

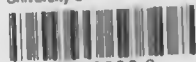
**REGIONAL WELFARE AND INCOME DISTRIBUTION IN KENYA: A NEW
APPROACH TO THE MEASUREMENT OF WELLBEING**

SETH OMONDI GOR

**Thesis Submitted in Fulfilment of the Requirements for the Award of
the Degree of Doctor of Philosophy in Economics of the University of
Nairobi**

2008

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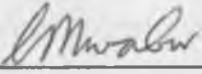
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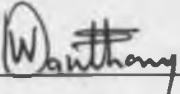
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Signed  Date 16/12/08
Seth Omondi Gor

This thesis has been submitted for examination with our approval as university supervisors

Signed  Date 16/12/2008
Professor Germano Mwabu

Signed  Date 16/12/2008
Dr Damiano Kulundu Manda

Signed  Date 16/12/2008
Dr Anthony Wambugu

REGIONAL WELFARE AND INCOME DISTRIBUTION IN KENYA: A NEW APPROACH TO THE MEASUREMENT OF WELLBEING

ABSTRACT

The income distribution of a region is a summary measure of many social processes and is directly associated with a region's level of welfare. This notwithstanding, regional welfare has been conventionally measured only with regard to a region's income. The primary objective of this study is to construct a theoretically consistent social welfare index that takes into account the level and distribution of income as well as the basic needs requirement of the population of a region. Using data obtained from a Kenyan household survey, we use a probit model to estimate parameters of an abbreviated social welfare function. Since welfare is not observable, it is proxied by a measurable variable, child survival at the household level. Regional child survival probabilities are computed and analyzed.

The probit index for child survival turns out to be a good approximation to an abbreviated social welfare index at the household level. This index, once computed, can be used to compare levels of wellbeing enjoyed by households and regions, given a certain income level, the distribution of that income, and the extent to which basic needs in a region are being met.

The study also investigates the pattern of income distribution across regions. We use data from an integrated labour force survey to estimate the gini coefficients. To complement this, we use the same data set to compute income shares of different ordinal groups by rural and urban areas. The results indicate that income inequality in Kenya is more pronounced in rural than in urban areas. For the rural areas, Rift Valley Province registers the highest and Coast, the

lowest inequality measure, while for the urban areas, Nairobi has the highest inequality measure.

Child survival probabilities are estimated and reported for each of the eight regions. Results show that the urban areas have higher overall survival probabilities, than the rural areas. Further, Nairobi has the highest survival probabilities, and North Eastern, the lowest. Coincidentally, North Eastern also has the lowest income inequality, and Nairobi, the highest urban inequality. However, whenever these two indices are combined to measure welfare, Nairobi ranks the first on the welfare ladder while North Eastern ranks the last.

The approach to the measurement of welfare developed in this thesis is new in the sense that the weights of its arguments are determined by household preferences and are consistent with utility theory. These weights are unique because they prevail only when the household welfare is maximum.

The empirical results reported in this thesis should help policy makers gain insights into the patterns of regional income distribution in Kenya, and provide guidance on how regional welfare differences may be addressed. With this information, it is possible for the government to design policies that can be implemented to improve welfare of regions that have lagged behind for decades.

ACKNOWLEDGEMENTS

This thesis has been accomplished with the support of many people. To them I sincerely owe many thanks. I am particularly grateful to my first supervisor, Professor Germano Mwabu who put in a lot of man-hours to help shape this work over the entire duration of the study. It would not have been possible without him; may God bless him abundantly. I am equally indebted to my second and third supervisors, Dr Damiano K. Manda and Dr Anthony Wambugu for their valuable suggestions and comments in the course of this study.

I also wish to express my thanks to colleagues in the School of Economics for their support in one way or another. In particular, I acknowledge the assistance from Dr Wilfred Nyangena, Dr Odhiambo Sule, Almadi Obere, Dr Urbanus Kioko, Bethwel Kinyanjui and Japheth Awiti in the course of this study. Professor Charles Okidi of the Institute for Development Studies has been a constant source of encouragement and support as have been my great friends Luke Obala, and Dr Okoth Ongore. I wish to thank them for their support.

I wish to register my appreciation to the Deans' Committee of the University of Nairobi, for the financial support that enabled me to undertake this study.

Finally, I wish to thank my family for their total and unwavering support over the entire duration of this study. My wife Mary, children, Phoebe and Osii, deserve special mention, as does my brother, George, with whom we have covered many miles together.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Income Distribution: Some Global Stylized Facts

Conventionally, welfare has been measured only with regard to income so that welfare and income are assumed to move in the same direction. However, considerations other than income levels are important for the identification of the poor, and the potentially poor, and for a more accurate measurement of living standards in a country or region. It is in this light that we introduce the concept of income distribution as an argument in the social welfare function. The income distribution of each region summarises a great many social processes associated with a region's welfare. As the social scorecard for all of society's distribution of material gains, income distribution is the net result of the social currents and conflicts, associated with the impacts of inflation, literacy levels, ownership of assets in society, and evolution of markets and institutions, all overlaid on basic demographic structure.

Current research on income distribution has two main viewpoints. One view is introspective, and seeks to decompose changes in the overall income distribution into sector, factor or regional components (Adelman and Levy 1984). An alternative, almost polar approach seeks to expand the income distribution and views it as the end result of a comprehensive social accounting model (Weisskoff 1992, Robinson 1989, Adelman and Morris 1973, Van Ginneken and Park 1984, and Cronwell 1977). Our study chooses a middle ground that seeks to borrow what is contextually relevant from each of these positions, to chart a new direction in understanding the relationship between distribution of income and regional welfare in Kenya.

For some time now, there has been a considerable debate on changes in the distribution of income between and within nations. For some, including most advocates of the world-systems perspective, the world economy has been characterized by a high level of inequality since its very origins (see Kuznets 1966 and 1971; Landes 1969 and Maddison 1983), and so the income gap between the poor and wealthy nations preceded the industrial revolution. For others, the gap in income between poor and rich nations was not very pronounced in the nineteenth century, but grew very rapidly after the late nineteenth century (Bairoch 1981, 1993; Hikino and Amsden 1994; Maddison 1995 and Pritchett 1997).

The debate notwithstanding, it is widely acknowledged that a precise evaluation of global inequality trends is extremely difficult owing to the absence of data. For example, the systematic collection of data on GNP or GDP, themselves limited indicators of the type of information that would be required for an adequate assessment of world income distribution, only began in the 1950s (Korzeniewicz et al 2003). While studies have calculated historical data for the vast majority of the developed countries, most developing countries, particularly in Africa generally lack such historical estimates. Kenya falls in the latter category.

Attempts have however, been made to estimate and analyse inequality between and within countries for which actual or proxy data is available. Much of the early work on inequality within nations drew from the arguments introduced by Simon Kuznets (1955). Simply stated, the inverted-U curve hypothesis introduced by Kuznets posits that inequality within nations tends to rise in the early stages of economic growth, becoming most accentuated at intermediate levels of development, and decreasing thereafter as countries reach advanced levels of development. In the last decade, these arguments came under severe challenge. Partly to deal with new data, but also to explain trends that departed from the

expected direction, several studies have indicated that the Kuznets hypothesis does not fit the observed relationship between economic growth and inequality.

It has been shown for example, that divergent patterns of rising and declining inequality can be found among industrialized, newly industrializing and less industrialized countries, regardless of their relative level of wealth i.e., regardless of their position on Kuznets curve. As an alternative explanation of the observed trends, studies have placed greater emphasis on institutional characteristics (such as political processes shaping state expenditures in areas such as education), that might explain divergent patterns and/or regional differences in within – country income inequality.

Using data on population and GDP for 24 countries between 1820 and 1990 to construct Gini coefficients as a measure of world income inequalities, the findings of Korzeniewicz and Moran (1997) reveal some interesting trends. Their findings show that income inequalities between poor and wealthy nations have been highly pronounced from the very beginning of the period under consideration. The data shows that inequality between nations increased over the 1930s -1970s period. Overall, world income inequality rose through the interwar period. However, the later years of the Great Depression and the onset of World War II, appear to have had a dampening effect on world inequalities. This was followed by a significant and rapid increase in inequalities between nations immediately after World War II. Finally, the findings indicate that income inequalities between nations became significantly more pronounced after the early 1970s. By the mid –1990s, world income inequalities were at their highest recorded level over the past two centuries.

Available data from the World Bank shows that during the period between the late 19th century and the 1920s, within country inequalities were characterized by two divergent patterns. In some countries, inequalities rose considerably around

the turn of the century. In various studies based on assorted data and methodologies, inequality was found to be rising in England from the mid – 1700s to the 1860s (Williamson 1991); Finland from 1891 to 1900 (Brenner, Kaelble and Thomas 1991); Germany from 1840 to 1913 (Kuznets 1955; Williamson and Lindert 1980), Italy (Brenner, Kaelble and Thomas 1991), up to the First World War. This evidence seems to support, as Kuznets had argued, the notion that industrialization was accompanied by rising inequalities (variously measured) that did not begin to level until the First World War.

Similarly, there are a number of studies showing that within country inequalities appear to have become less pronounced in at least some of the developed countries. Britain experienced a levelling in inequality after the 1860s (Williamson 1991). There is also some evidence that Australia experienced a continuous egalitarian trend or reduction in wage dispersion between the last half of the 19th century to the first part of the 20th century (Thomas 1991). Some past studies of Scandinavia have shown inequality falling in Denmark from 1870 to 1903 (Brenner, Kaelble and Thomas 1991).

The apparent divergence between these two patterns of within–country inequality around the turn of the century appears to have given way, after the 1920’s to some convergence towards declining within–country inequalities. After 1929, the United States and a number of countries in Europe experienced a levelling of incomes (Williamson 1991:13-5). In general therefore, it appears as if there was a general tendency for inequality within nations to remain either stable or even decline between the 1930s and the early 1970s.

According to Korzeniewicz et al (2003), the availability of data improved around the late 1960s. This new data showed that within–country inequality was again characterized by two divergent patterns. The most prevalent trend continued to be either a decline of inequalities or relatively stable levels of comparatively low

levels of inequality within countries. In the developed world, this included Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Japan, Netherlands, Spain and Sweden. In the newly industrializing countries, this included Indonesia, Malaysia, Singapore, Taiwan and Philippines, Colombia, Costa Rica and Uruguay. In the less industrialized regions were Bangladesh, Egypt and India.

It is worth noting that over this period, the number of countries escaping this trend increased significantly. Significant increases in inequality have taken place in the following core countries; Australia, New Zealand, the United States, and Great Britain. In the semi periphery, inequality has increased significantly in Argentina, Chile, Venezuela, and a number of East European countries emerging from communism after the late 1980s. In the periphery, data is more tentative, but generally inequality appears to be increasing in China and several African countries among them South Africa, Nigeria, Kenya, Malawi, Senegal and Uganda.

1.2 Trends in Inequality: Towards an Explanation

From the above outline of trends, it is observable that there are certain important dynamics that seem to explain these trends. Trends in inequality appear to be shaped by a complex array of forces. These include the rate of change in the demand and supply of labour, patterns of educational attainment, the ability of political forces to demand income redistribution on behalf of their constituencies and the capacity of the states to respond to these demands among many others.

To the above list, we add a number of key variables that, in our opinion, are equally important in explaining the observed patterns of change in inequality. These include global migration flows, the uneven development of countries, and

the expansion of markets, non-governmental organizations, and supranational organizations.

Mass Migration

First, literature associates mass migration with a decline in between-country inequalities. The argument here is that migration flows tend to increase the population of the high-income or rapidly growing countries that tend to be the main receiving nations. Secondly, mass migration reduces the population of lower-income or slower growth countries that tend to be the main sending nations.

To the extent that average incomes per capita for each country can be said to be an appropriate measure of between-country inequality mass migration has a direct impact on the world distribution of income. Furthermore, insofar as mass migration is accompanied by considerable return flows, it should also provide an indirect mechanism for reducing world income inequalities through the circulation of income, and innovations in the organization of production and consumption.

Mass migration has resulted in rising inequality within the receiving countries by generating a large supply of unskilled workers. Williamson (1991:26), for example indicates that in the United States, "new arrivals from abroad—who tended to be relatively unskilled—had their biggest impact on the growth of the American labour force in the fifteen years prior to the civil war, and between the 1890s and World War I. These were also periods of especially sharp increases in inequality".

However, mass migration resulted in declining inequality within sending countries. Dowty (1987:50-1), points out that emigration resulted in (a), rising wages in the sending countries by reducing the number of workers available; (b) property shifts in agriculture allowing efficiency gains; (c) income gains through

the remittances of migrants, (d) the acquisition of new technologies and skills through returning migrants; (e) the promotion of state reforms as an effort to prevent continuing emigration.

The Uneven Success of State Centred Growth Strategies

According to Korzeniewicz et al (2003), the key feature explaining trends in inequality between the periods 1930s and the late 1960s is the adoption of new models of development centred around the state. Such models varied in their precise features as these changed over time in different countries. In general, the main characteristics of these models of development were: a more active role for the state in regulating market activities so as to ensure effective demand and/or industrialization; greater intervention of the state in securing welfare of the populations; and a growing consensus around the need to adopt democratic procedures for the organization of political rule.

These developments appear to have resulted into declining within-country inequality. The introduction of state-centred strategies of growth after the 1920s was accompanied by reductions in the supply of unskilled workers, for example through dramatic reductions in mass migration or by sustaining the exclusion of minorities and women from the paid labour force. Second, state-centred strategies of growth tended to result in institutional arrangements (e.g. the growing role of organized labour) that facilitated income redistribution. Third, the state itself, in a number of countries, undertook to redistribute income (e.g., through progressive tax systems or the development of welfare programs).

The relative weight of each of these features in reducing within-country inequalities has however, generated some debate. Williamson (1991), for example, attributes the levelling of inequalities in the industrialized countries to the interaction between the growth of factor productivity (when such growth

tends to increase the skills of, and relative returns to, labour) and the growth of the labour force (as shaped for instance by migration and demographic forces).

The uneven distribution in the strength of welfare states, democracy, and the relative effectiveness of states in promoting high rates of economic growth, had three direct consequences in relation to world inequality. First, in relation to within-country inequalities, this uneven distribution shaped different rates of decline in such inequalities.

Korzeniewicz et al (2003), note that in the developed regions, some countries experienced rather steep declines in inequality. Less developed regions of the world like Latin America, which had already developed high levels of within-country inequality around the turn of the century, were characterized by minimal declines in such inequalities, particularly insofar as state-centred arrangement failed to remove key obstacles faced by the poor, such as lack of access to education in rural and poor urban areas.

Second, this uneven distribution has led to a considerable increase in between-country inequality. Most countries in the developing regions are simply not able to fulfil the welfare functions that are crucial in order to develop social capital and support innovation. This has translated into a lack of economic growth in most of these countries (Sassen, 1996).

The Return of Market-Centred Strategies

The failure of state-centred strategies to reduce inequalities between nations seems to have led governments in the developing economies towards the adoption of market-centred strategies of growth. The adoption of these strategies, appear to have been accompanied by the adoption of new organizational arrangements that seek to advance welfare and provide regulatory framework for markets. Korzeniewicz and Awbrey (1992), observe that by the

mid-1990s, market centred strategies of growth appear to have developed an unprecedented hegemony throughout the world, and their adoption has been accompanied by a wave of democratization particularly in the newly developing countries.

According to the convergence literature (e.g., Baumol, Nelson & Wolff 1994), the adoption of these market-centred strategies was likely to be accompanied by a reduction of inequalities between nations, particularly the developed regions. This reason has been advanced to explain the growing convergence in levels of wealth and welfare in the industrialized countries, at the turn of the century.

It is widely acknowledged even within the convergence literature, that such a reduction of inequality does not appear to accompany the adoption of market-centred strategies today (Baumol, Nelson and Wolff 1994). Instead, there has been a rise in inequalities between nations over the last decade. In regard to the patterns of within-country inequalities, the impact of market-centred strategies of growth is more ambivalent. Some observers emphasize that economic stagnation punishes the poor more than the wealthy, and that growth is likely to be accompanied by enhanced opportunities for the poor.

Such studies, (see Ryscavage 1999), indicate that growth in general creates employment opportunities for the poor and excluded, and that export-oriented growth in particular is likely to draw upon abundant resources, hence generally benefiting unskilled labour. They also argue that market centred growth often entails structural reforms that eliminate the rents drawn through the state by the rich and privileged, increasing the purchasing power of poor consumers by introducing greater competition among producers, and allowing for state expenditures to be targeted more precisely towards the poor.

Other studies on the other hand (e.g., Tilly 1998a), suggest that, market-centred strategies of growth can generate rising inequality. The argument here is that established areas of production can be displaced by increased competition, generating rising unemployment, thereby undermining the privileges previously enjoyed by important sectors of the economy.

In general however, evidence suggests that it is unlikely that the impact of the adoption of market-centred strategies of growth on inequality has gone in the same direction in all countries. Over the years, these changes appear to have combined in ways that sustain 'a growth with equity' path in some countries, but rising inequality in others.

1.3 Income Distribution and Wellbeing

One dimension of income inequality, whose importance appears to swamp that of others, is the inequality due to differences in living standards among and within nations. In most cases, this has been attributed to differential rates of regional and national economic growth. In fact, disparity among countries in the level of economic development is considered the greatest source of global inequality.

Differences in well-being between developed and developing countries are massive. The average developed nation's per capita income is seven times that of the average developing country (Frieden et al, 2001). At the extremes, even controlling for differences in price levels, income in the United States is fifty times the incomes in such countries as Angola, Ethiopia and Tanzania (\$30,600 per person, compared to \$600).

More generally, per capita income is \$1,450 per person in sub-Saharan Africa as a whole, which means that the income of the average American is greater than

that of 21 Africans combined. This means that the economy of the state of California is substantially larger than that of all of Africa, and that the average American living in poverty has an income three times that of the average African. (All data, from World Development Report, 1999).

Inequality is also great among regions of the developing world. The report notes that the gap between Latin America and sub-Saharan Africa is greater than the gap between the developed world and Latin America. So too are contrasts among countries within regions. The average inhabitant of Botswana has a standard of living ten times higher than the average inhabitant of Angola. The analogous differences are also ten times between South Korea and Bangladesh, eight times between Argentina and Haiti, and eight times between the former Soviet republics of Estonia and Tajikistan.

Frieden et al (2001), contend that differences in current standards of living are the result of past differences in rates of economic growth between and within countries. He goes on to show that relatively small disparities in growth rates can make an enormous difference when compounded over time.

To illustrate this, Thailand is currently a country at the middle ranges of world income (about \$6000 per capita), comparable to Turkey, Costa Rica, Tunisia or Venezuela. With a growth rate of just over 3% a year since 1950, it is neither a major developmental success story nor a massive failure. If however, Thailand's rate of growth had been 2% slower over those fifty years, that is 1.3% a year instead of 3.3% a year, it would now have a per capita income two-thirds lower, about \$2000 a year- making it poorer than India, Bolivia, or Papua New Guinea.

By the same token, with a 2% faster rate of growth, Thai per capita income would now be roughly equivalent to that of Greece. The implication is that a couple of percentage points a year, over the course of several decades, can

make the difference between living in Bolivia or India, on one hand, and living in Costa Rica or Thailand, on the other- or between Thailand and Greece.

1.4 Statement of Research Problem

As already stated, welfare is traditionally measured by income alone. Studies, however, show that even though income enters positively and significantly into the social welfare function, several other variables particularly, the distribution of income itself are significant in explaining variations in wellbeing. Inequality in income distribution is thus a major determinant of social welfare. Income, as a measure of welfare therefore conceals underlying inequalities that are bound to exist within and across regions and which are negatively associated with welfare. Currently, there is no information on effects of changes in regional distribution of income on the wellbeing of regions in Kenya. For example, it is not known how changes in the regional gini-coefficient would alter the social welfare indices of the eight regions in the country. This information gap is a serious handicap in regional planning because policies for addressing inter-regional inequalities cannot be assessed in terms of their effects on social welfare. This study will fill this information gap that currently hinders effective regional planning in Kenya.

1.5 Research Objectives

Using Kenyan data, the study aims at:-

- (a) Determining the regional pattern of income distribution.
- (b) Estimating regional child survival probabilities as the underlying determinants of levels of a region's well-being.
- (c) Constructing a theoretically consistent social welfare index that takes into account the *level* and *distribution* of income, as well as the basic *needs* requirements of the population.

1.6 Justification of the Study

Income distribution may be equal or unequal and is most frequently analysed across time, using time series data. However, it is also of interest to examine distribution across and within regions overtime, using panel data. It is well known that differences in individual regional characteristics are important in explaining regional income inequalities (Rati,1992). Explanations of differences across and within regions enable policy makers to gain insight into policies that can be designed to address existing income disparities. They also make it possible to assess how government policies on inter and intra-regional distributions of income affect regional welfare. This study is significant in that it proposes to account for effects of income distribution and its correlates in the measurement of social welfare.

CHAPTER TWO

2.0 INCOME DISTRIBUTION IN KENYA

2.1 Introduction

There is a wide variety of distribution problems in economics, each corresponding to different divisions of income according to groups, classes or regions. Economists have traditionally concentrated their attention on two parameters for such division of income. The primary distribution problem for an economist typically addresses functional distribution of income. By this is meant the division of income according to the relative importance of functions performed by factor inputs in the production of goods and services. Thus, in broad terms, the value of the output produced can be divided into income to labour (human capital), and income to property (non-human capital).

Often, each of these broad categories is broken down further. Labour incomes are subdivided into wages (incomes of manual workers), salaries (incomes of white-collar workers) and executive compensation (incomes of managerial workers). Likewise, property income is frequently subdivided into incomes from rents, interest and dividends.

There is also a third, or mixed income category, the income people receive from businesses they own either by themselves or in partnership with others. The category is called proprietor's income or income of unincorporated enterprises. It is frequently tabulated separately from pure labour or property income, but it may be divided between them by one or another ingenious statistical devices.

The secondary distribution problem that an economist deals with is personal income distribution, by which is meant division of income (or wealth) by size, or

more precisely, by size brackets of economic units or population groups. There exist many sorts of patterns of income distribution by size. The most important size distribution of income is occupational distribution, which involves the division of income by different industries or by occupational groups. Other distributions include geographical or regional distribution, which involves division of income or wealth by regions within a given country or across different countries, racial distribution, which entails distribution of income by race and sexual distribution or distribution of income or wealth by gender.

The theoretical rationale for studying regions is not well developed, but several possibilities come to mind. First, regions are more localized constituent parts of the national economy. They exhibit varying disparities in resource endowment, capabilities of residents, lifestyles and value systems, all of which affect the regional welfare levels. If the national economy is to prosper, then, its constituent regional economies must be brought into some sort of harmony. Towards this end, it is imperative that regional dynamics be studied.

Second, studying regions makes sense if there is a political aspect to the links between inequality and health, since political dynamics do determine resource allocation to regions, in addition to generating differential policy impacts on regions. Third, region-level differences in inequality do exert a significant impact on the level of economic segregation in a region, which then has the potential to affect child survival. Finally, studying regions is useful since a region's gini coefficient actually picks-up the individual or cluster level effects of inequality that derive from the relation between income and child survival.

2.2 Historical Background

Following on Bigsten (2006), we can assign the discourse on income distribution in Kenya to four historical phases namely, the period up to the World War I, the inter-war period, the post war period and the post-independence period.

The Period up to World War I

Not much is known about the income distribution in Kenya before the arrival of the British. The inland was hardly integrated with the outside world, while there were long-distance trading activities along the coast, where there were some Arabic traders, slave traders and plantation owners as well as some Indian moneylenders. The inland Kenyans of African origin were mainly pastoralists, settled farmers, small craftsmen, or traders. In these early years, there certainly was no serious land shortage. One can therefore safely assume that people could use as much land as they needed, to ensure a standard of living roughly comparable to that of the other members of the community.

Towards the end of the 19th century, the British presence was established in Kenya. For a start, their presence was confined to the coastal region, but with the building of the railway line, the inland was opened up to trade and settlement. The railway construction was done by coolies from India, and a good proportion of them remained in the country. The majority of these set up small stores and started trading, while some took up intermediate level positions in private industry or the public sector. At around this time a rapid increase in the numbers of Asians and Europeans began in earnest in the colony.

According to Bigsten (1984), there had already been a considerable expansion of wage employment in Kenya by 1914. It is instructive that practically, all of this employment was male, and the African male employment rate was about 15 percent in this category. Another category of workers was engaged in the settler

agriculture either as squatters resident on the farm or as contract labour (normally for some three months per year). The latter category was made up almost exclusively of adult men, while men, women and children were working in the former capacity. Finally, a category of African traders and businessmen also emerged. This group was engaged in stock trading, maize milling, butchering, selling of food and drinks, and some small scale retail in and around Nairobi (Kitching, 1980).

This period can therefore be said to have witnessed an increased involvement of male Africans outside agriculture. Despite this, the period before and during World War I saw an expansion of cash crop production on African farms and an increase in the cultivated area. This was made possible by an increase in the labour input of women in traditional agriculture. Already at this time the increasing occupational differentiation started to increase inequality.

The Inter-War Period

By the time World War I was breaking out, pass laws had been introduced in Kenya. The implication of this was that in the White Highlands the Africans could only work as contract or resident labour or be repatriated. The reason for the measures that were instituted to increase the supply of African labour was that the Europeans were unwilling to pay the competitive supply price (Bigsten, 2006). By restricting the scope for development on the African farms, the farm labourers were made to work for still less. One can therefore say that even though the Europeans represented a small minority, they chose to protect their privileges by administrative means.

Chege (2005) observes that at around this time, some 4,000 European farmers owned 7.7 million acres of high quality farmland in the "White Highlands," as compared to a total of 18 million acres of arable land allocated to 7 million Africans in the "Native Reserves". With the exception of a few districts like Kisii

and Meru, African farmers were prohibited from growing high value cash crops like coffee and tea, and from keeping exotic (grade) dairy cattle which have higher milk yields than the local "Zebu" variety. Asians on the other hand, were not allowed to own land at all. Education for European and Asian children was compulsory and subsidized by the state, but that of the Africans was restricted and left largely to communities and European missionary initiative.

The consequence of the European protection of their privileged position was the emergence, in the mid-twenties, of a three class society established along racial lines. The whites monopolized export crop agriculture, the higher administrative posts and the professions, while the Asians dominated trade, commerce and the middle reaches of the bureaucracy, with the Africans being left with unskilled wage employment, small holder farming, petty trade at the village level and the lower level clerical posts in the administration (Collier and Lal, 1986). Despite these restrictions imposed by the government, the African cash crop agriculture continued to expand in tandem with a growing internal market for food crops.

Kenya was not spared the effects of the global depression in 1929. When the effects of the depression receded, the labour force participation rate started to increase again, particularly from 1938 to 1948. The economic decline during the depression meant that the major market for African food crops was curtailed. This does, however, not seem to have had so severe effects on African agriculture, and the acreage expanded quite a lot during this period. The process of commercialization of African agriculture continued and it accelerated even more during World War II.

It is noteworthy that it was around this time that an African trade and business class started to emerge. It engaged itself primarily in shop and restaurant keeping, maize milling and the provision of transport. Also various types of handicrafts started to expand. The most rapidly developing provinces in this

respect were Central and Nyanza. During the Second World War farmers as well as traders made considerable profits.

Obviously, the Europeans and Asians still dominated business, but the African businessmen and traders were making progress and the labour movements were gaining importance (Bigsten, 1984). Within this time inequality among African smallholders started to increase, and the major differentiating factor was land. Those who had large land holdings in areas where cash crops could be produced therefore continued to improve their relative position. At the same time, a rural elite was buying up land (Kitching, 1980).

The Post-War Period

Wage employment continued to be quite intensive in Kenya after the war, but much of it was still of a temporary nature. Bigsten and Durevall (2006), observe that before 1952, Europeans, Asians and Africans in identical positions of the public service received different wages in descending order. Labour migration continued to be very common for a long time. African wage employment increased rapidly between 1950 and 1955. Then up to independence African agriculture wage employment stagnated, and non-agricultural employment even declined. This decline was more severe in the private sector than in the public sector. Collier and Lal (1986) argue that this decline was due to rapid increase in real wages over this period, among other things due to the efforts to increase the minimum wages.

A rapid increase in employment in the agricultural sector was witnessed during the first half of the 1950s. This reflected an increase in demand, which was due to rising producer prices and switches to new crops such as tea. During the second half of the decade the government changed its policy towards the African small farmers, who were now allowed to grow coffee. This should have been reflected in a higher supply price of labour, but this was more than offset by

rising demand for labour, so that employment continued to increase. During the period 1960-1967 however, employment in modern agriculture fell (Bigsten, 2006).

According to Bigsten (2006), a considerable gap developed between agricultural and non-agricultural wages during the 1940s, but this was to some extent offset by higher costs of living and less opportunities in urban areas of supplementing the incomes with farm incomes. The gap increased rapidly during the 1950s. Real wages in agriculture rose rapidly during the 1960s due to increasing commercialization of agriculture and a simultaneous increase in the supply price of labour, but during the same period non-agricultural real wages increased even faster. Thus, during the 1950s and 1960s the gap between agricultural and non-agricultural wages increased drastically. Of course, the entire gap was not due to market imperfections. Half of it, according to Collier and Lal (1986), was due to differences in skill composition.

The consequences of the discriminatory educational practices of the inter-war period, in which education was compulsory and subsidized for European and Asians but restricted for Africans, became much more glaring by the early 1960s. According to the Republic of Kenya (1966), among the 20–29 year age cohort, 53% of the Europeans had acquired high school education and above, as compared to 59% of the Asians, but only 4% of the Africans.

This translated to obvious inequalities in outcomes, as evidenced by the fact that by 1963, the Europeans and Asian communities (200,000 people), accounted for Ksh 936 million in wages as compared to Ksh 42 million for the entire African labour force. About 29% of the European males earned over 36,000 shillings each per year, 18% of Asian males earned 14,400 shillings a year on average, while only one percent of African men in employment earned above 12,000 shillings a year (Republic of Kenya, 1965).

The Post-Independence Period

The extent of racial discrimination, unfair distribution of opportunities, unequal taxation and public expenditure in colonial Kenya is well documented (see for instance, Brett 1971). Given these entrenched inequalities in opportunities and outcomes, an important plank in the fight for independence was therefore the abolition of the perceived gross inequalities, particularly those defined by racial privilege.

The transition from colonialism to neo-colonialism can therefore be seen to have been a planned one, aimed at preserving the greater part of the monopolistic colonial economic structure in the interests of large scale commercial, financial and estate capital by coming to terms with those leaders in the nationalist movement, a majority, who represented the new petty bourgeois strata which had been formed throughout most of Kenya under colonialism (Leys, 2006).

Independence therefore ushered Kenya into the trajectory of trying to equalize opportunities and dismantling racial privileges. With independence in 1963 came a change in the interracial distribution of both political power and incomes. Even though the income structure, to a large extent remained the same, employment was no longer as systematically racially segregated. In spite of this however, average incomes in the post-independence period still was highest for Europeans and lowest for Africans, with the Asians somewhere in between. The degree of overlapping, though, increased significantly.

The colonial crypto-apartheid system of land ownership, "native reserves", and segregated urban residential areas came to an end. The residue of economic and social inequalities of that era however, dogged the young African Republic till the late 1960s, when questions of social stratification along African class lines took centre stage in the political and academic arenas, pushing aside race as a determinant of income inequality.

This saw the introduction of the policy of 'Africanization' intended as a tool for redistribution. 'Africanization' openly discriminated against Kenya Asians. This was especially the case after the Government passed the 1968 Trade Licensing Act, which restricted business in all downtown areas of Nairobi and all the country's major towns to Kenyan citizens of African origin. In principle, it was intended to allocate trading licences in these lucrative areas to Kenya citizens of African origin only.

With the coming of independence there was a great need for qualified manpower in the public sector. To satisfy this, the public sector increased its relative wages dramatically. Between 1963 and 1965 public sector real wages increased by 48 per cent, while they increased by merely 6 per cent in the private sector (Collier and Lal, 1986). In 1968 wages by skill were higher in the public sector than in the private sector, although private sector wages also started to increase rapidly after 1966.

Another factor, in addition to 'Africanization' which continued to be of importance for the income distribution during the early years of independence was therefore the increase in minimum wages. For the skilled African workers, the late 1960s represented a period of rapid increase in earnings. Towards the latter part of the 1960s the private employees started to regain their relative earnings position. However, this trend was reversed during the 1970s, when private real wages fell again.

The debate triggered by the policy of Africanization in academic and political circles, persisted for much of the 1960s and early 1970s. By the time this debate was winding down in the early 1970s, political concerns had shifted to inequalities between emergent African social classes; the poor versus the wealthy Africans who were considered to have been the beneficiaries of Africanization programs in job, land, and business allocations.

For example, even though the first decade after independence witnessed a marked improvement for many smallholders, there were, however, significant differences in development within the same group. Bigsten (2006) notes that there remained a hard-core group of rural poor consisting of smallholders with little land of low potential, those with inadequate access to off-farm income or urban markets and groups which were reluctant to innovate given prevailing incentives, plus landless workers with little education and most pastoralists.

An important milestone on inequality discourse at about this time emerged in the form of the report of the International Labour Organization (ILO) mission on the informal sector of the Kenyan economy. An awareness of income inequality underlay the work of the ILO Mission on Unemployment in Kenya (ILO, 1972). The mission concluded that the mass of the Kenyan population, while working were abjectly poor (the report called them the working poor) while a small minority enjoyed highly rewarding employment. It attributed this to little or no land in the rural areas, which forced people to migrate to towns where modern sector employment did not expand commensurately owing to the capital intensive nature of import-substitution production. The report traced the above relationship to the fact that at independence the colonial economy had been taken over largely intact and the economy had been structured to yield high income for the small white minority. It also pointed out that the school system, the pattern of Government spending, the fiscal and tax system, investment policy, among others, reinforced this economic structure.

According to this report therefore, the policy of Kenyanization radically changed the racial composition of the group of people at the centre of power and many of the policies, but had only limited effect on the mechanisms which maintain its dominance, the pattern of Government income and expenditure, the freedom of foreign firms to locate their offices and plants in Nairobi, and the narrow stratum

of expenditure by a high-income elite superimposed on a base of limited mass consumption.

Whereas, the debate on inequality dates back to the 1960s, its regional dimension took an important turn with the publication of the "Geographic Dimensions of Wellbeing in Kenya" (Republic of Kenya, 2003a). For the first time in the history of Kenya, comprehensive and detailed information on wellbeing, disaggregated by administrative units as well as socio economic and cognate characteristics had been assembled. The results of this report show a considerable geographic variation in the distribution of well-being among and within regions.

2.3 The Current Situation

Many people consider the wide economic and social disparities that exist among various regions as a unique and special development problem of Kenya. It is important to note that regional disparities are a universal phenomenon. The economic growth factors of resources, human skills and access to the markets are not evenly distributed among the regions of any nation and mobility of factors is quite imperfect between the regions.

Furthermore, there can be little doubt that for an economy to lift itself to higher income levels, it must first develop within itself one or several regional centres of economic strengths. Consequently, interregional inequality of growth is an inevitable concomitant and condition of growth itself. Regions differ in terms of opportunities and in terms of inequality outcomes in virtually every manner. Following on this, households within specific regions are equally different.

Comparison of household income and expenditure across provinces is reflective of this disparity. Table 2.0 shows mean monthly household income from different sources by province.

Table 2.0: Mean Monthly Household Income (Ksh) by Source across Regions, 1998/99

Region	Source of Income			Total
	Paid Employees	Own business	Other	
Nairobi	13,232	4,166	1,804	19,202
Central	2,023	1,574	1,866	5,308
Coast	3,689	2,453	2,256	8,398
Eastern	2,695	1,104	2,917	6,713
N/Eastern (Urban)	6,216	778	3,141	10,135
Nyanza	1,513	1,332	2,076	4,920
Rift Valley	2,731	1,835	2,164	6,607
Western	1,825	1,069	1,958	4,852

Source: Republic of Kenya (2003b)

The table shows that households residing in Nairobi, urban North Eastern and Coast provinces had comparatively higher mean incomes mainly due to their large urban populations. Mean incomes for households in Western and Nyanza Provinces are shown to be the lowest compared to households in other Provinces. These regional differences in income earning opportunities are

indicative in many ways because employment whether wage or self, is a major source of income and by extension, an important factor in distributional discourse.

The distribution of employed people across regions in Kenya varies considerably. Some regions contribute more to the total national workforce than others. A spatial distribution of those aged 15-64 years who were employed by 1998/99 is presented in Table 2.1.

Table 2.1: Spatial Distribution of Employed Persons Aged 15-64, 1998/99

Region	Male	Female	Total
Nairobi	592,794	323,222	916,016
Central	812,832	877,976	1,690,808
Coast	490,265	303,894	794,159
Eastern	954,194	1,021,531	1,975,725
N.Eastern(urban)	118,616	92,859	211,475
Nyanza	776,666	884,166	1,660,832
Rift Valley	1,264,535	1,101,573	2,366,108
Western	463,907	446,581	910,488
Total	5,473,809	5,051,802	10,525,611

Source: Republic of Kenya (2003b)

The table shows obvious disparities across regions, with Rift Valley showing the highest levels of employment followed by Eastern. With the exception of North Eastern Province (whose coverage is restricted to urban areas), the lowest levels of employment were registered in Western and Coast Provinces. Distribution is also skewed with respect to gender. Central, Eastern and Nyanza, have a higher

proportion of females than males, in employment as opposed to the rest of the provinces.

The Labour Force Survey (LFS) report of 1998/99 indicates that of the totals given in Table 2.1, rural areas absorbed 70.1% of the employed persons where majority were engaged in farm activities as self-employed and unpaid family workers. This raises the question of land distribution across regions as a significant income generating opportunity. Kenya is predominantly an agrarian economy. The quality of land and the form of land ownership are therefore very critical considerations for the general well-being of the populace. Table 2.2 details the categories of agricultural land distribution by regions.

Table 2.2: Categories of Agricultural Land by Region ('000 hectares)

Region	High Potential	Medium Potential	Low Potential	Others	Total
Central	909	15	41	353	1,318
Coast	373	796	5,663	1,472	8,304
Eastern	503	2,189	11,453	1,431	15,576
Nairobi	16	-	38	14	68
N. Eastern	-	-	12,690	-	12,690
Nyanza	1,218	34	-	-	1,252
Rift Valley	3,025	123	12,220	1,515	16,883
Western	741	-	-	82	823
Total	6785	3157	42,105	4,867	56,914

Source: Republic of Kenya (2005)

The table shows highly skewed distribution of land by categories. It is evident that Rift Valley has the largest share of the total high potential land, followed by

Nyanza and Central respectively. North Eastern has no high potential land, while Nairobi has the smallest share followed by Coast.

The distribution of low potential land is similarly skewed. The largest share is accounted for by North Eastern, followed by Rift Valley and Eastern. Nyanza has no low potential land, but Nairobi accounts for the least share, followed by Central. The highest proportion of the total agricultural land in the country is accounted for by Rift Valley, followed by Eastern and North Eastern. Nairobi accounts for the least, followed by Western.

The above account indicates that income earning opportunities are unevenly distributed across the various regions of the country. How then are the inequality outcomes distributed across regions? To answer this question, we examine the spatial distribution of infrastructure, in particular, roads, water and electricity.

Infrastructure is identified in economic literature as being significantly important in increasing the well being of a region for the simple reason that access to clean drinking water is a serious health concern and is associated with low life expectancy. Good roads and reliable electricity are important not only in production and distribution of goods and services but also in the sense that they are final use facilities.

Table 2.3 shows the spatial distribution of infrastructure in Kenya. As is expected, the distribution of good water and electricity is not even across regions in Kenya. This raises the question of the extent to which they affect wellbeing levels in the respective regions. The table shows that the distance to water sources was shortest in Nairobi, Urban North Eastern and Coast. Nyanza (22.5%), Western (37.8%) and Eastern (40.7%) Provinces had the highest proportion of households travelling long distances to fetch water.

Table 2.3: Spatial Distribution of Infrastructural Facilities

Region	Roads (Total length of roads in Kms)	Water (% of households within 50 meters of water)	Electricity (% of households with electricity)
Nairobi	2,234	90.2	71.4
Central	26,542	46.4	19.2
Coast	21,496	51.6	19.3
Eastern	38,441	40.7	6.9
North Eastern	13,096	85.1	3.2
Nyanza	22,849	22.5	5.1
Rift Valley	61,484	45.9	10.5
Western	11,832	37.8	1.6
National	197,974	46.2	16

Source: Republic of Kenya (2003b, 2004a)

The table further shows that only 16% of Kenyan households have access to electric power. Wide regional variations in the supply of electricity are evident with Nairobi Province registering the highest proportion of households (71%) connected to electricity and Western Province the lowest (1.5%). This underlying skewed distribution is also witnessed in the health and educational outcomes across the various regions in Kenya.

To deepen our understanding of the apparent skewed distribution of opportunities and outcomes across the regions in Kenya, we used raw un-weighted data from the Labour Force Survey (LFS) report of 1998/99 (Republic of Kenya, 2003b), to generate Gini coefficients for household incomes in Kenya

by geographical regions. Household income covered all receipts that accrued to the household or its individual members. It is the sum of primary income (consisting of income from paid and self employment); property income (consisting of imputed rents of owner-occupied dwellings, interest received and paid, dividends received, and net rents and royalties received for the use of the buildings, land, copyrights and patents); current transfers (consisting of social security benefits, pensions and life insurance annuity benefits, alimonies etc); and other benefits received by all the members of the household (Republic of Kenya, 2003b). The results are shown in Table 2.4.

From the table, pronounced income inequality is evident in the rural areas as compared to the urban areas for all the regions except coast province where inequality is more pronounced in the urban areas. In the rural Kenya, Rift valley and Western show the highest inequality figures of 0.5592 and 0.5538 respectively, while the lowest is in Coast at 0.4452.

Table 2.4: Gini Coefficients by Geographical Regions, 1998/99

Region	Rural	Urban	Total
Nairobi	-----	0.5628	0.5628
Central	0.501	0.4408	0.5008
Coast	0.4452	0.501	0.4936
Eastern	0.5372	0.5156	0.5524
North Eastern	-----	0.3892	0.3892
Nyanza	0.532	0.4808	0.5482
Rift Valley	0.5592	0.4922	0.5604
Western	0.5538	0.4872	0.5704
Kenya	0.5358	0.5218	0.5536

Source: Own Computations (see appendix A2 for computational details)

Looking at the urban areas, Nairobi and Eastern are shown to have the highest levels of inequality, posting 0.5628 and 0.5156 respectively, while the lowest level is seen in North Eastern and Central at 0.3892 and 0.4408 respectively. Overall, the rural areas show a high level of inequality, at 0.5358 compared to urban areas at 0.5218. This is an indication that rural areas contribute more to overall inequality in the country. Overall, regions with large sections of rural populations are therefore bound to have higher inequality levels than those with more urban populace.

A computation of income shares of different ordinal groups divided by urban and rural criteria complements the above findings as illustrated by Tables 2.5 and 2.6. The tables show that if the total income is divided into urban and rural incomes, it ranges from Ksh 200-2400 on the lower limit to Ksh 24600-270000 on the upper limit for urban areas. In the rural areas it ranges from Ksh 40-700 on the lower limit to Ksh 11000-210000 on the upper limit. On the average therefore, the rural incomes are a lot lower than the urban incomes at both the lower and upper limit entries.

From Table 2.5, it is evident that 43.5 % of the total urban income is earned by the top 10% of the population while only 1.2 % of the total income is earned by the bottom 10%. On its own, this shows existence of high level of income inequality in the urban areas.

Table 2.5: Percentage and Cumulative Shares for Urban Incomes, 1998/99

Deciles	Income levels (Ksh)	% shares	Cumulative % shares
1	200-2400	1.2	1.2
2	2401-3500	2.4	3.6
3	3500-4500	3.2	6.8
4	4500-5800	4.1	10.9
5	5800-7000	5.2	16.1
6	7000-8800	6.4	22.5
7	8800-11000	7.9	30.4
8	11000-15377	10.7	41.1
9	15400-24500	15.4	56.5
10	24600-270000	43.5	100

Source: Own Computations (see appendix A3 for computational details)

Table 2.6 shows that in the rural areas, 42.2% of the total income is earned by the top 10%, while the bottom 10% of the population earns 0.8% of the total income. On average therefore, contrary to popular expectations, income distribution is more uneven in the rural than in the urban areas of Kenya.

Table 2.6: Percentage and Cumulative Shares for Rural Incomes, 1998/99

Deciles	Income levels (Ksh)	% shares	Cumulative % shares
1	40-700	0.8	0.8
2	700-1200	1.8	2.6
3	1200-1800	2.8	5.4
4	1800-2380	3.9	9.3
5	2400-3000	5.2	14.5
6	3000-4000	6.6	21.1
7	4000-5000	8.5	29.6
8	5000-7000	11.4	41
9	7000-11000	16.8	57.8
10	11000-210000	42.2	100

Source: Own Computations (see appendix A3 for computational details)

From the foregoing, it is clear that the underlying distribution of income is highly skewed in favour of certain regions and groups in the Kenyan society. What is not definite is the welfare effect of this sort of distribution. The effects of particular patterns of income distribution on welfare are examined in detail in chapter 7.

CHAPTER THREE

3.0 MEASURING INCOME INEQUALITY

3.1 Theoretical Literature on Income Distribution

The major conceptual work in the measurement of wellbeing using income method is attributable to the works of Kuznets (1941), Gilbert (1951) and Jaszi (1958, 1956). These studies identify two sources of wellbeing. First, that wellbeing is a consequence of the intrinsic benefits from all activities, engaged in by individuals. This is to say that people have preferences over the way they spend their time, and therefore employment is an important source of wellbeing.

Second, that people derive utility from their states in society (Juster et al, 1981), and that these satisfactions are independent of the way in which they use their time. When allocated to market activities, human time represents an input into the production of goods and services. It can also be allocated to among others, non-market production like cooking, cleaning, childcare (Becker, 1981). Time can also be allocated to leisure activities and to biological maintenance functions, such as sleeping and eating (Aigner and Heins, 1967).

The outputs associated with these inputs of time are various, and define welfare in its broadest sense. These outputs include command over market goods and services, non-market outputs, like orderly houses, and well-behaved children, improved health status, longevity, security, skills and stocks of information. The stock of wealth inherited from the past together with the outputs associated with time input, define the substantive link between income and welfare. A positive bequest of income is a source of utility, as are returns to input time, for they both enhance welfare in its various dimensions.

If income facilitates the enjoyment of life, then its distribution must have obvious implications for welfare. If income is equally distributed, then command over goods and services is spread over many more households than if it is unequally distributed. This equality in income itself enhances the welfare of all households and that of regions. In addition, it raises aggregate demand, which acts to further reinforce the enjoyment of life. From a normative perspective, society is therefore better off, with an equally distributed income.

Several theoretical perspectives have informed income distribution discourse over the years, in conformity with leading political and economic philosophies. In justifying resource distribution under a developed market-friendly democratic capitalist state, Rawls (1971), argues that human beings in any society ought to have the same initial expectations of 'basic goods', the bundle of material goods necessary to sustain a decent life.

To this end, he proposed the 'difference principle' as a conceptual tool for analyzing the distribution of income and wealth. This principle states that income inequalities that favour the most economically privileged sections of society are justified only as long as they serve to raise the material conditions of the poorest members of the community in absolute, not relative terms. An entrepreneurial millionaire's additional fortune would therefore be acceptable as long as its acquisition served to advance the economic conditions of the poorest sections of his community, through say, availability of high quality jobs.

In a cognate but differently formulated 'quality of resources principle', Dworkin (2000), contends that economic inequalities are acceptable only to the extent that they are based on individual initiative, rather than circumstances beyond one's control, like heritage, physical handicap, and environmental adversities. The contention here being that people's states in society should be determined by the choices and decisions they make in life, rather than their circumstances.

Sen (1997), in his capabilities approach, defends the belief that the state has the obligation to provide the basic goods, services and skills to all citizens. These goods include literacy, education, health, basic nutrition, income, opportunities, individual liberties, and the social basis of self-respect.

From a libertarian standpoint, Nozick (1974) argues that distributive justice derives from individual liberty and free markets, rather than from government policies and rearrangement of social rights. Governments should therefore, according to this view, mainly exist to keep law and order as any intervention beyond that would constitute an infringement of people's natural rights. This perspective justifies state intervention only on condition that there is war or domestic political instability.

3.2 Empirical Literature

Empirical research on income distribution has generally been largely concerned with its measurement issues. Whereas most of the studies achieve this by identifying and then measuring a particular feature of income distribution, others simply approximate the entire income distribution by one or the other of the various functional forms.

Traditionally, one of the most important features of the distribution of income is the degree of income inequalities. In this section, we examine some of the major measures of income inequality and welfare that have been developed and discussed in economic literature. Measures of inequality fall into two classes, namely, positive measures, which make no explicit use of any concept of social welfare, and normative measures, which are based on a social welfare function that makes explicit the loss incurred from unequal distribution of income.

A good measure of income inequality, whether positive or normative, should ideally satisfy the following criteria;

Mean Independence. This says that if all incomes are doubled, the measure should not change.

Population Size Independence. If the population were to change, a good measure of inequality should not change, and vice-versa.

Symmetry. This implies that if two people were to swap incomes, there should be no change in the measure of inequality.

Pigou-Dalton Transfer Sensitivity. This is a basic principle for inequality comparisons. It states that a positive transfer of income from a richer to a poorer individual, other things remaining the same, including the relative rank in the distribution, decreases the extent of income inequality.

Decomposability. This means that a good measure is one that permits inequality to be broken down by population sub-groups or income sources, or by any other appropriate dimension.

Statistical Testability. One should be able to test for the significance of changes in the measure of inequality over time.

3.2.1 Positive Measures

The range. Assuming distributions of income over n persons, $i = 1, \dots, n$, and letting y_i be the income of person i , and further assuming the average level of income is μ , it is clear that

$$\sum_{i=1}^n y_i = n\mu$$

If the relative share of income going to person i is x_i , we find that income of person y_i is

$$y_i = n\mu x_i$$

This inequality measure is based on a comparison of extreme values of the income distribution, i.e., the highest and the lowest income levels. The income range E , can then be defined as the gap between these two levels, normalized by mean income, and may be expressed as (see Sen, 1997);

$$E = \frac{(\text{Max}, y_i - \text{Min}, y_i)}{\mu}$$

The normalization of the income range, E , by mean income, μ , facilitates comparisons of E s computed from income distributions of different means. If income is divided absolutely equally, then $E = 0$. At the other extreme, if one person receives all the income then $E = n$, since as already shown, maximum income = $n\mu$. The weakness of the range is that it ignores the distribution between the extremes. Besides, it is not based on each and every item of the distribution and it is subject to fluctuations of considerable magnitude from sample to sample.

The relative mean deviation. One way of looking at the entire income distribution, and not merely the extreme values is to compare the income level of each person with the mean income, to sum the absolute values of all the differences and then to look at the sum as a proportion of total income (Sen, 1997). This yields the relative mean deviation, M .

$$M = \frac{\sum_{i=1}^n |\mu - y_i|}{n\mu}$$

With perfect equality, $M = 0$ and with all income going to one person only,

$$M = \frac{2(n-1)}{n}$$

Unlike E , M takes note of the entire income distribution. The main trouble with M is that it is not sensitive to transfer from a poorer person to a richer person as long as both lie on the same side of the mean income.

The Variance and the Coefficient of Variation. Instead of adding the absolute values as in the relative mean deviation, these values can be squared and then added (Shorrocks, 1980 and Murray, 1981). This procedure has the effect of accentuating differences further away from the mean, so that a transfer would reduce inequality. The variance has this property and is expressed as

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

However, the variance depends on the mean income level, and one distribution may show much greater relative variation than another and still end up having a lower variance if the mean income level around which the variation takes place is smaller than the other distribution. A measure that does not have this deficiency and which concentrates on relative variation is the coefficient of variation, which is the square root of the variance divided by the mean income level (Sen, 1997), and may be expressed as;

$$C = \frac{V^{1/2}}{\mu}$$

However, C does have the characteristic of attaching equal weights to transfers of income at different income levels, i.e., the impact of small transfer from a person with income y to one with income $(y - d)$ is the same, irrespective of the value of y . According to Bourguignon (1979), C is a measure of inequality that is aggregative without being decomposable.

The Standard Deviation of Logarithms. If one wishes to attach greater importance to income transfers at the lower end, a reasonable way of going about it is to take some transformation of income that staggers the income levels. In Sen's words, the logarithm recommends itself (Sen, 1997). The logarithm, in contrast to taking the variance or the standard deviation of actual values, eliminates the arbitrariness of the units and therefore of absolute levels.

This is so because a change of units, which takes the form of a multiplication of the absolute values, comes out in the logarithmic form as an addition of a constant, which cancels out when pair-wise differences are taken. In this case, the deviation is taken from the geometric mean rather than from the arithmetic mean (Sen, 1997). In the income distribution literature, the arithmetic mean, μ , is commonly used to construct a dispersion measure (Atkinson, 1970a; Stark, 1972), and is expressed as

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

The fact that a logarithmic transformation staggers the income levels tends to soften the blow reflecting inequality since it reduces the deviation. However, it has the property of highlighting differences at the lower end of the scale as noted earlier on.

Variance of the Natural Logarithm. This is a popular measure of relative earnings dispersion, because earnings distributions are approximately lognormal and the lognormal distribution has particular properties conducive for analysis. The measure (Sen, 1997), is written as

$$Var \ln Y = \frac{\sum_{i=1}^n (\ln y_i - \ln \bar{y})^2}{n}$$

Where $\ln y_i$ is the natural logarithm of person i 's annual earnings, $\ln \bar{y}$ is the mean of annual earnings of individuals, and n is the number of persons with earnings. This measure does not always satisfy Pigou-Dalton's principle of transfers, that when income is transferred from a highly paid worker, to a less highly paid worker, earnings inequality should be reduced. However, in some instances, this measure can produce the opposite finding. In addition, this measure is particularly sensitive to changes in earnings level in the lower end of the distribution.

Bourguignon's L Measure. This, according to Bourguignon (1979), is the only (population weighted) inequality measure that is additively decomposable (Theil, 1965), differentiable, symmetric and homogeneous of degree zero in income, and satisfies the Pigou-Dalton principle. This measure therefore has several desirable properties, besides being computationally convenient (Rati, 1992). This measure is expressed as;

$$L = \sum_{i=1}^n P_i \log P_i - \log y_i$$

Where, P_i and y_i are respectively, the shares of region i in the total population and total personal income.

Theil's Entropy Measure. Proposed by Theil (1965), this measure derives from the notion of entropy (the expected information content of a situation) in information theory. According to this measure, when x is the probability that a certain event will occur, the information content, $h(x)$, of noticing that the event has in fact occurred, must be a decreasing function of x (Shorrocks, 1980; Padmaja et al, 1992). That is, the more unlikely an event the more interesting it is to know that that thing has really happened. One formula that satisfies this property, among others, is the logarithm of the reciprocal of x which can be expressed as;

$$h(x) = \log\left(\frac{1}{x}\right)$$

In the above case, if we are now given n possible events, $1...n$, we can then take the respective probabilities x_1, \dots, x_n such that $x_i \geq 0$ and

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

The entropy index can be viewed as the sum of the information content of each event weighted by the respective probabilities, and can be expressed as

$$H(x) = \sum_{i=1}^n x_i h(x_i)$$

$$H(x) = \sum_{i=1}^n x_i \log\left(\frac{1}{x_i}\right)$$

The closer the n probabilities x_i are to $(\frac{1}{n})$, the greater is the entropy i.e., when each x_i equals $(\frac{1}{n})$, $H(x)$ attains its maximum value of $\log n$. If we subtract the entropy $H(x)$ of an income distribution from its maximum value of $\log n$, we get an index of inequality which is Theil's measure of inequality, expressed as,

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

Theil's entropy measure satisfies the Pigou–Dalton condition (Farhad, 1976; Sala-i-Martin, 2002). In addition, Theil's measure can be aggregated in a simple manner over groups. Its primary advantage in the analysis of inequality is its property of decomposition (Arrighi et al, 2002; Sala-i-Martin, 2002), which enables overall inequality to be decomposed into 'between' and 'within' groups inequalities in income distribution.

According to Bourguignon (1979), this measure is differentiable, symmetric and homogeneous of degree zero in all incomes. However, it is an arbitrary formula and the average of the logarithms of the reciprocals of income shares weighted by income shares does not make much intuitive sense. In addition, it is most sensitive to income movements within the middle of the distribution.

Besides, it suffers, like the Gini, the problem of Lorenz dominance. Given two income distributions, X and Y , if the Lorenz curve for distribution X lies somewhere above and never below the Lorenz curve for distribution Y , then X is said to Lorenz-dominate Y , in which case X has a more equal distribution than Y (Fields, 2000).

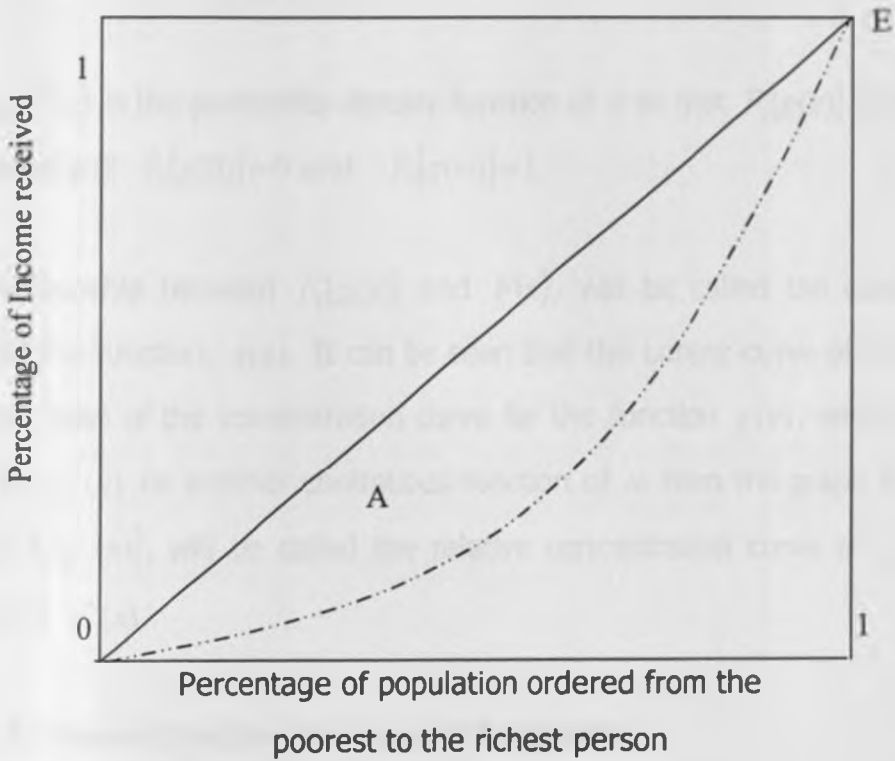
The Gini Coefficient and the Relative Mean Difference. A measure that has been widely used to represent the extent of inequality is the Gini coefficient attributed to Gini (1912) and much analysed by Dalton (1920), and later, by Yntema (1938), Atkinson (1970a), Newbery (1970), Sheshinski (1972), Dasgupta et al

(1973), Podder et al (1976), Pyatt (1976), Gastwirth (1977), Murray (1981), Bourguignon and Morrison (2002), Sala-i-Martin (2002), Government of Kenya (2004) and Noorbakhsh (2005). One way of viewing it is in terms of the Lorenz curve, whereby the percentages of the population arranged from the poorest to the richest are represented on the horizontal axis and the percentage of income enjoyed by the bottom x-percentage of the population is shown on the vertical axis.

The Lorenz curve relates the cumulative proportion of income units to the cumulative proportion of income received when units are arranged in ascending order of their income shares. In the past, the curve has been used mainly as a convenient graphical device to represent the size distribution of income and wealth. The generalized Lorenz curves are called concentration curves and the Lorenz curve is only a special case of such curves, namely, the concentration curve for income.

A hypothetical Lorenz curve is illustrated in Figure 3.0. The dashed curve OE is the Lorenz curve. The area between the 45° line and the Lorenz curve is the area of concentration. The Gini ratio, G , is the ratio of the area of concentration to the area of the Lorenz triangle, OE1.

Figure 3.0: Lorenz Curve



The concentration curves. Let x be the income and $F(x)$ its cumulative distribution function which represents the population of income units having income less than or equal to x . If it is assumed that the mean, μ , of the distribution exists, then the first moment distribution function $F_1(x)$ is defined and it represents the proportion of total income earned by income units having income less than or equal to x .

The Lorenz curve is the relationship between $F(x)$ and $F_1(x)$. The most widely used measure of income inequality, the Gini index, is equal to one minus twice the area under the Lorenz curve. Let $g(x)$ be a continuous function of x such that its first derivative exists and $g(x) \geq 0$. If the mean $E[g(x)]$ exists, then one can define

$$F_1[g(x)] = \frac{1}{E[g(x)]} \int_0^x g(x) f(x) dx$$

Where, $F(x)$ is the probability density function of x so that $F_1[g(x)]$ is monotonic increasing and $F_1[g(0)] = 0$ and $F_1[g(\infty)] = 1$

The relationship between $F_1[g(x)]$ and $F(x)$, will be called the concentration curve of the function, $g(x)$. It can be seen that the Lorenz curve of income x is a special case of the concentration curve for the function $g(x)$, when $g(x) = x$. If we let $g^*(x)$ be another continuous function of x ; then the graph of $F_1[g(x)]$ versus $F_1[g^*(x)]$, will be called the relative concentration curve of $g(x)$, with respect to $g^*(x)$.

3.2.2 Preferred Positive Measure of Inequality

In this study, we choose the Gini index as the measure of inequality (distribution) because it is widely reported in official sources that are based on primary data. Besides, past studies that investigated several inequality measures (Anand and Kanbur, 1993), found results to be similar for different measures of inequality. The Gini coefficient meets the Pigou-Dalton condition. A linear inequality measure satisfies this principle if and only if its score function is strictly increasing.

One disadvantage of an aggregate measure such as the Gini index is that there is no unique mapping between changes in the index and the underlying income distribution, so that redistribution from the top to the middle class may be associated with the same change in the aggregate indicator as an increase in the share of income received by the bottom quintile at the expense of the middle class. In addition, the Gini index does not satisfy the diminishing principle, which

states that inequality among the rich is less important than inequality among the poor (Sen, 1997, Bourguignon, 1979).

The Gini is more sensitive to changes in the middle of the earnings distribution rather than the tails. This is because it is derived from the Lorenz curve, which expresses the relationship between the cumulated percentage of aggregate earnings, and cumulated percentage of earners. An increase or decrease in earnings in the middle of the distribution will have a greater impact on the measure, than a similar change at either end, since there are more earners in the middle ranks. If the Gini is derived from distributions with intersecting Lorenz curves, meaningful comparisons of the indices become problematic. This is referred to as the Lorenz dominance (Braun, 1988).

3.2.3 Normative Measures

Dalton's Measure. This is a utilitarian measure that is based on a comparison between actual levels of aggregate utility and the level of total utility that would obtain if income were equally divided (Sen, 1997). Dalton took the ratio of actual social welfare to the maximal social welfare as his measure of inequality. Taking the utility levels to be all positive, the measure is expressed as

$$D = \frac{\left[\sum_{i=1}^n U(y_i) \right]}{nU(\mu)}$$

Dalton's measure is decomposable. However, it is not income-homogeneous (Bourguignon, 1979). In addition, this measure suffers from the difficulty that it is not invariant with respect to positive linear transformations of the utility function (Atkinson, 1970a). Cardinal utility implies that any positive linear

transformation would do just as well. Besides, Dalton's measure takes arbitrary values depending on which particular transformation is chosen.

Atkinson's Measure. Atkinson (1970), defines what he calls "the equally distributed equivalent income" of a given distribution of a total income. This, he defines as that level of per capita income which if enjoyed by everybody, would make total welfare exactly equal to the total welfare generated by the actual income distribution. Putting y_e as the "equally distributed equivalent income", we see that

$$y_e = \left[\sum_{i=1}^n U(y_i) y_i^{1-e} \right]^{1/(1-e)}$$

Where y_i is the proportion of total income earned by the i th group, and e is an inequality aversion parameter. The parameter reflects the strength of society's preference for equality and can take values ranging from zero to infinity. When $e > 0$, there is a social preference for equality (or an aversion to inequality).

The sum of the actual welfare levels of all equals the welfare sum that would emerge if everyone had y_e income. Since each $U(y)$ is taken to be concave i.e., with non-increasing marginal utility, y_e cannot be larger than the mean income μ and the more equal the distribution the closer will y_e be to μ . Atkinson's measure of inequality is

$$A = 1 - \left(\frac{y_e}{\mu} \right)$$

So that if income is equally distributed, then y_e is equal to μ and the value of Atkinson's measure will be 0. For any distribution, the value of A must lie

between 0 and 1. The Atkinson's measure was developed to overcome the problem of Lorenz dominance.

The measure allows one to shift the 'weight' given to the middle ranks of the distribution to either the lower or upper ends of the distribution. As e rises, society attaches more weight to income transfers at the lower end of the distribution and less weight to transfers at the top. There are some difficulties with Atkinson's measure though. First, Atkinson requires that the function $U(y)$ be concave but not necessarily strictly concave, i.e. $U' > 0$ and $U'' \leq 0$. To see the implication of this measure, consider two distributions between two persons with a given total amount of income, say (0,10) and (5,5). If we chose a $U(y)$ function such that it is proportional to y , both will have precisely the same Atkinson measure of inequality. Yet we cannot describe the two as being equally unequal.

The second problem concerns the use of the utilitarian framework whereby the values of U of each person are simply added to arrive at the aggregate social welfare. If, instead of that, social welfare were taken to be a strictly concave function of individual utilities, then these two distributions would not have had the same measure of inequality and indeed (0,10) would have been more unequal than (5,5).

Sen's Alternative Measure. To illustrate this measure, attributed to Sen (1997), assume a social welfare function, W , to be an increasing function of individual income levels, so that

$$W = W(y_1, \dots, y_n)$$

A more general normative measure of inequality is the following. Define y_f (the generalized equally distributed equivalent income) as that level of per capita income, which if shared by all would produce the same W as the value of W generated by the actual distribution of income.

Assuming W to be symmetric and quasi-concave, y_f would be less than or equal to μ for every distribution of income. In this more general form, W need not even be a function of individual utilities, i.e., it need not even be individualistic. With equation (1) being the assumed social welfare function, the measure of inequality that we can use with this more general approach will now be given by

$$N = 1 - \left(\frac{y_f}{\mu} \right)$$

This means that Atkinson's and Sen's general measures will be completely equivalent if the welfare function to be used is of the utilitarian form:

$$W = \sum_{i=1}^n U(y_i)$$

3.3 Studies on Income Inequality

Numerous studies have been conducted in the world to determine the extent of income inequality, and to assess the effects of various components of income on overall inequality. Even though literature relating to Kenya is sparse and far between in this area, internationally there is a vast amount of work spanning several years; we review some of it below.

Using a micro-data set for the US, Canada, Australia, West Germany and Sweden to carry out a cross-national comparison of earnings inequality, Green et al

(1992), applied several measures of inequality including variance of the natural logarithm of annual earnings, the Gini index or coefficient of income concentration, Theil's entropy index and three of Atkinson's measures. The results showed that irrespective of the measure used, the US distribution of earnings was the most unequal followed by Canada's, with Sweden's being the most equal.

Slottje et al (1992) carried out an analysis of the level of income inequality across states in the US in 1970 and 1980 for several demographic groups. In addition, they examined the impact of labour force participation, education and other variables on inequality. The study employed Gini index to measure inequality. The Results indicated that for the whole population, states with high labour force participation by females had low inequality, the same held true for states with high labour force participation for men. When disaggregated by race, the results showed consistency for whites but not for blacks. States with relatively high education levels appeared to be associated with high inequality levels for the white cohort and the whole population, but there appears to be no similar association between education and inequality across states for blacks.

Rati (1992) used Bourguignon's L measure of inequality to model the path of interstate inequality in the United States. He explored the sensitivity of the inequality measure to adjustments for price level (cost of living) variation across states. Two other characteristics of interstate inequality are discussed. First, he decomposes the inequality changes over each decade into the components due to changes in income and population. Second, he identifies states that have contributed most to inequality in selected years. Results of this study show that income changes account for most of the inequality change in each decade.

Padmaja and Parikh (1992), using Theil's L and T measures, and Atkinson's index A, did undertake a decomposition analysis of household consumer expenditure

inequalities in India by regions (states) and sectors (urban-rural) for the years 1977-78 and 1983, based on the national sample survey data. Their results consistently indicated that the inequality within states contributes much more towards national inequality, and that within-sector inequality explains a large part of state level inequality.

There have been many studies of inequality in the literature using the technique of decomposition by population sub-groups. Bhattacharya and Mahalanobis (1967) decomposed the Gini coefficient and the standard deviation of logarithms for the year 1957-58 based on household consumer expenditure survey data of India. Their findings were that one quarter of the total inequality was explained by the within-state inequality. Similar studies have been done in other countries. Pyatt (1976) decomposed the Gini-coefficient for regions in Philippines and Sri Lanka respectively. Glewwe (1986), and Fields and Schultz (1980), have used decomposition analysis for studying inequality in Sri Lanka and Colombia respectively.

All these studies have agreed more or less on the lack of importance of regional effects in the total inequality of a country even with much pronounced inter-regional income disparities. Mukherjee and Shorrocks (1982), found a broadly consistent pattern across a number of indices used for studying the trends in the UK inequality.

Using a nonparametric technique based on the Kolmogorov- Smirnov test, Alexeev and Gaddy (1993) fitted Soviet data to a lognormal distribution in an attempt to derive inequality measures for income distributions in the USSR overtime and across republics. The study employed the Gini coefficient and Atkinson's measure on grouped data. The results of this study suggest that even though inequality declined throughout the 1980's in the Soviet Union, income inequality was greater in the poorer southern republics than in the north.

Podder (1993) derives a formula of the elasticity of the Gini coefficient with respect to specific income components. The formula is then applied to Australian household expenditure survey data to determine the effects of various components of income on overall income inequality. Results indicate that wages and salary contributes most to inequality. The second most important component in this regard is the income from own business and self-employment. Income from interest is found to have no effect on total inequality but income from investment and property rent are found to have a positive effect on inequality. It is seen from these results, that all types of government benefits reduce total inequality. Of these, the old age pension and unemployment benefits are found to be the most significant.

Smeeding et al (1993), using the Luxemburg Income Study data base, carried out a study to assess the impact of a non-cash income on living standards, income distribution and poverty across Germany, Australia, Switzerland, UK, Canada and Sweden at the beginning of the 1980s. Results of the study confirmed that non-cash benefits from education and health are equalizing, increasing the income share at the bottom and decreasing it at the top. The rank order of nations in terms of the income shares of the lowest quintile remained unaffected by the addition of health and education benefits. In all countries, the bottom quintile did better with non-cash benefits included. Effects on the top quintile were found to be generally small.

Mirer (1973) developed a micro analytical simulation model to examine the effects of micro economic fluctuations on the distribution of income. A representative sample of the population of the United States was then linked with equations determining the variability of various types of factor incomes. Each family income expense was then simulated under alternative aggregate conditions, and the income distribution arising under these conditions compared. Results showed that the incidence of a downturn in economic activity, whether

accompanied by changes in the rate of inflation or not and measured in terms of the loss of factor income, leaves the upper middle class relatively better off than before and leaves most others relatively worse off. The very rich, it emerges, bear the heaviest burden.

Michal (1973) undertook a study to measure the inequality (relative dispersion) of earnings and household incomes in three European socialist countries (Czechoslovakia, Hungary and Yugoslavia) in selected years in the 1950's and 1960's on the basis of available official distributional statistics. The former two, were centrally planned while the latter was a socialist market economy with substantial labour management. Two measures of inequality, the Gini coefficient of concentration and a set of ratios of income at selected percentiles to the median were used in this study.

It was observed from the results that inequality was less in small capitalist countries, despite the reversal of the socialist egalitarian trends in the sixties. The main factors of equalization of socialist earnings were found to be small inter occupational and interregional differentials, and a very flat age profile. With very narrowly dispersed short-term earnings, lifetime earnings were found to be rather unequally distributed, because of the variation of earning years among occupations. With largely equalized primary incomes per capita, household incomes tended to be more unequally distributed in spite of massive transfers, because of the varying ratio of earners to dependants within households. The need for income differentials as incentive to work, the probable trade off between income equality and economic growth, and socialist distribution principle are underscored in this study.

In an analysis of recent changes in income inequality, Kanbur and Lustig (1990), looked at comparative inequality data for 68 countries from across the world. Results show that while rising inequality is by no means the norm, there have

been very sharp upward movements in a number of countries. In eleven of the countries sampled, the gini coefficient has increased between five and nine percentage points; in seven countries, between ten and nineteen percentage points and in two countries, by more than twenty percentage points. These changes occurred in a span of a decade or less. The results further show that even though all of the very large increases occurred in transition economies, upward movements were witnessed in countries with very different structural characteristics. Inequality has risen in countries that were traditionally more egalitarian (for example Thailand), or very unequal, such as Mexico; in advanced nations like the US and UK; in poor countries like Panama and Ethiopia, and in long-standing market economies like Hong-Kong, or countries in transition like China and Russia.

This analysis also establishes the fact that there is no systematic relationship between the evolution of inequality and growth performance. That output growth was positive in 16 of the 37 countries, where inequality increased and in 9 of the 14 countries where inequality declined.

In a study to estimate the distribution of income for the G20 countries for every year for the period 1970-1998, Sala-i-Martin and Mohapatra (2002), reached the following conclusions. That income inequality as measured by the Gini coefficient, declined by around 8% in the period under study. The across-country Gini, which assumes that all individuals in a country, have the same per capita income, follows a very similar pattern to the overall Gini, though the decline in the across country Gini is distinctly larger during the 1990s.

Using three other "non-decomposable" measures of income inequality, the following is observed. The variance of logarithmic incomes (or Varlog) in the G20, shows a small increase during the 1970s, but decreases substantially in the next two decades, by over 22%. A similar, but more marked downward trend is

observed for the across- country component in 1980s and 1990s. Two Atkinson indices, A (0.5) and A (1) also confirm the declines in overall dispersion and across-country dispersion of individual incomes during the period under study. The G20 global inequality measures therefore demonstrate that large gains have been made in reducing income disparities across people in the G20 group of countries.

In a study of the evolution of the world size distribution of income for the period 1820-1990, Bourguignon and Morrison (1999), estimated the distribution of income on the basis of the real GDP per capita, population and the distribution of income summarised by vintile income shares. Results of this study show that; first, world income inequalities have truly exploded since the early 19th century. The Gini coefficient has increased by 30% and the Theil index has increased by 60%, between 1820 and 1992. Second, the evolution is due to a dramatic increase of inequality among countries or regions of the world. The between country component of inequality as measured by the Theil index is estimated to have been 0.06 in 1820, but 0.50 in 1992.

Applying a panel data analysis across the 32 federal entities of Mexico between 1960 and 2002, Ortega-Diaz (2003), undertook an assessment of how income inequality influences growth by estimating a reduced form growth equation. Using dynamic panel data analysis, with both urban personal income for grouped data and household income from national surveys, this study found that inequality and growth are positively related. When analysing different periods, two different relationships emerge. One, a negative influence of inequality on growth in a period of low trade policies, and a positive influence in a period of more open trade, when urban personal income is considered. This relationship is reversed when monetary household income is used.

Lee and Slotsve (2001) carried out a study on the effect of changes in the world politico-economic environment, such as globalisation or changes in the world composition of political regimes, on inter-country income distribution between 1960 and 1990. Their analysis was based on a comparison between actual and counterfactual densities, which was estimated by a Kernel density method.

Using trade openness and foreign direct investment flow as a proxy for globalisation, results of this study show that there is no definite evidence that globalisation (deglobalisation) increased (decreased) inter-country inequality during that period. When openness to trade is used as an indicator of globalisation, an increasing degree of globalisation between 1960 and 1980 decreased inequality across nations. For the period between 1980–1990, both indicators were used with mixed results. When measured by trade openness, the period exhibits deglobalisation, but it did not decrease inequality across nations. When measured by foreign direct investment, the period exhibits globalisation and that globalisation increases inter-country inequality. In both cases however, the effect is so small that any definite conclusion cannot be drawn.

O'Rourke (2001) explored the historical links existing between trade, migration and capital flows (globalisation) on the one hand and inequality on the other. The study traces the evolution of globalisation during the 19th and 20th centuries, distinguishing between the different dimensions involved. It explores in greater detail the inequality experiences of the two most dramatic globalisation episodes of the late 19th and 20th centuries.

His findings indicate that the link between globalisation and within country income distribution, are ambiguous. Globalisation affects factor prices differently in different countries and that, different dimensions of globalisation (e.g. trade versus factor flows) may have different implications for factor prices in a given country. In addition, a given dimension of globalisation (e.g. capital flows) may

have ambiguous effects on factor prices in a given country depending among other things, on patterns of complementarity or substitutability between factors of production. And that a given impact on factor prices, can have different effects on inequality, depending on the distribution of endowments across individuals.

Deininger and Olinto (2001) used panel data econometric methods on assets rather than income data, applying a Generalized Method of Moments (GMM) estimator to examine the robustness of the relationship between inequality and growth. This study uses a sample of 5-year averages for 60 countries, with a total of 300 observations. Results indicate that initial asset inequality, as measured by the land distribution, has a significant growth-reducing impact.

Use of a measure of the economy's human capital stock reveals that higher levels of human capital, contribute positively to a country's growth. In addition, the interaction between asset inequality and a country's human capital stock is negative and significantly different from zero. This could possibly imply that the adverse effects of asset inequality on a country's economic growth far outweigh the favourable effects of human capital stock.

Using aggregate GDP data and within-country income shares for the period 1970-1998 to assign a level of income to each person in the world, Sala-i-Martin (2002), estimated the gaussian kernel density function for the worldwide distribution of income. He estimates global income inequality using seven different popular indices- the Gini coefficient, the variance of log-income, two of the Atkinson's indices, the mean logarithmic deviation, Theil's index and the coefficient of variation. His findings are that all indices show a reduction in global income inequality between 1980 and 1998. He also finds that most global disparities can be accounted for, by across-country, and not within country inequalities.

One may ask what it is that accounts for the difference in outcome of these studies. Several of these studies (see for instance Wood, 1998), explain the increases in inequality as stemming from the same global forces of skill-biased technological change and, for the higher income countries, of increased trade with cheap countries whose abundant factor is unskilled (cheap) labour. Atkinson (1998), argues that in addition to differences in government policies, social norms may also play an important role.

Kanbur and Lustig (1999), on the other hand, argue that the size distribution of income, is the result of a number of complex forces which sometimes move in the same direction, but sometimes countervail each other, even to the point that their effects cancel each other out. Some of these forces stem from the evolution of the distribution of endowments and their market returns. The latter in turn, are affected by trends in technology, openness and decisions affecting the rate of labour market participation and occupational choice. Other forces are related to family formation decisions, such as the choice of partner and the number of children. Yet, other forces are related to tax and transfer policy and how it affects after-tax income levels.

There are a number of other studies in the wider literature, that highlight how changes in returns, endowments and preferences may contribute to the evolution of the size distribution of income. After decomposing the observed trends in the distribution of income, Ferreira and Barros (1998), employed Theil's index in a study of Brazil. Their findings were that household per capita income inequality in urban Brazil fell from 0.88 in 1976 to 0.68 in 1996 (the Gini fell from 0.62 to 0.59 over the same period). Controlling for age and gender, results showed that, an increase in the returns to education was noted, implying that overall, the returns or price effects were found to be unequalizing.

Applying a micro-simulation decomposition methodology proposed by Bourguignon, Fournier and Gurgand (1998), the results showed that there are three main equalizing factors at work in Brazil over the same period, which, together, more than offset the unequalizing effect of increasing returns to education. First, was the change in the educational composition of the population. As the average years of schooling of Brazilians rose, from 3.8 to 5.9 over the period, the simulated effect of changes in educational endowments in both the individual earnings distribution and on that of household per capita incomes was equalizing.

The second was demographic in nature. Higher levels of schooling, particularly for women, were found to contribute to a noticeable reduction in family size, through a decline in the number of children. The average household size declined from 4.3 to 3.5 persons, and the dependency ratio also fell. This decline was more pronounced for poorer households, leading to a disproportionate relative increase in their per capita incomes, and a reduction in inequality.

The third effect was a reduction in the variance of returns to unobserved characteristics, including skills unrelated to education, regional location, race, and the firm size in which one works. This effect suggests a reduction in the degree of segmentation in the Brazilian labour market over that period, as well as possible decline in regional inequalities.

Bouillon, Legovini and Lustig (1998), in an attempt to identify factors behind the rise in inequality in Mexico, similarly applied micro-simulation decomposition methodology. Using a reduced form household income regression model for estimation, this study revealed the following. That the widening gap in the returns to education, explain close to 50% of the observed increase in inequality, while the returns to regional location, around 24%, with the south alone, accounting for 15% of the latter. That is to say, that most of the rising inequality

in Mexico should be ascribed to increasing disparities in returns to education. Endowment effects like the distribution of skills, account only for about one fourth of the increase in inequality.

A study of Taiwan by Bourguignon, Fournier and Gurgand (1998), on similar methodological lines as the above two, made no departure in terms of findings. Taiwan experienced the same trend in rising returns to education, as is the case with other countries throughout the world. This occurred despite the incredibly rapid expansion in the supply of labour with more years of education. Higher returns to education in Taiwan therefore had an unequalizing effect on the distribution of earnings.

The literature on income distribution in Kenya is heavily dominated by the work of Arne Bigsten. He has pursued inequality from a number of perspectives including inequality between the races, within regions and between the rich and the poor. The lesson to be drawn from Bigsten's wide ranging contribution to this subject is that inequalities should be addressed since inequality impacts negatively on economic growth, besides having the potential to stoke political violence in a country. Bigsten (1986), argues that economic welfare is best defined by rising average personal incomes, equality and declining poverty.

Kmietowicz and Webley (1974) carried out a statistical analysis of income distribution in the central province of Kenya. The study sought to redefine income and to compile a frequency distribution of household income for the province and its five districts. Measures of central tendency, dispersion and skewness were calculated for each income distribution. Lorenz curve analysis was also employed to compare inequality of income distribution in the province and the districts.

Results of this study showed that all the distributions were highly, positively skewed. Great differences were observed in average household incomes between districts. The variability of incomes was also found to differ considerably, between districts. The coefficient of variation was found to be larger for the three poorest districts of Fort Hall, Embu and Meru, indicating that relative variability of incomes is higher in poorer districts.

Jain (1975), Crawford and Thorbecke (1978), Jamal (1982), Anker and Knowles (1983), and Vandemoortele (1984), all attempted to measure the national aggregate inequality in Kenya. Although these studies arrived at Gini indices that varied by as much as twenty percent, probably due to data inadequacies, they helped to establish the fact that Kenya is one of the most unequal societies in Africa.

Restricting themselves to the rural sector, House and Killick (1983), pointed out the extent of poverty and income inequalities between Kenya's regions. In conclusion, they attributed both to failure in public policy; in other words, to political decisions that either discriminate or were at best indifferent to the less developed areas. Judging by the statistical differences in rewards between Kenya's regions as evidence of 'social justice' the ideal of equality embodied in this work was that of radical egalitarianism, under which everyone is entitled to equal shares of the national cake. This position had earlier been advocated by Vandemoortele and Van der Hoven (1982).

Mwangi Wa Githinji (2000), while agreeing with the findings of the earlier studies, faulted the preceding literature for adhering too closely to rural-urban dualism, pointing out that intra-rural household inequalities (particularly in assets) tend to be higher than urban ones and should be accorded priority in any poverty-reduction policy. He attributed the country's high inequality indices to the rural disparity factor, warning that a wealthy 10% of prosperous rural

producers with privileged access to input and cash crops were raking in 64% of the total non-urban income.

Society for International Development (2004) carried out a survey on the various types of inequality in Kenya. The survey, based exclusively on secondary data sources, sought to report on the various types of inequality. Findings indicated massive levels of inequality in its various dimensions and forms. It found the top 10% of the households to be controlling 42% of the total income, while the bottom 10% controlled less than 1%. The results further show that within the provinces (regions), the distribution of incomes and expenditure is skewed in favour of the higher income groups. Wide disparities between regions were also reported in terms of the socio-economic outcomes.

Using the ratio of wages in manufacturing to wages in agriculture as a measure of wage inequality, Bigsten and Durevall (2006), carried out a study to analyze the evolution of wage inequality in Kenya over the period 1964 to 2000. Results of the study indicated that changes in relative wages were primarily driven by the degree of openness, while other factors such as the capital-output ratio, educational attainment, relative labour productivity, and the ratio between agricultural and manufacturing prices had no significant effect.

3.4 Summary of Literature

It is noticeable from the review that the distribution of income is important for welfare considerations, particularly for the different classes in society, even though a number of studies pay more attention to the level of income. Several factors are identified in the literature, as being responsible for high or low inequality levels.

Labour force participation rate by sex, is an important equalizing factor, as are all types of government benefits (pension, unemployment benefits etc). Non- cash benefits from education and health are found to be equalizing, as are growth, globalization and higher or widening gap in returns to education. Whereas income from interest is found to have no effect on inequality, a number of other factors are identified as having an unequalizing effect.

High education and poverty levels, wages and salaries and income from investment and property rent, all lead to high inequality levels. A downswing in economic activity returns to regional location and endowment effects such as the distribution of skills are also identified as being unequalizing.

CHAPTER FOUR

4.0 CONVENTIONAL MEASURES OF WELFARE

4.1 Introduction

An important goal of any government is to improve the quality of life of its citizens. This calls for the establishment of a mechanism of establishing what the quality of life is and whether it has improved or not. One common approach is to use quality of life indicators, which usually include measures of some dimension of economic wellbeing. Quality of life indicators allow governments to evaluate how well they are doing compared to other countries, or relative to their own development goals. The indicators may also be used by outside observers or researchers to evaluate a country's performance. Indicators can also be used to help understand the relationships among different aspects of society.

In development literature, there exist several ways of measuring wellbeing. Common measures of wellbeing include single representative indicators such as gross domestic product per capita, life expectancy, literacy rates, or composite indices of these and many others, such as the physical quality of life index or the human development index. Some measures are objective or countable, such as GDP, GDP per capita, infant mortality rate or literacy rate. Others are subjective and focus more on individual perceptions of wellbeing or satisfaction, evaluations, and appreciation of life and living conditions. In this section, we discuss some of them, assessing their relevance to this study.

4.2 Objective Measures of Welfare

Gross Domestic Product (GDP) has for many years been used as a benchmark in the determination of temporal changes in individuals' and countries' wellbeing.

Changes in real per capita GDP are generally accompanied by broadly similar rates of change in per capita consumption (Bleys, 2005), so that making the link between changes in GDP and changes in the standard of living is appropriate. This link was established way back in the 1920s in Pigou's treatise entitled "The Economics of Welfare" (Pigou, 1929).

However, it is recognised today that GDP growth is an imperfect measure of changes in economic wellbeing due, in part, to particular decisions that have been taken to define its scope, the fact that it is a gross measure and not a net measure (i.e depreciation is not deducted), but mostly because it is simply a measure of the value of marketed goods and services produced and consumed in an economy. For example, for reasons of practicality, the scope of GDP excludes the production of services produced and consumed within the household, and by definition, GDP does not reflect the income flows between a country and the rest of the world. In using GDP as a measure of welfare, the implicit assumption needed therefore, is that all economic growth adds to welfare, without making a distinction between the desirable and the undesirable outputs, or between costs and benefits of the outputs.

Per Capita Income is a quotient which represents the fact that welfare is enhanced if the national income increases at a faster rate than the growth in population, see for instance, Theil (1996), Theil and Seale (1994), Firebaugh (1999), Wade (2001), Schultz (1998), Dowrick and Akmal (2001), and Sala-i-Martin (2002). As the money metric is corrected for changes in prices, monetary welfare becomes synonymous with the real per capita income (Clark, 1976). The assumption here is that every individual in a country has the same level of income.

A major weakness of this measure is that it fails to capture the actual movements in wellbeing within a country. The measure is also considered

inadequate because it ignores the distribution of income, which has an important bearing on the welfare of the people. Implicit in this index is the assumption that each extra shilling earned is of equal importance whether earned by the rich or the poor, which is not the case. In fact, in welfare terms, it matters a lot as to who benefits from growth

Basic Needs Index (BNI) measures welfare in terms of the extent to which the basic needs of the population, particularly the poor, are satisfied. The approach involves satisfying the minimum levels of physical needs, which include consumption of food, provision of shelter and access to essential public services such as clean drinking water, sanitation, health and education (Kundan Lal, 1992).

Depending upon the level of development, the physical conditions and the culture of society, these needs may differ. Their relative significance too varies in different climes and at different times. There is as yet no single most acceptable index to represent this measure but an approximate one is the expectation of life at birth. The approach proposes a variety of ways of indicating separately each basic need so that the indicator for nutrition status for example is the calorie intake per head, for housing, the number of people per room of a particular size, and for water supply the percent of population with access to clean water.

Physical Quality of Life Index (PQLI), proposed by economic historian David Morris (Morris, 1979), is a direct forerunner of the human development index. It is a composite index of three elements namely; life expectancy, infant mortality and literacy. Scores in respect of each of these three components are equally weighted on a 0 to 100 scale, but before the components are averaged, infant mortality and life expectancy are first indexed. It is the indexed infant mortality rate, indexed life expectancy and the literacy rate that is averaged to obtain the physical quality of life index

In the case of different regions, the highest figure in respect of life expectancy achieved by any region is assigned the upper limit of 100 for the life expectancy index. The lowest figure in this respect is assigned the lowest limit of 0. Similarly, for the lowest infant mortality and the highest literacy levels, the assigned numbers are 100 each. For the highest infant mortality and the lowest literacy, the assigned number is 0 in each case. In between the highest and the lowest, other regions are ranked, see for instance Misra and Puri (1991), Morris (1979), Meier (1988) and Jhingan (1988). This index is widely criticised on grounds that there is a considerable overlap between infant mortality and life expectancy.

Human Development Index (HDI), a summary measure, developed by the United Nations Development Programme (UNDP), is probably the best known composite index of social and economic wellbeing. The index was calculated for the first time in 1990. The HDI keeps track of three dimensions that are considered important for human well-being namely, a long and healthy life as measured by the life expectancy at birth, knowledge, as measured both by the highest achievements in adult literacy and gross enrolment and finally, a decent standard of living, as measured by the highest GDP per capita in purchasing power parity (PPP) terms in US dollars.

The HDI is calculated by according equal weights to all its three components (Anand and Sen, 1994; Kundan Lal, 1992; UNDP, 2003, 2006). Before the HDI is calculated, an index is first created for each of these dimensions. To calculate these indices, minimum and maximum values are chosen for each underlying indicator. Performance in each dimension of welfare is subsequently expressed as a value between 0 and 1 by applying the following formula:

$$\text{Welfare index} = \frac{\text{actual value} - \text{minimum value}}{\text{maximum value} - \text{minimum value}}$$

The prescribed goalposts for each of the dimensions are as follows (UNDP, 2006); life expectancy at birth has a maximum value of 85 and a minimum of 25, adult literacy rate and the combined gross enrolment ratio each has a maximum of 100 and a minimum value of 0. The GDP per capita takes a maximum value of 40,000 and a minimum of 100. The HDI is then the average of the three dimension indices, and ranges from 0 to 1.

The composite index formed by combining the three indices, does not measure absolute levels of wellbeing. It ranks regions in relation to each other. The ranking is done according to how far regions have progressed from the lowest levels of achievement, and how far they will have to travel towards the present highest level of achievement on each of the three indicators. To prepare a composite index or to rank regions on a uniform scale, a common denominator is prepared in terms of the "distance" which each region travels from the minimum value and the maximum desirable value are taken note of from the relevant date in respect of each of the three components of the index. The index then takes the distance travelled (or progress made from the minimum towards the maximum) and is expressed in percentage terms.

The HDI is certainly a useful measure of the extent of 'catch-up' in the development process. It indicates how well the less developed countries meet some attainments that are characteristic of the developed countries. Veenhoven (2004), however, contends that HDI is of little value as a measure of overall wellbeing, since it adds together, 'apples and oranges', that is, chances for a good life (wealth and education) are added to outcomes (life expectancy), and outer qualities (wealth, equality) are added to an inner one (education). The HDI is also not suited for monitoring progress in wellbeing in advanced nations, since its components are subject to the law of diminishing utility.

This is acknowledged in the case of wealth, but not in the cases of equality and education. We cannot have too much of social equality and schooling. Further, life expectancy is of value only if life remains satisfying in old age, but the HDI does not take the enjoyment of life into account. Later variants of the HDI involve further items e.g., gender-equality measured by the gender-related development index (GDI) and the gender empowerment index and human poverty, measured by prevalence of premature death, functional illiteracy and income deficiencies.

Human Poverty Index (HPI) was developed by UNDP as an improvement on the HDI. While the HDI measures average achievement, this index measures deprivation in terms of three essential elements of human life captured in the HDI. These are a long and healthy life as measured by the probability at birth of not surviving to age 60, knowledge, as measured by the percentage of adults (ages 16-65) lacking functional literacy skills and finally, a decent standard of living as measured by the unweighted average of two indicators, the percentage of the population without sustainable access to an improved water source and the percentage of children under weight for age. Two alternative indices exist: HPI-1, which tracks poverty in developing countries, and HPI-2, which is designed to measure deprivation in developed countries. In addition to the three basic dimensions, HPI-2 also captures social exclusion.

The first deprivation index P_1 , relates to survival. That is, the vulnerability to death at a relatively early age. It is represented in the HPI by the percentage of people expected to die before age 40. The second dimension (P_2), relates to knowledge. That is, exclusion from the world of reading and communication. It is measured by the percentage of adults who are illiterate. The third aspect (P_3)¹,

¹ The composite variable is constructed by taking a simple average of the three variables P_1 , P_2 and P_3 . Thus,

relates to inability to achieve a decent standard of living, in particular, overall economic provisioning. This is represented by a composite of three variables; the percentage of people without access to safe water (P_{31}), the percentage of people without access to health services (P_{32}), and the percentage of malnourished children under five years of age (P_{33}), (UNDP, 2003). The problem with the HPI is that the choice of its components is arbitrary. In addition, the HPI, unlike the headcount measure cannot be used to associate the incidence of human poverty with a specific group or number of people.

Gender-related Development Index (GDI) has also been developed by UNDP, as a later day addition to the HDI. GDI adjusts the average achievement to reflect the inequalities between men and women in three dimensions. These are, a long and healthy life, as measured by life expectancy at birth, knowledge, as measured by the adult literacy rate and the combined primary, secondary and tertiary gross enrolment ratio and finally, a decent standard of living, as measured by estimated earned income (PPP US\$).

The calculation of the GDI involves three steps. First, female and male indices in each dimension are calculated according to the following general formula,

$$\text{Welfare index} = \frac{\text{actual value} - \text{minimum value}}{\text{maximum value} - \text{minimum value}}$$

Second, the female and male indices in each dimension are combined into an 'equally distributed index' that rewards gender equality and penalizes inequality.

$$P_3 = \frac{P_{31} + P_{32} + P_{33}}{3}$$

The HPI-1 is then computed following UNDP(2006) as,

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

It is calculated as the harmonic mean of the two indices. Finally, the GDI is calculated by combining the three 'equally distributed indices' in an unweighted average (UNDP, 2006).

Gender Empowerment Index (GEI) focuses on women's opportunities rather than their capabilities, by capturing gender inequality in three important areas. First, is the political participation and decision-making power, as measured by women's and men's percentage shares of parliamentary seats, economic participation and power over economic resources. Second, the economic participation and decision-making power, as measured by two indicators- women's and men's percentage shares of positions as legislators, senior officials and managers, and men's and women's percentage shares of professional and technical positions. Third is the power over economic resources, as measured by women's and men's estimated earned income (PPP US\$).

For each of these three dimensions, an equally distributed equivalent percentage (EDEP) is calculated, as a population-weighted average that rewards gender equality and penalizes inequality. For political and economic participation and decision making, the EDEP is then indexed by dividing it by 50, the rationale being that in an ideal society, with equal empowerment of the sexes, the GEM variables would equal 50% - that is, women's share would equal men's share for each variable. Where a male or female index value is zero, the EDEP is not defined. However, the limit of EDEP, when the index tends towards zero, is zero (UNDP, 20006). The EDEP for income is computed from gender sub-values that are indexed to a scale from 100 to 40,000 (PPP US\$). Finally, the GEM is calculated as a simple average of the three indexed EDEPs.

Measure of Economic Welfare (MEW) is the result of one of the earliest efforts (Nordhaus and Tobin, 1972) in the measurement of welfare. MEW is a comprehensive measure of the annual real consumption of households. In the

MEW-index, consumption includes all goods and services, marketed or not, valued at market prices or at their equivalent in opportunity costs to consumers. Collective consumption is also included (as far as these expenditures are not considered as instrumental expenditures), and allowance is made for negative externalities: environmental damage, and disamenities of congestion and urbanization.

The study that culminated into this measure was undertaken to answer the question; "how good are measures of output for evaluating growth of economic welfare?" Conclusion of the study indicated that even though GNP and other national income aggregates are imperfect measures of welfare, the broad picture of secular progress which they convey remains after correction of their most obvious deficiencies. Daly and Cobb (1989) disagree with these findings, claiming that the relatively close association between growth of per capita GNP and MEW disappears when the results are more carefully examined. They find that, when looking at specific time intervals or when adjusting some of the assumptions, the GNP is not a good proxy for welfare at all.

Index of Sustainable Economic Welfare (ISEW) was coined by Daly and Cobb (1989), on the basis of ideas presented by Nordhaus and Tobin (1972), in their MEW. The ISEW, like most other welfare indices, starts with the personal consumption expenditure, then uses the Gini coefficient (in the original ISEW) or Atkinson's index (later versions) to adjust this figure for inequality, net capital growth, resource depletion, environmental damage and the value of unpaid household labour.

The basis for this index is a factor 'e', which reflects how concerned society is about equality of distribution of incomes. This index is therefore an attempt to measure the portion of economic activity which delivers genuine increases in the quality of life. For example, it makes a subtraction for air pollution caused by

economic activity, and makes an addition to count unpaid household labour, such as cleaning or child-minding.

ISEW is based on factors that measure what one considers progress for a given country hence it varies from one country to another. More generally however, it covers such areas as income inequality, domestic labour, capital formation, personal consumption, depreciation of natural capital, health/education, service from durables, air pollution, public and private expenditure on defence, climate change, ozone depletion, cost of commuting, personal pollution control, car accidents, water pollution, noise pollution, loss of habitat, loss of farmlands, net international positions, among others.

The ISEW is definitely one of the most important efforts particularly in integrating all critiques on the GDP when used as a welfare measure into one accounting scheme. The index touches on the welfare effects of both macro-economic activity and social inequality, and takes into account the effects of economic growth on the environment. The index therefore has a high value for policy making. There is a high likelihood that policies governed by the index can truly stimulate economic welfare since the ISEW highlights policy areas that should receive most attention, which include reducing income inequality, investing more to sustain the economy into the future and taking measures to control environmental pollution.

An important limitation of the index is that the base of the ISEW relies on consumption. Although consumption is certainly a more appropriate measure of welfare than production, it is questionable given the diminishing welfare returns of increases in consumption. It is also evident that the ISEW lacks a sound theoretical foundation and that the weightings used in the index are arbitrary and so are the components it includes or excludes as contributors to welfare.

According to Neumayer (1999), the authors of the ISEW commit the mistake of methodological inconsistency in two respects. First, the ISEW cannot at the same time, function as both an indicator of current welfare and an indicator of sustainability since what affects current wellbeing need not affect sustainability and vice-versa. Second, the index is not an indicator of strong sustainability, but one of weak sustainability, since the ISEW framework allows for perfect substitution among different types of capital.

Finally, being an economic measure, ISEW should ideally incorporate a mechanism of assigning financial costs to non-financial impacts such as climate change and ozone depletion, to enable one to quantify their true impacts. Besides, the weightings used in the ISEW appear to be arbitrary and to reflect the prejudices of the index's creator.

Genuine Progress Indicator (GPI) is an elaboration of ISEW. The measure adds a number of new categories to the ISEW, such as the value of volunteer work, costs of crime and family breakdown, loss of leisure time, cost of underemployment and cost of ozone depletion. The GPI is a concept in green economics and welfare economics that has been suggested as a replacement metric for gross domestic product as metric for economic growth. The GPI is an attempt to measure whether or not a country's growth, increased production of goods, and expanding services have actually resulted in the improvement of the welfare (or wellbeing) of the people in the country.

GPI takes into account the enhancement of nature's ability to provide services and generate water, air, soil and produce. These factors are part of a more inclusive ideal of progress, and are more easily perceived and believed by most people, than are raw industrial production metrics. GPI also reflects sustainability that is, whether a country's economic activity over a year has left the country with a better or worse future possibility of repeating at least the same level of

economic activity in the long run. For example, agricultural activity that uses replenishing water resources, such as river runoff, will score a higher GPI than the same level of agricultural activity that drastically lowers the water table by pumping irrigation water from wells.

In support of the GPI, Daly and Cobb (1989), and Lawn (2003), assert that a country's growth, increased production, and expanding services have both costs and benefits and not just the benefits that contribute to GDP. They argue that, in some situations, expanded production facilities and other free market activities damage the health, culture, and welfare of people in ways that conservative free market economists ignore. This position is supported by the "threshold hypothesis" developed by Max-Neef (1995) that when macroeconomic systems expand beyond a certain size, the additional benefits of growth are exceeded by the attendant costs.

Lawn (2003), has developed a theoretical framework for determining the 'costs' of economic activity that balance against the 'benefits' of growth in a genuine progress indicator, to determine whether economic development improves or harms the welfare of the people. According to this model, the 'costs' of economic activity include the potential harmful effects of resource depletion, crime, ozone depletion, family breakdown, air, water, and noise pollution, and finally, loss of farmland and wetlands

More specifically, the Genuine Progress Indicator starts with real personal consumption spending, adjusts for income distribution, and then adds or subtracts to reflect ecological and social benefits or costs. The adjustment factors added include the value of household work and parenting, and the value of volunteer work. The adjustment factors subtracted include the costs of crime, family breakdown, underemployment, commuting, pollution abatement and

automobile accidents and the loss of wetlands, farmlands, non-renewable resources, ozone layer and old-growth forests.

Index of Economic Well-Being (IEWB) was developed by the Canadian Centre for the Study of Living Standards. The starting point of this index is the flow of private and government consumption (but not household work). The stock of physical and human capital owned by residents is the second pillar and it tries to measure the stock of productive resources that can be passed on to the next generation. The third pillar captures inequality through the Gini coefficient and the poverty intensity. Finally, the security component aggregates diverse items, such as divorce rates and employment rates. The overall Index of Economic Well-Being is then derived as a weighted average of the four pillars outlined above. The weights were originally set at 0.4, 0.1, 0.25 and 0.25. Indices based on alternative weights have also been developed (Osberg and Sharpe, 1998).

Weighted Index of Social Progress (WISP) was developed by Richard Estes (1984) as another multi-dimensional index for measuring social wellbeing. This index was originally designed to serve as a reliable tool for assessing shifts in the capacity of nations to provide for the basic needs of their populations and to facilitate the analysis of welfare-relevant data at regular intervals.

The updated methodology for the Weighted Index of Social Progress (WISP) aggregates 46 social indicators into ten sub-indices before arriving at the final index. The sub-categories of the ISP are: education, health status, women status, defence effort, economy, demography, geography, political participation, cultural diversity and welfare effort. The statistical weights for the exercise are derived through a two-stage factor analysis in which each indicator and sub-index is analysed for its relative contribution towards explaining the variance associated with changes in social progress over time (Estes, 1997). Although WISP is acclaimed to be more comprehensive and reliable as an instrument for

assessing changes in social welfare, critiques point to the very high complexity of the WISP calculation as limiting a clear comparison with the competing measures.

Economic Aspects of Welfare (EAW) index was developed by Xenophon Zolotas in 1981, in an effort to construct a measure that could depict the full range of actual changes in a society's quantifiable wellbeing, regardless of whether or not these changes were the outcome of market transactions. The EAW-index also takes the private consumption expenditures as its starting point, while various other magnitudes are added or deducted according to whether they are positively or negatively related to economic welfare.

Negative adjustments are made for expenses on consumer durables, advertising, the depletion of natural resources, the rapid growth and the rising social cost of environmental pollution, the cost of commuting and private health and education outlays. Positive corrections include services from the stock of public capital, services from durable consumer goods, household services, leisure time and public sector services (relating mainly to expenditure on education and health). The EAW differs from the MEW-index by more sharply focusing on the current flow of goods and services and by largely ignoring capital accumulation and the issue of sustainability. The EAW also addresses the issue of environmental damages more directly than MEW-index, where there is only an imputation for urban disamenities.

Measure of Domestic Progress (MDP) is an adjusted economic measure that has been developed by the New Economics Foundation of the UK. From the economic indicators (mainly consumer expenditure), they subtract social costs (congestion, inequality, accidents, crime, family breakdown etc), environmental costs (such as air pollution, loss of natural resources and the hidden costs of

climate change) and makes adjustments for long term investment and economic sustainability, and the overall result is the MDP.

Allardt's Welfare Index (AWI) was first applied by Allardt (1976), in his seminal study on comparative welfare, in which he measured wellbeing in Scandinavian nations by means of self-reports on nine items; (1) Income, (2) quality of housing, (3) political support, (4) social relations, (5) health, (6) education, (7) being irreplaceable, (8) doing interesting things, and (9) life-satisfaction. Allardt classified these indicators by drawing a distinction between 'having' (income, housing, political support, health and education), 'loving' (social relations) and 'being' (irreplaceable, doing interesting things and life satisfaction).

4.3 Subjective Measures of Welfare

Happy Life Expectancy (HLE) is a comprehensive measure of wellbeing, developed by Veenhoven (1996b). The basis of this indicator is that, when a person lives long and happily so, the preconditions are apparently sufficient; both the environmental conditions and the person's coping abilities must surpass the minimum level.

The degree to which a person lives a long life and is happy in a country can be measured by combining data on length of life from civil registration with data on satisfaction with life as assessed in surveys. A simple measure is to multiply life-expectancy with life satisfaction. This measure of how long and happy people live is what Veenhoven calls 'Happy Life Expectancy' (HLE).

There is of course much doubt about the value of subjective life-satisfaction and these misgivings apply to this measure in equal dosage. It is commonly objected that matters of the mind are unstable, incomparable, and unintelligible. It is argued that attitudinal phenomena vary over time and that this variation has

little link with reality. For instance, attitudes about safety in the streets could depend more on media sensationalism than on actual incidence of robbery. In this view, a subjective indicator like HLE cannot be relied on to provide a steady policy compass and to protect policy makers against the whims of the day.

It is also true that subjective appraisals cannot be compared between persons or cultures. One assertion is that different people use different criteria, so that two persons stating they are happy could say so for different reasons. This means that subjective appraisals cannot show whether one person (or social group) is better off than another, and hence the HLE kind of indicator is of little help in selecting those most in need of policy support.

Happy Planet Index (HPLI) developed by the New Economics Foundation of the UK, is used to rank countries where people live long and happy lives without damaging the planet. The HPLI combines data on life expectancy, surveys on life satisfaction and the consumption of natural resources (energy, land etc). With its strong focus on the environment, this index has been said to favour countries near the equator.

WHO Quality of Life Scale (WHOQOL) is a recently developed indicator in the field of health related quality of life research. The World Health Organization Quality of Life (WHOQOL) scale is a questionnaire about self-perceived well-being over a two-week period. The domains addressed are: (1) physical health, (2) psychological health, (3) social relationships, and (4) environmental conditions. The questionnaire also includes an item on perceived overall quality of life. The full questionnaire involves 100 items, the short version 26.

4.4 Overview of Measures of Wellbeing

In summary, each of the above approaches has generated specific indicators to evaluate wellbeing. Unfortunately, only a few of the welfare measures discussed above have gained widespread acceptance.

A composite scale is useful as an overall indicator. However, a single composite may sometimes be considered problematic, as different scales use different indicators or give different weights to indicators, and the construction of the composite scale may not always be clearly explained. Besides, single scales may oversimplify the concept and in some cases, may not present information about its components.

Subjective measures are dismissed on a number of grounds, including the fact that they do not allow for comparisons between persons and across cultures. The criteria used for the subjective appraisals are largely implicit. Though people know fairly well, how satisfied, anxious, or trustful they are, they typically know less well why they think this is so. The appraisal process is quite complex and partly unconscious, and this creates an interpretation problem for social policy. Satisfaction judgements in particular can depend too little on real quality of life and too much on fashionable beliefs and arbitrary comparison.

In spite of these weaknesses, subjective indicators are indispensable in social policy, both for assessing policy success and for selecting policy goals since objective indicators alone do not provide sufficient information, especially not on the subject of wellbeing.

Objective indicators fall short on a number of issues, not only in attitudinal matters but also in the assessment of objective substance. Objective measures also have limited validity and reliability. An important constraint to objective

measures, are the limits to aggregation. Although objective counts are often quite useful for assessing detail, they are typically less helpful in charting the whole. For example, in assessing the quality of housing, objective indicators can help in quantifying aspects such as space, light and sanitation, but these aspects' scores do not simply add into a meaningful overall estimate of dwelling quality. Most of the measures discussed in this section have attempted to combine piecemeal objective observations into a comprehensive index, but all these attempts labour with almost the same problems of incomplete information and arbitrary weights.

These indices are incomplete, because they are limited to a few aspects, typically issues that are on the political agenda and happen to be measurable. Most of the indices give equal weight to all items, yet it should be rather evident that the importance of various aspects does vary. The most significant limitation in these indices is that they do not have any sound theoretical foundation. The main contribution of this study is to solve the problem of arbitrary and atheoretical weighting of the various components of wellbeing that have been in use in the development economics literature for a long time.

CHAPTER FIVE

5.0 WELFARE MEASUREMENT MODEL

5.1 Introduction

In order to compare levels of social wellbeing across the various provinces in Kenya, it is imperative that we devise a theoretically sound method of doing so. One way of ranking alternate social welfare states is through the formulation of a social welfare function (swf). In this study, we construct an index of social welfare, using the concept of *abbreviated social welfare function*. Lambert (1989) was probably the first to introduce the concept of the *abbreviated social welfare function* into the development economics literature. A social welfare is abbreviated if it is expressed as a function of statistics calculated from the income distribution vector, controlling for other summary indicators of wellbeing.

Following Fields (2000), the general form of the abbreviated social welfare function can be expressed as

$$W = f(\text{PCI}, \text{GIN}, \text{POV}, \text{YCO})$$

Where

W = Abbreviated Social Welfare Function

PCI = Per Capita Income

GIN = Gini coefficient

POV = Poverty index or status

YCO = Control covariates, e.g., key demographics, such as, family size, parents' education, age and area of residence, whose welfare effects are uncertain a priori.

Where

$$\frac{\partial W}{\partial PCI} > 0; \quad \frac{\partial W}{\partial GIN} < 0; \quad \text{and} \quad \frac{\partial W}{\partial POV} < 0$$

In the literature, the FGT index is used as a measure of poverty (see Kimalu et al, 2002), and the formula for computing it can be expressed as

$$P_{\alpha} = \frac{1}{N} \sum_{i=1}^q \left(1 - \frac{y_i}{z} \right)^{\alpha}$$

Where, P_{α} is a measure of absolute poverty, including food poverty; y_i is the total expenditure of household i , expressed in per adult equivalent terms ($i = 1 \dots N$), Z is the poverty line expressed in per adult equivalent, N is the total number of households, q is the total number of poor households and α is the FGT parameter, interpreted as a measure of poverty aversion, $\alpha > 0$. For purposes of this study, we estimate and use only one of the three FGT measures, namely, the headcount ratio, for which $\alpha = 0$.

5.2 Operationalizing the Abbreviated Social Welfare Function

Since W is not observable, there is need to proxy social welfare with a measurable variable. We use child survival as a proxy for wellbeing at the household level. That is, a household with a surviving child is deemed to have a higher welfare than a household with a recent experience of a child death. There is ample evidence that within countries, as well as among countries, survival rates of individuals and their welfare levels are positively related. See for instance Adelman (1963), Rodgers (1979), Anker and Knowles (1980).

A high level of welfare implies that people are well fed, have better sanitary conditions, have healthy children, and can live longer. If a household is facing a high risk of child death, its welfare level is deemed to be low. In this study, survival to age five is used to proxy wellbeing of a household, since one of the most striking features of African mortality is the heavy incidence of deaths in the second and third years of life relative to the normally high rates in the first year in other countries (Brass ,1975).

5.3 A Dichotomous Model of Child Survival

The Model

This section presents a dichotomous model of determinants of child survival. The probability of a child surviving in a particular household is determined by an underlying response variable that captures the true socioeconomic and environmental conditions that the household faces. Since at a particular point in time, survival of a child is a binary variable (*i.e.*, a child is either alive or dead), let the underlying response variable y^* be defined by the following regression relationship:

$$y_i^* = \sum x_i' \beta + u_i \tag{1}$$

where

$$\beta' = [\beta_1, \beta_2 \dots \beta_k] \text{ and } x_i' = [1, x_{i2}, x_{i3} \dots x_{ik}]$$

In equation [1], y^* is not observable, as it is a latent variable. What is observable is an event represented by a dummy variable y defined by:

$$y = 1 \text{ if } y^* > 0, \text{ if a child survived over a particular time period} \tag{2}$$

and
 $y = 0$ otherwise.

From expressions (1) and (2) we can derive the following equation:

$$\begin{aligned} \text{Prob}(y_i = 1 | \beta, \mathbf{x}_i) &= \text{Prob}(u_i > -\sum \mathbf{x}_i' \beta) \\ &= 1 - F(-\sum \mathbf{x}_i' \beta) \end{aligned} \tag{3}$$

where F is the cumulative distribution function for u_i , and

$$\text{Prob}(y_i = 0 | \beta, \mathbf{x}_i) = F(-\sum \mathbf{x}_i' \beta) \tag{4}$$

The observed values of y are the realization of the binomial variable with probabilities given by equation (3), which varies with \mathbf{X}_i . Thus, following Maddala (1983), the likelihood function can be given by:

$$L = \prod_{y_i=0} [F(-\sum \mathbf{x}_i' \beta)] \prod_{y_i=1} [1 - F(-\sum \mathbf{x}_i' \beta)] \tag{5a}$$

Which can be re-written as:

$$L = \prod_{y_i=1} [F(-\sum \mathbf{x}_i' \beta)]^{1-y_i} [1 - F(-\sum \mathbf{x}_i' \beta)]^{y_i} \tag{5b}$$

The functional form imposed on F in equation (5)² depends on the assumptions made about u_i in equation (1).³ The cumulative normal and logistic distributions are very close to each other. Thus, in certain circumstances, using one or the

² The log likelihood function for expressions [5a] and [5b] can be written as,

$$L(\beta) = \log L(\beta) = \sum_{i=0}^n y_i \log (1 - F(-\sum \mathbf{x}_i' \beta)) + (1 - y_i) \log F(-\sum \mathbf{x}_i' \beta)$$

³ This basically forms the distinction between *logit* and *probit (normit)* models.

other will basically lead to the same result [Maddala, 1983]. Moreover, following Amemiya [1981], it is possible to derive the estimates of a probit model once we have parameters derived from the logit model.

The logit model assumes a logistic cumulative distribution of u_i in F (in equations (5a) and (5b)), so that the relevant logistic expressions are:

$$p(y_i = 1) = 1 - F(-\sum \mathbf{x}_i' \beta) = \frac{e^{\sum \mathbf{x}_i' \beta}}{1 + e^{\sum \mathbf{x}_i' \beta}} \quad (6a)$$

$$F(-\sum \mathbf{x}_i' \beta) = \frac{e^{-\sum \mathbf{x}_i' \beta}}{1 + e^{-\sum \mathbf{x}_i' \beta}} = \frac{1}{1 + e^{\sum \mathbf{x}_i' \beta}} \quad (6b)$$

As before, \mathbf{x}_i are the characteristics of the households/individuals, and β_i the coefficients for the respective variables in the logit regression. Having estimated equation (5) with maximum likelihood (ML) technique, equation (6a) basically gives us the probability of a child dying [Prob ($y_i=1$)] and equations (6b) the probability of a child surviving, i.e., Prob ($y_i = 0$).

The underlying response variable (y^*) for the probit model [see eq. (1) for the logit model] can be expressed as:

$$y^*_i = \beta' \mathbf{x}_i + u_i \quad (7)$$

Where, the disturbance term in (7) follows a normal distribution and the dichotomous variables are defined as:

$Z_i = 1$ if y_i is observed and

$Z_i = 0$ otherwise.

The cumulative probability distribution of the child survival status can now be written as:

$$Prob(Z_{ij} = 1) = \Phi(\alpha_j - \beta' x_i) - \Phi(\alpha_{j-1} - \beta' x_i) \quad (8)$$

where, Φ is the cumulative distribution function⁴. The likelihood and log-likelihood functions for the model can be given by equations (9) and (10) respectively, as:

$$L = \prod_{i=1}^n \prod_{j=1}^m [\Phi(\alpha_j - \beta' x_i) - \Phi(\alpha_{j-1} - \beta' x_i)]^{Z_{ij}} \quad (9)$$

In log-form, expression (9) becomes

$$L' = \log L = \sum_{i=1}^n \sum_{j=1}^k Z_{ij} \log [\Phi(\alpha_j - \beta' x_i) - \Phi(\alpha_{j-1} - \beta' x_i)] \quad (10)$$

Equation (10) can be maximized in the usual way, and can be solved iteratively by numerical methods, to yield maximum likelihood estimates of the probit model [see Maddala 1983].

Probit Index as a Welfare Index

The latent variable expression, $y^*_i = \beta' x_i + u_i$, depicted in equation (7) is the logit or probit index, depending on whether it is the logistic or the normit model of child survival that is estimated. It shows the subjective welfare index that a household attaches to child survival. As is evident from equations (1) and (7),

⁴ The cumulative density is given by the following expression (see Wooldridge, 2002),

$F = \Phi(z) = (1/\sqrt{2\pi}) \exp(-z^2/2)$. Moreover, the probit model marginal effects are:

$\partial F_i / \partial x_i = \phi(x_i' \beta) \beta_j = \phi(\Phi^{-1}(F_i)) \beta_j$ where $F_i = \Phi(x_i' \beta)$

the subjective welfare index y^* , depends on socioeconomic and environmental characteristics (X) of a household. In other words, the wellbeing of a household in any period depends on whether the household escaped child death in the previous period (this is implicit in the model), and on other control variables such as household income, and education and health of household members. Sen (1988) has argued that survival or death of a household member is the single most important summary measure of the wellbeing of a household at any particular time. Death of a family member, in this case a child, necessarily makes a household worse-off, relative to households which have not suffered child death. That is, there is nothing that can replace the survival of a family member to keep the household at the same welfare level as before death.

This observation amounts to making a strong non-substitution assumption between survival of a family member *and* other goods that yield utility to the household. In other words, the household has Leontief preferences over *survival probabilities* of its members and other *goods*, e.g.; real income and education. However, since death is eventually inevitable, this assumption applies only in cases of *premature* death. Without this assumption it is possible for a household to be made better-off by a monetary compensation after losing an elderly member, already at the natural end of a lifespan. We focus on child deaths because they are the prime examples of premature deaths in a society.

In Equation (7), the parameters of interest, the β s, are welfare weights. Once estimated, the total welfare that the household derives from child *survival* and from other "goods" can be computed. The weights indicate the contributions of the various factors to household welfare. That is, they are the ones used to weight the arguments of the welfare function. These weights are optimal, in the sense that they are the ones that maximize the wellbeing of the household given its environment. Moreover, the weights are consistent and non-arbitrary because

they reflect a household's *preference orderings* of the arguments of the welfare function (i.e., the various determinants of the wellbeing). The weights here differ sharply from arbitrary welfare weights routinely reported in World Development Reports (UNDP, 1997). Estimation of the welfare weights using equation (10) and computation of the welfare index via equation (7) enables calculation of the child survival probabilities using equation (6) or the normit formula in footnote 4.

Probit Index as an Indirect Utility Function

The relationship between wellbeing and the price that a household must pay to avert a child death can be expressed as

$$v = v(p, y; a) = \max u(s, a) \text{ subject to } s \cdot p = y. \quad (11)$$

where

p = price that households pay to increase child survival i.e. to improve child health.

y = exogenous household income;

a = economic, social and environmental conditions of the household

s = child survival, defined more precisely later;

v = indirect utility, i.e., the maximum level of wellbeing the household can achieve if it must pay a price, p , to avert a child death when its income is equal to y ,

u = direct utility, i.e.; the maximum level of utility the household can obtain if it were to spend its income to avert a child death, while holding its income constant.

The demand for child survival, $s(p, y; a)$ can be obtained via Roy's identity from the indirect utility function, $v(\cdot)$ or by maximizing the direct utility, $u(\cdot)$ subject to the budget constraint (see Varian, 1978). Letting s be a binary variable that takes a value of 1 if a child is alive and a value of 0 otherwise, the demand for s

is clearly a probabilistic demand function for child survival as shown in equation (6). That is, the probability of child survival, s , decreases as p increases, holding constant household income, y , and its socioeconomic milieu, a . It is clear from equation (11), that by Roy's identity, the demand for child survival, s , is simply the negative of the marginal disutility of price divided by the marginal utility of income. The quantity demanded of child survival s , is expressed by a unitless probability measure that lies between zero and unity.

Thus, the welfare of a household conditional on child survival is $W = W(s)$; where s , is empirically represented by child survival over a particular period. In this case, a household derives utility from child survival alone. Expanding the above expression we find that it can be re-written as $W = W(s, a, y)$, where, a and y are other factors other than s that affect the wellbeing of a household; as before, y is income and a is a social milieu. An income poor household with a surviving child is considered better-off, in welfare terms, than a poor household without a surviving child. That is, if two households have the same income over a given time period, and at the end of the period, one has a surviving child, whereas the other has lost a child, the household with a surviving child is considered better-off; and likewise for rich households.

From equation (7), or (1), y^* , is the logit index and β are parameters to be estimated. In this case, y^* , is precisely the abbreviated social welfare index. It shows the level of wellbeing at the household level, conditional on child survival. If the error term u is normally distributed, the probit model follows and y^* , becomes the probit index, which again, measures the wellbeing at the household level, conditional on child survival. From the perspective of microeconomic theory, the probit/logit index associated with child survival is an indirect utility index, which at income, y , and price, p , (at which child survival can be secured) is equal to the direct utility the household derives from child survival, when all income is spent to ensure that the child survives.

From Utility Index to an Abbreviated Welfare Index

In order to make the idea of abbreviated social welfare empirically operational, it is necessary to specify a particular functional form for a probit index. The abbreviated social welfare function, as proxied by either a probit or a logit index, can be written in linear form as

$$Z = a + \beta_1 Y + \beta_2 G + \beta_3 FGT + \gamma W + \varepsilon$$

Where

Z = Abbreviated social welfare index, the empirical value of a probit index

Y = Household income per adult equivalent

G = Distribution of income in a cluster

FGT = Poverty status in a cluster, which shows whether a household falls within a particular income distribution, or the proportion of poor households in that cluster.

W = Control variables at the household level, including maternal age, parental education, residence and household size.

As it happens, the probit or the logit index, y^* in equation (7), which can be aggregated at any level, is exactly the abbreviated social welfare index, Z , that is needed to rank regions according to the standard of living enjoyed by their populations.

CHAPTER SIX

6.0 TYPES AND SOURCES OF DATA

6.1 Sources of Data

In order to analyse inequality and construct an abbreviated social welfare index, we use data derived from socio-economic surveys conducted by the Kenya Central Bureau of Statistics. The main data set is the Welfare Monitoring Survey II of 1994 which covered 47 districts. This Survey was based on the National Sample Survey and Evaluation Programme (NASSEP III), a multi-purpose frame that follows a two-stage stratified cluster design. The frame covered a total of 1,048 rural clusters and 329 urban clusters.

This frame makes the allocation of rural clusters to districts proportionate to population size in such a way that for districts with 500,000 or more, 36 clusters were selected; for districts with population ranging from 250,000-499,999, 24 clusters were selected; those with 100,000-249,999, 16 clusters were selected, while 12 clusters were selected in districts with a population under 100,000.

The urban master sample consisted of all the district headquarters irrespective of their population size, and all other towns which had a population of 10,000 and above by 1989 population census. In total, 329 clusters were selected and the allocation of town clusters was approximately proportionate to population size. The 329 clusters were distributed among 59 towns out of which 26 have one cluster each. In all other major towns, a larger number of clusters were selected ranging from 10 in Eldoret to 120 in Nairobi.

The rest of the data is obtained from a number of other surveys, including; the Integrated Labour Force Survey of 1998/99, The Kenya Demographic and Health

Survey of 2003, Annual Trade Statistics Year Books, and the Roads Department's Country Status Reports.

The 1998/99 Integrated Labour Force Survey (ILFS) was conducted in all the administrative districts of Kenya. The survey covered 11,049 households out of the 12,814 households randomly selected for interview. It utilised the household sampling frame known as the National Sample Survey and Evaluation Programme (NASSEP III). The multi-purpose sampling frame followed a two-stage stratified cluster-design. It contained 1,139 operational clusters, comprised of 930 rural clusters and 209 urban clusters.

The 2003 Kenya Demographic and Health Survey (KDHS) was the fourth survey of its kind to be undertaken in the country. It differed from the previous ones in the sense that it covered all parts of the country, including the arid and semi-arid districts that had previously been omitted from the KDHS. The sample for the 2003 KDHS covered the population residing in households in the country. A representative probability sample of 10,000 households was selected for the survey. The survey sampled only a small number of households in the North Eastern Province and oversampled the urban areas. It utilised a two-stage sample design based on the fourth National Sample Survey and Evaluation Programme (NASSEP IV). A total of 400 clusters, 129 urban and 271 rural, were selected from the master frame.

We found it necessary to use data from the last two surveys to complement the main data set because the latter two provide information on a number of other dimensions of inequality such as spatial distribution of infrastructural facilities which are equally important in assessing overall inequality patterns. Besides, the ILFS data set provides the benefit of employment data decomposed by sectors.

6.2 Data Processing

In order to compare the distribution of income across regions, we estimated the gini coefficients for all the households and regions. We complemented this with the income shares of population quantiles as a way of combining maximum coverage of regions with some acceptable level of quality and also to overcome some of the shortfalls of the former. In addition, we estimated the welfare effects of per capita income, income distribution, poverty, and of other covariates specified in the measurement models. To process and analyse the data, DAD version 4.4 (Jean-Yves Duclos et al, 2006) and STATA version 9.3 softwares have been used.

6.3 Description of variables

Several variables have been used in the analysis in this study in order to measure the regional distribution of income, and to construct an abbreviated social welfare index. Following, is a brief description of the key variables.

Under- Five Mortality (UFM). Under-five mortality is the probability of dying before the fifth birthday, taking into account both the mortality risks to which the child is exposed, and the length of exposure to the risk of dying. The primary cause of mortality change as children age, from factors related mostly to biological conditions, to factors related to their environment (KDHS, 2003). For this reason, it serves as a very good indicator of the welfare of the household in which a child lives. In this study, we use this variable to proxy welfare of the households. It is measured as the proportion of children ever born who have died, classified by the mother's five year age group. This provides estimates of probabilities of dying between birth and age five. These probabilities of dying are then converted into under-five mortality rates using the North Model of the Coale-Demeny life tables and the Trussel version of the Brass method.

Mother's Age (mage). This is the maternal age at first birth. Age at first birth is a crucial demographic indicator which reflects age at first marriage, level of contraceptive use and pre-marital sexual exposure among others. Early initiation into child-bearing has been shown to have profound implications for nutrition, healthcare, and length of breastfeeding, all of which affect child survival. Mother's age is measured in completed years by the mother.

Educational Attainment of Parents (meduc, feduc). Studies have shown a high correlation between educational attainment and earning levels. Educational attainment, whether of the father or the mother, therefore predisposes one towards high incomes, which is an important dimension not only in the distribution of income, but also for child survival. Maternal education in particular, has been shown to be intrinsically related to infant mortality. Caldwell (1979) for instance, found that educated women are more likely to be proactive mothers, taking initiatives in providing the best care for their children and willing to go against traditional norms to access modern health care facilities for children, increasing their rate of survival. For both the mother (meduc) and the father (feduc), it shall be measured by the number of years of schooling.

Place of Residence (Residence). Is a dummy variable that defines the binary option for place of residence of a household. The standard of the physical environment around a household has an effect on the child's risk of exposure to infectious diseases. In Kenya for instance, education, health care and other resources that may promote child survival are not easily accessible in the rural areas. In addition, programs and initiatives that are run by the government and international organizations are particularly more effective in urban than rural areas due to the ease of dissemination of information and resources. This variable takes a value of one when the place of residence is rural and zero, otherwise.

Per Capita Income (logpce a). This variable defines the share of each household in the national income, if the latter is shared out equally among the existing households. Since household income determines its expenditure on goods and services, it is therefore indicative of the supposed spending power of each household, and by extension, its supposed welfare levels. In this study, the log of per capita expenditure of adults is used to measure it.

Gini Index (gini). Inequality in incomes is one of the factors that can be used to explain the difference in the availability of resources that have effects on child survival. This variable measures the extent to which the distribution of income deviates from a perfectly equal distribution. The higher the Gini index, the greater is the degree of inequality between the distributions under comparison. In this study, it shall be our measure of income distribution in a cluster.

Household Size (hhsiz). This is defined as the number of persons living in the same compound but answerable to the same head and sharing a common source of food and/or income.

Twins. Is a dummy variable that defines the binary option of begetting twins or otherwise, in a household. It takes a value of one for a household with surviving twins, and zero otherwise.

Poverty status (indx1). This is an index indicating the magnitude of poverty in a given region. In this study, we use the FGT, an aggregate measure that quantifies the main elements of poverty namely, its level, depth and severity. In this study, the level of poverty is measured by the headcount ratio, which is the ratio of the number of poor individuals to the total population.

Interaction of Maternal Education and Poverty (meducxp). On their own, maternal education and poverty have been shown to impact on wellbeing. It is of

interest to know whether jointly, they act to reinforce the individual effect of each other on the household's wellbeing. Maternal education is measured by the number of years of schooling, while poverty is measured by the ratio of the number of poor individuals to the total population.

Total Holding Area (land). In Kenya, more than 75% of the population is employed in the agricultural sector. Since arable land is the primary asset required for agricultural and other forms of production, differential access to it in terms of size and quality, may lead to a differentiated set of outcomes in various regions. Incomes are therefore likely to be higher in regions with more of high potential land than low potential land and vice-versa. In this study, it is measured by the size of land held in acres, by a household. In this study, landholding refers to land owned/or operated by a household being used wholly or partially for agricultural purposes.

Number of Cattle Owned (cattle). An important measure of wealth, particularly in rural Kenya is livestock. The size of a household's herd of livestock could therefore provide an indication of the household's income and by extension its wellbeing. In this study, it shall be measured by the number of cattle reared/owned by a household.

Non-Agricultural Rent (Rent1). This is the non-agricultural rent received by a household. Household income can be broadly categorised into wage income and non-wage income. Non- agricultural rent is a critical source of household income particularly in regions where agriculture is not widespread. It is measured as the income a household received from rent of non-agricultural assets, one month prior to the survey, the time-frame helping to establish any possible change in use or household holding size.

Agricultural Rent (Rent2). Is defined as the agricultural rent received by a household. In this study, it is measured as the income from rent of land and/or other agricultural assets that a household received twelve months prior to the survey. The essence of the twelve month period, was to determine whether households continued practising agriculture or not, as an option for their livelihoods.

6.4 Analytic Samples

In order to estimate the welfare effects of per capita income, income distribution, poverty, parental education and other covariates specified in the measurement models, we constructed analytical sub-samples by under-five child mortality status. The samples were derived from the full probability sample of 59,183. From this sample, we constructed two sub-samples for under-five children; a sub-sample, comprising households with surviving and non-surviving male children below age five, and a sub-sample, consisting of households with surviving and non-surviving female children below age five. From these sub-samples, we constructed two dummy variables, showing a boy-child survival rate and a girl-child survival respectively. We found it necessary to introduce the two analytic sub-samples, because we thought that households value health of boys and girls differently.

CHAPTER SEVEN

7.0 ESTIMATION RESULTS

In this chapter, we report the estimation results for the determinants of probability of child survival and instrumental variable probit. In addition, we construct the abbreviated social welfare indices by province and sex of surviving child and compare the same to poverty rankings. Descriptive statistics for the variables used in estimations are shown in Table A5 in the appendix.

7.1 Determinants of Probability of Child Survival

In order to determine the effects of the various factors on survival of the child, we carried out estimations of a probit model of child survival. The aim was to explain changes in the probability of child survival in terms of variables such as mother's age, parental education, place of residence, per capita income and income distribution. Finally, we endogenized household size using twins, and included it among the regressors. Both direct and indirect effects of the various variables on the probability of child-survival are shown in Table 7.0 for different survival functions.

The estimation results show that for the boy-child, all the estimated coefficients on covariates are statistically different from zero. In the case of the girl-child, all the effects of the covariates are statistically significant, except for the coefficient on higher level of income inequality. Table 7.0 indicates that mother's age significantly affects a child's chances of survival. The coefficients on age and age squared shows that children born to older mothers are at higher risk of death than those of younger mothers.

TABLE 7.0: Marginal Effects of Child Survival: Dependent Variable is Survival Probability (asymptotic *t*-statistics in parentheses)

Variables	Survival rates			
	Boy-child		Girl-child	
	1	2	1	2
Age of mother, years	0.0196 (24.2)	0.0196 (24.30)	0.0195 (26.04)	0.0195 (26.0)
Age of mother squared	0.0003 (30.18)	-0.0003 (30.18)	-0.0003 (30.40)	-0.0003 (30.41)
Education of mother, years	0.0165 (20.77)	0.0165 (20.77)	0.0136 (17.98)	0.0136 (17.9)
Education of father, years	0.0017 (2.37)	0.0016 (2.36)	0.0043 (6.38)	0.0043 (6.36)
Residence (rural=1)	-0.0391 (4.45)	-0.0392 (4.46)	-0.0718 (8.54)	-0.0719 (8.55)
Log of per capita income per adult	0.0054 (1.60)	0.0054 (1.60)	0.0120 (3.78)	0.0121 (3.79)
Income inequality (gini)	0.6641 (3.87)	0.6650 (3.87)	0.4316 (2.59)	0.4326 (2.59)
Income Inequality squared	-0.8358 (2.00)	-0.8388 (2.0)	0.0794 (0.18)	0.0751 (0.17)
Twins (1=multiple birth)	---	-0.0133 (0.92)	---	-0.1970 (1.44)
Number of Observations	32083	32083	32083	32083
Percent correctly Predicted	74.38	74.38	77.66	77.67
Log-likelihood function	-17248.90	-17248.48	-16248.46	-16247.44
Pseudo R ²	0.0781	0.0781	0.0797	0.079

Table 7.0 shows that mother's age; mother's age squared and mother's education exhibit particularly large t-ratios, an indication that the true value of the coefficient is significantly different from zero for each of the variables. The three variables can therefore not be excluded from the model.

An extra year of mother's schooling increases the probability of child survival, with the effect being about the same for both boys and girls. Compared to mother's education, father's education has a far smaller effect on child survival. One year of father's schooling is estimated to increase probability of survival of the boy-child by 0.0016 and that of the girl-child, by 0.0043. This is an indication that father's education has a stronger effect on survival of the girl-child than on that of the boy-child. In a society where the girl-child is discriminated against in terms of economic opportunities, going to school makes fathers want to treat all children the same and to rectify any existing inequalities within the family.

Income per adult is an important variable that affects child survival directly and indirectly. The effect of income on child survival is well documented (see Guo, 1993; Madise et al, 1999 and Alderman et al, 2003) and is reflected in the socio-economic status of family members. An increase in income per adult increases probability of child survival of both the boy and girl child. It is worth noting that the coefficient on income per adult is significantly different from zero at 1% level in the case of the girl-child, while its significance is at the 10% level in the case of the boy-child.

The nature of the association between income inequality and child survival is not clear cut. Contrary to expectations, income inequality increases with boy child survival up to the point at which $G=0.4$, beyond which survival starts to decrease with inequality. For the girl child, the results suggest that survival rate declines with inequality up to a point, but this finding is not emphasized here on account of the highly insignificant coefficients. Besides, there appears to be an obvious

effect of mother's education on the relationship between inequality and girl-child survivorship. When mother's education is dropped (Table A4) survival rate starts to increase with inequality, up to a point, beyond which they start to decline together, but again statistical significance is moderate. These results suggest that inequality is linked to several aspects of social policy which makes it difficult to ascertain its independent effect on survivorship.

The coefficient on rural residence is statistically significant for both the boy-child and the girl-child. If a household lives in a rural area, the chances of child survival in that household are reduced.

Twins can be used as a proxy for household size. When the twin variable is introduced, it is found to be negatively correlated with child survival, but its coefficient is statistically insignificant.

7.2 Instrumental Variable Probit Results

Using 1994 poverty lines, that is KES 978.27 for rural and KES 1489.60 for urban areas respectively, we estimate the headcount ratio ($P_a = 0$). We recognise that poverty status is endogenous to child survival and so we correct for endogeneity using instrumental variable probit regression. In the first stage regression, we regress poverty status on the age, education, inequality and place of residence, in addition to a set of instrumental variables, namely; log values of land, cattle, non-agricultural rent, and agricultural rent. Results of the first stage regression are shown in Table 7.1.

Results show that all the covariates are significant determinants of poverty status. Mother's age, rural residence, income inequality and land affect poverty. Rural residence exhibits the highest statistical significance in this regard. It is

followed by mother's education, and then age. As mother's age increases within a 10-24 year threshold, poverty declines, probably owing to the fact that human capital is greater at older ages and therefore the earning potential of women is high. It is also possible that older women are stable in marriage or are supported by spouses. As expected, schooling reduces poverty, as does the ownership of cattle, and rent-generating assets.

TABLE 7.1: First Stage Regression Results (dependent variable is equal to one if the household head is poor and zero otherwise)

Variable	Coefficient	t-values
Age of mother, years	0.0126	16.08
Age of mother squared ($\times 10^{-2}$)	-0.0001	14.30
Education of mother, years	-0.0194	27.05
Education of father, years	-0.0074	11.47
Residence (rural=1)	0.3158	37.22
Income inequality (gini)	2.2343	14.87
Income Inequality squared	-3.7066	10.94
Total land holding area	0.0051	1.78
Total number of cattle owned	-0.0380	18.15
Non-agricultural rent	-0.0278	12.97
Agricultural rent	-0.0190	9.42
Number of Observations	32,216	
Adjusted R ²	0.1471	

In the second stage regression, we use the predicted poverty status as a regressor in a probit model of child survival. We carried out the estimations using four different specifications of the child survival functions. In the first specification, we estimate the basic abbreviated social welfare equation, in which we seek to explain changes in the probability of child survival in terms of per capita income, income distribution and poverty status, in addition to maternal

age and father's education as control variables. Results are shown in Table A4 in the appendix. Except for the coefficient on gini squared for the girl-child, all the other variables are statistically significant. Gini squared, poverty status and mother's age are negatively associated with child survival, while per capita income, income distribution and father's education are positively associated with child survival.

In the second specification, we omit household size and twin variables. In the third, we introduce household size, which is endogenous to child survival, and finally, we endogenized household size using twins. Income is not included in the estimation due to its strong correlation with income inequality. The estimation results are shown in Table 7.2.

It is evident that probability of survival of both the boy-child and girl-child is largely a function of mother's age, since the coefficient on mother's age is significant for both sexes. A marginal increase in mother's age increases probability of child survival, in all the three specifications. This however, holds only up to a point, beyond which any further increase in mother's age reduces the probability of child survival by an identical proportion for both sexes in all specifications. It is also evident that the coefficients on mother's age and mother's age squared are significant across the specifications for both sexes. These results are consistent with the findings of several other studies such as Madi (2004), Majumder et al (1991), Kim (1988) and Bhuiya and Streatfield (1991).

Findings of these studies suggest that maternal age is one of the most important determinants of infant mortality, indicating that young mothers have the highest probability of losing their infants and that the risk of death in early childhood increases among children born to mothers who are too young or too old.

Madi (2004), in a study of early childhood mortality in Palestine showed that child mortality was highest among young mothers aged below 20 years, followed by mothers at age 40 years and above. The study showed that in Lebanon, the highest child mortality rate was among young mothers less than 20 years of age and the lowest rate was among mothers 20- 29 years of age. In Syria, the lowest rate was observed among mothers and the highest rate was found among mothers 40 years or more. These findings are corroborated by Ahmed (1992). Greater child mortality is associated with young mothers (18 years and below) due to limited maternal preparation, ignorance, limited access to proper and adequate healthcare and low incomes. Older mothers (40 years and above), also experience greater child mortality possibly due to the increasing number of children and subsequent demand on the mother's physical strength for child rearing.

Table 7.2: IV Probit Results (z-values in parentheses)

Variables	Maximum Likelihood Coefficient Estimates					
	Boy-child			Girl-child		
	(1)	(2)	(3)	(1)	(2)	(3)
Age of mother, years	0.0186 (19.43)	0.0193 (19.89)	0.0186 (19.44)	0.0196 (21.87)	0.0208 (22.72)	0.0196 (21.89)
Age of mother squared ($\times 10^{-2}$)	-0.0003 (25.27)	-0.0003 (25.22)	-0.0003 (25.28)	-0.0003 (26.38)	-0.0003 (26.38)	-0.0003 (26.40)
Education of mother, years	0.0363 (12.40)	0.0350 (11.9)	0.0363 (12.39)	0.0318 (10.82)	0.0300 (10.11)	0.0318 (10.82)
Education of father, years	0.0013 (1.71)	0.0017 (2.26)	0.0013 (1.7)	0.0033 (4.56)	0.0039 (5.42)	0.0033 (4.54)
Residence (rural=1)	-0.0198 (1.26)	-0.0139 (0.88)	-0.0198 (1.26)	-0.0278 (1.85)	-0.0187 (1.23)	-0.0277 (1.84)
Income inequality (gini)	0.3784 (2.07)	0.4857 (2.64)	0.3798 (2.08)	0.3339 (1.89)	0.5051 (2.83)	0.3356 (1.90)
Income inequality squared	0.0385 (0.09)	-0.1345 (0.33)	0.0351 (0.09)	0.5699 (1.35)	0.2850 (0.67)	0.5653 (1.34)
Predicted poverty status	0.0992 (2.27)	0.0700 (1.59)	0.0987 (2.26)	-0.0122 (0.29)	-0.0573 (1.36)	-0.0130 (0.31)
Mother's education \times poverty status	-0.0294 (7.21)	-0.0290 (7.10)	-0.0294 (7.21)	-0.0291 (7.11)	-0.0284 (6.94)	-0.0291 (7.11)
Size of the household	---	-0.0085 (4.89)	---	---	-0.0127 (7.76)	---
Twins (1=Multiple birth)	---	---	-0.0124 (0.86)	---	---	-0.0193 (1.41)
Number of Observations	32,216	32,216	32,216	32,216	32,216	32,216
Percent correctly predicted	74.53	74.55	74.53	77.90	77.94	77.89
Log-likelihood function	-17275.687	-17263.748	-17275.319	-16256.097	-16226.106	-16255.104
Pseudo R ²	0.0799	0.0805	0.0799	0.0820	0.0837	0.0821

As expected, parental education increases the probability of child survival. Save for maternal age, mother's education has a much higher level of statistical significance than any of the other explanatory variables, again indicating that the true value of the coefficient is significantly different from zero for each of the first three variables. Although both the coefficients on the mother's and father's education, respectively, are statistically significant for the girl-child, father's education is not significant across all the specifications in case of the boy-child. The effect of mother's education is therefore shown to be strong in influencing survival of both the boy-child and the girl-child. In contrast, father's education is found to be much stronger in influencing survival of the girl-child.

The evidence on the importance of mother's education for child survival is corroborated by a host of other studies, key among them being Caldwell's (1979) seminal paper on Nigeria. Other studies in this vein include the works of Hobcraft et al (1984), Mensch et al (1984), Lindenbaum (1990), Cleland (1990), Levine (1991), Graham (1991) and Ssewanyana and Younger (2007), the latter of these studies confirms that mother's education has a significant impact on infant survival, and that the impact is larger for mothers with more schooling.

These and many other studies suggest a number of pathways involved in lowering the mortality of children born to educated mothers.

First, education leads to a shift from 'fatalistic' acceptance of health outcomes towards implementation of simple knowledge in healthcare, a shift in the familial power structures that permit educated women to exert greater control over health choices for their children, and an increase in the woman's capability to manipulate the modern world, including interaction with medical personnel. Second, education is important in ensuring that the mother utilizes health services for her children, since education enables one to have a closer social identification with the modern healthcare practices, greater confidence at handling bureaucracies or a more innovative attitude to life.

Third, better educated mothers expect earlier intellectual and emotional development of their children. Because of this, educated mothers place greater emphasis on child quality (Becker, 1981), perhaps ensuring that if the family size is small, children are more likely to survive, have greater food and human capital investments and thus end up being higher quality citizens, that are healthier, better educated, more affluent and emotionally better developed.

Other probable associations with education of women that have a bearing on child survival include the fact that educated women tend to marry later and have their first births later. If this delay moves the first birth beyond the teenage years, then according to Hobcraft (1993), the women themselves are more likely to survive the hazardous first birth, and the first born child is also more likely to survive. Besides, educated women generally experience lower rates of maternal mortality, both on a per birth basis and as a result of having fewer children. This is an important finding because loss of a mother can be potentially disastrous for children's survival chances and their future welfare. Graham (1991) estimates that in a typical sub-Saharan African country, the lifetime risk of maternal mortality is one in 20 for uneducated women, but only one in 70 for educated women. Still, there is the apparent role of greater cleanliness and hygiene among educated women that could help explain differentials in child survival.

Although the role of mother's education is predominant in much of the literature, it is also of interest to note that father's education, just like mother's education, through its impact on household income, has both direct and indirect effects on child survival. Father's education increases the survival chances of children through the greater knowledge and affluence it brings to the household. Educated fathers are more likely to protect their children from conflicts, famine, and disruptions of the social and physical environment, since such fathers are more likely to have better coping strategies and better economic resources. The

observed association between father's education and child survival is corroborated by Toros and Kulu (1988) and Caldwell and Caldwell (1992).

Living in a rural area, is associated with a reduction in the probability of child survival for both the boy-child and girl-child across all the specifications. However, in both cases, the coefficient on rural residence is statistically insignificant. Since there are large differences between the urban and rural areas in Kenya, possible explanations for this correlation can be found in the effect of economic development on child survival. Rural areas in Kenya are much poorer and therefore lack modern social amenities, have poorer sanitary conditions, little or no access to health care facilities and mothers lack adequate medical and nutritional information.

Besides, the parental levels of education are much lower in the rural areas which, in effect reduces their propensity to use modern medical facilities and to effectively adopt modern health practices. Some studies have indeed shown that children who live in urban areas are slightly more likely to be breastfed earlier than those who live in the rural areas, yet it has long been established that early breastfeeding has a major positive impact on child survival. Huyen-Vu (2001), using Vietnamese data confirms that the likelihood of a baby being breastfed within 6 hours after birth among children of mothers who do not work in the agricultural sector is 1.3 times higher than that of children whose mothers work in the agricultural sector. This particular finding is relevant to this study because more than 52% of women in rural Kenya are engaged in the agricultural sector (Republic of Kenya, 2003). Further, rural areas in Kenya tend to be associated with extended familial relations.

The association between child mortality and income distribution was first reported by Rodgers (1979). Since then it has been confirmed by several other studies including research by Flegg (1982), Le Grand (1987), Waldmann (1992),

Wennemo (1993) and Kaplan et al (1996). From our regression results, it is evident that the distribution of income is a significant determinant of boy-child survival across all the specifications. For the girl-child however, it is significant only in specification two. Contrary to expectations, an increase in income inequality is associated with an increase in probability of survival for the boy-child and girl-child, in all specifications. This finding might be attributable to positive externality and social learning, since the non-poor, by providing better healthcare and nutrition for their own children, will unintentionally end up protecting the children of the poor from disease epidemics.

However, as income inequality increases to higher levels, its coefficient becomes insignificant in all the specifications. Minujin and Delamonica (2000), corroborate this finding. For all the specifications, as income inequality increases, the probability of child survival increases, with the exception of specification (2) for the boy-child. In the latter specification, an increase in income inequality reduces the probability of boy-child survival.

Such an association as reported in Table 7.2 is not entirely unexpected. Total child mortality is influenced by what happens to the larger proportion of the population. A number of studies are in agreement with our findings, that sex of the child is associated with the probability of early child mortality, as mortality is higher among males (Ariunaa and Dashtseren, 2002 ; Madi, 2004; Ssewanyana and Younger, 2007). Total infant mortality in Kenya is influenced heavily by boy-child mortality. In Kenya studies have shown that the top 10% of the population earns in excess of 40% of the total income, while the bottom 10% earns just about 1% of the total income. We can safely say that the large majority of Kenyans are poor and poverty is associated with lower levels of health and increased mortality.

By raising death rates among the deprived majority, relative deprivation will raise national mortality rates unless the excess mortality can be offset to the same extent, by improvements in mortality in another section of the society. The existence of large numbers of deprived areas with high levels of poverty, crime, and violence is likely to harm health more widely. National mortality rates would then be raised by poorer health in deprived areas as well as by some wider knock-on effects. The larger part of this relation would therefore probably reflect an association between inequalities in income and in health within societies. This suggests that large increases in income inequality would have deleterious effect on population health.

These results further show that an increase in poverty is, paradoxically associated with an increase in the probability of survival of the boy child while being negatively correlated with the chances of survival of the girl-child in all the specifications. In all cases however, the coefficient on poverty is statistically insignificant for the girl-child but fairly significant for the boy-child. These results, although varying in statistical significance, give some support to the observed differences in the probability of early childhood mortality by sex in Kenya and in other regions of the developing world (see also Ssewanyana and Younger, 2007).

Evidence on the relationship between poverty and mortality is controversial. On one hand are the studies that confirm the above observed result for the girl child, that poverty reduces probability of child survival. They include Persson (2000), Garenne et al (2003), and Deen et al (2002). Friedman et al (2005) also confirm the same for children aged 0-35 months in Western Kenya. On the other hand are studies that confirm the above observed results for the boy child, that some level of poverty can actually enhance chances of child survival through unexpected pathways. Most of these studies suggest that malnourished children are protected to some degree against malaria. Using Nigerian data, Hendrickse

et al (1971) found that among children admitted to hospital in Nigeria with clinical malaria, higher parasite density was more frequent among the better nourished children. This finding is also reported by Genton et al (1998) using data from Papua New Guinea.

Nyakeriga et al (2004), used Kenyan data to investigate the association between malaria and malnutrition in a cohort of Kenyan children. In the overall analysis, no difference was noted in the incidence of malaria in malnourished and well-fed children. However, when the data was stratified by age, an association emerged. An elevated incidence of malaria was seen in children below two years of age who were subsequently found to be malnourished. A reduced incidence was however seen in older children. Ahmad et al (1985) confirmed a negative relationship between malnutrition and malarial infection, while Murray et al (1978), noted an increase in the incidence of clinical attacks of malaria, including cerebral complications, when starving refugees were fed.

These studies, in addition to our controversial findings, that male children of the poor are more immune to malarial attacks, suggest that poverty could be protecting children in a highly malaria prone country like Kenya. Since girls are not as predisposed to malarial attacks, they might not be as immune as the boys. This probably explains the decline in girl-child survival probabilities as poverty increases. In Kenya however, most child deaths occur due to malaria. We can therefore hypothesize that poverty could be lowering probability of survival, but through an uncertain and complicated process.

The relationship between education and poverty in Table 7.2 is worthy of note. Lack of education, for instance secondary education, may force poor households to engage in low-productivity activities which may result in poverty. On the other hand, poverty may also lead to low investment in education. The interaction of mother's education and poverty has a coefficient that is statistically different

from zero for both the boy-child and the girl-child across all specifications. Our results further suggest that mothers' education interacts with poverty status to reduce probabilities of survival for both sexes. When both the education of the mother and poverty increases, probability of child survival declines. These findings suggest that the beneficial effects of mother's education on child survival are counterbalanced by the negative effects of poverty, such that the effects of the latter eventually prevail.

The intuition behind this result is that high education accompanied by high poverty would force one to seek employment, particularly wage-work, which takes women outside their homes, thus neglecting children, since their low wages do not allow them to employ care-givers while they are away working.

There are several reasons to expect women's participation in the labour force to have beneficial effects. A number of studies (Basu and Basu, 1991; Kishor, 1992; Desai and Jain, 1994; Leslie, 1989; and Popkin and Doan, 1990) have, on the other hand, shown that such participation could have detrimental effects on child survival. More direct effects are seen on nutrition of children and shortened breastfeeding among mothers who work. Other effects include reduced availability of time and a consequent likelihood of increased inability of working women to provide personal and timely care for their children. These negative consequences on health and welfare of children are likely to be exacerbated whenever there is lack of appropriate alternative child care.

Holding constant education while varying poverty status, an educated woman who is also poor, is more likely to have her child die compared to an educated woman who is not poor. Similarly, an uneducated woman who is poor, is more likely to have her child die, than an uneducated woman who is not poor. If on the other hand, we hold poverty status constant, while varying education, a poor woman who is educated has a better chance of having her child survive, than a

poor woman who is not educated. Similarly, a rich woman who is educated has a better chance of having her child survive than a rich woman who is not educated. The overall interaction effect therefore depends on which of the two variables has an overwhelming impact on child survival.

The results further show that the coefficient on household size is statistically significant, and that, large households are negatively associated with child survival for both sexes. Children living in larger households have lower chances of survival than their counterparts living in smaller households. An increase in household size reduces the probability of child survival by 0.0085 and 0.0127 for the boy-child and girl-child, respectively. These results confirm the findings of other studies in this area (Mahadevan et al 1985; Manun'ebo et al 1994; Burstrom et al 1999 and Bawa, 2001). One reason that can be advanced to explain this relationship is that, large households may be associated with overcrowding, which could trigger higher child mortality, especially in situations of epidemics such as measles and chicken pox. Besides, large households imply that scarce resources are spread over many heads, a situation that may reduce a household's ability to care for children. However, since household size is endogenous, these results should be interpreted with caution.

The presence of twins in a household is found to reduce the probability of survival for both sexes. However, the coefficient on twins variable is insignificant in both cases. This is probably the true effect of household size on child survival, given that the twins variable is a good proxy for the household size, and that this variable is exogenous.

7.3 The Abbreviated Social Welfare Indices

Introduction

In order to make the idea of social welfare function empirically operational, it is necessary to specify the particular functional form that it should take. This issue involves a considerable amount of value judgement and generates many defensible alternative forms. Atkinson's seminal paper (1970) on second order stochastic dominance indicated a way of ranking alternative social states without specifying the form of the welfare function. Extension of the theory has developed into third degree stochastic dominance (and statistical significance tests). These procedures have been criticised on the grounds that they concentrate on the equity aspect of the welfare function, ignoring the efficiency aspect.

Lorenz dominance ranking procedure is another widely used approach for ordering various social states. Mukhopadhaya (2001), points out the main flaws of this approach. It gives an incomplete ranking of social states, and that the function underlying the Lorenz principle is such that welfare can be compared only when mean incomes are equal. Shorrocks (1983) using the generalised Lorenz dominance approach has overcome the second problem. However, the problem of partial ranking has not yet been solved.

The generalised Lorenz dominance criterion has been criticised for being too heavily biased towards efficiency, such that a moderate increase in mean income is sufficient to compensate for an increase in inequality. Mukhopadhaya (2001) argues that the generalised Lorenz criterion suffers from the problem of what he calls extreme Paratianity- a situation in which welfare of the society increases for the increase of the richest person's income only, while income of others remain the same. Tam and Zhang (1996) have also criticised the generalised Lorenz criterion on the same point.

In a nutshell, it is evident that all the three options have serious flaws. Stochastic dominance criteria have several disadvantages when used to rank alternative economic situations. The Lorenz dominance has excessive equity bias and the generalised Lorenz dominance has profound efficiency bias. The most serious problem with all the three is that the ranking based on these criteria is not complete (Mukhopadhyaya, 2001). Completeness demands that given two distributions, then for any resultant pair of social states, X and Y, either X is ranked above Y, or Y is ranked above X, or both. The implication is that one should be able to express a preference or indifference between the two alternate states however alike or unlike they may be. An alternative method is the formulation of an abbreviated social welfare function.

An important way of considering and ranking the distributional implications of alternative social states in a complete and consistent manner is through the formulation of a social welfare function (swf). Sen (1970) defines a social welfare function as a real-valued function that maximizes conceivable, hypothetically feasible welfare measures of members of the society on an ordering of the corresponding social states.

The concept of social welfare function was first developed by Bergson (1938). The object was to state in precise form the value judgements required for the derivation of the conditions of maximum economic welfare. Bergson's original welfare function was specified to describe the society as a whole. It was designed to rank the combinations of all those variables on which the individual welfare depends. Arguments in the function included the quantities of different commodities produced and consumed and of resources used in producing different commodities, including labour. In using individual welfare measures as arguments, the social welfare function is individualistic in form. The standard form of this individualistic social welfare function is distinguishable from the 'reduced-form' version that is expressed in terms of inequality measures and

mean income. The latter is generally referred to as 'abbreviated social welfare function' (see Fields, 2000).

In order to estimate the household welfare levels and to rank the various regions in the country according to their levels of welfare, we construct an index of social welfare based on the concept of "abbreviated social welfare function" (*aswf*), first used by Lambert, (1989). Social welfare is abbreviated if it is expressed as a function of statistics calculated from the income distribution vector (Fields, 2000). Abbreviated social welfare function is one way of studying the contributions of average income and the level of distributive equality to welfare in an integrated manner. It considers average income and inequality exclusively when evaluating the level of welfare associated with a specific income distribution. This kind of abbreviated social welfare function has the advantage of providing a criterion for ordering income distributions according to their levels of welfare.

Dutta and Esteban (1992) and Lambert (1993), have discussed the conditions that the general form of the abbreviated social welfare function must have for the results to have a natural interpretation with regard to welfare. This is in recognition of the fact that the inequality index and the form of the chosen abbreviated function have a decisive influence on a welfare index. Our interest is to construct a theoretically consistent social welfare function that is based on individual preferences. In particular, *aswf* uses gini as the inequality index, and cardinal indicators of social welfare, such as the poverty index, household size, parental education, maternal age, area of residence and per capita income. We choose gini index because the use of an *ad hoc* inequality measure begs the question of whether the empirical judgements made using such an *ad hoc* measure will be in accordance with conventional welfare properties. The gini has one property that is particularly appealing, that it is consistent with the monotonicity criterion of ranking welfare levels across individuals.

Under-five mortality rate is useful as a starting point in measuring household welfare, not only because of its place in much of the literature relating income inequality to health, but also because a number of studies have shown that it is likely to respond more rapidly than adult mortality, to changes in the environment, including any effects of income and income inequality (see Deaton and Paxson, 2001). Besides, some studies have confirmed that a striking feature of African mortality is the heavy incidence of deaths in the second and third years of life relative to the first year (Brass, 1975).

Constructing an Abbreviated Welfare Index

To recapitulate, this study uses under-five child survivorship to proxy household welfare, and employs IV probit to estimate the underlying response variable depicted in equation (7), which is also the probit index (y_i) as well as the parameters of interest, β s (see page 87) which are the welfare weights captured in Table 7.2 (page 107). The probit index, y_i is the total subjective benefit that the household derives from child survival and other arguments that enter the welfare function. It can also be interpreted as the abbreviated social welfare index, Z that can be used to rank regions according to their welfare levels. The weights of the welfare function indicate the contributions of the factors that households value to their overall wellbeing. That is, they are weights to each of the arguments of the welfare function.

In order to rank regions according to the standards of living of their populations, we generate a set of welfare indices (Z), by sex and province, using the IV probit estimates in Table 7.2 (page 107). We also use the same estimates to predict the probability of child survival by province. The two sets of results are the welfare indices and probabilities of child survival, respectively, that are used to rank the provinces according to their levels of wellbeing. The results are shown in Table 7.3.

Table 7.3: Abbreviated Social Welfare Indices by Province and Sex of the Surviving Child

Province	Boy-Child			Girl-Child		
	Abbreviated Welfare Index	Probability of survival	Rank	Abbreviated Welfare Index	Probability of survival	Rank
Nairobi	1.0000	0.8041	1	1.2461	0.8474	1
Central	0.8416	0.7867	2	0.9515	0.8139	2
Coast	0.5626	0.7004	7	0.6667	0.7303	7
Eastern	0.6605	0.7315	5	0.7741	0.7624	5
N.Eastern	0.4077	0.6553	8	0.4957	0.6860	8
Nyanza	0.6744	0.7358	3	0.7897	0.7675	3
R. Valley	0.5900	0.7117	6	0.6888	0.7410	6
Western	0.6706	0.7344	4	0.7838	0.7660	4
Rural	0.6225	0.7222		0.7162	0.7502	
Urban	0.9828	0.8092		0.2306	0.8593	
National	0.6604	0.7314		0.7703	0.7617	

The indices generated in Table 7.3, are values of an *aswf* that are determined by child survival, conditional on a number of covariates, including mother's age, poverty status of the household, parental levels of education, household size, place of residence and the interaction between poverty and mother's education.

This welfare indicator, i.e., *aswf*, is a composite measure that captures the welfare effects of income and its distribution, poverty status, parental education, mother's age and other socio-economic characteristics. It departs sharply from the UNDP's Human Development Index. While the UNDP estimates welfare by combining educational attainment, income and life expectancy in an arbitrary

manner, our welfare index captures the welfare effects of each of the welfare determinants in a well specified, and theoretically consistent manner. So, whereas the UNDP measure is subjective, the index proposed here is not. Further, whereas the UNDP index ignores income distribution and poverty status, the proposed index captures them both.

The probability estimates in Table 7.3 can be viewed as non-income measures of wellbeing. The abbreviated social welfare index-Z, combines several dimensions of welfare, including income, survivorship, income distribution and education, among others. It is evident from the table, that welfare ranking obtained using boy-child survival probability is exactly the same as that obtained using girl-child survivorship. It should however, be noted that the probability of survival of the girl-child across all provinces, is uniformly higher than that of the boy-child.

This confirms the findings of a number of studies such as Kishor and Parasuraman (1998), Genton et al (1998), and Madi (2004) that, for all early childhood mortality indicators, mortality is consistently higher for males than for females.

It should further be noted that the probability measure of wellbeing is bounded between zero and unity, whereas the abbreviated welfare measure theoretically stretches from minus infinity to plus infinity. When an abbreviated social welfare measure is negative, it means that the arguments in the welfare function reduce subjective wellbeing and the vice-versa for a positive welfare index. The estimates in Table 7.3 show that welfare levels are higher in urban areas for both the boy-child and for the girl-child, and once again, survival probability is higher for the girl-child (see Ssewanyana and Younger, 2007, for Uganda).

The abbreviated social welfare rankings, shown in Table 7.4 (as column 1994c) compare favourably with poverty rankings generated by Republic of Kenya (1998), see column 1994a, and to poverty rankings reported by Mwabu et al

(2000), see column 1994b. All these rankings are based on the same data set. The differences in rankings are due to the fact that the poverty rankings are based only on income, whereas, the abbreviated welfare rankings are based on a composite index, that includes income and non-income indicators of wellbeing. Nairobi, Central, Nyanza and North Eastern provinces are ranked the same way by income and non-income measures of wellbeing. Notice that although Coast is ranked relatively high on an income dimension alone, it ranks very low when a composite index of welfare is used. Similarly, Eastern province does much better along a composite index of wellbeing.

Table 7.4: Comparing Poverty Rankings to Abbreviated Welfare Rankings (Regions are Ranked from Richest to Poorest)

Province	Poverty rankings		Welfare rankings 1994c
	1994a	1994b	
Nairobi	1	1	1
Central	2	2	2
Coast	6	6	7
Eastern	7	7	5
N.Eastern	8	8	8
Nyanza	3	3	3
Rift Valley	4	3	6
Western	5	5	4

Source: Republic of Kenya (1998), Mwabu et al (2000) and own estimates.

In this study, we assume that for each of the characteristics under analysis, the welfare weights (coefficients on arguments of a probit index) remain constant over time and are the same for all the people in the country. The coefficient in this case, serves a benchmark role, much the same way as the mean income or

the poverty line would. The rationale for this is that society is assumed to determine the benefits associated with child survival, or with a unit of education or income. Thus, everyone benefits the same way from each of these units, much the same way that a person benefits after being at a certain threshold level of income, such as the poverty line.

Differences in wellbeing then arise due to regional differences in probability of child survival or to differences in other endowments and not because one region values an endowment differently. Thus, households with the same levels of characteristics or endowments have the same abbreviated welfare levels. This means that in order to improve the wellbeing of people or regions, it is necessary to improve their endowments (such as assets, income, education or health).

The striking similarities between the income poverty index and the abbreviated social welfare index in terms of what needs to be done to improve the wellbeing of the population should be noted. However, the abbreviated social welfare index has the advantage that it combines many dimensions of wellbeing into a single measure in a theoretically consistent way. Moreover, like the FGT poverty measure, the abbreviated social welfare index can be additively decomposed by regions or social groups using population shares of the groups or regions as welfare weights. There is also need to note that the *aswf* takes into account economic deprivation of households. Thus, the abbreviated social welfare function incorporates effects of poverty in the wellbeing of the population.

CHAPTER EIGHT

8.0 SUMMARY AND POLICY IMPLICATIONS

8.1 Summary and Main Findings

The main contribution of this study is the construction of the abbreviated social welfare index, a theoretically consistent composite measure of household wellbeing. The index captures both the welfare and dis-welfare parts of the wellbeing. Unlike the income poverty index which is based only on income, and which captures only the bottom part of the household wellbeing, the abbreviated social welfare index includes both the income and non-income measures of wellbeing over the entire distribution of wellbeing.

The second contribution of the thesis is its unravelling of the complex channels through which income inequality is associated with child survival. The findings of this study coincide with a heightened awareness and concern in the country, over the extent of income inequality between the rich and the poor. In our analysis, we attribute the positive association between income inequality and child survival to positive externality and social learning. The latter two pre-suppose that the greater rewards offered to the high income earners and the entrepreneurially successful, makes them even more successful, which in turn leads to higher quality overall economic provisioning for their children, which indirectly benefits the children of the poor.

This, however, does not negate the need for redistributive social policies. Current welfare policy in Kenya (Republic of Kenya, 2007a) posits that overall national health can be improved by transferring resources from society's more affluent members to its most vulnerable groups. This position recognizes that there are several ill effects of income inequality. The problem with regard to health is that

inequality has a multitude of causes and consequences, and almost all of these could affect health. However, the factors that might cause inequality might also be consequences of inequality. Proponents of income inequality hypothesis for instance, argue that the health effects of income inequality work through social and cognitive processes, rather than by directly affecting material standards. Implication of this is that the psychosocial effects of being at the low end of social ladder are detrimental to health.

The paradoxical positive association between poverty and survival of the boy-child, which suggests that in a high malaria mortality zone, malnourished children are protected to some extent, against malaria, needs further investigation. Even though most child deaths in Kenya are attributable to malaria, it is our contention that the socio-economic status of poor households, adversely affects child health because it limits access to adequate healthcare, safe water, and sanitation.

The fourth contribution of this study is an exposition of the child-sex preference of parents in Kenya. There exists a large body of literature that documents parental preferences for sons over daughters in much of the developing world; what is referred to as the 'the son preference hypothesis'. Khan and Sirageldin (1977), using Pakistani data, confirmed preference for sons over daughters. Leung (1988), using Chinese data, found evidence of preference for sons as did Aly and Shields (1991), for Egypt and Larsen, Chung and Das Gupta (1998), for Korea. Similarly, Gangadhavan and Maitra (1999) confirmed the same for South Africa and Indian household.

The results of this study, add a new dimension to the 'son preference hypothesis'. Evidence based on Table 7.3 shows that the abbreviated social welfare index is consistently higher for the girl-child relative to that of the boy-child. This is attributable to the higher probability of survival exhibited by the

girl-child in this sample. In a high mortality environment, parents should be inclined to prefer gender of children with a higher survival probability.

Numerous studies report a strong association between parental education and child survival (see Caldwell, 1979; Hobcraft et al, 1984; Mensch et al, 1984; Toros and Kulu, 1988; Caldwell and Caldwell, 1992 and Ssewanyana and Younger, 2007). The findings of this study highlight this widely acknowledged importance of maternal education in the wellbeing of children. Several of these studies also report that female education is more strongly associated with child survival than male education, because mothers are more involved in childcare, also because they spend more time with children. Our study confirms that a mother's education is indeed a more critical factor for child survival, than father's education.

The association between maternal age and child survival is well documented in the literature and the findings of most studies confirm that the right age for motherhood generally lies between 20 and 35 years. The findings of this study confirm this association. Most studies in this area (see Madi, 2004; Majumder et al, 1991; Kim, 1988 and Bhuiya and Streatfield, 1991), are unanimous on the fact that young mothers (below 20 years), have the highest probability of losing their children. Reasons for this are varied, ranging from economic deprivation, ignorance, to limited maternal preparation.

Many of the risk factors associated with this can be mitigated with effective programs for preconception, nutrition and prenatal care during pregnancy. Preconception screening and counselling provide an opportunity to identify and mitigate maternal risk factors before pregnancy begins (Kotelchuck, 1994). Prenatal visits also offer an opportunity to provide information about critical issues, such as information about the adverse effects of substance use, including alcohol (see Chasnoff et al, 1989 and Bigol et al, 1987) and smoking during

pregnancy (Jones, 1986 and Lundsberg et al, 1997), breastfeeding and nutrition (Kovar et al, 1984; Popkin et al, 1990 and Beaudry et al, 1995), all of which affect child survival. It can also provide a vehicle for referrals to services. Yet those least likely to receive adequate preconception and prenatal care are teenagers and low-income mothers (Republic of Kenya, 2004).

Rural residence is negatively associated with child survival. This is because rural Kenya provides conditions that are far from ideal in terms of material wellbeing, yet maternal wellbeing is an important determinant of child survival. Child deaths due to birth injuries can be controlled to a large extent by hospitalization at birth and effective obstetrical care (Powell, et al, 1995 and Kirby, 1996). In Kenya however, 53.9% of births occur at home (Republic of Kenya, 2007b), largely due to cost and accessibility constraints and only 39.1% are delivered in a health facility and a majority of these cases are in the rural areas. This information shows that children in rural areas (60.8%) are twice as more likely to be born at home compared with urban children (25.7%). Overall, 39% of the children are delivered by trained medical personnel, and 39.1% by traditional birth attendants. In the rural areas, 44.4% of the children are delivered by the traditional birth attendants, compared to 17.9% in the urban areas (Republic of Kenya, 2007b).

Some of the commonly touted leading causes of infant mortality such as pre-term birth and low birth weight are associated with nutritional status of the mother (see Mwabu, 2008). According to Sen (1987), however, the nutritional status of the mother, apart from being a function of quantum of food consumed, is a function of nutritional intake of the body. Nutritional intake capacity depends on the health status of the mother, which in turn depends on a number of environmental factors that are far too common in rural Kenya. Principal among these are availability of clean drinking water, malaria and availability of clean fuel for energy requirements (Jayaraj and Subramanian, 2004).

Apart from access to basic amenities, the nature of women's work in the rural areas is also an important determinant of the incidence of infant deaths. Patrizia and Francoise (1987), argue that domestic work or drudgery influence the health status of the mother and the survival of infants. Swaminathan (1997) contends that agricultural work, which in rural Kenya is more often performed by women, has adverse implications for pregnancy outcomes. This position is supported by Batiwala (1998), who observes that the kind of physical strain involved in agricultural work, is an important trigger of premature birth which is a major cause of infant mortality.

Child survival in rural Kenya is therefore under threat from a number of conditions peculiar to such areas. Domestic drudgery, particularly cooking, has been found to have adverse health effects in the rural areas particularly because of high biomass smoke levels and poor ventilation of kitchens. High biomass smoke levels and poor ventilation that are common in most rural homes lead to respiratory infections in young children; adverse pregnancy outcomes for women exposed to smoke during pregnancy, chronic lung disease and associated heart disease in adults, and cancer (Tata Energy Research Institute, 1994). This finding is also supported by Banerjee (1996), who points out that polluted air indoors, apart from causing adverse pregnancy outcomes, also cause high infant mortality. In Kenya, firewood is the most predominant fuel for cooking. According to Republic of Kenya (2007b), two-thirds of Kenyan households depend on firewood. In the urban areas, 51% of the households use kerosene, while 26% use charcoal. In the rural areas however, 85% of the households use firewood. This is indicative of high biomass smoke levels in the rural households.

The findings of this study also confirmed that the household size is inversely related to child survival. Republic of Kenya (2007b), indicate that mean size of Kenyan households grew from 4.4 members to 5.1 members and that the rural areas had larger household sizes than the urban areas (5.5 members compared

to 4.0). It is also instructive to note that the highest recorded household size was in North Eastern (6 members), and the lowest in Nairobi (3.8).

8.2 Policy Conclusions and Implications

The estimated welfare weights, in equation (7) reveal the key determinants of the wellbeing of a household. The elasticity of the welfare index with respect to its determinants suggests policy instruments that can be used to increase child survival and improve household welfare. Moreover, social groups, regions and districts can be ranked according to this welfare index as a way of facilitating targeting of public resources to individuals or areas with low levels of welfare. It is also interesting to compare the welfare ranking obtained using the probit welfare index with the ranking obtained using the FGT class of poverty indices (Foster, Greer and Thorbecke, 1984). It should be noted that a poverty index simply represents the low-end segment of a welfare function.

Thus, the welfare indices computed in this thesis subsume the poverty indices, because they encompass entire distributions of welfare measures, such as incomes and life expectancies. In contrast to the poverty index that ignores the upper distribution of a welfare measure, the probit index displays the entire distribution of a welfare measure. Moreover, in addition to life expectancy and income, other determinants of welfare are encompassed in a probit index. Indeed, a probit index of the form formulated here, is a consistent device for aggregating the various dimensions of welfare into a single index.

The link between income inequality and child survival is important in showing how child health could be improved through improvements in health care and broad-based equity and social justice within and across regions in the country. The findings of this study are also important because of their relevance for the design of policies in non-health sector which have a bearing on child health, such

as promotion of female employment and investment in community level infrastructure such as clean water supplies.

However, income inequality is linked to several other aspects of social policy and this may make it difficult to isolate its independent effect on child survival. Besides, a number of studies (see Wolfson et al, 1993; Menchik, 1993 and Hart et al, 1995), bear out the expectation that cumulative measures of lifetime social circumstances such as wealth, family assets, lifetime earnings and occupational careers are some of the most crucial socio-economic indicators of longevity.

The paradoxical association between poverty and survival of the boy-child notwithstanding, economic and social policies are needed to address problems of poor child health. Attention should not only be directed at poverty alleviation programs, but also at programs that improve child survival, and early child development. There is also need to make improvements in preventive medicine and in maternal healthcare. With increased expenditure on healthcare, it is possible to have in place, programs that focus on public health information, behavioural change and health education. Such programs can serve to promote better initiatives, in areas of reproductive and environmental health, thereby promoting child survival. Increased public expenditure can also lead to more facilities and improved access to physicians, improving the accessibility of healthcare to most of the poor.

Higher girl-child survivorship probability has important welfare implications. In a low-mortality area, child survivorship is not a critical element in the welfare function of parents. In a high mortality area however, a child that has a higher survival probability, irrespective of sex, is valued more. The results of this study suggest that if Kenyan parents had a say in choosing a child's sex, they would prefer girls, on account of their higher chances of survival in a high mortality environment.

Since maternal education has a positive influence on child survival, there is need to ensure that education of the girl-child receives due attention in policy making, so that when she becomes an adult, she can use that education to raise healthy children thereby contributing to better health of the next generation. The results further imply that a change in population health related policies is needed in Kenya to reduce socioeconomic inequalities in under-five mortality, especially among vulnerable groups. The policies should consider the cause-affect relationship between under-five mortality and a household's socioeconomic status as captured by maternal education, and such policies should strive to reduce the burden of excess child mortality and morbidity suffered by children in poor households.

It is notable that the evidence of strong association between mother's education and child survival has been used as an argument in favour of targeting educational expenditures towards girls. The findings of this study suggest that father's education is also important in boosting children's chances of survival. Expanding educational opportunities for both boys and girls would therefore be a concrete policy change that the government could make, and that would ultimately help reduce child mortality.

The effect of interaction of maternal education with poverty on child survival provides another entry point for the prevention of under-five mortality through policies that seek to reduce poverty and social inequity. It is notable that at present, efforts aimed at reducing infant mortality in the general population is mainly focused on the delivery of various clinical and public health technologies, which tend to ignore the economic and psycho-social constraints related to the effective use of health services. These factors that restrict households from using the available health facilities and new health technologies, (such as maternal education, and poverty), may well be the factors that predispose the child to higher risks of mortality in many parts of the country, particularly the rural areas.

In order to address the effect of maternal age on child survival, there is need to ensure that as many pregnancies as possible occur at the right age (see Mwabu, 2008). Policy intervention should therefore target unwanted and poorly timed pregnancies, and improvement of coverage and quality of prenatal and postpartum care, especially among the teenage girls (see Chasnoff et al, 1989 and Bigol et al, 1987). In addition, intervention should target promotion of cross-sectoral linkages that can create enabling policies and political commitment, enhance community participation and address contextual factors such as poverty, access to economic resources, teenage girls' education, nutritional status and special needs of adolescents.

A more critical intervention would be to encourage delayed marriages and first birth for adolescents. This can be done by ensuring at least secondary school education for girls, and by discouraging early marriage by raising the minimum legal age of marriage from the present level of 18 to 20 years for girls. First births can be delayed by postponing the onset of sexual activity and by using effective methods of fertility regulation. Towards this end, efforts should focus on changing individual and societal motivations for early child bearing. Education and employment opportunities could play a critical role in providing alternatives to early motherhood.

Rural households have peculiar needs. By ensuring that households have access to the basic amenities of life, particularly safe and protected drinking water, a large number of conditions which affect the nutritional intake capacity of mothers in the rural areas could be prevented. Provision of safe and adequate drinking water also helps to conserve the energy of the mother, which improves her nutritional status and that of the foetus (Burger and Esrey, 1995). Availability of clean water is also likely to reduce the incidence of late foetal and infant mortality due to diarrhoea and other intestinal infestations. Republic of Kenya (2007b), however, show that in rural Kenya, only 48% of the households have

access to safe sources of drinking water (piped water, borehole, and protected spring and well) compared to 83% of the urban households. Every effort should therefore be made to ensure that rural households are placed within easy reach of safe water sources.

In order to address the problem of child- deaths that result from the nature of women's work, it may be necessary to provide females in the rural areas with an alternative source of employment or income. This calls for a policy of diversification of female employment opportunities away from agriculture to other sectors, particularly the services and allied auxiliary sectors. In the long run, there may be need to promote education of the girl-child, with a view to equipping them with technical and professional skills needed to perform the physically less demanding jobs in the manufacturing and services sectors. This is particularly important, in view of the fact that in Kenya, there are notable variations in literacy levels between the sexes. Republic of Kenya (2007b), confirms that males are more literate than females in all provinces.

To reduce the adverse health effects of high biomass smoke levels in the rural households, policy measures could be put in place to harness cheap, clean, sustainable alternative energy sources such as solar energy, but above all measures to reduce poverty in the rural areas in general, could lead to a switch to cleaner, efficient but definitely, financially more costly alternatives.

8.3 Areas for Further Research

The nature of the association between income inequality and child survival is not clear cut, given that the former is linked to several aspects of social policy. Consequently, it is not certain what its independent effect on child survival is. This calls for further research to enable a proper understanding of all socio-economic indicators and environmental characteristics that are not directly measurable and how these factors affect wellbeing of households.

Second, evidence on the relationship between poverty and child survivorship is controversial and inconclusive. This study suggests a paradoxical role for poverty in child survival, a position which supports conclusions drawn from a number of other studies (see Hendrickse et al, 1971; Ahmad et al, 1985; Murray et al, 1978; Genton et al, 1998 and Nyakeriga et al, 2004). Nevertheless, we concede that the process through which this interaction takes place is rather uncertain and complicated. Further studies should therefore aim at confirming this relationship and exploring the potential mechanisms involved.

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APPENDIX

Calculation of Gini Index and Income Quantiles

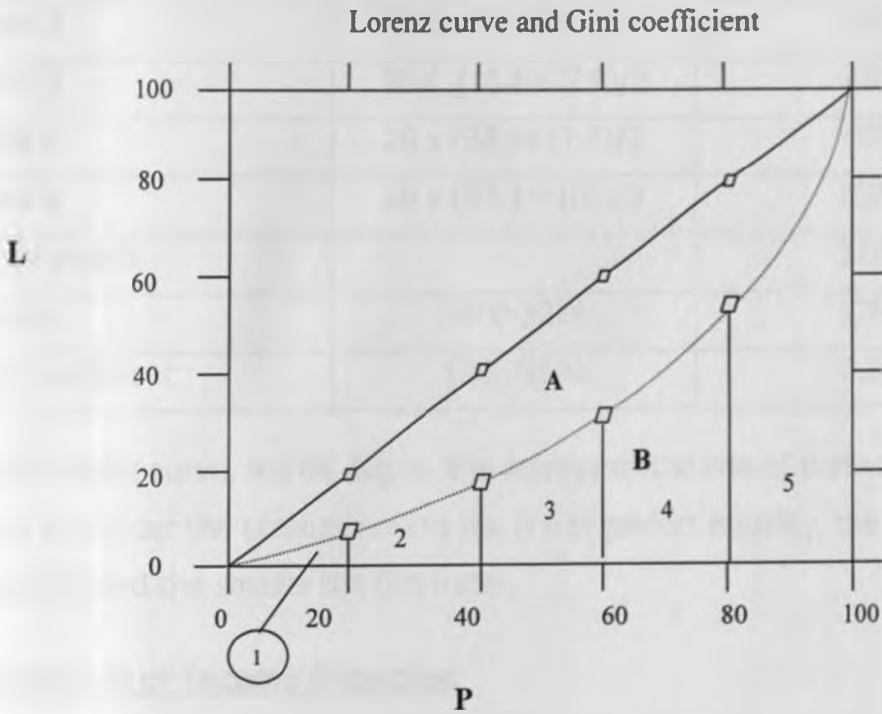
In order to estimate the gini coefficients, we constructed the Lorenz curve. To do this, we first ordered all household income from the lowest to the highest. Each income was then plotted according to their cumulative percentage share of population in income as captured in Table A1.

Table A1: Household Income Distribution

Households by income category	% share of income	% share of population (P)	Cumulative share of income (L)
First 20%	4.7	20	4.7
Second 20%	11.1	40	15.8
Third 20%	17.1	60	32.9
Fourth 20%	24.4	80	57.3
Last 20%	42.7	100	100.0

The Lorenz curve (Figure A1), was then plotted as the cumulative income share L against the cumulative population share p . The Gini coefficient was defined graphically as a ratio of two surfaces involving the summation of all vertical deviations between the Lorenz curve and the perfect equality line (A) divided by the difference between the perfect equality and perfect inequality lines (A+B).

Figure A1: Lorenz Curve and Gini Coefficient



Calculation of Gini Index

The Gini index was calculated from the Lorenz curve as the ratio of for example $G = \text{Area A} / \text{Area A} + \text{Area B}$ in the above illustration. Area A + Area B is the area of the triangle given by $100 \cdot 100 / 2 = 5000$, i.e., half base times height. This is shown in Table A2.

Table A2: Calculation of Gini Index

Area A + Area B	$100 \times 100/2$	5000
Area 1	$20 \times 4.7/2$	47
Area 2	$20 \times (4.7+15.8)/2$	205
Area 3	$20 \times (15.8+32.9)/2$	487
Area 4	$20 \times (32.9+57.3)/2$	902
Area 5	$20 \times (57.3 +100)/2$	1573
Total area B		3214
Area A	$5000-3214$	1786
Gini coefficient	$1786/5000$	0.36

In the Lorenz curve, the 45 degree line represents the line of perfect equality. Thus, the closer the Lorenz curve to the line of perfect equality, the less the inequality and the smaller the Gini index.

Calculation of Income Quantiles

Household incomes for all households were used to compute the income deciles. The distribution obtained was then used to compute cumulative percentage shares of incomes and the Gini index as summarized in the Table A3.

Table A3: Calculation of Gini Index and Income Deciles

Income deciles	% share of total income	Cumulative share of income	Calculation of Area B	Total
1	0.8	0.8	$(10 \times .8)/2$	4
2	1.7	2.5	$(10 \times (2.5+.8))/2$	16.5
3	2.7	5.2	$(10 \times (2.5+5.2))/2$	38.5
4	3.6	8.8	$(10 \times (5.2+8.8))/2$	70
5	4.9	13.7	$(10 \times (8.8+13.7))/2$	112.5
6	6.2	19.9	$(10 \times 13.7+19.9)/2$	168
7	8.1	28.0	$(10 \times (19.9+28.0))/2$	239.5
8	11.0	39.0	$(10 \times (28 + 39))/2$	335
9	16.3	55.3	$(10 \times (39.0 +55.3))/2$	471.5
10	44.7	100	$(10 \times (55.3 +100))/2$	776.5
Total	100		Total area B	2,232
Total			$(100 \times 100)/2$	5,000
Area A+Area B				
Area A			$5000 - 2232$	2768
Gini Coefficient			$2768/5000$	0.5536

TABLE A4: IV Probit Basic Regression Results (z-values in parentheses)

Variables	Survival probabilities	
	Boy-child	Girl-child
Log of per capita income per adult	0.0282 (8.51)	0.0312 (9.90)
Income inequality (gini)	0.8958 (5.09)	0.7743 (4.51)
Income Inequality squared	-1.1424 (2.68)	-0.4562 (1.04)
Predicted poverty status	-0.0993 (4.98)	-0.1436 (7.39)
Age of mother, years	-0.0033 (14.20)	-0.0017 (7.69)
Education of father, years	0.0091 (13.42)	0.0098 (14.91)
Number of Observations	32083	32083
Percent correctly Predicted	73.63	76.07
Log-likelihood function	-18149.12	-17082.50
Pseudo R ²	0.0300	0.0324

TABLE A5: Variables in Probability and Instrumental Variable Probit Estimates

Variable	Observations	Mean	SD
Age of mother, years	32216	0.7071	0.4551
Age of mother squared ($\times 10^{-2}$)	32216	1394.7	820.26
Education of mother, years	32216	4.2038	4.2290
Education of father, years	32216	4.4998	4.5925
Residence (rural=1)	32216	0.8947	0.3069
Log of per capita income per adult	32083	9.7999	0.8597
Income inequality (gini)	32216	0.0361	0.0381
Income inequality squared	32216	0.0028	0.0166
Poverty status	32216	0.7086	0.4544
Predicted poverty status	32216	0.7086	0.1744
Mother's education \times poverty status	32216	2.4788	2.4824
Size of the household	32216	7.1292	2.4509
Twins (1=Multiple birth)	32216	0.0311	0.1737
Total land holding area	32216	4.1853	9.8864
Total number of cattle owned	32216	8.0650	42.035
Non-agricultural rent	32216	49.272	590.85
Agricultural rent	32216	21.35	208.03
Log of total land holding area	32216	1.1287	0.9070
Log of total number of cattle owned	32216	0.9989	1.1865
Log of non-agricultural rent	32216	0.1805	1.1028
Log of agricultural rent	32216	0.2673	1.1718
Boy-child survival (1=survival)	32216	0.7305	0.4437
Girl-child survival (1=survival)	32216	0.7612	0.4264