28	0.30
Guatemala	14.71	13.70	11.53	11.94	2.02	1.70	1.76
Guyana	0.79	5.33	11.25	11.55	0.04	0.09	0.09
Haiti	10.03	51.60	54.85	55.58	5.18	5.50	5.57
Honduras	7.78	16.48	18.75	19.11	1.28	1.46	1.49
Jamaica	2.70	0.03	0.98	1.02	0.00	0.03	0.03
Mexico	119.36	1.10	2.94	3.06	1.31	3.51	3.65
Nicaragua	5.91	6.83	9.72	9.81	0.40	0.57	0.58
Panama	3.74	3.55	3.98	4.07	0.13	0.15	0.15
Paraguay	6.57	4.43	5.47	5.67	0.29	0.36	0.37
Peru	29.61	2.97	4.35	4.57	0.88	1.29	1.35
St. Lucia	0.18	11.75	28.05	28.74	0.02	0.05	0.05
Suriname	0.53	10.52	18.83	18.83	0.06	0.10	0.10
Trinidad and Tobago	1.33	1.15	0.36	0.37	0.02	0.00	0.00
Uruguay	3.38	0.25	0.32	0.34	0.01	0.01	0.01
Venezuela	29.50	5.58	8.52	8.65	1.65	2.51	2.55

(*continued*)

Table A8.2 (continued)

Country	Population in 2011 (million)	Poverty rate (%) $1.25 in 2005 PPP	$1.90 in 2011 PPP	$1.93 in 2011 PPP	Number of poor (million) $1.25 in 2005 PPP	$1.90 in 2011 PPP	$1.93 in 2011 PPP
Middle East and North Africa	*125.18*	*1.061*	*0.854*	*0.907*	*1.33*	*1.07*	*1.14*
Djibouti	0.85	10.20	18.18	18.64	0.09	0.15	0.16
Iran	75.42	0.77	0.13	0.14	0.58	0.10	0.11
Jordan	6.18	0.07	0.19	0.20	0.00	0.01	0.01
Morocco	32.06	1.81	1.80	1.94	0.58	0.58	0.62
Tunisia	10.67	0.71	2.13	2.22	0.08	0.23	0.24
South Asia	*1599.28*	*24.49*	*22.20*	*23.24*	*391.69*	*355.10*	*371.74*
Bangladesh	152.86	39.56	39.67	41.06	60.47	60.64	62.76
Bhutan	0.73	3.01	2.55	2.78	0.02	0.02	0.02
India	1221.16	24.67	22.53	23.63	301.26	275.13	288.56
Maldives	0.33	0.02	0.19	0.23	0.00	0.00	0.00
Nepal	27.16	25.41	15.46	16.40	6.90	4.20	4.45
Pakistan	176.17	12.74	8.30	8.75	22.44	14.62	15.41
Sri Lanka	20.87	2.84	2.36	2.54	0.59	0.49	0.53
Sub-Saharan Africa	*847.84*	*46.85*	*44.35*	*45.14*	*397.20*	*376.02*	*382.74*
Angola	20.18	42.97	29.76	30.54	8.67	6.01	6.16
Benin	9.78	51.61	53.11	53.90	5.05	5.19	5.27
Botswana	1.99	10.02	14.57	15.12	0.20	0.29	0.30
Burkina Faso	16.00	40.80	50.38	51.51	6.53	8.06	8.24
Burundi	9.54	79.79	75.90	76.79	7.61	7.24	7.33
Cabo Verde	0.49	11.87	14.30	14.84	0.06	0.07	0.07
Cameroon	21.16	24.94	28.13	29.14	5.28	5.95	6.17
Central African Rep.	4.44	56.68	61.08	61.66	2.52	2.71	2.74
Chad	12.08	36.53	38.43	39.11	4.41	4.64	4.72
Comoros	0.70	48.18	14.57	14.83	0.34	0.10	0.10
Congo, Dem. Rep. of	63.93	84.01	80.51	81.07	53.71	51.47	51.83
Congo, Rep. of	4.23	32.82	28.71	29.28	1.39	1.21	1.24
Cote d’Ivoire	19.39	37.31	31.19	31.67	7.23	6.05	6.14
Ethiopia	89.39	36.79	33.54	34.48	32.89	29.98	30.82
Gabon	1.59	5.39	7.20	7.59	0.09	0.11	0.12
Gambia, The	1.73	34.02	46.54	47.47	0.59	0.81	0.82
Ghana	24.82	18.02	14.61	15.27	4.47	3.63	3.79
Guinea	11.16	41.28	40.97	42.15	4.61	4.57	4.70
Guinea-Bissau	1.62	48.66	60.69	61.69	0.79	0.98	1.00

Table A8.2 (continued)

Country	Population in 2011 (million)	Poverty rate (%) $1.25 in 2005 PPP	$1.90 in 2011 PPP	$1.93 in 2011 PPP	Number of poor (million) $1.25 in 2005 PPP	$1.90 in 2011 PPP	$1.93 in 2011 PPP
Kenya	42.03	38.03	26.65	27.46	15.98	11.20	11.54
Lesotho	2.03	45.70	59.25	59.60	0.93	1.20	1.21
Liberia	4.08	70.91	49.85	51.23	2.89	2.03	2.09
Madagascar	21.68	87.83	82.17	82.59	19.04	17.81	17.91
Malawi	15.46	71.56	70.47	71.07	11.06	10.89	10.99
Mali	14.42	50.83	49.53	50.39	7.33	7.14	7.27
Mauritania	3.70	23.54	11.35	11.77	0.87	0.42	0.44
Mauritius	1.29	0.39	0.50	0.51	0.01	0.01	0.01
Mozambique	24.58	55.77	64.31	65.19	13.71	15.81	16.02
Namibia	2.22	21.98	21.06	21.78	0.49	0.47	0.48
Niger	16.51	40.81	50.34	51.74	6.74	8.31	8.54
Nigeria	164.19	60.08	52.51	53.31	98.65	86.22	87.53
Rwanda	11.14	63.02	60.25	61.20	7.02	6.71	6.82
Sao Tome and Principe	0.18	42.19	32.29	33.60	0.08	0.06	0.06
Senegal	13.33	34.06	37.98	38.64	4.54	5.06	5.15
Seychelles	0.09	0.20	0.21	0.21	0.00	0.00	0.00
Sierra Leone	5.87	56.63	52.33	53.73	3.32	3.07	3.15
South Africa	51.58	9.42	16.56	16.99	4.86	8.54	8.76
Sudan	36.43	17.21	12.38	13.04	6.27	4.51	4.75
Swaziland	1.21	39.84	43.54	44.02	0.48	0.53	0.53
Tanzania	46.35	43.48	48.52	49.57	20.15	22.49	22.98
Togo	6.47	52.46	54.18	54.97	3.39	3.51	3.56
Uganda	35.15	36.95	35.07	36.09	12.99	12.33	12.69
Zambia	13.63	73.19	63.18	63.81	9.98	8.61	8.70
All countries	*5501.87*	*17.63*	*16.92*	*17.51*	*969.85*	*930.88*	*963.43*

Source: Authors' calculations

Note: *PPP* purchasing power parity

9

Measuring Food Insecurity: Global Estimates

9.1 Introduction

Food is a basic necessity but in some parts of the world, having three meals a day or even two is already considered a luxury. This injustice illustrates the concept of food insecurity which occurs when people become unsure if and when their next meal will come, and when they are not able to afford the food that they want to eat. Food security can be ensured if people can always buy the basic food that they are accustomed to.

The 2009 Declaration of the World Summit on Food Security states that "food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food, which meets their dietary needs and food preferences for an active and healthy life". This definition is widely accepted by the international community, and the Food and Agriculture Organization (FAO) even used it to derive several indicators of food security as presented in its flagship publication, *The State of Food Security in the World*.

Food insecurity can be viewed as an extreme form of poverty. The relationship between the two is evident from Rowntree's (1901) work

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on measuring the absolute poverty line, which he defined as the cost of maintaining a minimum standard of living. He first estimated the minimum monetary costs for food that would satisfy the average nutritional need of families of different sizes. To these costs, he added rent and minimum amounts for clothing, fuel, and sundries to arrive at a poverty line of a family of given size. A family is classified poor if its total earnings are less than its absolute poverty line.

The idea of food insecurity is closely related to Rowntree's food poverty line, defined as the minimum money cost of food that would meet the average nutritional needs of families of different sizes and compositions. A family is unlikely to suffer from food insecurity if its total earnings are not less than the food poverty line. Hence, food security is achieved when all families and individuals have sufficient earnings to satisfy their average nutritional requirements. This definition of food security is very similar to that of the 2009 World Summit on Food Security.

If households and individuals do not obtain sufficient food to meet their average nutritional needs, they suffer from undernourishment. FAO defines hunger in terms of prevalence of undernourished people whose calorificic intake is less than their minimum energy requirements. FAO estimates that in 2011–13, 12 % of the global population, equivalent to 842 million people, suffered from chronic hunger.

Maintaining good health, however, also requires sufficient intake of other basic nutrients such as protein, fat, and carbohydrates. Since FAO's measure of hunger is derived exclusively from the inadequacy of calorific needs, it does not measure undernutrition (or malnutrition). Thus, FAO's measure of hunger does not inform whether people are becoming nutritionally better-off or worse-off. The 2009 Declaration of the World Summit on Food Security clearly emphasizes that all people should have access to nutritious food at all times. FAO's measure of hunger, therefore, does not provide what it is intended to measure.

This chapter proposes a new methodology of measuring food insecurity. Households or individuals suffer from food insecurity if they do not command enough resources to buy food sufficient to meet their nutritional needs. This definition is more relevant to the 2009 World Summit on Food Security's definition of food security.

The main contribution of this chapter is to estimate the per capita monetary cost of a food basket that provides a balanced diet through adequate nutrients including calories, protein, fat, and carbohydrates to maintain good health. The cost is measured in U.S. dollars based on the 2005 Purchasing Power Parity (PPP) to allow for comparison across countries.[1] Per capita household expenditure is also measured in 2005 PPP U.S. dollars. A household is identified as food-insecure if its per capita expenditure is less than the estimated per capita cost of food. If a household suffers from food insecurity, then all individuals belonging to the household are assumed to be food-insecure. This is standard assumption commonly used in the measurement of poverty. This chapter uses the World Bank's PovcalNet program to measure the percentage of population deemed food-insecure in 126 countries, which account for nearly six billion people worldwide.

9.2 Distinction Between Food and Nutritional Security

While food security and nutritional security are closely related, they are not the same. According to FAO, food security consists of four dimensions: (i) food availability, (ii) economic and physical access to food, (iii) food utilization, and (iv) stability (vulnerability and shocks). FAO's definition of food security encompasses production, consumption, access, and utilization of food. Among the four dimensions, food utilization is the only dimension that focuses on nutrition. Hence, nutritional security is a component of food security. Food security and nutritional security are, therefore, related but they are two distinct concepts.

Food contains a number of basic elements such as carbohydrates, proteins, fats, and alcohol that produce different quantities of energy when burnt. The amount of energy produced when one gram of any of these elements is burnt is known as its calorific value. Food security should,

[1] The costs of a food basket in local currencies do not allow us to compare them across countries. The costs have thus to be measured in some international currency such as U.S. dollar. The conversion of local currency to U.S. dollar is accomplished using purchasing power parity exchange rates, which account for differences in the costs of living across countries.

therefore, be concerned with whether people have access to food that meets their nutritional requirements. To directly measure food security, one needs to measure the extent to which people are able to acquire food that meets their nutritional requirements. This approach, as will be discussed in this chapter, is related to Sen's (1981) entitlement approach to measuring food deprivation in the population. Food security is influenced by factors such as poverty, food prices, social protection, unemployment, and earnings, among others.

Nutritional security, on the other hand, is concerned with adequacy of nutrients, not just calories, required to remain healthy. Although food is the main source of nutrients, nutritional security also depends on the efficiency with which individuals are able to convert food into nutrients. Nutritional insecurity is commonly measured by the prevalence of undernourishment and undernutrition (malnutrition).

Undernourishment is measured by the percentage of population unable to meet their dietary energy requirement. Energy needs are determined by metabolic rates, which vary from one person to another. Hence, nutritional needs differ substantially across people. A person's energy requirements depend on age, gender, and activity level. Even if such differences are taken into account, interpersonal variations still exist due to an individual's metabolic rates that cannot be measured. As will be discussed in Sect. 9.4, the energy requirements are also known to vary intra-individually—that is, requirements can vary for the same individual over time.[2] These conceptual problems make the measurement of undernourishment highly problematic.

The processes through which malnutrition afflicts households or a community are also very complex. In addition to inadequate entitlement to food, health care, lack of nutritional education, unhygienic environment, and food preparation also influence nutritional status. Osmani (1992a) points out that the nutritional status of a person is almost the outcome of a complex interaction between nutrient intake and disease environment. Given such complexities, it is almost impossible to directly measure undernutrition. Indirectly, the existence and magnitude of undernutrition can be measured through the percentage of children

[2] For an excellent discussion of inter- and intra-personal variations, see Osmani (1992b).

under five years of age affected by wasting, underweight, and stunted. But they cannot tell us the many possible constraints that may have led to that deprivation.

9.3 Prevalence of Undernourishment

FAO's measure of food insecurity, which is based on the prevalence of undernourishment, compares usual food consumption expressed in terms of dietary energy (kilo/calories) with certain energy requirement norms. It measures food insecurity through the percentage (or number) of population whose dietary energy intake is below the energy requirement norm. As argued in the previous section, food insecurity is not the same as prevalence of undernourishment as they are determined by different factors. The prevalence of undernourishment may be called nutritional insecurity, the measurement of which is far more complex than food insecurity.

Suppose x is the energy intake of an individual and r is his energy requirement (need), then the percentage of population who suffer from undernourishment is given by

$$U = Pr\left(x < r\right) = \iint_{x<r} f(x,r)\,dxdr \tag{9.1}$$

where $f(x, r)$ is the joint density function of x and r.

The degree of undernourishment can be easily estimated if we know the joint density function $f(x, r)$. A critical question is whether we can estimate $f(x, r)$ from household surveys or any other data sources. To answer this question, a brief overview of the debate on energy deficiency is provided in Sect. 9.4.

Equation (9.1) can at best measure the percentage of population unable to meet their dietary energy requirements. However, FAO's measure of food security, which is based on caloric needs, does not take undernutrition (or malnutrition) into consideration. Maintaining good health also requires the intake of other basic nutrients such as protein, fat, and carbohydrates. As such, FAO's measure given in (9.1) does not inform whether people are becoming nutritionally better-off or worse-off. FAO considers chronic undernourishment as synonymous with hunger, according to *The State of Food Security in the World*.

9.4 The Debate on Nutritional Insecurity: A Brief Overview

The prevalence of undernourishment is a gauge of nutritional insecurity. Economists and statisticians, however, have yet to reach a consensus on how to estimate the joint density function defined in (9.1), which is a measure of undernourishment.[3] In determining undernourishment, FAO focuses on the average dietary energy requirements of individuals among different age and gender groups that would allow them to maintain the required physical efficiency. It periodically publishes the average calorie requirements separately for men and women of different ages including children. This approach classifies a person as undernourished if his calorie intake is below the required average norms.[4] Despite many attempts to measure undernourishment using these norms, this approach has been severely criticized by Sukhatme (1981) and Srinivasan (1981), among others.

Much of the controversy centers on the problems in using the "average" requirement norm. However, dietary energy requirements vary interpersonally—that is, from person to person even controlling for age, gender, and activity level—and intra-individually—that is, for the same individual at different points in time. Sukhatme (1961) argued that intra-individual variation is by far the more important source of variation than inter-individual variation. Nutritionists, however, are deeply divided on this issue, and many of them hold the opposite view that intra-individual

[3] See particularly Sukhatme (1977, 1982), Srinivasan (1981), Seckler (1982, 1984), Sukhatme and Morgan (1982), Lipton (1983), Payne (1985, 1992), Gopalan (1992), and Kakwani (1989, 1992).

[4] See Ojha (1970) and Dandekar and Rath (1971) for India and Reutlinger and Selowsky (1976) and Food and Agriculture Organization [FAO] (1977) at the global level.

variation is of a minor order of magnitude (Gopalan 1992; Payne 1992; Osmani 1992b; Srinivasan 1992).

Sukhatme's main argument for intra-individual variation has been that an individual can "adapt" to a low calorie-intake level without suffering any impairment to health; in other words, when an individual's calorie intake falls, then his or her calorie requirement also falls in line with calorie intake. The individual will suffer undernourishment only when his or her calorie intake falls much below the "average" calorie requirement norm.

Sukhatme (1961) suggested the following formula for estimating the proportion of undernourished individuals with the same age, gender, body weight, and activity level:

$$U = Pr\left(x < r_L\right) = \int_{x<r_L} f\left(x\right)dx \tag{9.2}$$

where $f(x)$ is the marginal frequency distribution of dietary energy intake and r_L is a cut-off point reflecting the lower limit of the marginal distribution of energy requirement.

The existence of intra-individual variation suggests that there is a positive correlation between calorie intake and calorie requirement. Naiken (1998) has theoretically shown that the general measure of undernourishment defined in (9.1) reduces to the cut-off point formula given by (9.2), assuming that the marginal distributions are unimodal and continuous, and a positive correlation exists between energy intake and requirement. Following this seminal work, FAO has adopted this lower cut-off point in the calculation of undernourishment.

The idea of correlation is not different from Sukhatme's thesis of adaptation mechanism. The positive correlation between calorie intake and calorie requirement implies that if a person is unable to consume the required calories, the body adjusts to a lower requirement so that he or she does not suffer any health impairment. Given this adaptation mechanism, the cut-off point could be set at a much lower level of dietary energy requirement of a healthy person. However, the existence of such correlation does not inform which way the causation goes: Does low calorie intake lead to a lower requirement or the other way around? If a person is constrained to consume lower calories because of his or her inability to acquire food, he or she should not be identified as food-secure because the body is adapting to a lower calorie requirement.

How should this cut-off point be determined? In his 1961 article, Sukhatme had taken the cut-off point as corresponding to the lower limit of the 99 % confidence interval, $r_L \cong \mu_r - 3\sigma_r$, where μ_r and σ_r are the mean and the standard deviation of the requirement distribution, respectively. Later in 1982, he set the cut-off at the 95 % confidence interval, $r_L \cong \mu_r - 2\sigma_r$. This change can have enormous implication because the estimate of undernourishment is highly sensitive to the cut-off.

To get an idea of how sensitive to the cut-off undernourishment estimates are, a study by the World Bank in 1986 calculated the percentage of undernourished persons based on the following assumptions:[5] (i) 80 % of FAO's norm of calorie requirement should prevent stunted growth and serious health risks, and (ii) 90 % of FAO's norm of calorie requirement should prevent impairment of an active working life. The World Bank study found that 340 million people or 16 % of the population in developing countries in 1986 were suffering from nutritional deprivation that could lead to stunted growth and serious health risk. Moreover, 730 million or 34 % of the population in developing countries in 1986 did not lead an active lifestyle because of calorie deficiency. These figures show that a slight change in the cut-off point can make a major difference in the magnitude of undernourishment in the world.

Sukhatme's justification for a lower cut-off point is that an individual can "adapt" to a low calorie-intake level without any impairment to health. This process of adjustment occurs through changes in metabolic efficiency—that is, the efficiency with which food is converted to energy. In his writings, Sukhatme tends to assume that this lower limit is the same for all individuals, but this is not the case. The lower limit is determined by an individual's metabolic ability to regulate his energy expenditure. There is no reason to expect that all individuals have the same capacity for metabolic regulation. Thus, the problem of inter-individual variation in average dietary energy requirement cannot be avoided.

[5] These are just assumptions and not based on any scientific study.

The conceptual problems with the estimation of people suffering from undernourishment are complex. Moreover, there are uncertainties on the quality of data used, which we have not yet discussed. A pertinent question is whether it is possible at all to obtain credible estimates of the number of undernourished people around the world. FAO accomplishes this task every year through its flagship publication, *The State of Food Insecurity in the World*. In 2013, FAO estimates (with the methodology described in Sect. 9.3) that 842 million people, or 12 % of the global population, were unable to meet their dietary energy requirement. The methodology behind such numbers has attracted considerable criticism. The next section will provide a brief review of FAO's methodology of estimating global hunger.

9.5 The FAO Method of Measuring Hunger

FAO defines chronic undernourishment as synonymous with hunger. Its estimates of global hunger were widely used by different development agencies to track progress towards the Millennium Development Goal of halving poverty and hunger by 2015. This section assesses FAO's methodology for estimating hunger and the reliability of such estimates in monitoring global hunger.

FAO deems that a person is suffering from hunger if his calorie intake is less than a cut-off point of calorie requirement, which is called the minimum dietary energy requirement (MDER). If the distribution of calorie intake and the MDER are known, it is then easy to identify whether or not the person is suffering from hunger. The most direct method of deriving the distribution of calorie intake is through household expenditure surveys, which comprise data on all food acquired by households including their food purchase, food consumed from their own production, and food received in kind. These food quantities can be converted into calories by means of food calorie conversion factors, which are available for almost all countries.

Given the quantities of food consumed by each sample household in household expenditure surveys, we can compute the actual calorie intake of each sample household by multiplying the quantities by the calorie conversion factors. Dividing the calorie intake of each household by its size would give us each household's per capita calorie intake. Thus, the entire distribution of calorie intake can be estimated from household expenditure surveys. Each sample household has an associated population weight. Given the cut-off point of calorie requirement, the percentage of undernourished or hungry persons can be accurately estimated by the weighted average of per capita calorie intake with the weight proportional to the population weight associated with each sample household. The total number of undernourished persons in a country can then be obtained by multiplying the percentage of undernourished persons by the country's total population.

FAO follows a rather approximate method of estimating hunger. It assumes that the distribution of calorie intake, denoted by $f(x)$, follows a two-parameter lognormal distribution. This implies that $ln(x)$ is normally distributed with mean μ and variance σ^2.[6] It follows from the lognormal distribution that

$$\sigma^2 = ln\left(CV^2 + 1\right) \tag{9.3}$$

and

$$\mu = ln\left(\bar{x}\right) - \sigma^2 \tag{9.4}$$

where $\bar{x}$ and σ^2 are the mean and variance of calorie intake, respectively, and $CV = \sigma / \bar{x}$ is the coefficient of variation of calorie intake. Together, these two equations show that the lognormal distribution can be characterized by mean $\bar{x}$ and coefficient of variation CV.

Using the lognormal distribution, the estimation of the percentage of undernourished population requires only two parameters: average calorie intake $\left(\bar{x}\right)$ and coefficient of variation (CV). Suppose $\bar{x} = 2414$ calorie

[6] Recently, the FAO has adopted a more flexible model of skewed normal and log-normal distributions introduced by Azzalini (1985) with the results published in *The State of Food Security in the World 2012*. It is not reported how well these distributions fit to the data. The loss of efficiency due to grouping still remains.

intake per person per day and $CV = 0.29$. Substituting these in (9.3) and (9.4) immediately gives $\sigma = 0.2842$ and $\mu = 7.7487$. Assuming that the MDER, which is the cut-off point of the calorie requirement intake, is equal to 1680 per person per day, the probability that a person is undernourished is given by

$$Pr\left[x < 1680\right] = Pr\left[ln\left(x\right) < ln\left(1680\right)\right] = N\left[\frac{ln\left(1680\right) - 7.7487}{0.2842}\right] = N\left(-1.1335\right)$$

where $N(X)$ is the standard normal cumulative distribution. Utilizing the standard cumulative normal tables gives $N\left(-1.1335\right) = 0.1285$, and thus the percentage of undernourished population in this hypothetical country would be 12.85. If the total population of the country is 100 million, then the number of undernourished persons is about 13 million.

9.6 Limitations of FAO Method

Based on FAO's estimates, the distribution of calorie intake follows a lognormal distribution.[7] This model is convenient from an analytical point of view, but not flexible enough to capture the variation at the bottom of the distribution. Nevertheless, it gives reasonable fit in the middle range of the distribution covering about 60 % of the population. Since undernourishment primarily occurs at the lower end of the distribution, the lognormal distribution will underestimate the percentage of population suffering from undernourishment because of its limited flexibility.

The lognormal distribution was popular in the 1950s and 1960s, during which national statistical offices did not release unit-record data for household surveys, providing only group data so data analysis was carried out using some distribution model. The lognormal model was found to be analytically simple, and its close relationship with normal

[7] An elaborate history and analytical properties of log-normal distribution are presented by Aitchison and Brown (1957).

distribution provided ready access to efficient procedures and statistical inference.[8] India's five-year development plans extensively utilized the lognormal distributions to project consumer expenditures. Today, household unit-record data are readily available and the use of lognormal distribution has become rather obsolete. Poverty and inequality measures are now directly and more efficiently estimated from household surveys, which provide the entire distribution.

FAO has continued the practice of estimating the distribution of calorie intake from group data using the lognormal distribution. The main justification for such practice is that direct estimates of deficiency in calorie intake captures excessive variability and does not provide the variance of habitual food consumption in the population. The excessive variability in calorie intake is, therefore, controlled by calculating the CV of calorie consumption of a representative individual. However, FAO's methodology does not inform how such representative individual is defined; is it a person with an average calorie intake? It does, nevertheless, inform how the CV of calorie intake for a representative individual can be calculated. The procedure is as follows:

Household surveys provide information on per capita expenditure and per capita calorie consumption for each sample household along with household weights. From this information, the CV of calorie intake can be directly and more accurately estimated. All these unit-record data are grouped into per capita expenditure classes, with each class giving the median value of per capita dietary energy consumption. The CV is then estimated from the median values for each expenditure class. However, the resulting CV completely ignores within-group variation in calorie consumption, thus underestimating the total variation in calorie consumption. The degree of underestimation will depend on how many expenditure classes are constructed. It is thus difficult to understand why the CV calculated from grouped data will provide habitual consumption of dietary energy for the representative individual. The calculation of CV from grouped data will only amount to loss of efficiency.

[8] Iyenger (1960) extensively used log-normal distribution to analyze consumption patterns in India.

Although the CV is estimated from household surveys, FAO estimates the mean calorie intake from food balance sheets (FBSs), which provide the quantities of different food items available in a country from the country's production data. The calculation of FBS is done by adding national food production and imports, and subtracting exports, food losses, food used for seeds, animal feed, and stock changes. Food quantities are then converted into calories by means of food calorie conversion factors. Combining this with population data provides the total calories available for human consumption per person in each country.

Estimates of average calorie intake obtained from FBSs may be less reliable than those obtained from household expenditure surveys. Some economists at the World Bank have raised a few concerns about these estimates of food availability.[9] First, as food availability is residual, any errors in reported production, trade, and stocks will affect the estimates of national food availability. Second, production and trade data for grain crops are potentially reliable since it is feasible to measure production with sample plots and a real mapping, among others. However, the same is not true for root crops such as potatoes, sweet potatoes, and cassava, which are important sources of nutrition for the poor. In addition, there are problems associated with storage, food fed to animals, and crops kept for seeds. Given these practical problems, it is difficult to ascertain the amount of food grains available for human consumption.

The MDER is a crucial factor in FAO's methodology to estimate undernourishment, as it establishes a cut-off point (or threshold) to estimate the prevalence of undernourished population in a country. When the threshold changes, so does the prevalence of people estimated to be undernourished. As noted earlier, the estimates for the undernourished population are highly sensitive to the threshold. A small error in the estimation of the cut-off point can have a substantial impact on the estimates for the undernourished.

FAO compiles the MDER for the individuals by age and gender. As Naiken (2002) points out, the gender-age-specific MDERs have been derived not by Sukhatme's formula, $\mu_r - 2\sigma_r$, but by directly considering the energy expenditure that corresponds to the lowest acceptable

[9] See De Weerdt et al. (2014).

weight-for-height activity level. There is a range of body weights that is considered to be healthy. Similarly, there is a range of physical activity levels (PALs) required to perform economically necessary activity. The cut-off point is the lowest value in these ranges and it varies with age and gender of the population. Thus, the MDER is calculated separately for each gender and age group.

The cut-off point for a population is derived by aggregating gender- and age-specific MDERs using the proportion of the population in different gender and age groups as weights. Since the gender-age distribution of the population changes over time, the cut-off point is updated annually to reflect changes in the demographic structure of the population.

There is considerable uncertainty regarding the actual requirement level of individuals. This uncertainty stems from the fact that energy requirement is specified as the average for a group of individuals. However, the actual requirement for each individual in the group is not known. In addition, calorie requirements are known to vary interpersonally and intra-individually. As such, the assumption is that all individuals whose calorie intake is above the MDER can "adapt" so that their calorie intake always matches their respective requirements and are not, therefore, undernourished. The accurate estimation of the MDER is crucial. Naturally, its estimation involves normative judgments at various stages, thereby making the task more challenging.

9.7 Food Insecurity as Entitlement Failure

FAO views food insecurity from the perspective of nutritional deprivation. This might be valid as undernourishment could lead to severe health problems. Undernourished people tend to have low immunity and are susceptible to infections. Undernourishment among children under five years of age, the most affected by undernourishment, can result in them becoming wasted (low weight for height), stunted (low height for age) and underweight (low weight for age). Undernourishment among people is a consequence of not being able to consume sufficient amount of food that meets their dietary needs. Thus, the direct method of measuring food security is to capture the extent to which people are able to acquire food that meets their nutritional requirements. This method is closely related to Sen's (1981) entitlement approach to measuring food deprivation in the population. A brief description of it is as follows.

According to Sen (1989), every individual is endowed with a bundle of resources, which he can exchange for food and other commodities. A person's entitlements depend on what he owns initially and what he can acquire through exchange. If the entitlement set does not include a commodity bundle with an adequate amount of food, the person would go hungry and become food-insecure. This, according to Sen, is an entitlement failure.

An entitlement failure can occur for many reasons. For instance, if food prices go up sharply, the entitlements of some individuals may cease to include an adequate bundle of food. Such individuals will thus suffer from food deprivation. Similarly, people can suffer from food insecurity due to sickness, unemployment, or death of breadwinner. Given these, this chapter proposes an alternative definition of food security: *Food security exists when all people, at all times, have entitlement to sufficient and nutritious food that meets their dietary needs.*

The proposed definition of food security emphasizes the entitlement to food, whereas the definition proposed by the 2009 Declaration of the World Summit on Food Security emphasizes access to food (or actual consumption of food). Individuals make their own choices on what food they want consume, so policy-makers can only ensure that people have necessary resources to consume sufficient and nutritious food. Thus, the entitlement approach is more realistic than the access approach. This entitlement approach is directly linked to income or employment generation, food production, food prices, and social security—all of which have an important impact on food security. For instance, following the 2008 global financial crisis, many households lost their source of livelihood and may have suffered a severe failure of entitlement to food. Thus, the measurement of food security based on the entitlement approach helps determine the magnitude of the contribution of such shocks to food insecurity and of policies to the reduction or prevention of food deprivation.

9.8 Measuring Household Food Security: A Proposed Method

This section proposes a new method of measuring food security among households based on Sen's (1981) entitlement approach. Since this approach only deals with food security among households, the issue of intra-household food security is not addressed. Given data limitation, it is generally not possible to measure food deprivation within households.

In a market economy, a person can exchange whatever he owns for other goods including food. This exchange can take place through monetary income at given market prices. The person's income in the reference period can be used as a composite measure of his entitlement. A household's composite index of its entitlement can similarly be measured by its per capita income (or consumption), which is denoted by y_i for the ith household. Suppose z_i is the per capita cost of food bundle for the ith household that meets the nutritional needs of all its members. Given this, the ith household is defined as food-secure if at all times y_i is greater than z_i. If y_i is less than z_i at all times, then the ith household is chronically food-insecure.

A household's food bundle that is sufficient, safe, and nutritious for all members of the household should meet both the average dietary energy needs of all household members and the average basic requirements of protein, fat, and carbohydrates of all household members.

9.9 Households' per Capita Minimum Dietary Requirement

To construct a food bundle that meets the dietary energy needs of household members, we need to know the energy requirement norms or standards adopted at the international level. A 1985 report by the FAO, World Health Organization, and United Nations University's Expert Consultation on Energy and Protein Requirements defined energy requirements as follows:[10]

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[10] See FAO, World Health Organization, and United Nations University (1985).

> The energy requirement of an individual is the level of energy intake from food that will balance energy expenditure when an individual has a body size and composition and level of physical activity, consistent with long-term good health; and that will allow for the maintenance of economically necessary and socially desirable physical activity. In children and pregnant or lactating women the energy requirement includes the energy needs associated with the deposition of tissues or the secretion of milk at rates consistent with good health.

These norms differ across individuals depending on age, gender, weight, and activity level. Household expenditure surveys provide information on the age and gender of each individual within a household, but the activity level and body weight of each individual are not available in these surveys. Thus, we can control for age and gender of individuals, but not weight and activity level.

In determining calorie norms, we assume that the reference person has the median height and weight to give a body mass index (BMI) of 21.5 for adult females and 22.5 for adult males. Table 9.1 presents the estimated number of calories required to maintain energy balance for various gender and age groups at three different levels of physical activity. Estimates are rounded to the nearest 200 calories.

The calorie requirements for different gender and age groups can be aggregated by means of weighted average, with weights proportional to the population in each group. The population in each gender and age group is available from household surveys. The aggregate requirement will be different across countries given differences in their gender and age composition. Using unit-record data for nine countries in Asia and the calorie norms given in Table 9.1, we can calculate the average calorie norms for each of the nine countries. The estimates for three alternative activity levels are presented in Table 9.2.

Table 9.2 shows that the average calorie norms vary with activity levels. The variation is much larger across activity levels than across countries. We cannot measure the activity levels of all individuals in a country. Hence, the determination of undernourishment by comparing individuals' calorie intake with their calorie needs will be highly unstable and unreliable. But if food insecurity is measured using income or consump-

Table 9.1 Calories required for energy balance by gender and age groups

Gender	Age	Sedentary[a]	Moderately active[b]	Active[c]
Child (female or male)	1–3 years	1000	1000	1000
Female	4–8 years	1200	1600	1800
	9–13 years	1600	2000	2200
	14–18 years	1800	2000	2400
	19–30 years	2000	2200	2400
	31–50 years	1800	2000	2200
	51 years and above	1600	1800	2200
Male	4–8 years	1400	1600	2000
	9–13 years	1800	2200	2600
	14–18 years	2200	2800	3200
	19–30 years	2400	2800	3000
	31–50 years	2200	2600	3000
	51 years and above	2000	2400	2800

Source: Estimated Energy Requirements, Institute of Medicine Dietary Reference Intakes macronutrients report, 2002

[a]Sedentary means a lifestyle that includes only the light physical activity associated with typical day-to-day life

[b]Moderately active means a lifestyle that includes physical activity equivalent to walking about 1.5–3 miles per day at 3–4 miles per hour, in addition to the light physical activity associated with typical day-to-day life

[c]Active means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3–4 miles per hour, in addition to the light physical activity associated with typical day-to-day life

Table 9.2 Aggregate caloric norms for three levels of activity in selected Asian countries

Country	Year	Sedentary	Moderately active	Active
India	2007–08	1835	2137	2420
Indonesia	2014	1839	2134	2417
Bangladesh	2000	1788	2086	2362
Pakistan	2007–08	1773	2066	2340
Sri Lanka	2009–10	1829	2122	2419
Bhutan	2007	1823	2122	2405
Nepal	2010	1776	2067	2344
Philippines	2011	1827	2128	2412
Vietnam	2008	1867	2170	2466

Source: Authors' calculations

tion at the household level, the variation in individuals' calorie requirements will not be that large. The resulting estimates will be more reliable because different caloric needs of individuals within households will be averaged.

In the construction of food basket, we assume that, on average, individuals within households have moderate activity level. That is, these individuals have a lifestyle that includes physical activity equivalent to walking about 1.5–3 miles per day at 3–4 miles per hour, in addition to the light physical activity associated with typical day-to-day living. Table 9.2 also shows that the calorie norms with moderate activity are around 2100 kilo/calories per person per day.

The U.S. Department of Agriculture also uses an "average" energy requirement for each country, which averages about 2100 calories per person per day for 67 developing countries. If a household has access to food that provides a minimum of 2100 kilo/calories per person per day, it will be highly unlikely that the household faces chronic hunger. While some household members may have caloric needs greater than 2100 kilo/calories, others may have less; hence, on average, the household is unlikely to suffer hunger.

FAO's (1996) cut-off for undernourishment is about 1800 calories per person per day which is about 300 calories less than the average calorie requirements of 2100 of a healthy person. FAO's lower cut-off point is justified on the ground that the human body can adapt to a lower calorie intake without any adverse effect on health. However, even if humans can adapt, households may still feel food-deprived if they purchase food with no more than about 1800 kilo/calories per person. To address food insecurity, households and individuals must not only meet dietary energy needs, but also have adequate amount of protein, fat, carbohydrates, and other micronutrients. If households limit their consumption to only 1800 kilo/calories per person, they may not meet other nutritional needs. In the next section, we calculate the cost of the food basket, which provides 2100 kilo/calories per person per day and meets the recommended requirements of protein, fat, and carbohydrates.

9.10 What is the Cost of a Nutritious Food Basket?

This section calculates the cost of a nutritious food basket, which satisfies the daily caloric requirements of 2100 kilo/calories and the recommended requirements of protein, fat, and carbohydrates. The cost is calculated in 2005 PPP U.S. dollars ($) so that it can be applied to all countries. The PPP exchange rates are used to convert local currencies into U.S. dollars.

The cost of the nutritious food basket is estimated using FAO data for 30 countries (32 spells). The data were downloaded from the FAO website and contain the following variables:

(i) Per capita household expenditure (in local currency)
(ii) Per capita household food expenditure (in local currency)
(iii) Per capita daily kilo/calorie intake
(iv) % share of calories obtained from protein
(v) % share of calories obtained from fat
(vi) % share of calories obtained from carbohydrates

Per capita food and total expenditures in local currency are converted to U.S. dollars using the 2005 PPP. These estimates are presented in Table A9.1 in the Appendix. Per capita household expenditure in 2005 PPP provides a measure of average standards of living that is comparable across countries. Of the 30 countries with available data, Mozambique and Nepal have the lowest standards of living, with daily per capita expenditures of $1.15 and $1.28 in 2005 PPP, respectively. On the other hand, the richest country in the list is Hungary, with per capita expenditure of $11.57 per day. As shown in Table A9.1, standards of living vary substantially from one country to another.

While calories are derived from food, there is no one-to-one relationship between calorie intake and food expenditure. This is because individuals consume various types of food that provide different quantities of calories. Hence, we cannot expect a one-to-one relationship between the two variables. In this chapter, we estimate this relationship using a cross-country regression model. A theoretical, plausible relationship between per capita calorie intake C and per capita food expenditure F is specified to take on the semi-logarithmic form

$$C = \alpha + \beta ln(F) \tag{9.5}$$

where $\beta > 0$ and which gives:

$$\frac{\partial C}{\partial F} = \frac{\beta}{F} \text{ and } \frac{\partial^2 C}{\partial F^2} = -\frac{\beta}{F^2}$$

which implies that as food expenditure increases, calorie intake also increases but at a decreasing rate. In other words, the rate of increase in calorie intake slows as people become more affluent. Instead of consuming more calories, people consume more protein and fat as their food expenditure increases. The regression model in (9.5) was estimated using 32 observations given in Table A9.1, with each country as an observation. Such cross-country regressions have been widely used in the literature (Reutlinger and Selowsky 1976). One potential drawback of using cross-country data for estimating the regression model (9.5) is that they may have a limited range of variation in per capita food expenditure as compared to using household data. Fortunately, the countries used in this study provide sufficient variability to reasonably estimate regression coefficients. The estimated equation is:

$$\begin{array}{ll} C = 2090.4 + 361.5\, ln(F) & \qquad R^2 = 0.44. \\ \quad\;\;(42.8) \quad (5.1) & \end{array} \tag{9.6}$$

The t-values in the bracket show that the coefficients are highly significant. This equation can be used to calculate the cost of food basket that provides an average of 2100 kilo/calories per person per day. Substituting $C = 2100$ in (9.6) gives $F = 1.03$. Therefore, the cost of a food basket that gives on average 2100 kilo/calories per day per person is $1.03 in 2005 PPP. Accordingly, the estimated cost of calorie is equal to $0.49 in 2005 PPP per 1000 kilo/calories.

The calorie cost is obtained by dividing total food expenditure by the number of calories derived from food. The calorie cost varies with a household's standards of living: the richer the household is, the higher the cost of calories (Kakwani 2010). This is because richer households tend to consume a greater variety of food containing more protein and other nutrients, while the poor are likely to consume more carbohydrates, which are less expensive than protein.

Using (9.6), the calorie elasticity with respect to food consumption is estimated at 0.172. To measure the impact of food consumption on calorie cost, we estimate the following semi-logarithm form based on the data presented in Table A9.1 in the Appendix:

$$\begin{array}{ll} Ccost = 0.49 + 0.65\,ln(F) & \qquad R^2 = 0.94 \\ \qquad\qquad (24.8)\,(22.4) & \end{array} \tag{9.7}$$

Equation (9.7) estimates that the calorie-cost elasticity with respect to food consumption is 1.33 at the point where the calorie cost is 0.49 per 1000 kilo/calories. The calorie-food elasticity is 0.172 whereas the calorie-cost-food elasticity is 1.33. Many studies have found that the calorie-food elasticity is low, which has been of much concern in the literature.[11]A low elasticity of calories implies that economic development would either never or take a very long time to eliminate hunger (Deaton 1997).

If the calorie-cost elasticity is greater 1, people incur greater calorie costs as their incomes increase because they buy food of better quality with higher nutrient contents. In contrast, the poor tend to consume calorie-intensive food and are deprived of other nutrients necessary for good health. They suffer from malnutrition because they cannot afford to buy nutritious food. Similar to MDERs, there should be also a requirement of minimum calorie costs (MCC), which on average provide a balanced diet that meets nutritional needs necessary to maintain good health. In this context, a pertinent question would be whether a food basket with the estimated calorie cost of \$0.49 in 2005 PPP per 1000 kilo/

[11] Alderman (1993) has provided an excellent review of econometric techniques, which have been used in the literature to estimate the calorie-intake elasticity.

calories will be able to provide a balanced diet. The next section attempts to answer this question.

9.11 A Balanced Food Basket

Food contains a number of basic nutrients such as carbohydrates, proteins, and fats that produce different quantities of energy when burnt. The amount of energy produced, when one gram of any of these nutrients is burnt, is known as its calorific value. A balanced food basket is one that provides 2100 kilo/calories per person per day, of which 60–70 % is obtained from carbohydrates[12], 15–30 % from fats[13], and 10–15 % from proteins[14], according to the Healthy Diet Plans.

The calorific values of different nutrients are: One gram of carbohydrates yields 4 calories, protein 4 calories and fat 9 calories. Using these calorific values, a balanced food basket with the calorie consumption of 2100 kilo/calories per person per day is estimated to provide the three nutrients in the following ranges of quantity: 52.5–78.7 grams of protein, 35–70 grams of fat, and 315–367 grams of carbohydrates.

Holding the daily calorie requirements constant, the calorie cost becomes the main determinant of the quantities of protein, carbohydrates, and fats as sources of calories. To calculate these quantities, we fitted the following three cross-country semi-logarithmic regressions using the 32 observations from Table A9.1:

$$\underset{}{pc\_protein = \underset{(32.7)}{71.2} + \underset{(5.0)}{18.4}\, ln(Ccost)} \qquad R^2 = 0.45 \tag{9.8}$$

[12] Carbohydrates are the main source of energy for the human body and are obtained from food such as whole-grain cereals and breads, pasta, corn, beans, peas, potatoes, fruit, vegetables, and milk products.

[13] Fats are important for the absorption of fat-soluble vitamins such as vitamins A, D, E, and K. They also provide essential fatty acids, which are important for the structure and function of cells, and cushion vital organs and protects the body from extreme cold and heat.

[14] Proteins are complex nitrogen-containing compounds that build and repair body tissue. Protein deficiency can retard growth and development and inhibit the body's ability to fight infection.

$$pc\_carb = 353.1 - 33.7\,ln(Ccost) \qquad R^2 = 0.10 \tag{9.9}$$
$$(32.8) \quad (-1.86)$$

$$pc\_fat = 67.4 + 41.2\,ln(Ccost) \qquad R^2 = 0.59 \tag{9.10}$$
$$(18.2)(6.6)$$

where *pc_protein* is per capita consumption of protein; *pc_carb* is per capita consumption of carbohydrates; *pc_fat* is per capita consumption of fats; and *Ccost* is calorie cost per 1000 kilo/calories in 2005 PPP.

Equation (9.9) shows that the *t*-value for the coefficient of *ln*(*Ccost*) is 1.86, which is not statistically significant at 5 %. This indicates that an increase in calorie cost has a non-significant impact on the consumption of carbohydrates, but a significant impact on the consumption of protein and fat.

The estimated calorie cost of the food basket is \$0.49 in 2005 PPP, which upon substituting in (9.8), (9.9) and (9.10) gives the estimates for per capita quantities of protein, carbohydrates, and fat, respectively. Thus, our proposed per capita food basket, which costs \$1.03 in 2005 PPP, provides 2100 kilo/calories per person per day and consists of 58 grams of protein per person day, 377 grams of carbohydrates per person per day, and 38 grams of fats per person per day.

The quantities of the three nutrients lie in the ranges of nutrient requirements for a healthy person, except carbohydrates which is slightly higher by 9 grams. This food basket provides the required nutrients for a healthy person and, therefore, offers a balanced diet of an average person. A household is deemed suffering from food insecurity if its entitlement, as measured by per capita expenditure, is less than the cost of basket estimated to be \$1.03 in 2005 PPP.

As noted earlier, FAO's (1996) recommended calorie requirements are about 1800 kilo/calories per person per day, 300 calories less than the average calorie requirements for a healthy person. This chapter estimates the calorie cost of a food basket that provides 1800 kilo/calories per person per day from (9.6) at \$0.25 in 2005 PPP per 1000 kilo/calories. Substituting this value of calorie cost in (9.8), (9.9) and (9.10), we obtain a food basket that provides 1800 kilo/calories per person per day and comprises 46 grams of protein per person day, 400 grams of carbohydrates per person per day, and 10.2 grams of fats per person per day.

Except in carbohydrates, a food basket of 1800 kilo/calories per person per day is deficient in both protein and fats, with their values lying outside the range of nutrient requirements for a healthy person. Even if the human body can adapt to a lower dietary energy intake, households may consume excessive carbohydrates and experience severe deficiency in both protein and fats. In this case, households will not meet their nutritional needs and consequently suffer chronic malnutrition. Therefore, adopting a lower threshold, based on FAO's minimum dietary energy requirement, will not provide a balance diet.

9.12 Global Estimates of Food Insecurity

Departing from FAO's measure food insecurity which compares energy intake with requirement, we build upon the entitlement approach, which compares per capita household expenditure with per capita food cost. We estimate that the per capita cost of a food basket that provides sufficient nutrients for maintaining good health is \$1.03 per day in 2005 PPP.

Using the World Bank's PovcalNet program, this chapter gives measurements of global food insecurity through data from 124 countries, which account for 5.7 billion people. In calculating the incidence of food insecurity, the poverty line is set at \$1.03 in 2005 PPP. The international poverty line of \$1.25 per person per day in 2005 PPP is widely used to measure extreme poverty in the world.

The World Bank recently refined its estimates of the PPP, which is a currency conversion for comparing the size and price levels of economies, by updating the base year from 2005 to 2011. The 2011 PPPs are deemed superior compared to the 2005 PPPs in terms of coverage of countries and estimation based on more accurate prices collected from individual countries. With the latest conversion rates available, it is appropriate to ask what the threshold of food insecurity in 2011 PPP that corresponds to \$1.03 in 2005 PPP would be. To calculate a single threshold of food insecurity based on 2011 PPP, we have used a new methodology of equivalence poverty lines, discussed in Chap. 8. There is no single threshold for food insecurity in 2011 PPP that is equivalent to \$1.03 in 2005 PPP. Hence, we estimate a single threshold for food insecurity using the weighted average of equivalent thresholds for 101 countries with weights proportional to their population. The resulting threshold calculated accordingly is equal to \$1.59 in 2011 PPP.

The threshold for food insecurity was estimated by incorporating the cost of calorie intake, which has never been considered by earlier studies in this field. To this extent, this chapter covers demand-side issues of food insecurity neglected in the past. Any supply-side interruptions, whether natural or man-made, will automatically be reflected in food prices that affect calorie cost and consequentially food insecurity. Thus, the proposed method implicitly incorporates both supply and demand sides of food production or availability as important determinants of food insecurity.

Rich, industrialized countries have been excluded from the study because they are not expected to struggle with food deprivation. Table A9.2 in the Appendix provides the estimates for individual countries by selecting individual countries in the latest PovcalNet program for 2002 and 2012. Aggregated estimates from individual countries are presented in Table 9.3 for six major regions in the world. These aggregated estimates are directly obtained from the PovcalNet program. The aggregation is performed using the weighted average method, with weights proportional to the countries' population.

Table 9.3 shows impressive progress in reducing the overall food insecurity worldwide. In just one decade, 2002–12, the percentage of the population dealing with food insecurity in the six major regions declined from 23.05 % in 2002 to 10.01 % in 2012. Similarly, the number of people suffering from food insecurity has fallen by 576.37 million, despite the serious food crisis in 2007–08 when food prices skyrocketed.

Several regions have charted notable progress in addressing food insecurity (see Fig. 9.1). In East Asia and Pacific alone, the number of people suffering from food insecurity decreased from 368.93 to 72.76 million between 2002 and 2012. The incidence of food insecurity is thus reduced to about 3.81 % of the region's population in 2012. One plausible explanation for such an impressive reduction could be due to rapid economic growth as experienced by many East Asian countries such as China.

Table 9.3 Percentage and number of food-insecure persons by region, 2002 and 2012

Region	2002		2012		Annual change	
	Percentage (%)	Number (million)	Percentage (%)	Number (million)	Percentage (%)	Number (million)
East Asia and Pacific	20.85	368.93	3.81	72.76	–1.70	–296.17
Europe and Central Asia	1.66	7.35	0.26	1.15	–0.14	–6.20
Latin America and Caribbean	10.00	51.97	4.40	25.90	–0.56	–26.07
Middle East and North Africa	1.99	2.24	0.39	0.49	–0.16	–1.75
South Asia	27.07	380.99	10.02	162.34	–1.71	–218.65
Sub-Saharan Africa	48.37	322.18	33.84	294.63	–1.45	–27.55
Developing world	23.05	1133.65	10.01	557.28	–1.30	–576.37

Source: Authors' calculations using PovcalNet

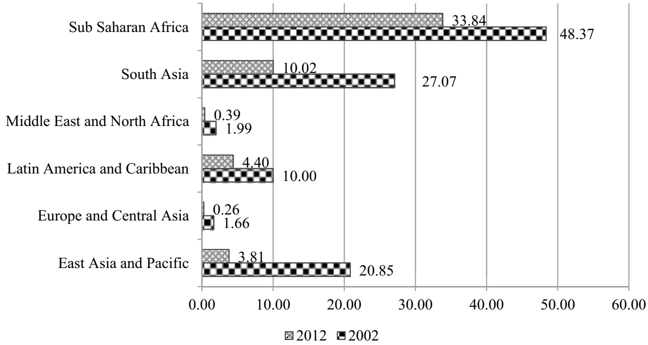

Fig. 9.1 Percentage of food-insecure people in the world by region (*Source*: Authors' calculations)

South Asia's performance in reducing food insecurity is equally commendable. The number of food-insecure people in the region declined from 380.99 million in 2002 to 162.34 million in 2012, lifting 218.65 million out of food insecurity. Given such rapid reduction in the number of food-insecure people, it could take only a few more years to eliminate food insecurity in South Asia.

Food insecurity is not much of an issue in Europe and Central Asia and Middle East and North Africa, where the percentage of food-insecure people is less than 1 % in 2012. In Latin America and Caribbean, the percentage of food-insecure people is 4.4 % in 2012. In contrast, Sub-Saharan Africa suffers from extreme food insecurity, with 48 % of its population suffering from food insecurity in 2002. This percentage declined to 33.84 % in 2012. As a result, the number of people struggling with food insecurity fell from 322.18 million in 2002 to 294.63 million in 2012, accounting for a net reduction of 27.55 million in one decade.

Despite the impressive progress in ensuring food security, some 557.28 million around the globe were unable to meet their minimum food requirements in 2012. These people are more likely to suffer from chronic hunger. One of the United Nations' new agenda in its Sustainable Development Goals aims to end hunger, and achieve food security and improved nutrition by 2030. To achieve this goal, these 557.28 million people need to break out of food insecurity and hunger.

Table A9.2 in the Appendix provides estimates of the percentage of the population dealing with food insecurity in 126 countries. Of these

126 countries, 60 have less than 3 % of their populations suffering from food insecurity and are likely to have no serious issues on food insecurity. On the other hand, food insecurity is severe in Burkina Faso, Cameroon, Congo Democratic Republic, Madagascar, Malawi, and Zambia, where more than 50 % of their populations struggled with food insecurity in 2012. The global development community needs to commit greater resources to address food insecurity in these countries.

China and India are often compared with regard to their performance in reducing malnutrition of children. It is generally perceived that India's performance in providing adequate amount of food to its population is poorer than China's. China has reduced the percentage of its population coping with food insecurity from 23.91 % in 2002 to 3.59 % in 2012, with 258 million people emerging out of food insecurity. In comparison, India has reduced the percentage of its food-insecure people from 27.09 % in 2002 to 9.76 % in 2012 (see Table A9.2). As a result, almost 171 million have been lifted out of food insecurity. In addressing food insecurity, India's progress is not that much behind China's.

Severe malnutrition among children is widely prevalent in India, but this may not be only due to food deprivation. Other factors such as poor public hygiene, low rate of immunization, and low access to basic health services may also influence malnutrition. As the July 2015 issue of The Economist points out, one reason why Indians may experience more malnutrition compared to Africans is that outdoor defecation is more prevalent in India. This practice may result in more people suffering disease and diarrhea, which make it harder to absorb nutrients, especially for children.

9.13 Linkage Between Economic Growth and Food Insecurity

Growth generates additional goods and services enjoyed by the population. It is measured by the gross domestic product (GDP) and per capita GDP.[15] But the entitlement to the output produced varies from one person to another depending on the pattern of growth. The pattern of growth

[15] The total amount of goods and services produced within a year is measured through GDP and per capita GDP measures the total output that on average is available to each person.

determines growth's impact on reducing poverty and income inequality, and its impact on expanding economic opportunities that improve well-being. This chapter shows that the level and pattern of growth can also influence food security in a country.

Table 9.4 presents the annual growth rates of per capita GDP between 2002 and 2011 in different regions. As expected, East Asia and Pacific is the fastest growing region, with its per capita real GDP increasing at an annual rate of 7.8 % in the given period. South Asia is the second fastest growing region with an annual per capita real GDP growth rate of 5.47 %. The developing world's annual growth rate of per capita real GDP is estimated at 2.68 %.

In linking growth to food insecurity, the relevant question is how effective growth would be in reducing food insecurity. One method to

Table 9.4 Growth effectiveness in reducing food insecurity in the world, 2002–12

Region	Per capita GDP in 2002 ($US in 2011 PPP)	Per capita GDP in 2012 ($US in 2011 PPP)	Growth rate in per capita GDP (% per annum)	GERFI	Years to end food insecurity
East Asia and Pacific	12.64	27.58	7.80	−0.22	2.15
Europe and Central Asia	22.41	35.28	4.54	−0.03	1.82
Latin America and Caribbean	29.03	36.72	2.35	−0.24	7.29
Middle East and North Africa	25.15	31.67	2.31	−0.07	2.40
South Asia	7.24	12.51	5.47	−0.31	5.22
Sub-Saharan Africa	6.55	8.85	3.01	−0.48	17.94
Developing world	28.7	37.51	2.68	−0.49	7.09

Source: Authors' calculations

Note: *GDP* gross domestic product, *PPP* purchasing power parity, *GERFI* growth effectiveness of reducing food insecurity answer this question is through the growth-food insecurity elasticity. This elasticity measures the growth effectiveness of reducing food insecurity (GERFI)

$$GERFI = \frac{\Delta Food\ Insecurity}{\Delta ln\left(Per\ Capita\ GDP\right)}$$

which is the ratio of change in food insecurity to the growth rate of per capita GDP. For instance, this elasticity is −0.22 for East Asia and Pacific, which implies that a 1 % growth in per capita GDP reduces the percentage of people suffering from food insecurity by 0.22 percentage points. In contrast, a 1 % growth in per capita GDP trims down the percentage of people struggling with food insecurity by 0.48 percentage points in Sub-Saharan Africa. The results suggest that growth is more effective in reducing food insecurity in Sub-Saharan Africa than in the other regions examined. A slower progress in reducing food insecurity in Sub-Saharan Africa is due to region's lower growth rate in per capita GDP.

We now pose a practical question as to how many years it will take to eliminate food insecurity in the world. In making such a projection, we assume that (i) the regions continue to have the same growth rate as in the past and that (ii) the GERFI is constant. We will use 2012 as the reference year. To illustrate, calculations for South Asia are shown below.

The percentage of the population of South Asia suffering from food insecurity in 2012 is 12.51 %, which is projected to reduce to 0 %. The GERFI for the region is −0.31, which gives the total growth rate required to eliminate food insecurity to 0 % equal to 32.05 %. As shown in Table 9.4, the annual growth rate in per capita GDP for South Asia is 5.47 %. Using the compound interest formula, $\left(1+\frac{5.47}{100}\right)^n = \left(1+\frac{32.05}{100}\right)$, and solving for n will yield the number of years equal to 5.22.[16]

[16] The authors are grateful to Jacques Silber for suggesting the compound interest formula to be used to estimate the number of years for this study.

In Sub-Saharan Africa, about 33.84% of the population is suffering from food insecurity in 2012, which is extremely high compared to other regions. If Sub-Saharan Africa continues to have the same growth rate of per capita GDP, it will take almost 18 years to eliminate food insecurity in the region.

9.14 The Link Between Food Insecurity and Extreme Poverty

Poverty and food insecurity are somewhat related concepts. Poor people lack sufficient resources to adequately meet basic necessities including food. This section assesses the linkage between extreme poverty and food insecurity.

An estimated 1.9 billion lived below $1.25 a day in 1990–92, which declined by 835.5 million to 1.065 billion in 2015.[17] Meanwhile, FAO estimates that about 991 million suffered from hunger in 1990 and declined to 775 million in 2015, reducing by 216 million in 25 years. The decline in the number of hungry people by 216 million between 1990 and 2015 was only about a quarter of the estimated decline in the number of extreme poor at 835.5 million in 2015.

Lele (2015) in a recent blog post, *Measuring Poverty and Hunger can Raise More Questions than Answers,* raised a pertinent question: why is there no link between hunger and poverty, as measured by FAO and the World Bank, respectively? Progress in hunger reduction seems underwhelming relative to the reported absolute levels and rates of decline in poverty. This puzzle can be understood given the following justification.

Poverty is measured through income or expenditure. As economic growth increases people's incomes, poverty is likely to be reduced

[17] People living on less than $1.25 a day in 2005 PPP are trapped in extreme poverty. This poverty line was adopted to monitor the Millennium Development Goal of halving extreme poverty in 25 years between 1990 and 2015.

because poor people also benefit from growth if not in the same proportion as the non-poor. Meanwhile, FAO measures hunger through calorie intake, which is compared with a fixed value of calorie requirement. As this study shows, calorie intake increases very slowly with growth even among the poor and may at some point remain the same. As such, when the calorie requirement is fixed, reduction in hunger will be likely very slow. With prosperity, people tend to buy higher quality food, fresh and hygienic, and with more protein and other micro-nutrients. FAO's measure of undernourishment is only based on calorie consumption, which fails to indicate whether people are becoming nutritionally better- or worse-off.

Like poverty, food insecurity is measured through expenditure. There is almost a one-to-one relationship between the two as is evident from the following cross-country regressions:

$$\underset{}{ln\left(hfood2012\right)} = \underset{(-3.64)}{-1.52} + \underset{(57.28)}{0.80}\, ln\left(hpoor2012\right) \qquad R^2 = 0.97$$

where *hfood*2012 is the percentage of population suffering food insecurity in 2012; and *hpoor*2012 is the percentage of population suffering extreme poverty in 2012.

Food insecurity or hunger is an extreme form of poverty. Concepts of poverty and food insecurity are closely related. The equation above establishes that there is an almost one-to-one relationship between the two.

9.15 Concluding Remarks

Eradicating food insecurity remains one of the development agenda in many countries. Measuring food insecurity is conventionally done by comparing calorific needs against requirements. However, nutrients such as proteins, fats, and carbohydrates are also required to maintain good health. Hence, to ensure food security, households and individuals must have sufficient resources to purchase food that satisfies nutritional requirements.

This chapter proposed a new methodology of measuring food insecurity. It calculated the per capita monetary cost of a food basket that satisfies the calorific and nutrient needs to maintain a healthy body. This nutritious food basket with a balanced diet provides 2100 kilo/calories per person per day, consisting of 58 grams of protein per person per day, 375 grams of carbohydrates per person per day, and 37 grams of fats per person per day. The quantities of proteins and fats fall within the range of nutrient requirements for a healthy person, whereas quantity of carbohydrates is marginally higher by 9 grams. Calculations in this chapter estimated that this nutritious food basket costs $1.03 in 2005 PPP.

With the 2011 PPP currency conversion rates recently released, we estimated that the threshold of food insecurity is $1.59 in 2011 PPP, which is equivalent to $1.03 in 2005 PPP. Accordingly, our global estimates for food insecurity are based on the new threshold of $1.59 per person per day in 2011 PPP.

In constructing the nutritious food basket, we identified calorie norms for reference individuals of median height and weight with a BMI of 21.5 for adult females and 22.5 for adult males. Individuals are also assumed to have a lifestyle with moderate activities including walking about 1.5–3 miles per day at 3–4 miles per hour, as well as light physical activity associated with typical day-to-day living. Given these assumptions, we estimated the calorie norm with moderate activity at around 2100 kilo/calories per person per day. The U.S. Department of Agriculture also uses the average energy requirements of around 2100 calories per person per day, which was estimated for 67 developing countries.

A household that has access to this nutritious food basket, which provides a minimum of 2100 kilo/calories per person per day, is unlikely to struggle with chronic hunger. Calorific needs of household members may be greater or less than 2100 kilo/calories, hence the household, on average, will not likely to experience hunger. In comparison, FAO recommends calorie requirements of 1800 kilo/calories per person per day—

300 calories lower than the average requirements for a healthy person. FAO justifies this lower threshold based on the human body's capacity to adapt to a lower dietary energy intake without any impairment to health. However, this lower cut-off based on FAO's minimum dietary energy requirement provides deficient amounts of protein and fats, and thus fails to deliver a balanced diet.

In this chapter we have identified a household suffering from food insecurity as one in which its entitlement, as measured by per capita expenditure, is less than the cost of the food basket estimated to be equal to $1.59 in 2011 PPP. Using this benchmark, the findings revealed notable gains in reducing food insecurity worldwide between 2002 and 2012. Despite the severe food crisis in 2007–08, the percentage of the global population struggling with food insecurity significantly decreased from 23 % in 2002 to 10 % in 2012. In just one decade, the number of food-insecure people declined by more than 576 million.

Progress in combating food insecurity has been notable in all regions. East Asia and Pacific recorded a rapid reduction in food insecurity largely on the back of China's impressive growth. The number of food-insecure people in East Asia and Pacific decreased from 368.93 to 72.76 million in 2002–12. In South Asia, food insecurity is expected to be eliminated in a few years, with the percentage of its population facing food insecurity rapidly decreasing from 27.07 % in 2002 to 10.02 % in 2012. Some 218.65 million people in South Asia broke out of food insecurity in the given decade. Similarly, the percentage of food-insecure people is less than 1 % of the populations in Europe and Central Asia and Middle East and North Africa, and 4.4 % of Latin America and Caribbean's population in 2012.

Food insecurity is, however, expected to remain a prevalent development concern in Sub-Saharan Africa in the years to come. The region charted a decrease in the percentage of its population dealing with food insecurity, from 48.37 % in 2002 to 33.84 % in 2012. Although Sub-Saharan Africa has made marked progress in reducing food insecurity, it will take about 18 years to eliminate food insecurity in the region assuming that the growth rate of per capita GDP remains at 3 % per annum.

How is food insecurity related to growth and poverty reduction? In explaining the linkage between growth and food insecurity, this chapter examined how effective growth is in reducing food insecurity. Based on our estimates, a 1 % growth in per capita GDP in East Asia and Pacific diminishes the percentage of food-insecure people by 0.22 percentage points. In Sub-Saharan Africa, the percentage of people suffering from food insecurity is reduced by 0.48 percentage points for every 1 % growth in per capita GDP. The study found that among six regions in the globe, economic growth in Sub-Saharan Africa is the most effective in reducing the incidence of food insecurity, despite having lower growth rate compared to the other regions.

Meanwhile, gains in reducing hunger appear marginal compared to the decline in poverty. FAO estimates that only 216 million people escaped hunger in the last 25 years, with the number of hungry people decreasing from 991 million in 1990 to 775 million in 2015. This decrease of 216 million in the number of people dealing with hunger was only about a quarter of the estimated decline in the number of extreme poor at 835.5 million in 2015.

This discrepancy between the progress in reducing poverty and hunger can be explained by the following. As FAO measures hunger by comparing calorie intake with a fixed value of calorie requirement, calorie consumption increases sluggishly or may even remain the same given an increase growth. With a fixed calorie requirement, progress in reducing hunger is expected to be very slow. In contrast, poverty, which is measured through income or expenditure, is reduced with growth since people's income increases. With higher incomes, people tend to buy better quality food with higher contents of nutrients. Since FAO's measure of hunger is only based on calorie intake, it does not indicate whether people are becoming nutritionally better- or worse-off as incomes change.

Appendix

Table A9.1 Food and nutrition consumption per country

Country	Survey year	Per capita expenditure	Per capita food	Per capita kilo calorie	Per capita protein	Per capita fats	Per capita carbohydrates
Azerbaijan	2006	6.04	3.13	2856	78.31	76.10	448.62
Bangladesh	2000–01	1.61	0.83	2195	56.52	29.98	411.04
	2005	1.88	0.91	2119	49.61	26.43	417.26
Bolivia	2003–04	4.99	1.81	1866	63.54	38.85	305.11
Cambodia	2004	1.60	1.14	2014	55.09	29.33	370.41
	2009	2.25	1.59	2055	63.12	36.65	352.75
Chad	2009	2.05	1.44	2461	82.11	52.25	393.75
Côte d'Ivoire	2002	3.66	1.11	2105	63.69	46.74	343.89
Guatemala	2006	5.93	2.17	2290	65.02	50.12	379.11
Haiti	1999–2000	2.68	1.54	2324	57.50	61.76	384.96
Hungary	2004	11.57	2.96	2450	79.91	107.5	280.79
Kenya	2005–06	2.84	1.30	1799	52.40	41.94	301.02
Lao PDR	2008	2.82	1.55	2571	69.09	24.98	502.75
Lithuania	2002	9.41	4.38	2811	86.50	123.74	319.43
Malawi	2004–05	1.57	1.03	2237	74.32	47.51	375.70
Mali	2001	1.76	1.15	2276	63.49	44.73	396.68
Mexico	2004	10.68	2.89	2170	78.51	68.78	290.68
Moldova	2006	5.90	3.21	2690	92.62	90.08	364.37
Mozambique	2002–03	1.15	0.63	1955	51.60	41.83	341.26
Nepal	1995–96	1.28	0.77	2231	50.51	25.06	434.63
Niger	2007–08	2.17	0.68	1938	56.73	33.99	336.82
Pakistan	2005–06	1.93	1.05	1949	59.67	51.49	298.67

(*continued*)

Table A9.1 (continued)

Country	Survey year	Per capita expenditure	Per capita food	Per capita kilo calorie	Per capita protein	Per capita fats	Per capita carbohydrates
Panama	2008	11.24	3.38	2371	83.66	78.51	314.92
Papua New Guinea	1996	4.00	1.93	2003	47.61	43.54	334.42
Paraguay	1997–98	8.14	3.18	2837	84.06	94.09	388.31
Philippines	2003	3.38	1.57	1900	53.17	33.56	346.27
Sri Lanka	1999–2000	2.85	1.38	2182	56.42	47.29	372.32
Sudan	2009	2.78	1.70	2238	69.37	54.32	343.77
Tajikistan	2007	5.70	3.63	2617	69.55	71.93	408.85
Togo	2006	1.66	1.06	2159	66.41	37.65	385.94
Uganda	2002–03	1.84	0.84	2159	50.08	28.77	394.05
	2005–06	1.97	0.84	2006	47.48	25.15	365.78

Source: Authors' calculations based on FAO database

Table A9.2 Percentage and number of food-insecure persons for 126 countries, 2002 and 2012

Country	2002 Percentage (%)	2002 Number (million)	2012 Percentage (%)	2012 Number (million)
East Asia and Pacific	*20.85*	*368.93*	*3.81*	*72.76*
Cambodia	23.84	3.03	2.27	0.34
China	23.91	306.14	3.59	48.49
Fiji	2.68	0.02	1.67	0.01
Indonesia	11.38	24.47	4.95	12.22
Lao PDR	29.98	1.66	20.57	1.37
Malaysia	2.73	0.67	0.03	0.01
Micronesia (urban)	44.06	0.01	42.56	0.01
Papua New Guinea	50.91	2.88	26.58	1.91
Philippines	10.76	8.71	7.16	6.92
Thailand	0.52	0.33	0.03	0.02
Timor-Leste	31.59	0.28	14.94	0.17
Vietnam	26.04	20.71	1.46	1.30
Europe and Central Asia	*1.66*	*7.35*	*0.26*	*1.15*
Albania	0.94	0.03	0.48	0.01
Armenia	8.07	0.25	0.78	0.02
Azerbaijan	0.00	0.00	0.00	0.00
Belarus	1.20	0.12	0.00	0.00
Bosnia and Herzegovina	0.22	0.01	0.06	0.00
Bulgaria	0.75	0.06	1.54	0.11
Croatia	0.03	0.00	0.00	0.00
Czech Rep.	0.04	0.00	0.06	0.01
Estonia	0.71	0.01	0.83	0.01
Georgia	11.10	0.48	10.97	0.49
Hungary	0.00	0.00	0.26	0.03
Kazakhstan	3.32	0.49	0.02	0.00
Kyrgyz Rep.	21.91	1.09	1.71	0.10
Latvia	0.47	0.01	1.10	0.02
Lithuania	0.16	0.01	0.86	0.03
Macedonia	0.76	0.02	0.85	0.02
Moldova	10.14	0.37	0.07	0.00
Montenegro	0.19	0.00	1.18	0.01
Poland	0.01	0.00	0.01	0.00
Romania	3.13	0.68	0.00	0.00
Russian Federation	0.34	0.49	0.01	0.01
Serbia	0.25	0.02	0.05	0.00
Slovak Rep.	0.08	0.00	0.17	0.01
Slovenia	0.00	0.00	0.00	0.00

(*continued*)

Table A9.2 (continued)

Country	2002		2012	
	Percentage (%)	Number (million)	Percentage (%)	Number (million)
Tajikistan	22.46	1.44	2.36	0.19
Turkey	0.58	0.38	0.00	0.00
Turkmenistan	22.84	1.05	1.22	0.06
Ukraine	0.70	0.34	0.00	0.00
Latin America and Caribbean	*10.00*	*51.97*	*4.40*	*25.90*
Argentina (urban)	10.67	3.64	1.18	0.45
Belize	8.68	0.02	9.89	0.03
Bolivia	21.33	1.89	7.88	0.83
Brazil	8.91	15.98	3.77	7.49
Chile	1.97	0.31	0.82	0.14
Colombia	11.59	4.78	5.27	2.51
Costa Rica	5.18	0.21	1.26	0.06
Dominican Rep.	4.00	0.36	1.66	0.17
Ecuador	13.82	1.80	4.31	0.67
El Salvador	12.25	0.74	2.36	0.15
Guatemala	15.4	1.81	8.35	1.26
Guyana	10.11	0.08	7.85	0.06
Haiti	48.38	4.29	47.74	4.86
Honduras	25.07	1.63	17.04	1.35
Jamaica	1.60	0.04	0.51	0.01
Mexico	5.89	6.29	1.66	2.01
Nicaragua	10.74	0.56	6.43	0.39
Panama	9.24	0.29	3.25	0.12
Paraguay	10.78	0.60	2.57	0.17
Peru	11.60	3.10	2.66	0.80
St. Lucia	25.41	0.04	22.55	0.04
Suriname	20.87	0.10	16.95	0.09
Trinidad and Tobago	1.17	0.01	0.23	0.00
Uruguay (Urban)	0.46	0.01	0.19	0.01
Venezuela, Rep. Bolivariana de	13.36	3.38	7.44	2.23
Middle East and North Africa	*1.99*	*2.24*	*0.39*	*0.49*
Djibouti	14.19	0.11	14.12	0.12
Iran	1.50	1.02	0.05	0.04
Jordan	0.35	0.02	0.10	0.01
Morocco	3.04	0.89	0.70	0.23
Tunisia	2.12	0.21	0.92	0.10

Table A9.2 (continued)

Country	2002 Percentage (%)	2002 Number (million)	2012 Percentage (%)	2012 Number (million)
South Asia	*27.07*	*380.99*	*10.02*	*162.34*
Bangladesh	41.43	56.76	23.24	35.95
Bhutan	24.34	0.15	1.13	0.01
India	27.09	291.68	9.76	120.70
Maldives	8.11	0.02	0.03	0.00
Nepal	37.45	9.03	4.50	1.24
Pakistan	15.15	22.68	2.38	4.26
Sri Lanka	3.57	0.68	0.90	0.18
Sub-Saharan Africa	*48.37*	*322.18*	*33.84*	*294.63*
Angola	52.38	7.80	20.78	4.33
Angola (Urban)	23.72	1.80	40.85	4.11
Benin	38.54	2.86	8.81	0.18
Botswana	25.27	0.46	34.81	5.73
Burkina Faso	56.58	6.96	68.37	6.73
Burundi	72.39	5.10	9.01	0.04
Cabo Verde	20.84	0.10	19.18	4.16
Cameroon	15.69	2.63	51.57	2.34
Central African Rep.	55.66	2.10	28.28	3.52
Comoros	8.81	0.05	10.26	0.07
Congo, Dem. Rep. of	89.70	44.42	69.59	45.73
Congo, Rep. of	43.79	1.44	21.16	0.92
Cote d'Ivoire	16.18	2.70	20.65	4.10
Ethiopia	32.75	22.91	18.23	16.72
Gabon	4.55	0.06	3.53	0.06
Gambia, The	54.95	0.72	36.65	0.66
Ghana	22.88	4.53	9.16	2.32
Guinea	51.88	4.70	24.32	2.78
Guinea-Bissau	42.16	0.56	53.57	0.89
Kenya	22.60	7.46	18.57	8.02
Lesotho	55.02	1.04	50.60	1.04
Liberia	39.06	1.20	34.21	1.43
Madagascar	68.70	11.50	75.08	16.74
Malawi	64.21	7.66	62.51	9.95
Mali	47.18	5.13	38.80	5.76
Mauritania	12.02	0.35	6.10	0.23
Mauritius	0.35	0.00	0.27	0.00
Mozambique	74.79	14.45	52.39	13.20
Namibia	28.54	0.56	13.51	0.31
Niger	69.27	8.19	29.99	5.15

(*continued*)

Table A9.2 (continued)

Country	2002 Percentage (%)	2002 Number (million)	2012 Percentage (%)	2012 Number (million)
Nigeria	60.29	77.91	42.00	70.91
Rwanda	64.20	5.77	46.51	5.33
Sao Tome and Principe	22.41	0.03	21.64	0.04
Senegal	37.22	3.87	28.84	3.96
Seychelles	0.35	0.00	0.00	0.00
Sierra Leone	51.20	2.30	36.94	2.21
South Africa	28.29	12.89	11.56	6.05
Sudan	17.35	5.06	7.72	2.87
Swaziland	37.47	0.40	35.03	0.43
Tanzania	68.82	24.64	34.29	16.38
Togo	46.01	2.36	44.06	2.93
Uganda	51.46	13.35	23.73	8.63
Zambia	39.43	4.19	54.61	7.69
Developing world	*23.05*	*1133.65*	*10.01*	*557.28*

Source: Authors' calculations

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Social Rate of Return: A New Tool for Evaluating Social Programs

10.1 Introduction

A growing number of developing countries are investing in a variety of social programs to improve the welfare of their people, particularly those who are poor and vulnerable. In fact, these programs have become an important pillar of economic development policies. According to a World Bank report *The State of Social Safety Nets 2015,* as many as 1.9 billion people are beneficiaries of safety net programs; of which, 44 % receive in-kind transfers, 37 % receive cash based transfers, and the remaining 19 % receive other forms of benefits such as fee waivers.

Given the popularity of these social programs, it has become important to rigorously evaluate them so that policy-makers are informed of the extent to which these programs meet their intended objectives. A social program primarily aims to reduce poverty and, more generally, to increase social welfare. A social welfare function is often used to evaluate whether or not the program has achieved its intended objectives. To achieve program efficiency, the program should be designed to maximize social welfare while minimizing the cost.

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Cost is clearly important for any social program. Programs ought to be judged based on how much social welfare they generate in relation to their respective operational costs. In this chapter, we adopt a method for evaluating programs using the idea of *social rate of return* (SRR). In calculating SRR, we use a social welfare function that specifies normative judgments by assigning weights to different individuals. The concept of SRR is explained in detail in Sect. 10.4.

Targeting is a means to improve program efficiency so that program objectives are achieved with minimum cost. There are two distinct issues in designing targeted programs; first is identifying the genuine beneficiaries who are the most needy, and second is deciding on how much transfers should be given to them so that their minimum basic needs are adequately met. Accordingly, targeting efficiency is judged by two kinds of targeting methods that are derived from (i) beneficiary incidence and (ii) benefit incidence. We provide a brief review of these targeting methods in Sects. 10.2 and 10.3.

Ravallion (2009) concluded that the standard measures to evaluate targeting performance are uninformative, or even deceptive, about the impacts of programs on poverty and the cost effectiveness in reducing poverty. However, he arrived at this conclusion without exploring these measures' welfare interpretation. This chapter shows that all targeting measures proposed in the literature have a meaningful interpretation in terms of the SRR.

The conditional cash transfer (CCT) programs that originated in Latin America are now becoming an extremely popular social policy tool because of their ability to enhance both the income of the poor in the short run and their human capital in the long run. These programs provide transfers to poor beneficiaries, but the amount they receive are conditional on meeting targets in school attendance and healthcare checkups. The main objective of these programs is to reduce extreme poverty in the short run and to break the intergenerational poverty cycle through investment in human capital in the long run.

In 2003, the federal government in Brazil created the *Bolsa Familia* Program with the objective of organizing and unifying four existing federal programs: *Bolsa Escola*, *Bolsa Alimentacao*, *Auxilio Gas* and *Cartao Alimentacao*. This program has now become the world's largest with around 45 million beneficiaries in 2012. The popularity of CCT programs in Latin America has become widespread, and almost 64 countries around the globe have now adopted similar programs.

Patterned after the CCT schemes in Latin American and some African countries, the Philippines' CCT program was launched in 2008 and has now become the fourth largest in the world with about 20 million beneficiaries in 2013. The program called *Pantawid Pamilyang Pilipino* Program (4Ps) is the Philippines' largest social protection program.

The *Bolsa Familia* is the world's largest social welfare program and has been regarded as highly successful, while the 4Ps is relatively new but has expanded rapidly in a short period. Since the two programs follow different methodologies in identifying beneficiaries, policy-makers would be interested to know their relative targeting performance. This chapter provides a comparative evaluation of the two programs using the idea of SRR developed by the authors.

The evaluation is based on household surveys obtained from the two countries. Brazil conducts an annual national household survey called *Pesquisa Nacional por Amostra de Domicílio* (PNAD), making it possible to analyze the progress of *Bolsa Familia* over the period 2001–12. The Philippines has the multi-purpose annual national household survey called Annual Poverty Indicators Survey (APIS). However, detailed information about 4Ps is recorded only in the 2011 and 2013 APIS. Hence, our analysis in this chapter of the 4Ps is based on the most recently available APIS for 2011 and 2013.

10.2 Beneficiary Incidence

Safety net programs are designed to target certain types of individuals, families or households. For instance, the old age pension is targeted to the elderly who are 65 years and older. Conditional cash transfer programs are designed to give cash transfers to families with children who fulfill certain conditions. Meanwhile, unemployment benefits are given to those who are unable to find employment. Programs have both direct and indirect beneficiaries. Although programs are designed to provide direct benefits—cash or in-kind—to certain types of individuals within households, all household members indirectly benefit from them. That is, if a household is enrolled in a program, then all individuals belonging to that household are assumed to be beneficiaries of the program. This assumption is commonly used to evaluate programs and is therefore adopted in this study.

Suppose N is the total population of individuals, and among them N_p are the poor, then the headcount ratio of poverty is given by

$$H = \frac{N_p}{N}.$$

Suppose that N_b are the individuals who benefit from the program, then the probability of selecting a beneficiary from the population is given by

$$B = \frac{N_b}{N}.$$

If we had perfect information about the poor, then all beneficiaries of the program will be poor. However, this is not the case in practice. Suppose among N_b beneficiaries, N_{bp} are poor and the remaining $\left(N_b - N_{bp}\right)$ are the non-poor beneficiaries. The probability of selecting a beneficiary among the poor is given by

$$B_p = \frac{N_{bp}}{N_p}.$$

Similarly, the probability of selecting a beneficiary among the non-poor is given by

$$B_n = \frac{\left(N_b - N_{bp}\right)}{\left(N - N_p\right)}.$$

Then we have the relationship:

$$B = HB_p + \left(1 - H\right)B_n.$$

The following two indicators—exclusion error and leakage—are commonly used in the literature to evaluate targeting efficiency. Let us define exclusion error as the proportion of poor who are non-beneficiaries of the program. It is expressed as

$$E = 1 - B_p.$$

Similarly, we define the leakage of beneficiary as the proportion of all beneficiaries who are not selected from the poor:

$$L = \frac{B - HB_P}{B}.$$

An error of exclusion leaves out the poor from the program, thereby making it ineffective in reducing poverty. Leakage represents the program resources that are provided to the non-poor who are unintended beneficiaries. Exclusion error and leakage are related such that

$$L = 1 - \frac{H}{B}(1 - E). \tag{10.1}$$

If the probability of selecting a beneficiary is equal to the headcount ratio of poverty $(B = H)$, then leakage is equal to exclusion error $(L = E)$. If $B < H$, $L < E$ and similarly, if $B > H$, then $L > E$. While both errors are undesirable, they may not be simultaneously reduced. If beneficiaries are increased as the program expands, then we can reduce the exclusion error but the leakage increases. A reduction in one error may cause the other to increase. There is no simple formula to evaluate how well-targeted a program is. There might be a trade-off between the two errors; therefore, some normative judgment is required in evaluating the program.

The cost of any targeted program depends on what proportion of beneficiaries are included in the program: the larger the *B*, the greater the cost of the program will become. As governments face budget constraints, there is always a tendency to design programs that will have *B* as small as possible. Thus, governments are generally more concerned with high leakage than exclusion error. This is why most programs in developing countries have high exclusion error and low leakage.

China's Minimum Livelihood Guarantee Scheme, popularly known as *Di Bao,* is one of the largest social protection programs in the developing world. According to Ravallion (2009), the program covered 22 million people, which represents 6 % of urban residents. According to the *Di Bao* poverty line, 7.7 % of the total population has been identified as poor.

While the main objective of the program is to reduce poverty, only 29 % of the poor are beneficiaries. This means that 71 % of the poor are excluded from the program. This figure does not suggest, however, that *Di Bao* can be considered as an outlier in targeting performance internationally, as pointed out by Ravallion (2009). The percentage of beneficiaries among the non-poor is only a measly 1.83 %. The program, therefore, has high exclusion error but low leakage rate. Thus, the program performs well in terms of coverage and also has lower cost, but it excludes a large number of eligible beneficiaries. This is a usual pattern in many developing countries; governments get more political mileage out of larger coverage, which they try to achieve with minimum cost. Consequently, they end up with programs that have large exclusion error.

10.3 Benefit Incidence

There are two criteria that need to be considered in the design of a safety net program: (i) identifying the beneficiaries and (ii) determining the benefits to be given to each beneficiary. The benefit incidence is concerned with how the total transfers are distributed among the poor and the non-poor. Targeting efficiency should be judged on the basis of both of these criteria.

Suppose B is the average number of beneficiaries in the population and β is the average transfers given to each beneficiary, then the average benefits per person in the population will be given by $\bar{b} = \beta B$. Similarly, if β_p and β_n are the average transfers given to each beneficiary among the poor and the non-poor, respectively, then $\bar{b}_p = \beta_p B_p$ and $\bar{b}_n = \beta_n B_n$ are the average benefits per person among the poor and the non-poor, respectively. We then have the relationship:

$$\bar{b} = H\bar{b}_p + (1 - H)\bar{b}_n$$

which can also be written as

$$\beta B = H\beta_p B_p + (1 - H)\beta_n B_n.$$

Leakage of benefits is the most important targeting indicator. It is defined as the proportion of total transfers going to the non-poor:

$$l = \frac{\beta B - H\beta_p B_p}{\beta B}. \tag{10.2}$$

Recall that L is the proportion of the total number of beneficiaries selected from the non-poor. The relationships between l and L is shown by

$$l = L + \frac{HB_p}{\beta B}(\beta - \beta_p) \tag{10.3}$$

which implies that if $l > (<) L$, then $\beta > (<) \beta_p$. That is, if the leakage of benefits is higher (lower) than the leakage of beneficiaries, the benefits per beneficiary will be higher among the non-poor (poor). This suggests that the targeting efficiency should be judged on two accounts: (i) how beneficiaries are distributed among the poor and the non-poor and (ii) how much of the benefits are given to the poor and non-poor beneficiaries. If the poor and non-poor beneficiaries receive exactly the same benefits, the leakage of benefits will be exactly the same as the leakage of beneficiaries.

Given the negative correlation between household size and household welfare level, larger households are generally poorer than smaller households. If the program is pro-poor, which is a minimum requirement of a social protection program, more larger-sized households will be selected as beneficiaries. If the program gives exactly the same benefits to each beneficiary household, the per capita benefits received by the poor beneficiaries will be lower than those received by the non-poor beneficiaries mainly because of the poor households' larger size. Benefit analysis is generally based on per capita household income. This implies that the benefits per beneficiary among the poor will be lower than that among the non-poor. This leads to higher leakage of benefits, even if the program gives the same benefits to each beneficiary household. Thus, in the design of a program, household size should be accounted for when determining the benefits per beneficiary.

10.4 Social Rate of Return

Social rate of return (SRR) is defined as the social welfare generated by a program as a percentage of the cost of the program. To measure the social rate of return, we need to specify a social welfare function that can be measured in money metric. For instance, we should be able to say how much, as measured in a country's currency, the increase in social welfare is so that we can compare it with the cost of the program measured in the same currency. Logically, social welfare should outweigh the cost of the social welfare program.

Suppose there are n persons in a society whose incomes are given by a vector:

$$\tilde{x} = \left(x_1, x_2, \ldots\ldots\ldots\ldots\ldots\ldots, x_n\right).$$

Then, a general social welfare function is defined as

$$W = W\left(\tilde{x}\right).$$

The minimum requirements of a social welfare function are: (i) it should be non-decreasing in its arguments and (ii) it should be quasi-concave.[1]

When a social program is introduced, incomes of different persons in society are increased but not by the same amount. Suppose the distribution of program benefits is defined by the vector:

[1] A social welfare function is quasi-concave if $\min\left[W\left(x\right), W\left(y\right)\right] \le W(\rho x + \left(1-\rho\right)\ y)$ for any ρ with $0 < \rho < 1$ and for any two vectors x and y in the domain of W.

$$\tilde{b} = \left(b_1, b_2, \ldots\ldots\ldots\ldots\ldots, b_n\right).$$

In this vector, if $b_i > 0$ then the *i*th individual is a beneficiary; otherwise, the individual is a non-beneficiary.

To calculate the SRR, we have to determine how much the program increases social welfare. Suppose $W(\tilde{x})$ is the social welfare without the program, then the usual procedure of estimating the contribution of the program to social welfare is given by

$$\Delta W = W\left(\tilde{x} + \tilde{b}\right) - W\left(\tilde{x}\right).$$

In this procedure, the impact is measured by the post-transfer minus pre-transfer social welfare function. However, this assumes that the program does not have any impact on other sources of income. When a program is put in place, some people may change their behaviors. For instance, beneficiaries may have reduced incentive to work or they may cease to receive private transfers that they were receiving in absence of the program. So the program may change the distribution of income.

Suppose that with the introduction of the program, initial income distribution $\tilde{x}$ changes to $\tilde{x}^*$ defined by

$$\tilde{x}^* = \left(x_1^*, x_2^*, \ldots\ldots\ldots\ldots\ldots, x_n^*\right)$$

then $\left(\tilde{x}^* + \tilde{b}\right)$ is the observed distribution of income after the program is implemented and $\tilde{x}$ is the counterfactual distribution of income—the distribution of income if the program had not existed. The net impact of the program on social welfare will be given by

$$\Delta W^* = W\left(\tilde{x}^* + \tilde{b}\right) - W\left(\tilde{x}\right)$$

which can be decomposed into two components: (i) direct impact of transfers on social welfare and (ii) indirect impact due to change of individuals' behavior. The two components can be separated using Shapley (1953) decomposition:

$$\Delta W^* = \frac{\left[W\left(\tilde{x}^* + \tilde{b}\right) - W\left(\tilde{x}^*\right) + W\left(\tilde{x} + \tilde{b}\right) - W\left(\tilde{x}\right)\right]}{2} + \frac{\left[W\left(\tilde{x}^* + \tilde{b}\right) - W\left(\tilde{x} + \tilde{b}\right) + W\left(\tilde{x}^*\right) - W(\tilde{x})\right]}{2}. \tag{10.4}$$

The first term on the right-hand side of (10.4) measures the direct impact of transfers on social welfare, while the second term is the indirect impact due to change in behavior.

To measure the impact of a program on social welfare, we need to make some simplifying assumptions. A social welfare function is defined as decomposable by components if

$$W\left(x + y\right) = W\left(x\right) + W\left(y\right) \tag{10.5}$$

for any vectors $\boldsymbol{x}$ and $\boldsymbol{y}$. Applying this definition on (10.4) gives

$$\Delta W^* = \left[W\left(\tilde{b}\right)\right] + \left[W\left(\tilde{x}^*\right) - W\left(\tilde{x}\right)\right]. \tag{10.6}$$

The first term on the right hand side of (10.6) is the direct impact, which can be easily estimated if we know the vector of program benefits (obtained from benefit analysis) and social welfare function. The second term on the right hand side of (10.6) is the indirect impact, which cannot be easily estimated because we do not know $\tilde{x}$, the counterfactual distribution of income. The post-transfer income distribution given by $\left(\tilde{x}^* + \tilde{b}\right)$ is known from the household surveys that provide information on incomes from different sources including transfers from the program.

The direct impact of the program will be positive because social welfare will always increase when transfers are made to households. The indirect impact, which may be referred to as the behavioral impact, can be negative or positive. For instance, if the program leads to disincentives to work, then some people may become worse off with the program given that the loss of employment income is offset by the transfer they receive from the program.

It is hard to measure the indirect effects using household surveys. Impact evaluation studies are mainly designed to capture the indirect impacts. According to World Bank's *The State of Social Safety Nets 2015*, as many as 86 impact evaluation studies focusing on social safety nets have been conducted between 2010 and 2015. These studies confirm the positive, significant impact of safety net programs on school attendance, health, nutrition, and food security. Program evaluations in Brazil, Chile, Honduras, Mexico, Nicaragua, and the Philippines show that the disincentive to labor market participation has been insignificant. The World Bank report does not mention any study conducted to measure the indirect impact of programs on income distribution. Impact evaluations are generally carried out after the program has been implemented for a few years. Hence, it becomes almost impossible to measure the income distribution just before the program is implemented or the counterfactual income distribution. Thus, we estimate SRRs based on social welfare functions derived from direct impacts of the program.

Calculating the SRR requires the program costs. There are two types of costs associated with running a program. One is the amount of money that is transferred to households, denoted by T, and the other is the administrative cost of the program, denoted by A. The total cost of the program is given by $C = T + A$.

Administrative costs vary from one program to another and even for similar programs implemented in different countries. They also depend on how well the targeting method is applied. Programs are mostly means-tested, suggesting that they require detailed information on households' economic situation. Collecting such information is associated with costs. As such, the more information we collect, the less likelihood of leakage of resources to unintended beneficiaries will be. Costs are also incurred in delivering program transfers to households. Electronic transfers have become a common method of delivering transfers directly to households, thereby reducing administrative costs. Suppose the administrative cost is $\in \%$ of the total transfers delivered to the beneficiary households, then the total program cost will be given by $C = (1 + \in)T$.

Like any investment, when capital is invested in a social program, there should be some social returns. The social returns can be measured by how much the program contributes to social welfare. Suppose the term $(\tilde{x}^* + \tilde{b})$ is the observed distribution of income after the program has been implemented, generating the total social welfare in the society equal to $W(\tilde{x}^* + \tilde{b})$. Using the decomposability assumption of social welfare functions defined in (10.5), we obtain:

$$W\left(\tilde{x}^* + \tilde{b}\right) = W_1\left(\tilde{x}^*\right) + W_2\left(\tilde{b}\right)$$

which shows that the total post-transfer social welfare in the society is equal to sum of two components: (i) contribution to social welfare by all income sources other than transfers from the program and (ii) contribution to social welfare by the program. The percentage contribution of the program to total social welfare is given by

$$R = \frac{100 \times W_2\left(\tilde{b}\right)}{W\left(\tilde{x}^* + \tilde{b}\right)}.$$

The program generates social welfare that can be expressed in monetary terms. Such social welfare is called money metric social welfare. The SRR is obtained using the money metric social welfare contributed by the program as a percentage of the program cost. Suppose $W_2\left(\tilde{b}\right)$ is the money metric social welfare contributed by the program, then the SRR is defined as

$$SRR = \frac{W_2\left(\tilde{b}\right)}{\left(1 + \in\right)T} - 1. \tag{10.7}$$

This is a simple ratio of social welfare generated by the program to the total program cost minus 1. Suppose the cost of the program is \$100 million and the increase in social welfare is \$160 million, then the SRR is 60 %. A negative SRR can occur for two reasons. One, the program is giving more benefits to the rich compared to the poor—that is, the program has high leakage. Another reason is that the administrative cost of the program is so high that it takes away the benefits intended for targeted beneficiaries.

In calculating the SRR, it is not necessary to know the social welfare based on the counterfactual distribution of income. Instead, what is required is the contribution of the program to the current level of social welfare, after the program has already been implemented.

10.5 Operationalizing Social Rate of Return

To make the idea of the social rate of return operational, we have to specify a social welfare function that meets the following conditions: (i) non-decreasing in its arguments, (ii) quasi-concave, (iii) measurable in money metric terms, and (iv) decomposable by components. Two social welfare functions satisfy these conditions: the poverty social welfare function and Sen's Gini social welfare function. In this section, we discuss how we can make the idea of the SRR operational using these two social welfare functions.

10.5.1 Poverty Social Welfare Function

The idea of shared prosperity proposed by the World Bank focuses on the mean income of the poorest 40 % of the population. Since safety nets programs are intended to help the extremely poor in society, we specify the social welfare function focusing on the poorest 20 % of the population. This social welfare function will be referred to as the poverty social welfare function.

More formally, suppose y is the post-transfer income of an individual defined by

$$y = x^{*} + b \tag{10.8}$$

where x^* is the income from all sources other than transfers from the program and b refers to the transfers received from the program. If $f(y)$ is the probability density function of y and z is the income defined by

$$0.2 = \int_0^z f(y)\,dy$$

then the poverty social welfare function is defined as

$$W(y) = \frac{\int_0^z y f(y)\,dy}{\int_0^z f(y)\,dy} \tag{10.9}$$

which shows that the poverty social welfare function is a weighted average of individual incomes. It is a money-metric social welfare function decomposable by components.

Substituting (10.8) into (10.9) yields

$$W(y) = W_1(x^*) + W_2(b)$$

where

$$W_2(b) = \frac{\int_0^z b f(y)\,dy}{\int_0^z f(y)\,dy}$$

is the contribution of the program to the total social welfare, noting that $W_2(b) = \bar{b}_p$ is the average transfers received by the poor. The average transfers per person going to the whole population is given by $\bar{b} = \int_0^\infty b f(y)\,dy$. If the administrative cost is $\in\%$ of the total amount of transfers delivered to the beneficiary households, then the average cost of the program to the society is given by $(1+\in)\bar{b}$. Given that the contribution of the program to the average social welfare is $\bar{b}_p$, the *SRR* is defined as

$$SRR = \frac{\bar{b}_p}{(1+\in)\bar{b}} - 1. \tag{10.10}$$

Hypothetically, the average transfer cost of the program is \$50 per person and the administrative cost is 10 % of the transfers delivered to beneficiary households. In this case, the average cost of the program to the society is \$55. If the poor receive an average transfer of \$100, which is deemed as the average social welfare per person generated by the program, then \$1 spent on the program will yield \$1.82 of social welfare and thus, the *SRR* is 82 %.

The *SRR* in (10.10) can also be written as

$$SRR = \frac{\beta_p B_p}{(1+\epsilon)\beta B} - 1 \tag{10.11}$$

where β_p is the average transfers given to the poor beneficiaries and β is the average transfer given to all beneficiaries in the population. Suppose all beneficiaries, whether poor or non-poor, are given equal transfers $(\beta = \beta_p)$ then the *SRR* in (10.11) is given by

$$(SRR)_e = \frac{B_p}{(1+\in)B} - 1. \tag{10.12}$$

Using (10.11) and (10.12), the relationship between the two SRRs can be expressed as

$$SRR = (SRR)_e + \frac{B_p(\beta_p - \beta)}{(1+\epsilon)\beta B}$$

which shows that the *SRR* will be higher (lower) than $(SRR)_e$ when the poor (non-poor) beneficiaries receive on average higher (lower) benefits per capita than the non-poor. Targeting performance is affected by two factors: (i) selection of beneficiaries and (ii) distribution of benefits. In evaluating safety nets programs, we should calculate SRRs to separate the impact of each factor.

How are the measures of targeting performance presented in Sects. 10.2 and 10.3 related to SRRs? Ravallion (2009) concluded that the standard measures used to evaluate targeting performance are uninformative, or even deceptive, about the impacts of programs on poverty and the cost effectiveness in reducing poverty. He arrived at such a conclusion because he did not explore the welfare interpretation of standard targeting measures. We show below that the measures of targeting are closely related to the SRRs in (10.11) and (10.12), which are derived from a social welfare function focused on the poorest 20 % and takes into account its cost effectiveness in reducing poverty.

The leakage of benefits defined in (10.2) is the most important targeting indicator. It is related to the SRR through the following:

$$SRR = \frac{(1-l)}{0.2(1+\varepsilon)} - 1 \tag{10.13}$$

which shows that for a fixed administrative cost, the SRR is a monotonically decreasing function of leakage; the larger (smaller) the leakage, the smaller (larger) the SRR. The leakage is not independent of the administrative cost and there is even a trade-off between the two. Reducing the leakage requires more resources spent on identifying beneficiaries. To this end, policy makers would be interested to know whether they should channel more resources toward administering the program in order to reduce leakage. Policy makers should aim at achieving higher SRRs and, by implication, improving a program's targeting performance.

The trade-off between the leakage and the administrative cost can be calculated from the total differentiation of (10.13) as

$$d(SRR) = -\frac{dl}{0.2(1+\in)} - \frac{(1-l)\,d\epsilon}{0.2(1+\in)^2}$$

which yields the trade-off between the two as

$$\frac{d\varepsilon}{dl} = -\frac{(1+\in)}{(1+l)}.$$

This equation informs how much the administrative cost should be increased to reduce the leakage while keeping the SRR unchanged. For example, suppose 50 % of the program benefits go to the non-poor, and the administrative cost is 10 % of the benefits delivered to beneficiary households. The trade-off between the leakage and the administrative cost is −2.2, which means that to reduce leakage by 1 percentage point the administrative cost should increase by 2.2 percentage points. Policy-makers should devote more (less) resources to improving targeting efficiency if the reduction of leakage by 1 percentage point increases the administrative cost by less (more) than 2.2 percentage points, in which case the SRR will increase (decrease).

10.5.2 Gini Social Welfare Function

The poverty social welfare function focuses on the poorest 20 % of population. It gives equal weight to incomes of all individuals belonging to the bottom 20 % and zero weight to all those belonging to the top 80 %. Hence, the evaluation of programs completely excludes a large proportion of population. Suppose the poverty line at the 20th percentile is \$100 per month, then all those having a monthly income of more than \$100 are excluded from such evaluation. This means that if a poor person earns even one extra dollar, society has no concern for such a person even if his poverty situation remains almost unchanged.

Although safety net programs are introduced primarily to help the poor and the vulnerable population, they can also play a role in reducing inequality. Any social program designed to target only the poor can create disincentives to work because one additional dollar earned can completely disqualify a person from benefiting from the program. As an alternative, we can have a social welfare function that gives the highest weight to the poorest person and the weight declines monotonically as the person's income increases. The Gini social welfare function has a monotonically decreasing weight and, at the same time, is decomposable by components.

Suppose y is the post-transfer income of an individual and is assumed to be randomly distributed with probability density function $f(x)$, then the Gini social welfare function is defined as

$$W(\tilde{y}) = 2\int_0^\infty y\left[1 - F(y)\right] f(y)\,dy \qquad (10.14)$$

where $F(y)$ is the probability distribution function. This social welfare function is a weighted average of individual incomes with weights declining monotonically as income rises. It captures the sense of relative deprivation of a person by taking into account the number of persons who are richer. Following Sen (1974), $W(\tilde{y})$ in (10.14) can be written as

$$W(\tilde{y}) = \mu_y (1 - G_y)$$

where μ_y and G_y are the mean and the Gini index of the post-transfer income distribution, respectively.

While $W(\tilde{y})$ is the total social welfare of the society, $W(\tilde{b})$ is the social welfare contributed by the program and is given by

$$W(\tilde{b}) = 2\int_0^\infty b(y)\left[1 - F(y)\right] f(y)\,dy \tag{10.15}$$

where $b(y)$ is the transfer received by an individual with income y. Following Kakwani (1980), the concentration index of program benefits can be written as

$$C_b = \frac{2}{\bar{b}}\int_0^\infty b(y)\left[F(y) - \frac{1}{2}\right] f(y)\,dy$$

which when substituted in (10.15) gives

$$W(\tilde{b}) = \bar{b}(1 - C_b)$$

where $\bar{b}$ is the average program transfers delivered to the population or also the average transfer cost of the program.

The percentage contribution of the program to total social welfare is given by

$$R = \frac{100 \times \bar{b}(1 - C_b)}{\mu_y (1 - G_y)}$$

which measures the extent to which the program contributes to total welfare of the society.

If the administrative cost is $\in\%$ of the total amount of transfers delivered to households, then the average cost of the program to the society is given by $(1+\in)\bar{b}$. The SRR is then obtained by comparing the social welfare contributed by the program measured in money metric with the total program cost. Thus, we have

$$SRR = \frac{(1-C_b)}{(1+\in)} - 1 \tag{10.16}$$

The concentration index can be either negative or positive. A negative value means that transfers from the program decrease as income increases; that is, the poorer the person is, the greater the benefits are. Similarly, a positive value of concentration index implies that the richer the person is, the greater the benefits are. Suppose that the concentration index is –0.40 and the administrative cost is 10 % of the transfers delivered to beneficiary households, then the SRR calculated using (10.16) is 27.3 %. This means that a dollar spent on the program will generate social welfare worth $1.27. If the program does not make any distinction between the poor and the rich and makes equal transfers to everyone, then the concentration index will be zero. Under this scenario, the cost of targeting the poor will be negligible, in which case the SRR will be almost equal to zero.[2]

10.6 Contribution to Poverty and Inequality

Policy-makers are often interested to know the extent to which social programs affect poverty and inequality. This section provides a methodology to quantitatively measure such impacts. In (10.5), we defined a decomposable social welfare function by components and from which, it was possible to capture the contribution of a program to social welfare.

[2] A high administrative cost is incurred when the program targets specific groups such as the poor and vulnerable.

The same idea can be applied to capture the contribution of a program to total inequality or poverty.

Suppose $\theta\left(\tilde{x}^* + \tilde{b}\right)$ is a measure of inequality or poverty based on the observed distribution of income after the program has been implemented. If this measure is decomposable by components, we can write it as

$$\theta\left(\tilde{x}^* + \tilde{b}\right) = \theta_1\left(\tilde{x}^*\right) + \theta_2\left(\tilde{b}\right).$$

The second term in this equation is the contribution of the program to total inequality or poverty. The percentage contribution of the program to total inequality or poverty is then given by

$$R_{(\text{inequality or poverty})} = \frac{100 \times \theta_2\left(\tilde{b}\right)}{\theta\left(\tilde{x}^* + \tilde{b}\right)}.$$

As is well known, the Gini index is decomposable by income components (Kakwani 1980). This decomposition is defined by

$$G_y = \frac{\mu_x^* C_x^*}{\mu_y} + \frac{\bar{b} C_b}{\mu_y}$$

where μ_y and G_y are the mean and the Gini index of the post-program distribution, respectively; μ_x^* and C_x^* are the mean and concentration index of the post-program distribution without benefits, respectively, when the individuals are arranged in ascending order of their post-program income; and C_b is the concentration index of the benefits accruing to individuals. The percentage contribution of the program to total inequality is then given by

$$R_{(\text{inequlity})} = \frac{\bar{b} C_b}{\mu_y G_y}. \tag{10.17}$$

The impact of the program on inequality depends on two factors. The first is the contribution of the program to the total household income that is captured by $\frac{\bar{b}}{\mu_y}$. If this contribution is relatively small, the impact of the program on inequality will be small. The second is the equity of program, which is measured by the concentration index of benefits relative to the Gini index. The negative (positive) value of concentration index implies that the program reduces (increases) inequality.

To measure the impact on poverty, we need to find a poverty measure that is decomposable by components. Among all poverty measures, the only one that is decomposable by components is the poverty gap ratio when the percentage of poor is kept fixed. Suppose the percentage of poor is set at 20 % and z is the corresponding poverty line, the poverty gap ratio is given by

$$PG = \frac{0.2\left(z-\mu_p\right)}{z} \tag{10.18}$$

where μ_p is the mean income of the poor in the post-program income distribution. Suppose $\mu_p{}^*$ is the mean income of the poor in the pre-program income distribution, then we have

$$\mu_p = \mu_p^* + \bar{b}_p$$

where $\bar{b}_p$ refers to the mean program benefits accruing to the poor. Substituting this equation in (10.18) gives the decomposition

$$\frac{0.2\left(z-\mu_p\right)}{z} = \frac{0.2\left(z-\mu_p^*\right)}{z} - \frac{0.2\bar{b}_p}{z}$$

which gives the percentage contribution of the program to poverty as

$$R_{(\text{poverty gap})} = -\frac{\bar{b}_p}{\left(z-\mu_p\right)} \tag{10.19}$$

which shows that the percentage contribution of the program to poverty reduction is proportional to program benefits as percentage of the poverty gap—that is, the extent to which the program contributes to a reduction in the poverty gap. For example, suppose the poverty line is $100 and the mean income of the poor is \$70, so the poverty gap is \$30. If the average of the program benefits accruing to the poor is \$10, then the percentage contribution of the program to reducing poverty will be 33.3 %.

10.7 *Bolsa Familia* Program

The *Bolsa Familia* Program (BFP) is Brazil's flagship social protection program and has become the most renowned CCT program in the world. This is a cash transfer program in which payment of the transfer is made conditional upon certain behaviors of the beneficiaries, such as school attendance of their children or regular health center visits. The program initially started at the municipal level in mid-1990s, but the federal government gradually espoused a series of CCT programs in the late 1990s. By mid-2003, Brazil had four CCT programs, each with its own implementing agency, its own financing schemes, and its own benefits and eligibility level (Soares 2012). As noted by Soares (2012), the federal government was transferring different amounts to different families and one family could receive transfers from all four programs while a neighboring family, living in identical circumstances, could receive nothing.

The chaos in running these programs ended in late 2003 when the federal government created the *Bolsa Familia* Program with the objective of unifying four existing CCT programs. In addition, it also incorporated an unconditional targeted transfer program run by the Mine and Energy Ministry.

In any discussion of targeted programs, the identification of genuine beneficiaries is key to the success of a program. Many developing countries use a proxy means test to identify beneficiaries. Brazil has developed a system of the Single Registry, which is a rolling census of the poor people. It enrolls families whose per capita income is less than half the minimum wage or whose total income is less than three minimum wages. The beneficiaries of *Bolsa Familia* are selected on the basis of information obtained from the Registry. The information in the Registry is collected by the municipalities using a standardized questionnaire. All families who are enrolled in the Registry, however, are not automatically selected in the program.

10.7.1 Coverage

The *Bolsa Familia* is not an entitlement; the number of beneficiaries depends largely on budget constraints. Therefore, eligible families may apply, but they may be denied the benefits. Although the direct beneficiaries of *Bolsa Familia* are the children within a household, all members of the household indirectly benefit from the program. If a household is enrolled in a program, then all individuals who belong to that household are assumed to be beneficiaries of the program. The rationale behind this is that the entire household benefits from the program. This definition is commonly adopted in measuring the coverage of programs. Table 10.1 and Fig. 10.1 show the coverage of *Bolsa Familia.*

The government's target in 2003 was to cover 11.2 million families and this figure was based on the number of poor identified in the 2001 PNAD. The coverage expanded gradually and it was only three years later in 2006 that the mark of 11 million families was reached (Soares 2012). Thereafter, the coverage of the program expanded rapidly. By 2012, almost a quarter of the Brazilian population was covered by the program, reaching 45.87 million beneficiaries. The number of beneficiaries increased at a rate of 2.65 million per year between 2001 and 2012. In terms of coverage, *Bolsa Familia* is now the largest CCT program in the world.

Table 10.1 Coverage of *Bolsa Familia* program in Brazil, 2001–12

Year	Percentage of beneficiaries (%)	Number of beneficiaries (millions)
2001	5.32	8.83
2002	11.51	19.43
2003	15.77	26.98
2004	21.68	37.45
2005	17.19	30.26
2006	23.09	40.94
2007	17.05	30.38
2008	20.70	37.12
2009	21.41	38.74
2011	24.51	44.12
2012	24.94	45.87
Growth rate (annual)	1.37	2.65

Source: Authors' calculations

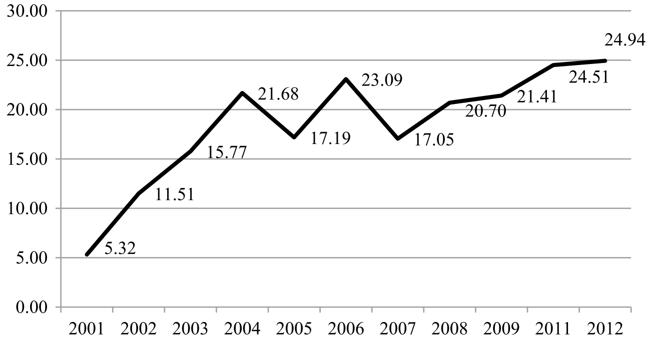

Fig. 10.1 Percentage of beneficiaries of *Bolsa Familia* program in Brazil, 2001–12

10.7.2 Transfers per Beneficiary

Since its inception, *Bolsa Familia* has had two eligibility levels, one for the extremely poor and the other for the poor. In 2009, a family was defined as extremely poor if its per capita monthly income was less than R$70, and as poor if its per capita monthly income was less than R$140. The transfers had two components: (i) a basic benefit of R$68 and (ii) a variable benefit of R$22 to R$66 for children and R$33 to R$66 for adolescents. The basic benefit was only given to extremely poor families. The poor families are entitled to variable benefits according to the number of children they have. As pointed out by Soares (2012), from 2003 to 2008, each family received one benefit per child aged below15 years, with a maximum of three per family. Since July 2008, the variable benefits were extended to include up to two teenagers aged 15 and 16. In 2011, the limit on the number of children was raised from three to five.

One important aspect of *Bolsa Familia* is that the mother collects the benefits in the first instance, but in case she is not present in the household, the father or another adult can collect the benefits. The benefit levels were adjusted four times in 2007, 2008, 2009 and 2011. These adjustments led to an increase in real benefits for all beneficiaries of the program. Initially, the entitlement to the program is for two years, which is then reviewed. The reviewing process is carried out by municipalities who try to keep their Registry updated.

To make an international comparison of social welfare programs, we need to convert transfers in local currency to a common international currency. This can be done using the recently available 2011 purchasing power parity (PPP) conversion rates. Table 10.2 and Fig. 10.2 present the transfers per beneficiary from *Bolsa Familia* in 2011 PPP. In 2001, the transfer per beneficiary was \$5.92 per month in 2011 PPP, which increased to \$22.48 per month in 2012, increasing at a rate of \$1.38 annually. The real benefits increased at an annual rate of about 11 %. Thus, along with a rapid increase in coverage, *Bolsa Familia* also substantially increased the

Table 10.2 Transfers per beneficiary of *Bolsa Familia* in Brazil, 2001–12

Year	Transfer per beneficiary per month (\$ in 2011 PPP)	Program cost as share of GDP (%)
2001	5.92	0.04
2002	8.10	0.12
2003	7.37	0.14
2004	9.49	0.24
2005	10.83	0.20
2006	11.44	0.27
2007	13.28	0.22
2008	14.88	0.28
2009	15.97	0.31
2011	18.47	0.36
2012	22.48	0.43
Growth rate (annual)	1.38	0.03

Source: Authors' calculations

Note: *PPP* purchasing power parity, *GDP* gross domestic product

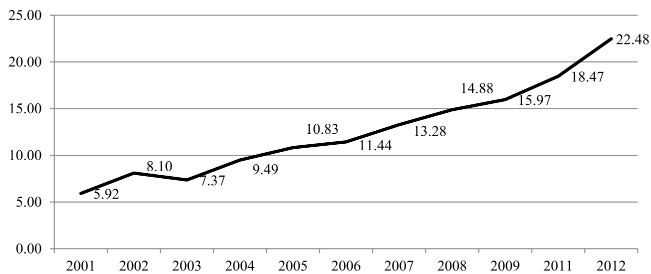

Fig. 10.2 Transfer per beneficiary in 2011 PPP of *Bolsa Familia* in Brazil, 2001–12

average transfers to beneficiaries. Accordingly, the transfer cost as a share of gross domestic product (GDP) also increased from 0.04 % in 2001 to 0.43 % in 2012.

10.7.3 Beneficiary Incidence Analysis

The beneficiary incidence analysis relates to how beneficiaries of the program are distributed among the poor and the non-poor. To perform this analysis, we need to define the poor and the non-poor, and there are two ways to do this. First, we can identify them in income space, which defines a fixed poverty line and anyone whose income is less than the poverty line is poor. Second, we can identify the poor and the non-poor using people's space, which defines a fixed proportion people in the population who are poor. In this study, we define poor in the people's space as those who belong to the poorest 20 % of the population when arranged by per capita household income. Table 10.3 presents the percentage of beneficiaries and benefits per beneficiary among the poor and the non-poor.

Table 10.3 Percentage of beneficiaries and benefits per beneficiary among poor and non-poor of *Bolsa Familia* in Brazil, 2001–12

	Percentage of beneficiaries		Benefits per beneficiary	
Year	Poor	Non-poor	Poor	Non-poor
2001	10.73	3.96	6.21	5.84
2002	27.03	7.63	7.46	8.26
2003	36.18	10.67	6.70	7.53
2004	50.85	14.39	9.57	9.47
2005	41.59	11.09	10.84	10.83
2006	53.97	15.36	12.04	11.29
2007	45.05	10.05	14.05	13.08
2008	52.93	12.64	15.40	14.75
2009	56.07	12.75	16.40	15.86
2011	62.16	15.10	19.01	18.34
2012	63.75	15.24	22.60	22.45
Growth rate (annual)	3.92	0.73	1.45	1.36

Source: Authors' calculations

The percentage of beneficiaries among the poor has increased at an annual rate of 3.92 percentage points, whereas among the non-poor the increase is only 0.73 percentage points. Thus, while *Bolsa Familia* has expanded rapidly, it has also become better targeted over the decade. In 2012, the probability of being selected in the program among the poor increased to 63.75 %, whereas among the non-poor, it increased to 15.24 %. Since the gap in percentage of beneficiaries among the poor and the non-poor has widened, it implies that targeting efficiency has improved (Fig. 10.3).

10.7.4 Exclusion Error and Leakage

Exclusion error and leakage are commonly used as indicators to evaluate targeting efficiency. The exclusion error is the percentage of poor that are excluded from the program. This is an important indicator because it informs what percentage of eligible persons is excluded from the program. It is a measure of horizontal inequity, which is created when individuals in the same economic circumstances are not treated equally. Meanwhile, leakage is defined as the percentage of all beneficiaries who are not poor (or not eligible for the program). Therefore, leakage measures the resources going to unintended beneficiaries of the program. Table 10.4 and Fig. 10.4 provide the trends in exclusion error and leakage.

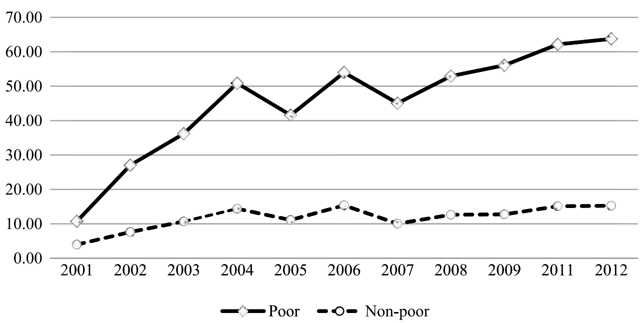

Fig. 10.3 Percentage of beneficiaries among poor and non-poor of *Bolsa Familia* in Brazil, 2001–12

Table 10.4 Exclusion error and leakage of *Bolsa Familia* in Brazil, 2001–12

	Beneficiaries		Benefits
Year	Exclusion error (%)	Leakage (%)	Leakage (%)
2001	89.27	59.19	57.14
2002	72.97	52.02	55.85
2003	63.82	51.34	55.72
2004	49.15	53.06	52.68
2005	58.41	51.53	51.49
2006	46.03	52.93	50.47
2007	54.95	47.08	44.00
2008	47.07	48.84	47.08
2009	43.93	47.63	46.21
2011	37.84	49.25	47.79
2012	36.25	48.54	48.26
Growth rate (annual)	–3.92	–0.71	–0.99

Source: Authors' calculations

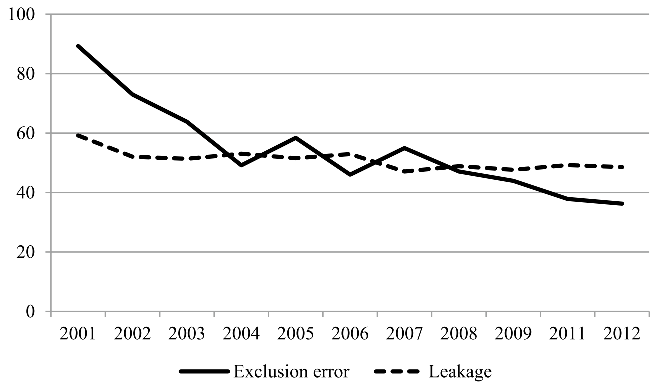

Fig. 10.4 Exclusion error and leakage of *Bolsa Familia* in Brazil, 2001–12

The results show that the exclusion error has declined at an annual rate of 3.92 percentage points during 2001–12, signifying a substantial improvement in identifying the beneficiaries. In 2001, almost 90 % of the poor were excluded from the program, but the corresponding figure declined to about 36 % in 2012. The leakage of beneficiaries, meanwhile, slowly declined at an annual rate of 0.71 percentage points during 2001–12. In 2001, almost 60 % of all beneficiaries were selected from the non-poor and by 2012, slightly less than 50 % were the unintended beneficiaries.

Leakage can also be defined in terms of the percentage of total benefits going to the non-poor. This indicator measures the percentage of actual resources in monetary terms that are going to unintended beneficiaries. Albeit the leakage declined at an annual rate of about 1 percentage point during 2001–12, the actual leakage of resources remained high at about 48 % in 2012.

Although the World Bank (2015), in its recently released *The State of Social Safety Nets 2015* report, gave *Bolsa Familia* high marks, saying it is one of the "largest and best-targeted social safety net programs in the world", the empirical analysis presented here suggests that there is still much scope to further improve its targeting.

10.7.5 Social Rate of Return of Bolsa Familia

We presented in Sect. 10.5 the methodology of calculating SRRs using two types of social welfare function. One is the poverty social welfare function, which focuses on the poorest 20 % of population, and the other is the Gini social welfare function, which focuses on inequality measured by the Gini index. In calculating SRRs, we need to know the total cost of the program that consists of transfer and administrative costs. The transfer cost can be obtained from household surveys, whereas the administrative cost needs to be collected from relevant governments' statistics.

The calculation of administrative cost for *Bolsa Familia* is a gigantic task. Although the Ministry of Social Development (MSD) is responsible for the program, municipalities play the key role in running it. They collect the information on who is poor or eligible for the program. The actual payments to families are made by the *Caixa Economica*, Brazil's federal bank. It processes the information collected by municipalities on per capita income and decides how much each particular family will receive. It also prints automated teller machine cards and sends them to each family. Table 10.5 provides the details of administrative and operational costs of *Bolsa Família* Program provided by the MSD.

Table 10.5 Administrative and operational costs of *Bolsa Familia* program in 2012 (in real million)

Budget category	Cost
Improvement of the dissemination of information from the BFP and Single Registry	12,519
National system for identification and selection of target groups for the social programs of the federal government—Single Registry	25,002
Service of support for decentralized management of the *Bolsa Família* Program (IGD)	603,972
Operationalization of the income transfer actions and of the Single Registry for social programs of the federal government—MDS (Contract with Caixa)	272,467
Income transfered directly to families in poverty and extreme poverty conditions (Law No. 108.36, from 2004)—(Benefit)	23,997,460

Source: Brazil's Ministry of Social Development

The total administrative and operational costs, excluding transfers to families, is equal to Real 913,960 million, which is 3.8 % of the total transfers going directly to families. The social rates of return were calculated using these costs.

The social rate of return makes a distinction between equal benefits and actual benefits. The fairness of the program requires that poorer beneficiaries receive more benefits than richer beneficiaries. If the program gives richer beneficiaries more transfers than poorer beneficiaries, then we can say that the program violates vertical equity in benefits. The vertical equity (inequity) entails gains (losses) in the SRR. The vertical equity can be measured by the difference between the SRR computed from actual benefits and the SRR from equal benefits. Table 10.6 presents the four kinds of SRRs based on two social welfare functions, with equal benefits and actual benefits.

A number of observations can be made from the SRRs presented in Table 10.6. The SRR for the actual benefits from the poverty social welfare function is around 147.51 % in 2012, suggesting that for every Real spent, the program generates the social welfare of Real 2.4751. The SRR from the poverty social welfare function is always higher than that from the Gini social welfare function. This is somewhat expected because while *Bolsa Familia* was designed to reduce poverty, inequality reduction was

Table 10.6 Social rates of return of *Bolsa Familia* in Brazil, 2001–12

	Poverty social welfare		Gini social welfare	
Year	Equal benefits	Actual benefits	Equal benefits	Actual benefits
2001	94.39	104.11	25.45	26.57
2002	126.30	108.23	34.32	25.55
2003	121.01	101.12	38.95	28.11
2004	125.94	127.81	40.64	38.56
2005	133.10	133.30	42.01	39.93
2006	125.24	137.05	41.81	43.07
2007	154.57	169.39	46.13	48.38
2008	146.37	154.87	45.25	46.04
2009	152.24	159.04	47.10	47.13
2011	144.33	151.36	46.45	46.99
2012	146.20	147.51	46.04	42.72
Growth rate (annual)	3.94	5.25	1.54	1.99

Source: Authors' calculations

a byproduct rather than an impact by design. Thus, the impact of the program on the poverty social welfare is expected to be higher than that on the Gini social welfare.

The SRRs have an increasing trend over the 2001–12 period. This means that the program's impact on poverty and inequality has outweighed the program cost. For instance, the SRR for the actual benefits based on the poverty social welfare has increased at an annual rate of 5.25 percentage points. Similarly, the SRR based on the Gini social welfare has also improved, but at a slower rate of 1.99 percentage points per annum. The increasing trend in SRRs implies that the program has become increasingly more efficient in reducing poverty and inequality.

Figures 10.5 and 10.6 depict SRRs based on poverty and Gini social welfare functions, respectively. As noted, the vertical inequity in benefits occurs when the SRR computed from actual benefits is lower than that from equal benefits. For both social welfare functions, the SRR computed from actual benefits is lower than that from equal benefits until 2005 and from then on the SRR from actual benefits becomes higher. Thus, the program after 2005 has become vertically equitable, giving more benefits to the poor than to the rich.

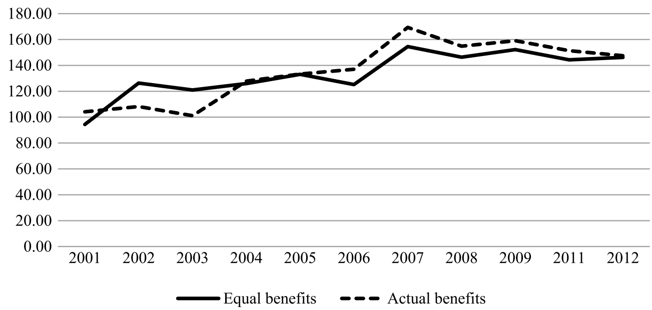

Fig. 10.5 Social rates of return of *Bolsa Familia* based on poverty social welfare, 2001–12

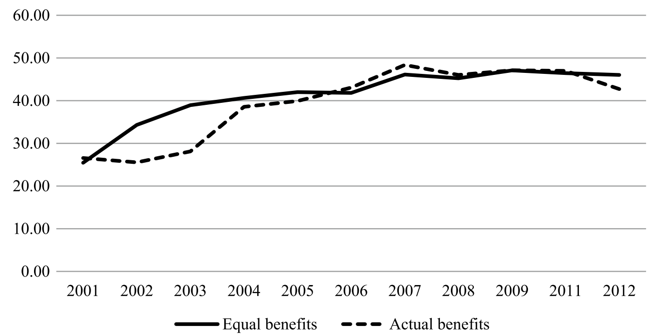

Fig. 10.6 Social rates of return of *Bolsa Familia* based on Gini social welfare, 2001–12

10.7.6 Impact of the Program on Poverty and Inequality

The *Bolsa Familia* has twin objectives: (i) to reduce poverty and (ii) to improve human capital by providing incentives for beneficiary families to send their children to school. Although the program is designed to reduce poverty, it also reduces inequality as a byproduct. Table 10.7 and Fig. 10.7 present the contribution of the program to the reduction in poverty, as measured by the poverty gap ratio, and inequality, as measured by the Gini index.

Table 10.7 Percentage reduction in poverty and inequality contributed by *Bolsa Familia,* 2001–12

Year	Poverty gap ratio	Gini index
2001	4.86	0.04
2002	10.42	0.12
2003	7.87	0.18
2004	12.72	0.42
2005	10.24	0.37
2006	12.02	0.52
2007	9.78	0.49
2008	10.15	0.62
2009	10.17	0.68
2011	9.30	0.87
2012	9.42	0.92
Growth rate (annual)	0.15	0.08

Source: Authors' calculations

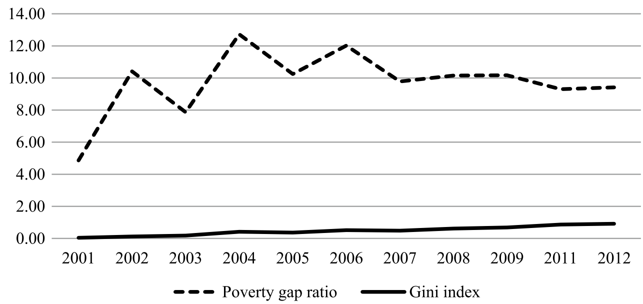

Fig. 10.7 Percentage reduction in poverty and inequality due to *Bolsa Familia*, 2001–12

The impact of the program is much larger on poverty than on inequality. This is somewhat expected because the program is targeted at the poor. The program contributed to the reduction in poverty by 0.15 percentage points annually during 2001–12. On inequality, the program reduced it at an annual rate of only 0.08 percentage points for the 12-year period. Such reductions indicate that the program has expanded rapidly in terms of total number of beneficiaries and benefit size per beneficiary; and that the program's targeting efficiency has improved over time.

10.7.7 Conditionality

The conditionality of *Bolsa Familia* requires that in order to receive benefits, families must send their children to school and get their health check-ups and vaccines on time. In this section, we measure the impact of the program only on school attendance.

In order to do the analysis, we need to control for all the factors that impact school attendance, except either being in the program or not in the program. It is widely known that children from poor families have lower probability of attending school because they are likely to work in the labor market. However, not all children from poor families are selected in the program even if they are eligible. Thus, this provides a counterfactual that controls for the poverty status of families. The target group consists of children who are eligible for the program and also enrolled in the program, whereas the control group is composed of children that are eligible for but are not enrolled in the program.

Table 10.8 shows that children in the target group have higher school attendance than those in the control group. Thus, the program does contribute to higher school attendance among children from poor families.

Table 10.8 Percentage of children attending school with and without *Bolsa Familia*, 2001–12

	Children 6–14 years		Children 15–17 years	
Year	Control group	Target group	Control group	Target group
2001	91.70	96.20	71.60	76.30
2002	91.60	96.20	72.50	79.80
2003	92.20	95.60	70.30	80.60
2004	92.20	95.40	67.70	78.70
2005	93.80	95.80	71.80	78.00
2006	93.50	96.40	69.30	77.80
2007	94.70	96.90	74.00	80.30
2008	94.90	97.60	73.90	83.30
2009	95.10	97.60	76.10	85.10
2011	95.80	98.40	76.20	84.90
2012	95.90	98.40	76.90	84.80
Growth rate (annual)	0.44	0.27	0.62	0.74

Source: Authors' calculations

The difference in school attendance between children in the target group and the control group measures the program's impact on school attendance. Figure 10.8 shows that the impact of the program on school attendance among children in the age group 15–17 years is much larger compared to children 6–14 years, varying between 4.70 and 11 percentage points. Among children in the age group 6–14 years, the program impact varies from 2.50 to 4.50 percentage points. The impact is higher among the older children because they are more likely to work in the labor market if their families were not enrolled in the program. The program provides incentives for the beneficiary families to send their children to school rather than work in the labor market.

10.8 *Pantawid Pamilyang Pilipino* Program

The *Pantawid Pamilyang Pilipino* Program or 4Ps is the Philippine government's largest social protection program. It was launched in 2008 covering only about 6000 households, but it rapidly expanded to three million families by 2012. The 4Ps is a conditional cash transfer program similar to Brazil's *Bolsa Familia*. The main objective of the program is to provide cash to families in extreme poverty in exchange for some education and health care commitments. It targets extremely poor families who have children up to 14 years old. The program has two components: education and health. Under the health component, the program provides PhP500 per month to each beneficiary family to cover their health and nutritional expenses (Reyes et al. 2015). Under the educational compo-

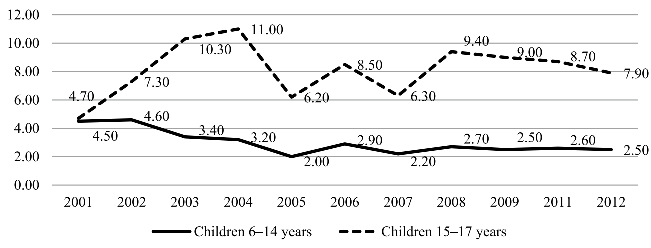

Fig. 10.8 Impact of *Bolsa Familia* on school attendance in Brazil, 2001–12

nent, the program targets children 6–14 years old, providing PhP300 per month per child for 10 months in one school year. A beneficiary family receives payments for a maximum of three children.

The *Bolsa Familia* and 4Ps differ with respect to the selection of beneficiary families. The *Bolsa Familia* selects the beneficiary families on the basis of their income. The municipalities in Brazil have developed an elaborate process of verifying families' income, which is then fed into a system of the Single Registry. The beneficiaries of *Bolsa Familia* are selected on the basis of information obtained from the Registry. The identification of beneficiary families in the 4Ps is done using the National Household Targeting System for Poverty Reduction. This system employs a proxy means test (PMT) to identify the poor families. The PMT is now commonly used to design social protection programs in many developing countries.

Developing countries with a large informal sector do not have a proper system of measuring and verifying families' incomes. A PMT is used to identify beneficiaries based on easily identifiable variables that accurately predict a household to be poor. A nationally representative household survey makes it possible to design such a PMT. The PMT for the 4Ps was developed using the 2006 Family Income and Expenditure Survey. The proxy variables used to predict the poverty situation of families included ownership of assets, type of housing, education and employment status of household head, and access to water and sanitation.

10.9 Comparison of *Bolsa Familia* and 4Ps

Table 10.9 presents a comparison between Brazil's *Bolsa Familia* and the Philippines' 4Ps. Brazil is a much bigger country with a population of about 184 million in 2012, whereas the Philippine population is about half of Brazil's. The *Bolsa Familia* covers almost a quarter of the population with around 46 million beneficiaries. The 4Ps covered only 8.77 % of the population in 2011, but expanded rapidly within two years, covering almost 21 % in 2013. The total number of beneficiaries in 2013 was 20.48 million, making the 4Ps the fourth largest CCT program in the world.

Table 10.9 Comparison of *Bolsa Familia* and 4Ps

Indicators	*Bolsa Familia* 2012	4Ps 2011	4Ps 2013
Population	183.88	95.80	97.64
% of beneficiaries in population	24.94	8.77	20.97
Number of beneficiaries (millions)	45.87	8.40	20.48
% of beneficiaries among poor	63.75	23.97	50.92
Exclusion error	36.25	76.03	49.08
Leakage of beneficiaries to non-poor	48.54	45.33	52.20
Per capita monthly income (in 2011 PPP)	560.71	204.76	243.65
Per capita monthly benefits per beneficiary (in 2011 PPP)	22.60	6.67	6.75
Per capita monthly benefits per beneficiary among poor (in 2011 PPP)	22.48	5.92	7.14
Leakage of benefits to non-poor (%)	48.26	51.50	49.45
Inequity in benefits per beneficiary (%)	−0.27	6.17	−2.74
SRR based on poverty social welfare function	147.50	96.08	130.70
SRR based on Gini social welfare function	42.72	22.16	38.00
Impact of program on poverty gap ratio	−9.42	−7.75	−17.41
Impact of program on Gini index	−0.92	−0.30	−0.64
% of children 6–14 attending school in control group	95.90	91.70	94.97
% of children 6–14 attending school in target group	98.40	95.76	96.41

Source: Authors' calculations

Note: *PPP* purchasing power parity, *SRR* social rate of return

As noted earlier, the exclusion error measures the extent to which the poor are excluded from the program. The *Bolsa Familia* had an exclusion error of 36.25 % in 2012. The 4Ps excluded more than 76 % of the poor from the program in 2011, but within two years, the exclusion error was reduced to 49.08 %. This remarkable reduction occurred due to the rapid expansion of the program.

During the phase of the program's expansion, the exclusion error tends to decline while the leakage of beneficiaries tends to increase. The rapid expansion of the 4Ps led to an increase in leakage of beneficiaries from 45.33 % in 2011 to 52.20 % in 2013. The *Bolsa Familia* program, on the other hand, expanded more slowly but steadily during 2001–12. The leakage of beneficiaries decreased at an annual rate of 0.71 percentage points instead of showing an increase. Thus, a rapid expansion of program in a short period, as happened in the case of 4Ps, can result in a large increase in leakage leading to a greater waste of resources going to unintended beneficiaries.

The rapid expansion of any social program within a short period comes at a cost. The implementation of a social program is highly complex and requires appropriate social infrastructure. A gradual expansion is desirable because it provides time to learn about the many complexities of the program and also to incorporate lessons learned during implementation.

The Philippines' per capita household income in 2011 was $204.76 in 2011 PPP, which increased to $243.65 in 2013, whereas Brazil's per capita income was $560.71 in 2012. Brazil, therefore, has a much higher average standard of living and can afford to pay higher transfers to the beneficiaries. The *Bolsa Familia* paid an average per capita monthly benefit of $22.60 (in 2011 PPP) to each beneficiary family in 2012. In comparison, the 4Ps paid the average benefits of only $6.67 in 2011 and $6.75 in 2013. Thus, compared to the 4Ps, the *Bolsa Familia* should have a much greater impact on reducing absolute poverty. In this study, we measure the impact of the program on relative poverty as our concern is with those belonging to the poorest 20 % of the population. Therefore, it is not possible to say a priori which of the two programs will have a greater impact on poverty reduction.

The leakage of benefits measures the proportion of actual resources going to the unintended beneficiaries. The *Bolsa Familia* generated the leakage of 48.26 % in 2012, whereas the corresponding figure for 4Ps was 51.50 % in 2011 and 49.5 % in 2013. The reduction in the leakage of benefits in the 4Ps is explained by a larger increase in benefits going to the poor beneficiary families. As seen in Table 10.9, inequity in benefits per beneficiary decreased from 6.17 % in 2011 to –2.74 % in 2013. This implies that the benefits transferred to families became more equitable, benefiting poor families more than non-poor ones.

To calculate the SRRs for the 4Ps, we need to know the administrative cost as the share of transfers to beneficiaries. Table 10.10 presents these costs in detail. While the total transfers to beneficiaries increased from PhP21,194 million in 2011 to PhP39,450 million in 2012, the administrative cost declined from PhP4,056 million in 2011 to PhP3,997

Table 10.10 Annual budget of the Philippines' 4Ps for 2011 and 2012 (in PhP million)

Budget category	2011	2012
Cash transfers to beneficiaries	17,138	35,453
Implementation support	4056	3997
Trainings	1625	703
Salaries and allowances for 1800 new personnel	716	1877
Bank Service Fee	171	346
Information, education, and advocacy material	649	252
Capital outlay	218	133
Monitoring, evaluation and administrative support	677	686
Administrative and operational cost as percentage of transfers to beneficiaries (%)	23.67	11.27

Source: Department of Social Welfare and Development, Philippines

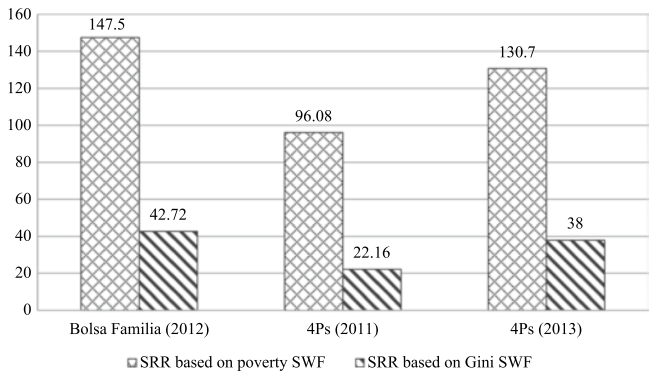

Fig. 10.9 Social rates of return for *Bolsa Familia* and 4Ps (*Note*: *SRR* social rate of return, *SWF* social welfare function)

million in 2012. Thus, the administrative cost as the share of transfers to beneficiaries decreased from 23.67 % in 2011 to 11.27 % in 2012. Thus, the program has become more cost-effective in delivering transfers to the beneficiaries. Since the administrative cost for 2013 was not available, we used the 2012 administrative cost as a share of transfers in calculating the SRR for 2013.

As shown in Fig. 10.9, *Bolsa Familia* has much higher SRRs than the 4Ps. There are two reasons for this. One is that *Bolsa Familia* is a better-

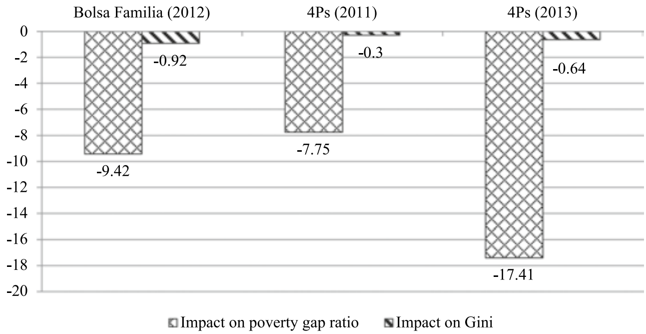

Fig. 10.10 Impact of *Bolsa Familia* and 4Ps on poverty gap and Gini index

targeted program. The other reason is that the administrative cost for *Bolsa Familia* is much lower than that for the 4Ps. The 4Ps has made impressive progress in improving its targeting efficiency and, at the same time, has been able to substantially reduce its administrative cost of delivering transfers to beneficiary families. It is commendable that both of these improvements have been achieved within two years.

As illustrated in Fig. 10.10, both *Bolsa Familia* and the 4Ps contribute to the reduction in the poverty gap much more than they contribute to the reduction in the Gini index. The 4Ps has contributed a 17.41 % reduction in the poverty gap in 2013. Such large contribution to poverty reduction in 2013 happened for of two reasons: (i) the shortfall in incomes of the poor has reduced and (ii) the transfers to families have become highly equitable.

Like the *Bolsa Familia*, the 4Ps also contributes to improvement in enrolment of children in the 6–14 age group. The 4Ps does not provide benefits to families with children in the age group 15–17 years so it was not possible to make comparisons of the two programs in this age group.

10.10 Concluding Remarks

Safety net programs such as CCT programs have become popular mechanisms for developing countries to reduce poverty and increase social welfare. With these programs becoming widespread around the world, it is crucial, especially for policy-makers, to evaluate whether the intended objectives for these programs are met. In this chapter we have adopted a method for evaluating programs that uses the concept of social rate of return (SRR), defined as the social welfare generated by a program as percentage of the cost of the program. Empirical analysis was conducted on two existing CCT programs: Brazil's *Bolsa Familia* Program and Philippines' *Pantawid Pamilyang Pilipino* or 4Ps Program. Data for *Bolsa Familia* covered the period 2001–12 and data for 4Ps covered only the years 2011 and 2013.

In terms of coverage, the number of beneficiaries of Brazil's *Bolsa Familia* has increased at a rate of 2.65 million per year from 2001 to 2012, and as of 2012 it has reached 45.87 million beneficiaries, making it the largest CCT program in the world. Meanwhile, 4Ps covered only 8.4 million beneficiaries (8.77 % of the population) in 2011 but the program rapidly expanded in two years, reaching 20.48 million (21 % of the population) in 2013, making it the fourth largest CCT program in the world.

Findings also indicate that *Bolsa Familia* has become better targeted throughout the years, with the percentage of beneficiaries among the poor increasing at an annual rate of 3.92 percentage points, reaching 63.75 % in 2012, compared to only 15.24 % among the non-poor. This means that exclusion error—the extent to which the poor are excluded from the program—has also been declining. Leakage of benefits, which is the proportion of total transfers going to the non-poor, has been slowly declining but actual leakage remained high at about 48 % in 2012.

The 4Ps, meanwhile, excluded more than 76 % of the poor in 2011 but with the rapid expansion of the program, the exclusion error reduced to 49.08 % in 2013. This rapid expansion, however, led to an increase in leakage of beneficiaries from 45.33 % in 2011 to 52.20 % in 2013. Hence, rapidly expanding the program in a short period may lead to higher increases in leakage, leading more resources to be transferred to unintended beneficiaries. It is more desirable, therefore, that programs gradually expand to provide time to learn more about the program and to apply these lessons in the implementation.

Brazil has greater standard of living compared to the Philippines and could therefore afford to provide greater benefits to CCT beneficiaries. *Bolsa Familia*'s average benefit of $22.60 (in 2011 PPP) to each beneficiary household per month in 2012 is much greater than 4Ps' $6.67 in 2011 and \$6.75 in 2013. Total administrative and operational cost as share of total transfers is lower in *Bolsa Familia* (3.8 %) than in 4Ps (23.67 % in 2011 and 11.27 % in 2012), suggesting that *Bolsa Familia* is more cost effective in delivering transfers than 4Ps.

The chapter used two types of social welfare function to calculate SRR—poverty social welfare function, which focuses on the poorest 20 %, and the Gini social welfare function, which focuses on inequality. Findings reveal an increasing trend in both SRRs of *Bolsa Familia* from 2001 to 2012 and in SRRs of 4Ps from 2011 to 2013, which suggests that the programs have become more efficient in reducing poverty and inequality. However, *Bolsa Familia*'s SRRs were higher than the 4Ps'. This is mainly because *Bolsa Familia* is a better targeted program than 4Ps and the administrative and operational costs for *Bolsa Familia* are much lower than 4Ps. Nevertheless, 4Ps was able to improve its targeting efficiency and reduce its administrative cost of delivering transfers within a short period of time.

Bolsa Familia and 4Ps contributions to the reduction in poverty gap are greater than their contributions to the reduction in inequality. *Bolsa Familia* contributed 9.42 % reduction in poverty gap in 2012 while 4Ps contribution increased from 7.75 % in 2011 to 17.41 % in 2013. The large impact of 4Ps on poverty reduction in 2013 occurred because of the poor's higher income and because transfers to families have become more equitable.

This chapter was able to show how social rate of return can be used to evaluate safety net programs. Using two types of social welfare function—the poverty social welfare function and the Gini social welfare function—and other targeting efficiency measures, the study provides evidence that CCT programs help in reducing poverty and improving social welfare by increasing income and enhancing human capital among the poor.

Bibliography

Aitchison, J., & Brown, J. (1957). *The lognormal distribution*. Cambridge: Cambridge University Press.

Alderman, H. (1993). New research on poverty and malnutrition: What are the implications for policy? In M. Lipton & J. van der Gaag (Eds.), *Including the poor*. Washington, DC: World Bank Regional and Sectoral Studies.

Ali, I., & Zhuang, J. (2007). *Inclusive growth toward a prosperous Asia: Policy implications* (ERD working paper series no. 97). Manila: Asian Development Bank.

Alkire, S. (2007). Choosing dimensions: The capability approach and multidimensional poverty. In N. Kakwani & J. Silber (Eds.), *The many dimensions of poverty*. New York: Palgrave Macmillan.

Anand, S., & Kanbur, R. (1984). Inequality and development: A reconsideration. In H. Nissen (Ed.), *Towards income distribution policies* (EADI book series 3). Tilburg: EADI.

Arrow, K. (1963). *Social choice and individual values*. New York: Wiley.

Atkinson, A. (1970). On the measurement of inequality. *Journal of Economic Theory, 2*(3), 244–263.

Atkinson, A. (2015). *Inequality: What can be done?* Cambridge, MA: Harvard University Press.

N. Kakwani, H.H. Son, *Social Welfare Functions and Development*,
DOI 10.1057/978-1-137-58325-3

Azzalini, A. (1985). A class of distributions which include the normal ones. *Scandinavian Journal of Statistics, 12*, 171–178.

Barry, B. (2005). *Why social justice matters*. Cambridge: Polity Press.

Basu, K. (2001). On the goals of development. In G. M. Meier & J. E. Stiglitz (Eds.), *Frontiers of development economics: The future in perspective*. New York: Oxford University.

Bergson, A. (1938). A reformulation of certain aspects of welfare economics. *The Quarterly Journal of Economics, 52*(2), 310–334.

Berkowitz, D.,& Jackson, J. (2005a, May 7). *Entrepreneurship and the evolution of income distribution in Poland and Russia*. Paper presented at the international conference on transitional economies, Hanoi.

Berkowitz, D., & Jackson, J. (2005b). *Evolution of an economic and political middle class in transition countries* (International poverty centre working paper series no 10).

Besley, T., & Burgess, R. (2003). Halving global poverty. *Journal of Economic Perspectives, 17*(3), 3–22.

Birdsall, N. (2007a). *Do no harm: Aid, weak institutions and the missing middle in Africa*. Washington, DC: Center for Global Development.

Birdsall, N. (2007b). *Income distribution: Effects on growth and development* (Working paper number 118). Washington, DC: Centre for Global Development.

Blackburn, M., & Bloom, D. (1985). What is happening to the middle class? *American Demographics, 7*, 18–25.

Bluhm, R., Crombrugghe, D., & Szirmai, A. (2014). *Poor trends—The pace of poverty reduction after the millennium development agenda* (MERIT working papers 006). Maastricht: United Nations University–Maastricht Economic and Social Research Institute on Innovation and Technology.

Bosmans, K. (2013). *Consistent comparisons of attainment and shortfall inequality: A critical examination*. Maastricht: Mimeo/Maastricht University.

Bourguignon, F. (1981). Pareto superiority of Unegalitarian Equilibria in Stiglitz' model of wealth distribution with convex saving function. *Econometrica, 49*(6), 1469–1475.

Bourguignon, F. (2015). *The globalization of inequality*. Princeton: Princeton University Press.

Bourguinon, F., Ferreira, F., & Menendez, M. (2007). Inequality of opportunity in Brazil. *Review of Income and Wealth, 53*(4), 585–618.

Bruno, M., Ravallion, M., & Squire, L. (1998). Equity and growth in developing countries: Old and new perspectives on the policy issues. In V. Tanzi & K. Chu (Eds.), *Income distribution and high-quality growth*. Cambridge, MA: MIT Press.

Clark, S., Hemming, R., & Ulph, D. (1981). On indices for the measurement of poverty. *Economic Journal, 91*, 515–526.

Dabla-Norris, E., Kolchhar, K., Suphaphiphat, N., Ricka, F., & Tsounta, E. (2015). *Causes and consequences of income inequality: A global perspective. IMF staff discussion note*. Washington, DC: International Monetary Fund.

Dalton, H. (1920). The measurement of the inequality of incomes. *Economic Journal, 30*(119), 348–361.

Dandekar, V., & Rath, N. (1971). *Poverty in India*. Poona: Indian School of Political Economy.

Dasgupta, P. (1990). Well-being and the extent of its realization in poor countries. *Economic Journal, 100*, 1–32.

Davis, J., & Huston, J. (1992). The shrinking middle-income class: A multivariate analysis. *The Eastern Economic Journal, 18*(3), 277–285.

De Weerdt, J., Beegle, K., Friedman, J., & Gibson, J. (2014). *The challenge of measuring hunger* (Policy research working paper series 6736). Washington, DC: The World Bank.

Deaton, A. (1997). *The analysis of household surveys: A microeconometric approach to development policy*. Baltimore: Johns Hopkins University Press.

Deaton, A. (2010). Price indexes, inequality, and the measurement of world poverty. *American Economic Review, 100*(1), 1–34.

Deaton, A., & Paxson, C. (2001). *Mortality, income, and income inequality over time in Britain and the United States* (NBER working papers 8534). Cambridge, MA: National Bureau of Economic Research, Inc.

Deininger, K., & Squire, L. (1998). New ways of looking at old issues: Inequality and growth. *Journal of Development Economics, 57*(2), 259–287.

Deutsch, J., Musahara, H., & Silber, J. (2015, October 8–9). *On the measurement of multidimensional well-being in some countries in the Eastern and Southern Africa*. Paper presented at the 10th anniversary PEGNet conference, Berlin.

Drenowski, J. (1974). *On measuring and planning quality of life*. The Hague: Institute for Social Studies.

Easterly, W. (2001). The middle class consensus and economic development. *Journal of Economic Growth, 6*(4), 317–335.

Erreygers, G. (2009). Can a single indicator measure both attainment and shortfall inequality. *Journal of Health Economics, 28*(4), 885–893.

Esteban, J., & Ray, D. (1994). On the measurement of polarization. *Econometrica, 62*, 819–852.

Ferreira, F., Chen, S., Dabalen, A., Dikhanov, Y., Hamadeh, N., Jolliffe, D., Narayan, A., Prydz, E., Revenga, A., Sangraula, P., Serajuddin, U., & Yoshida, N. (2015). *A global count of the extreme poor in 2012: Data issues, methodology* *and initial results* (Policy research working paper 7432). Washington, DC: World Bank.

Fields, G., & Ok, E. (1996). The meaning and measurement of income mobility. *Journal of Economic Theory, 71*, 349–377.

Fields, G., & Ok, E. (1999a). The measurement of income mobility: An introduction to the literature. In J. Silber (Ed.), *Handbook on income inequality measurement*. Boston: Kluwer.

Fields, G., & Ok, E. (1999b). Measuring movement of incomes. *Economica, 66*, 455–472.

Food and Agriculture Organization. (1977). *The fourth world food survey*. Rome: FAO.

Food and Agriculture Organization. (1996, November 13–17). *Rome declaration on world food security and world food summit plan of action*. World food summit. Rome: FAO.

Food and Agriculture Organization. (2009). *Declaration of world summit on food security*. Rome: FAO.

Food and Agriculture Organization. (2012). *The state of food insecurity in the world*. Rome: FAO.

Food and Agriculture Organization. (2013). *The state of food insecurity in the world: Multiple dimensions of food security*. Rome: FAO.

Food and Agriculture Organization. (2015). *The state of food insecurity in the world*. Rome: FAO.

Food and Agriculture Organization, World Health Organization and United Nations University. (1985). *Protein and energy requirements*. Rome: FAO.

Food and Agriculture Organization, World Health Organization and United Nations University. (2004). Human energy requirements: Report of a joint FAO, WHO and UNU expert consultation. Rome, 17–24 October 2001. Accessed at http://www.fao.org/3/a-y5686e.pdf.

Foster, J., & Wolfson, M. (1992, 2009). Polarization and the decline of the middle class: Canada and the U.S. *Journal of Economic Inequality*, *8*(2), 247–273.

Foster, J., Greer, J., & Thorbecke, E. (1984). A class of decomposable poverty measure. *Econometrica, 53*, 761–776.

Gebeloff, G., & Searcey, D. (2015). Middle class shrinks further as more fall out instead of climbing up. [online] *New York Times*. Available at http://www.nytimes.com/2015/01/26/business/economy/middle-class-shrinks-further-as-more-fall-out-instead-of-climbing-up.html. Accessed 25 Jan 2015.

Gopalan, C. (1992). Undernutrition: Measurement and implication. In S. R. Osmani (Ed.), *Nutrition and poverty*. Oxford: Clarendon Press.

Hey, J., & Lambert, P. (1980). Relative deprivation and Gini coefficient: Comment. *Quarterly Journal of Economics, 94*, 567–573.

Hicks, J. (1939). *Value and capital*. Oxford: Clarendon Press.

Hicks, J. (1979). Growth vs. Basic needs: Is there a trade-off? *World Development, 7*, 985–994.

Hicks, N., & Streeten, P. (1979). Indicators of development: The search for a basic needs yardstick. *World Development, 7*, 567–580.

International Labor Organization. (2012a). *Statistical update on employment in the informal economy*. Geneva: International Labor Organization.

International Labor Organization. (2012b). *Understanding deficits of productive employment and setting targets: A methodological guide*. Geneva: International Labor Organization.

International Labor Organization and World Trade Organization. (2009). *Globalization and informal jobs in developing countries*. Geneva: International Labor Organization and World Trade Organization.

Iyenger, N. (1960). On a method of computing Engel elasticity from concentration curves. *Economterica, 28*, 882–891.

Janvry, A., Finan, F.,& Sadoulet, E. (2006). *Evaluating Brazil's Bolsa escola program: Impact on schooling and municipal roles.* Berkeley: University of California at Berkeley. Available at http://are.berkeley.edu/~esadoulet/papers/BolsaEscolaReport6-6.pdf. Accessed 18 Sept 2015.

Jolliffe, D., & Prydz, E. (2015). *Global poverty goals and prices: How purchasing poverty matters* (Policy research working paper 7256). Washington, DC: The World Bank.

Kakwani, N. (1977). Measurement of tax progressivity: An international comparison. *Economic Journal, 87*, 71–80.

Kakwani, N. (1980). *Income inequality and poverty: Methods of estimation and policy applications*. New York: Oxford University Press.

Kakwani, N. (1981). Welfare measures: An international comparison. *Journal of Development Economics, 8*, 21–45.

Kakwani, N. (1984). Welfare ranking of income distributions. In R. L. Basmann & G. F. Rhodses (Eds.), *Advances in econometrics* (Vol. 3). Greenwich: JAI Press.

Kakwani, N. (1986). *Analyzing redistribution policies: A study using Australian data*. Cambridge: Cambridge University Press.

Kakwani, N. (1989). On measuring undernutrition. *Oxford Economic Papers, 41*, 528–552.

Kakwani, N. (1992). Measuring undernutrition with variable calorie requirements. In S. Osmani (Ed.), *Nutrition and poverty*. Oxford: Clarendon Press.

Kakwani, N. (1993). Performance in living standards. *Journal of Development Economics, 41*, 307–336.

Kakwani, N. (1994). Poverty and economic growth: With application to Cote d'Ivoire. *Review of Income and Wealth, 39*, 121–139.

Kakwani, N. (1995). Structural adjustment and performance in living standards in developing countries. *Development and Change, 26*(3), 469–502.

Kakwani, N. (2000). On measuring growth and inequality components of poverty with application to Thailand. *Journal of Quantitative Economics, 16*(1), 67–80.

Kakwani, N. (2010). *A new model for constructing poverty lines* (Discussion paper series 2010–06). Manila: Philippine Institute for Development Studies.

Kakwani, N., & Son, H. (2008). Poverty equivalent growth rate. *Review of Income and Wealth, 54*, 643–655.

Kakwani, N., & Son, H. (2015). *Measuring food insecurity: Global estimates* (ECINEQ working paper series no. 370). Milano: Society for the Study of Economic Inequality.

Kakwani, N., & Subbarao, K. (1994). Global development: Is the gap widening or closing? In T. DeGregori & H. Rodgers (Eds.), *Poverty policy in developing countries*. London: JAI Press.

Kaldor, N. (1939). Speculation and economic stability. *Review of Economic Studies, 7*, 1–27.

Kaldor, N. (1955). Alternative theories of distribution. *Review of Economic Studies, 23*, 83–100.

Kanbur, R., & Wagstaff, A. (2014). *How useful is inequality of opportunity as a policy construct?* (Policy research working paper series 6980). Washington, DC: World Bank.

King, E. (1983). An index of inequality, with applications to horizontal equity and social mobility. *Econometrica, 51*, 99–115.

Kmenta, J. (1990). *Elements of econometrics*. New York: Macmillan.

Kolm, S. (1969). The optimal production of social justice. In J. Margolis & H. Guitton (Eds.), *Public economics: An analysis of public production and consumption and their relations to the private sectors*. London: Macmillan.

Kolm, S. (1976a). Unequal inequalities. *Journal of Economic Theory, 1*(12), 416–442.

Kolm, S. (1976b). Unequal inequalities II. *Journal of Economic Theory, 13*, 82–111.

Kuznets, S. (1955). Economic growth and income inequality. *American Economic Review, 45*(1), 1–28.

Lambert, P., & Zheng, B. (2011). On the consistent measurement of achievement and shortfall inequality. *Journal of Health Economics, 30*(1), 214–219.
Lasso de la Vega, C., & Aristondo, O. (2012). Proposing indicators to measure achievement and shortfall inequality consistently. *Journal of Health Economics, 31*(4), 578–583.
Lazear, E. P., & Rosen, S. (1981). Rank-order tournaments as optimum labor contracts. *Journal of Political Economy, 89*(5), 841–864.
Lele, U. (2015). *Measuring poverty and hunger can raise more questions than answers, future development economics to end poverty*. Available at http://www.brookings.edu/blogs/future-development/posts/2015/06/15-poverty-hunger-lele. Accessed 15 June 2015.
Levy, F. (1987). The middle class: Is it really vanishing? *The Brookings Review, 5*, 17–25.
Lipton, M. (1983). *Poverty, undernutrition and hunger* (World bank staff working paper no 597). Washington, DC: World Bank.
Lipton, M., & Ravallion, M. (1995). Poverty and policy. In J. Behrman & T. Srinivasan (Eds.), *Handbook of development economics* (Vol. 3). Amsterdam: North-Holland.
Lustig, N., Arias, O., & Rigolini, J. (2002). *Poverty reduction and economic growth: A two-way causality* (sustainable development department technical papers series: POV-111). Washington, DC: Inter-American Development Bank.
Meade, J. (1976). *The just economy*. London: George Allen & Unwin.
Mello, L., & Hoppe, M. (2005). *Educational attainment in Brazil: The experience of FUNDEF* (OECD economics department working papers no. 424). Paris: Organization for Economic Co-operation and Development.
Mirrlees, J. (1971). An exploration in the theory of optimum income taxation. *Review of Economic Studies, 38*(114), 175–208.
Mitra, T., & Ok, E. (1998). The measurement of income mobility: A partial ordering approach. *Economic Theory, 12*, 77–102.
Morris, D. (1979). *Measuring the conditions of the world poor: The physical quality of life index*. New York: Pergamon Press.
Naiken, L. (1998). On certain statistical issues arising from the use of energy requirements in estimating the prevalence of energy inadequacy (Undernutrition). *Journal of the Indian Society of Agricultural Statistics, 2*(2.3), 113–128.
Naiken L. (2002, June 26–28). *FAO methodology for estimating the prevalence of undernourishment*. Paper presented at the international scientific symposium on measurement of food deprivation and undernutrition, Rome.
Nehru, J. (1946). *The discovery of India*. New Delhi: Penguin.

Nissanov, Z., Poggi, A., & Silber, J. (2011). Measuring bi-polarization and polarization: A short survey. In J. Deutsch & J. Silber (Eds.), *The measurement of individual well-being and group inequalities: Essays in memory of Z. M. Berrebi*. Oxon: Routledge.

Oghuvbu, E. (2010). Attendance and academic performance of students in secondary schools: A correlational approach. *Studies in Home and Community Science, 4*(1), 21–25.

Ojha, P. (1970). A configuration of Indian poverty: Inequality and levels of living. *Reserve Bank of India Bulletin, 24*(1), 16–27.

Okun, A. (1975). *Equality and efficiency: The big tradeoff*. Washington, DC: The Brookings Institution.

Osmani, S. (1992a). *Nutrition and poverty*. Oxford: Clarendon Press.

Osmani, S. (1992b). On some controversies in the measurement of undernutrition. In S. Osmani (Ed.), *Nutrition and poverty*. Oxford: Clarendon Press.

Pareto, V. (1897). *Cours d'Economie Politique*. Lausanne: Rouge.

Payne, P. (1985). Nutritional adaptation in man: Social adjustment and their nutritional implications. In K. L. Blaxter & J. C. Waterlow (Eds.), *Nutritional adaptation in man*. London: John Libbey.

Payne, P. (1992). Assessing under nutrition: The need for a reconceptualization. In S. Osmani (Ed.), *Nutrition and poverty*. Oxford: Clarendon Press.

Permanyer, I. (2015). Measuring achievement and shortfall improvements in a consistent way. *Review of Income and Wealth*. [online]. Available at DOI: 10.1111/roiw.12194. Accessed 1 Dec 2015.

Piketty, T. (2014). *Capital in twenty-first century*. Cambridge, MA: Harvard University Press.

Pogge, T. (2010). *Politics as usual: What lies behind pro-poor rhetoric*. Cambridge: Polity Press.

Ravallion, M. (1997). Can high inequality developing countries escape absolute poverty? *Economics Letters, 56*, 51–57.

Ravallion, M. (2004). *Competing concepts of inequality in the globalization debate* (Policy research working paper 3243). Washington, DC: The World Bank.

Ravallion, M. (2005a). *A poverty-inequality trade-off?* (Policy research working paper 3579). Washington, DC: The World Bank.

Ravallion, M. (2005b). *Inequality is bad for the poor* (Policy research working paper series 3677). Washington, DC: The World Bank.

Ravallion, M. (2009). *Why don't we see poverty convergence?* (Policy research working paper series 4974). Washington, DC: The World Bank.

Rawls, J. (1971). *A theory of justice*. Cambridge, MA: Harvard University Press.

Reutilinger, S., & Selowsky, M. (1976). *Malnutrition and poverty: Magnitude and policy options*. Baltimore: Johns Hopkins University Press.

Reyes, C., Tabuga, A., Mina, C., & Asis, R. (2015). *Promoting inclusive growth through the 4Ps* (Research paper study no. 2015–01). Manila: Philippine Institute for Development Studies.

Roemer, J. (1998). *Equality of opportunity*. Cambridge, MA: Harvard University Press.

Rosenblatt, D., & McGavock, T. (2013a). *A note on the simple algebra of the shared prosperity indicator* (Policy research working paper series 6645). Washington, DC: The World Bank.

Rosenblatt, D., & McGavock, T. (2013b). *Shared prosperity: Links to growth, inequality and inequality of opportunity* (Policy research working paper 6649). Washington, DC: The World Bank.

Rowntree, B. (1901). *Poverty: A study of town life*. London: Macmillan.

Runciman, W. (1966). *Relative deprivation and social justice: A study of attitudes to social inequality in twentieth-century England*. London: Routledge and Kegan Paul Ltd.

Samuelson, P. (1947). *Foundations of economic analysis*. Cambridge, MA: Harvard University Press.

Seckler, D. (1982). Small but healthy: A basic hypothesis in theory and measurement policy in malnutrition. In P. V. Sukhatme (Ed.), *Newer concepts in nutrition and their implications for policy*. Pune: Maharashtra Association for the Cultivation of Science Research Institute.

Seckler, D. (1984). Malnutrition: An intellectual Odyssey. In K. T. Achaya (Ed.), *Interfaces between agriculture, nutrition and food science*. Tokyo: United Nations University.

Sen, A. (1973a). On the development of basic economic indicators to supplement GNP measures. *United Nations Economic Bulletin for Asia and the Far East, 24,* 1–11.

Sen, A. (1973b). *On economic inequality*. Clarendon: Oxford University Press.

Sen, A. (1974a). Informational bases of alternative welfare approaches: Aggregation and income distribution. *Journal of Public Economics, 3*(4), 387–403.

Sen, A. (1974b). Rawls versus Bentham: An axiomatic examination of the pure distribution problem. *Theory and Decision, 4*(3/4), 301–309.

Sen, A. (1976). Poverty: An ordinal approach to measurement. *Econometrica, 44*, 219–231.

Sen, A. (1981). *Poverty and famines: An essay on entitlement and deprivation*. New York: Oxford University Press.

Sen, A. (1983). Development: Which way now. *Economic Journal, 93*, 742–762.

Sen, A. (1984). The living standard. *Oxford Economic Papers, 36*, 74–90.

Sen, A. (1985). Well-being, agency and freedom: The Dewey lectures 1984. *The Journal of Philosophy, 82*(4), 169–221.

Sen, A. (1987). The standard of living. In G. Hawthorn (Ed.), *The standard of living*. Cambridge: Cambridge University Press.

Sen, A. (1989a). Development as capability expansion. *Journal of Development Planning, 19*, 41–58.

Sen, A. (1989b). Food and freedom. *World Development, 17*(6), 769–781.

Sen, A. (1992). *Inequality reexamined*. Oxford: Clarendon Press.

Sen, A. (1995). Rationality and social choice. *American Economic Review, 85*, 1–24.

Shapley, L. (1953). A value for n-person games. In H. W. Kuhn & A. W. Tucker (Eds.), *Contributions to the theory of games II* (Annals of mathematics studies 28). Princeton: Princeton University Press.

Sheehan, G., & Hopkins, M. (1979). *Basic needs performance: An analysis of some international data*. Geneva: International Labor Organization.

Shorrocks, A. (1978). The measurement of mobility. *Econometrica, 46*(5), 1013–1024.

Silber, J. (1983). ELL (The Equivalent Length of Life) or another attempt of measuring development. *World Development, 11*(1), 21–29.

Silva, J., Almeida, R., & Strokova, V. (2015). *Sustaining employment and wage gains in Brazil: A skills and jobs agenda*. Washington, DC: The World Bank.

Soares, S. (2012). *Bolsa Familia, its design, its impact and possibilities for the future* (Working paper no. 89). Brasilia: International Policy Centre for Inclusive Growth.

Soares, F., Ribas, R., & Osorio, R. (2007). *Evaluating the impact of Brazil's Bolsa Família: Cash transfer programmes in comparative perspective* (Evaluating note no. 1). Brazil: International Poverty Center.

Son, H. (2012). A welfare-based approach to aggregating growth rates across countries. *Oxford Bulletin of Economics and Statistics, 74*, 152–161.

Son, H. (2013). Inequality of human opportunities in developing Asia. *Asian Development Review, 30*(2), 110–130.

Spain, D., & Bianchi, S. (1996). Women in the labor market. *Focus, 20*(1), 1–3.

Srinivasan, T. (1981). Malnutrition: Some measurement and policy issues. *Journal of Development Economics, 8*, 3–19.

Srinivasan, T. (1992). Undernutrition: Concepts, measurement and policy implications. In S. Osmani (Ed.), *Nutrition and poverty*. Oxford: Clarendon Press.

Stiglitz, J. (2012). *The price of inequality*. London: Penguin.

Stiglitz, J., Sen, A., & Fitoussi, J. (2010). *Mismeasuring our lives: Why GDP doesn't add up*. New York: The New Press.
Streeten, P. (1979). Basic needs: Premises and promises. *Journal of Policy Modeling, 1*, 136–146.
Sukhateme, P., & Margen, S. (1992). Autoregulatory and homeostatic nature of energy balance. *American Journal of Clinical Nutrition, 35*, 355–365.
Sukhatme, P. (1961). The world's hunger and future needs in food supplies. *Journal of the Royal Statistical Society, 124*, 463–525.
Sukhatme, P. (1977). Incidence of undernutrition. *India Journal of Agricultural Economics, 32*(3), 1–7.
Sukhatme, P. (1981). *Relationship between malnutrition and poverty*. Delhi: Indian Association of Social Science Institutions.
Sukhatme, P. (1982). Measurement of undernutrition. *Economic and Political Weekly, 17*(50), 2000–2016.
The Economist. (2015, July 4th–10th). *Nutrition in India: Of secrecy and stunting, 416*(8945), 24–25.
Thurow, L. (1984). The disappearance of the middle class. *The New York Times*, p. E2.
Todaro, M., & Smith, S. (2003). *Case studies in economic development* (3rd ed.). George Washington University. Available at http://wps.aw.com/wps/media/objects/277/284582/todarocasestudies.pdf. Accessed 18 Sept 2015.
United Nations Development Programme. (1990). *Human development report 1990*. New York: Oxford University Press.
United Nations Research Institute for Social Development. (1972). *Contents and measurement of socio-economic development: A staff survey*. New York: Praeger.
Wolfson, M. (1994). When inequalities diverge. *American Economic Review, 84*, 353–358.
World Bank. (2000). *World development report 2000*. Washington, DC: The World Bank.
World Bank. (2006). *World development report 2006: Equity and development*. Washington, DC: The World Bank.
World Bank. (2013). *World development report 2013*. Washington, DC: The World Bank.
World Bank. (2015). *The state of social safety nets 2015*. Washington, DC: The World Bank.
Yitzhaki, S. (1979). Relative deprivation and the Gini coefficient. *Quarterly Journal of Economics, 93*, 321–324.
Zepeda, E. (2006). Background research for Do CCTs reduce poverty?. *One Pager #21*. Brasilia: International Poverty Centre.

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