

**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**“Distributional Consequence of Trade Exposure in Rural
Ethiopia: A Household Level Analysis”**

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Ethiopia: A Household Level Analysis”**

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LISTS OF ACRONYMS

CGE:	Computable General Equilibrium
CV:	Coefficient of Variation
EDG:	Equally Distributed Growth
EEA:	Ethiopian Economic Association
ERHS:	Ethiopian Rural Households Survey
FDI:	Foreign Direct Investment
GLS:	Generalized Linear Regression
HH:	Household
IFPRI:	International Food Policy Research Institute
IMF:	International Monetary Fund
LDCs:	Least Developing Countries
MDGs:	Millennium Development Goals
MLE:	Maximum Likelihood Estimation
SAM:	Social Accounting Matrix
SNNPR:	Southern Nations Nationalities Peoples Region
UNDP:	United Nations Development Programme
UNU:	United Nations University
USAID:	United Nations Agency for International Development
WIDER:	World Institute of Development Economics Research

Abstract

The paper attempts to examine the determinants of income inequality, and the interrelationship between cultivation of cash crops and the existing income inequity in the rural Ethiopia from 1994-2000 applying the regression-based decomposition with Shapley value Decomposition of Shorrocks(1999) using the ERHS of Department of Economics, AAU. The result indicates that household size, dependency ratio and age of the head of the household in the family affect the per-capita consumption/income negatively. Producing exportable items contribute positively to the household's per-capita income. Per-capita land holding, credit facility, and proportion of working adults (both male and female) impact consumption expenditure/income positively. Male headed households have higher income compared to female headed. The decomposition result reveals that none of the included variables in the model are found to be equalizing, meaning that each of the variables exacerbates income inequality. Per-capita land holding, household size and location are the major contributor to the overall inequality.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

There exists debate among economists regarding income inequality; there are some who believe that economic growth especially when it is rapid can improve income distribution. But some economists forwarded counter-arguments that inequality is the consequence of economic growth that in turn could adversely affect economic growth (Kwan, 1996). So according to the latter argument, there is vicious cycle between economic growth and income distribution. On the other hand, Kuznets (1955) argued that even though income distribution gets deteriorated following growth, it can be rectified when there is sustainable economic growth and deterioration in income distribution is a not a longer period phenomena. Any ways economic equality is determining factor to growth.

Most Sub- Saharan African countries still remain underdeveloped with majority of its population live in a state of absolute deprivation earning less than a dollar per day which especially at the present time is not sufficient to fulfill the minimum daily calorie requirement. Surprisingly, on the other hand, there are few individuals who are enjoying luxurious life; they have got lion's share in the total national income, and it is mounting from time to time (Cornia, 2003).

Economic equity is also among the central and fundamental economic goals that every nation desires to attain. As explained briefly by Due (1963), in the modern market driven economies, there are four goals which are ordinarily considered to be paramount, so far as economic activity is concerned. These are:

- Guaranteeing higher level of individuals freedom of choice
- Optimum standard of living given the society's resource endowment

-Attainment of desired rate of economic growth

-Fair distribution of income among individuals in the nation in accordance with currently accepted standards of equity.

This implies that economic inequality is one of those prime economic goals. Hence to implement policies that harmonize equity with economic growth and to design a strategy that redistribute the spill over effect of growth in the process of economic development, it is self evident to identify the contributing factors to the already high income disparity especially developing countries including Ethiopia, which is the central point of this study.

So far as determinants of income inequality and factors that affect the inequality is concerned, different previous empirical studies as well as theoretical explanations are found to be much contradictory in different economic and political environment. And some variables even may have different impact on the level of income inequality across nation. Kassa (2005) puts this as follows:

“It can be said that in case of many factors of income inequality there is no agreement on earlier surveys about the character of the influence exerted by a particular factor on income inequality. Both the theoretical assumptions & the results of empirical analyses vary, often ranging from a negative to positive effect, including the possibility of no effects at all.”

Land, for instance, has equalizing effect on income in China (Wan, 2002) where as it is a contributing factor to the existing inequality in Korean farm households (Arayama et al, 2006).

Though there are various dimensions of inequality ranging from inequality in skills, education, opportunities, happiness, health, life expectancy, welfare, assets and social mobility (Heshimati,2004), here as economist the emphasis lies on identifying the determinants of

monetarily measurable inequality; and the possible consequence of international trade on the inequality thereby poverty in the country.

1.2 Statement of the problem

In the Sub-Saharan African countries, the trend of income distribution is that the urban-rural income gap falls where as the intra-urban and intra-rural inequality has showed a sharp increment (Cornia, 2002). The empirics on inequality in Ethiopia reveal that the degree of inequality in urban Ethiopia is rising from time to time; but it remains as it was at the initial level with a greater variation across time among Ethiopian rural households (Alemayehu et al, 2007). This rising inequality threatens the economic growth and poverty reduction strategies (Cornia and Court, 2001). Besides this such unequal income share among individuals of a given society may lead to social upheaval, and increased violence, all in all political instability in the country (Kwan, 1996). According to Uslaner (2006) economic inequality pave the way for a good ground to higher corruption rate.

In Ethiopia, the income share of the poorest 20 percent is less than 10 percent while the share of the richest 20 percent is about 48 percent which reflects the intensity of income disparity among the citizens. The same is true in the rural areas of Ethiopia.

Individuals in the rural area are mainly engaged in agricultural activities (rain fed agriculture) for their main livelihood and they don't have diversified source of income unlike the urban dwellers. Due to this, their sole source of income, agriculture, is susceptible to variation depending on weather condition, which has a direct bearing on income disparity. Farmers who diversify their income source through the cultivation of cash crops relatively may earn higher income. Therefore this study is undertaken with the intention of investigating the underlying economic rationale behind the prevailing income disparity among rural households and the effect

of international exposure in trade on income inequality.. In short the issues that are addressed include:

- What are the main determinants of income/consumption expenditure and income inequality in the rural areas of Ethiopia?
- What is the impact of cultivation of exportable commodities i.e. chat, coffee, oil seeds (the channel through which rural farm households are exposed to the international market) on the overall income distribution?
- What contributes to the rising income inequality among the households?

1.3 Objective of the Study

The specific objectives of the study include:

- To examine the level of income disparity in the rural areas of Ethiopia and identify the determinants of the existing income inequality among the rural households
- To quantify the contribution of each of the explanatory variables to the overall inequality by decomposing the total inequality.
- To investigate the impact of cultivation of exportable commodities by farm household in addition to the socio-economic factors on the per-capita income and on the prevailing unfair income distribution.

1.4 Significance of the Study

Identifying the main sources of income for the rural farm households that exacerbate the pattern of income distribution enables policy makers to direct developmental efforts towards those which reduce the inequality thereby absolute poverty. Some of the significances accruing to this study are the following:

-In any nation wide economic policy making process, identifying the appropriate instrument target mix is very much important which requires a thorough research. Hence this study gives information on the effect of different income sources on income inequality which have direct implication on the policy requirement.

-These days the world is so integrated in different social, economic, political aspects. The government should take different impacts in to consideration when deciding to liberalize the economy. The result of the study, therefore, enables the concerned authorities to be aware of the impact of liberalizing trade on the rural poor.

-It contributes to the stock of knowledge in the field, and paves the way for other researchers to further enhance the stock by identifying other factors that are overlooked here in this study.

1.5 Working Hypothesis

It is hypothesized that demographic factors and location are the main factors for the existing income inequality in rural Ethiopia; and international trade affects the rural farm households' per-capita income/consumption and also income disparity between households when farmers alter their production mix from consumables to the cultivation of exportable commodities.

It is also hypothesized that difference in the production mix among farm households puts upward pressure on income inequality.

1.6 Justification of the Study

This empirical investigation on inequality in Ethiopia incorporates the effect of production of cash crops like coffee, chat and oil seeds, which have got a lion share in Ethiopia's export earnings, on the lives of the rural households. Farmers who participate in the production of these primary commodities could be susceptible to the international market and could be affected by the external trade policy of the country. Here the question is how participation in the production of such exportable items does impact the consumption patterns; and does it have effect on income inequality among the rural farmers? If it is, how the direction goes on i.e. disequalizing or equalizing effect on the income disparity?

1.7 Organization of the Paper

The whole of the paper is organized as follows. In the first chapter, introductory parts are discussed. Related literatures with empirical evidence and theories are presented in the second chapter. The third chapter highlights methodologies that are applied for the analysis part. The descriptive parts followed by regression and decomposition results are presented under the fourth chapter. While the last chapter is devoted to drawn conclusion and forwarded recommendation.

CHAPTER TWO

THEORETICAL FRAMEWORK

2.1 Understanding Inequality:

Income inequality means different things to different observers; it is an ethical and moral issue for some commentators while for others including economists beyond that inequality is a determinate factor for poverty reduction strategies and economic growth. Compared to poverty which deals with only censored distribution of individuals or households below a certain threshold, income inequality has a broader concept for it is defined over the whole distribution in a given economic system. In short, income inequality refers to a measure of how various assets are distributed within a given system of units; when the income share of the upper quintile increases, the share of that of the lower quintile will decrease; and as the middle category in the income distribution gets weaker, the degree of inequality [measured by different indices like Gini-coefficient and others] will get higher (Väyrynen, 2005). Measures of inequality and poverty, and the size distribution of income/consumption and wealth can easily be analyzed using Lorenz Curve. The cumulative share of total income is plotted against the cumulative proportion of income receiving units which will give us the Lorenz Curve. Different inequality indices (including Gini-coefficient) originate from this curve. The divergence of a Lorenz curve for perfect equality (when there is one to one relationship between cumulative income generating units and cumulative income share) and the Lorenz curve for a given income distribution is measured by some index of inequality (Heshmati,2004). Income inequality seems synonymous with income polarization but they are slightly different for the later focus more on the upper and lower end of the distribution of assets measured by polarization index. Polarization index serves as a complementary to the conventional measures of inequality for the inequality index like Gini-coefficient may not fully capture inequality dynamics (Agenore, 2001).

Income inequality has three different levels (Cornea and Court, 2001). These are:

- i) Global inequality – income differentials between all individuals living in the globe.
- ii) Economic wise disparity among nations is referred to as international inequality
- iii) The third one refers to the kind of inequality that is observed between individuals or households with in a country- national inequality

National income inequality is so crucial for it may contribute to global inequality and it can be easily targeted at national level policies unlike global and international inequality (Cornea and Court, 2001).

2.2 Why does inequality matter?

Unequal opportunities and life chances are partially attributed to the existing extreme inequality among households. Such unbalanced opportunities and chances have got a direct bearing on what individuals can do and what they can be in their life career. Beyond this, good governance and democracy, social solidarity and economic growth including poverty reduction strategies in general can be highly influenced by deep disparity (UNDP, 2005)

Such inequity may also goes to the challenge of good realization of global strategies like the Millennium Development Goals which are, indeed, neutral in distributional aspect as they don't explicitly address the issue. Under the MDG's, whenever there exists aggregate improvement in human development , these goals could in principle be achieved even if the living standards of the poor which constitute majority population in developing country is getting worse. But with out giving due consideration for such proportion, the MDG's growth would be a mere development (the African Economist, 2007)

According to UNDP's 2005 Human Development Reports, there are four fundamental reasons why inequality does matter.¹

i) Social Justice and Morality

Even if income disparity is inevitable in the market functioning economy, economists argue that there should be limits to tolerable deprivation. Adam Smith two hundred years ago explained about the inevitability of inequality “No society can be flourishing and happy, of which the far greater parts are poor and undernourished”. He also added all members of the society should have sufficient income to appear in public with out shame.

ii) It affects Poverty reduction strategies and economic growth

Income distribution affects the poverty reduction strategies through its impact on economic growth. The consequence of such disparity on the economic growth is that more growth rate is needed to attain an equivalent poverty reduction outcome which is the prime strategies of most developing countries.

In their studies of growth, poverty and inequality in Ethiopia using the Ethiopian house data, Alemayehu et al (2007) find that economic growth is highly affected by extreme inequality. If growth were equally distributed across to all income percentiles, poverty would decline by more than half which indicates that how pro-poor growth is very crucial.

Developing nations have to grow at over three times the pre-1990 rate to achieve the same reduction in poverty incidences. This is due to the fact that there countries are experiencing increasing income inequality (Lopez, 2006).

Cornia and Court (2001) note that rising inequality threatens economic growth and poverty reduction targets in order to meet the global targets for reducing poverty, it will be essential to make pro-growth policies more distributionally favorable. All in all in a country where

¹ Human Development Report 2005. International Cooperation at a Crossroad

inequality is growing, the lower quintiles in income distribution find it difficult to send their children to school and they don't have the access even to basic-level education (if they are willing to send) & basic health care. Consequently, such families remain unproductive and can't be competitive with the rich family which will in turn intensify the disparity b/n these two economic classes. Such vicious cycle between growing inequality and lower productivity will thereby hamper the long run sustained economic growth (Kwan, 1996).

iii) Inequality leads to political instability and social unrest

As Kwan (1996) noted unfair distribution of income can also lead to unstable political systems and higher crime rate. As a consequence of inequality in income and human capabilities, individuals will have unfair political power and voice. Such unfair political power and voice will be reflected in higher crime rate and social unrest which is common in most African countries. The 1990's armed conflict, for instance, in Somalia and Rwanda are mainly due to distributional inequity among individuals and different ethnic groups.

iv) Diminished Returns to increased wealth

Redistribution of income from the rich to the poor is not actually Pareto optimal for the rich will be worse off following the redistribution policy. But the idea of diminishing returns to increased wealth provides a frame work for understanding a simple idea: an extra dollar in the hands of the landless agricultural laborers or urban slum dweller results in much higher welfare than an equivalent amount in the hands of a rich business man. Hence we can conclude that it is rational for government policy makers to favor a policy that entitle a poor peasant \$1, nevertheless it costs the rest of the society more than one dollar.

v) Public policy choice

Reducing poverty and removing unfair income distribution is prioritized as the most important public policy for it is believed that extreme disparities undermine the pursuit of different

economic goals. Similarly, extreme disparities in health and education reduce the scope of disadvantaged groups to take advantage of opportunities for improving welfare.

These are some of the reasons why inequality matters, even though there are some counter-arguments for the forwarded reasons (beyond the scope of the study).

2.3 Influencing Factors of Income Inequity

i) Economic Growth

Different empirical studies have been conducted on the association b/n economic growth and inequity in the distribution of income especially since 1950's when most developing countries have started experiencing growing inequality. The pioneer work in this regard is that of Simon Kuznet (1955). Kuznet (1955), on the basis of time series data from few developed countries (United States, United Kingdom and Germany), forwarded his argument on the link between income distribution and economic growth-known in economic literature as "***the KUZNET HYPOTHESIS***". According to this hypothesis, deterioration in income distribution is a consequence of growth in the earlier stage of the countries industrialization process, and the distribution will reach a 'turning point' when the (previously) excessive rural labor supply in the process of industrialization disappears, then after there will be improvement in the distribution pattern. Kuznet (1955) pointed out two forces in the long-term operation of developed countries experience that leads to escalating income inequality in the process of transformation away from agriculture.

The first of the forces is related to saving behavior of individuals i.e. it is the upper-income groups that usually save. Such inequality in saving among individuals has a direct bearing on asset holdings (i.e. there will be a concentration of income yielding assets in the hands of the upper class). As a result, the income share of the upper quintile goes up. Where as the second

force attribute to the industrialization process. The experience of the developed countries has shown us that the shift away from agriculture, a process referred to as industrialization and urbanization, follow when the country grows. Hence the total income distribution of the whole country consists of both the rural and the urban population. The two components of income distributions reveal that the average per capita income of the urban population is some what higher than that of the rural population and income distribution in rural areas is found to be fair than in urban areas (Mukheejee and Ghosh,1951; quoted in Kuznets (1955)). Given this, Kuznet (1955) concluded that the country's total inequality will get worse for the more unequal population has got a higher weight.

To sum up, Kuznet (1955) argued that economic growth at early stage causes growing inequality in income distribution (assuming the causality goes from growth to distributional consequence while ignoring the possibility of simultaneity between growth and inequality). Following this, debates among different economists have emerged and this hypothesis has been empirically tested in different countries which ended up with mixed findings.

Based on the East Asian experience, Stiglitz (1996) explicates that growth and equality could be achieved without any trade off between them provided that there are active policies. The experiences of East Asian countries of 1980s and early 1990s witnessed the possibility of higher economic growth without worsening income distribution which is against the 'Kuznet Hypothesis'. In the later years of these countries' economic growth, policies designed primarily to secure fair income distribution did contribute to further economic growth with the outweighed positive effects of reduced capital accumulation. In addition to this, such policies stabilized the political environment of these countries. Provision of rural credits in Thailand, for example, not

only had an equalizing effect on incomes the household but also brought reasonably high economic growth.²

Higher inequality does slow down economic development in developing countries; on contrary to this it fuels economic growth in developed countries (Barro, 1999). And Barro (1999) finds that the Kuznet hypothesis does hold true in a panel of rich and poor countries, but this relationship does not explain the disparity in income across countries overtime. Complementary to this, Atkinson (1999) found that income inequality is not inevitable in the process of economic growth using data from developed countries.

Xiaolu (2006) investigates whether the inverted U-shaped Kuznet's Curve does explain China's economic situation or not based on provincial level panel data between 1996 & 2002 when the country experienced increased average per-capita income accompanied by widening income gap between the poor and the rich which may in turn pose a serious threat to social stability and the sustainability of economic development. The study predicts that the increasing trend of income inequality will persist in the future as well. The urban-rural income inequality function is an increasing function and the Kuznet's hypothesis does not characterize the China's present situation. The factors that significantly affect the income disparity include trade dependence, investment ratio and FDI ratio (which have positive impact on urban-rural income inequality). Urban employment rate has an equalizing effect on income among individuals.

ii) Traditional causes of Inequality

Cornea and Court (2001) noted that economic growth is not the exclusive factor for income disparity, there are factors beyond economic growth that shape income distribution with in a given economic system which are considered to be the root causes. These comprise household characteristics, labour composition of households, geographical factors, land concentration

² Joseph E. Stiglitz (1996). Some Lessons from the East Asian Miracle

especially in rural areas, and urban bias and inequality in education, and so on which are referred to as ‘*traditional causes*’.

The common practice in the decomposition of inequality analysis was decomposition by population sub-groups on discrete basis which results in a quantitative measure for each of the determinants (factors) of inequality including household characteristics. Akita (2001) applied a Two-Stage Nested Inequality decomposition analysis by dividing the whole of China into three regions as adopted by the seventh five year plan (1986-90) – the western, central and Eastern (or coastal) Regions) to study regional income inequality in china, and finds that the overall regional inequality in the late 1990s is mainly the result of within provincial inequality.

The application of the standard decomposition by sub-groups was restricted because of the failure of the method for continuous categorical variables. Of course, Shorrocks and Wan (2004) review the spatial decomposition methodology which can be applied to analyze the spatial disparity in living standard with some propositions.

As an alternative to decomposition by sub-groups, researchers following Oaxaca (1973) have started using regressions analysis in inequality decomposition. Oaxaca, indeed, used regression estimate to analyze male-female wage earning differentials but the approach has attracted interests in inequality analysis in recent years for it overcomes the limitations associated with the decomposition by sub-groups.

Regression-based approach for inequality decomposition is employed in such a way that first the income flows from different sources are estimated using standard econometric tools. The methodology allows researchers to find the contribution of each of the included variables and the random error which is assumed to be white noise to the overall inequality. In regression analysis, the emphasis is on coefficients and statistical significance where, as in decomposition analysis; the intention is to supplement the regression analysis by quantifying the explanatory power of each of

the included independent variables. Additional advantage of this methodology is that it can be employed with different inequality measures.

Having rectified the pitfalls associated with such decomposition analysis of population sub-groups, Morduch and Sicular (2002) applied the regression-based decomposition method to rural China on the basis of panel data (1990 through 1993) taken from 16 villages consisting 259 farm households. According to this study, the relative contributions of three frequent explanations for growing inequality do depend on the decomposition rule used. Political status of the head of the household is included in the regression for it was believed in China that communist members are beneficiary, and it is found that it (whether the head is member of the communist party or not) has a disequalizing effect on the income distribution of rural farm households in China during the period under study even though it is not that significant. But Morduch and Sicular (2002) procedure imposes restriction on the structural form of the income generating function.

An early attempt to apply the regression-based decomposition framework with Shapley value decomposition of Shorrocks (1999) to the study of inequality accounting in rural China was done by Wan and Zhou (2004) using household level data. It is found that geography has been the dominant factor but is becoming less important in explaining total inequality. Capital input emerges as a most significant determinant of income inequality. Farming structure is more important than labour and other inputs in contributing to income inequality.³

Arayama and Kimhi (2006) applied the regression-based that takes different income sources and income regimes in to account and corrects for selectivity in to different income regimes using cross-section data from Korean farm households. According to the results of this

³ Guang Hua Wan (2002) of course applied the Shapley value approach of Shorrocks (1999) in rural china as an illustration. And it was found that land has got negative coefficient in income generating function for regions in China with more abundant land are backward and dependent on farming where as the land scarce areas are prosperous.

study, much proportion of the inequality in the Korean farm household income is because of the variation in family size and composition, and land ownership. Through its effect on farm income, family size and land ownership contribute to total inequality where as the family composition impacts income inequality via non-farm income.

To examine the determinants of income inequality in Nigeria, Taiwo Timothy (2006) employed the extended regression-based decomposition method and found that household size has a negative and highest impact on the level of household consumption. It was also found that household size constitutes the largest share in the total income inequality. In addition, education, age and productive hours committed to primary activity of the household impacts income positively.

2.4 Income Inequality-Free Trade Nexus

Directly or indirectly trade liberalization does affect the population of a given country as a whole and its effect may alter the pattern of income distribution for there might be losers and gainers from the liberalization process. Hence income inequality can be aggravated by freer trade because it is the poor that bear the adjustment costs of severe competition from imports, on contrary there are some individuals who may be beneficiaries from the export opportunities if they have sufficient assets and are entitled to market power (UNDP, 2005). Higher growth rate in exports does not necessarily heal poverty in a country. Studies, for instance, in Madagascar in the late 1990s showed that boom in textile exports did create employment opportunities to skilled workers but the overall result was escalating income inequality and a modest impact on poverty (UNDP, 2005).

Trade liberalization does also affect education (Carlson, 2001). In Latin America extreme disparities in primary and secondary school completion rates and resulting shortage of skilled

workers have increased the premium on higher education. As Human Capital theory explains that such educational disparity will exacerbate income inequality through its impact on productivity and earning of household.

According to UNDP (2005), deep structural changes in the world economy are narrowing the opportunities for exposed economies of developing countries to secure the free trade advantages to speed-up human development. Free trade has got economic challenges especially to developing nations like the long-run reduction in commodity prices and the increasing power of gatekeepers.

Coffee price is a good example that is subject to the first challenge which leads most developing countries (coffee exporters) to huge crisis. Studies by Gibbon (2003) indicate that exporters from developing countries are highly the victims of falling commodities' price in the international market. Because producers are small holders, declining such commodity price is directly translated to reduction of household incomes. This is true to Ethiopian coffee producers. Even if the Ethiopian exports of coffee had gone up in the 1990s; the export earnings had shown a dramatic decline.

Basically the adverse effect of falling price of such export commodity goes beyond household income, other human developments, and economic progress to wards the Millennium Development Goals would be undermined.

2.4.1 Theoretical outlook of Income Inequality- Trade liberalization Nexus

Nevertheless there is no theoretical framework that explicitly explain the link between income distribution and trade liberalization with in a country, the ***Heckscher – Ohlin model*** gives us a brief insight how free trade affects the real returns of factors of production in the respective country and the patterns of trade. According to the Model, countries specialize in the production

and export of a certain commodity that uses the relatively abundant resource in the country. Hence the pattern of trade is determined in accordance with the country's factor endowment. On the basis of some important assumptions, the Heckscher – Ohlin model predicts the pattern of international trade among countries.

As per the Heckscher – Ohlin model, the country that is relatively endowed with capital is expected to specialize in the production and exports of capital intensive goods where as countries with relatively labour abundant produce and export the labour intensive good. Consequently the demand for the relatively abundant factor and through that their relative prices will increase while that of the less relatively abundant factor will go down.

The price of the product does have a direct implication on the relative price of factors of production that is used intensively in the production of the commodity as per Stolper- Samuelson Theorem.

Stolper – Samuelson Theorem explains that whenever there exists a change in the relative price of a commodity, the real returns of the factors of production will be changed. For instance, an increase in the relative price of a good will increase the real return to the factor used intensively in that good, and reduce the real return to the other factor. This theorem shows that how income distribution is related to free trade.⁴

2.4.2 Empirical Review on Income Disparity Vs Trade Liberalization and Trade Exposure

A paper by Wan et al. (2006) discusses how China's globalization process impacts the prevailing inter-regional income disparity. Regression-based with the newly developed Shapley value decomposition technique is employed to quantify the contribution of economic globalization

⁴ See Feenstra (2002) or Alemayehu (2006) for mathematical derivation of the Stolper- Samuelson theorem.

along with other variables to the inter-regional inequality. In the income equation, FDI and trade variables in the respective regions are included. The study concludes that;

- Globalization constitutes a positive and substantial share of regional inequality and this share rises overtime.
- Domestic capital is found to be the largest contributor to the regional inequality in China.
- The relative contributions of education, location, urbanization and dependency ratio to regional inequality have been declining.

World price volatility of cash crops has an impact on the lives of those household who are involved in the cultivation of cash crops (Bourguignon et al.2004).According to Bourguignon et al. 2004, in an economy highly dependent of agricultural goods, the risk attached to the export price of these goods affects all households simultaneously, preventing the possibility of any mutual insurance mechanism. Therefore, the volatility of world commodity price generates a macro-economic risk for an export-dependent poor country. Moreover, households are affected in different ways depending on their income source, the structure of their consumption and the way they are affected by macroeconomic policies. This paper argues that to the usual study of the (average) income distribution, one should add the evaluation of the distribution of risk, or of a risk-augmented income distribution, at least for the less advanced countries.

Using macro data, Alemayehu (2006) find a positive correlation between inequality and openness for Africa (measured by export plus import divided by GDP), which indicates that more open economies in Africa have experienced high level of income inequality. As a consequence of trade liberalization the demand for unskilled may come down which further intensify the existing income inequality. According to their study, the impact of trade liberalization on income distribution depends on number of factors. Free trade can have a positive impact on the welfare of the households provided that majority of the population participate in tradable activities like

producing cash crops and working in the formal sectors (Winters, McCulloch and McKay, 2004 cited in Alemayehu, 2006). The impact of trade-liberalization on welfare depends on the pattern of income distribution and the incidence of poverty.

There are relatively various cross-country studies on the link between trade liberalization and income distribution. Such studies relate income distribution to macro variables like inflation, financial deepening in a country, corruption, macroeconomic volatility, and others including trade openness.⁵ Galli and Hoeven (2001) explore how monetary policy and inflation impact income equality in developed country. Empirical investigation of the hypothesis that the effect of monetary policy and inflation on inequality depend on the initial level of inflation is found to be true. In countries where inflation rate is high, restrictive monetary policy does reduce inequality, but reducing inflation in initially low inflation economies may deteriorate the income distribution.

Applying cross-country data that is averaged over decade for a wide range of countries in the 1980s and 1990s, Jakobson (2006) investigates how free trade (using different measures openness to increase the reliability) affects income distribution. It is found out that high level of income inequality is somewhat associated with more open economies at least in the 1990s. Even though the Heckscher-Ohlin model predicts that free trade results in increasing income inequality in developed countries while the unskilled labour abundant developing countries will experience narrowing inequality, under this study the theory doesn't hold true. The study also tested the hypothesis that greater openness will have different impact on income inequality depending on the countries' factor endowment. But this hypothesis can not be accepted for increased openness is not associated with higher inequality in countries well endowed with capital and land.

⁵ C. Bowdler & Adeel Malik (2005), Rossana Galli and Rolph van der Hoeven (2001), Eric M. Uslander (2006), G.A.Cornea & J.Court (2001), Richard Breen and Cecilia García-Peñalosa (1999), Michael Sarel (1997)

Cornea (2002) reviewed the impact that liberalization and globalization as a whole posit on income distribution (global, between and with in inequality) in developing and transitional economies. The study indicates that the prevailing change in global and between are not marked and depend in part on the convention adopted for their measurement. On the other hand with-in inequality which has shown increment in most economies is found to be because of the policy drive towards domestic deregulation and external liberalization.

For the decline in income equality observed in the 1980's and 1990 in such economies, Cornea (2002) indicates three set of explanations these are:

- The first one is related to the so-called traditional causes (like unfair land concentration in the hands of few, differences in educational achievement, and in general skill enhancing activities etc). High land concentration has been a major determinant of rural inequality, and worsening in the distribution of educational achievement too.
- Technological change: the composition of demand for skilled and unskilled workers will be affected as a consequence of technological change. Such changes in technology brings relatively higher demand for skilled labour than the unskilled which chronically surpass its supply and creates scarcity rent for the skilled labour. Equality in income between skilled and unskilled labor is affected by technological change negatively.
- The most pertinent explanation according to Cornea is domestic and external liberalization. It is because that the standard trade theory predicts that trade liberalization brings higher demand for unskilled labour in developing countries for such centrally have comparative advantage. But this explanation does not hold true in most developing countries because of i) choice of technologies inconsistent with local factor endowment, ii) fallacy of composition historical context under which trade liberalization took place in the 1990's was entirely different from other previous liberalization eras and iii) trade

liberalization especially in African countries has led to unsatisfactory export performance attributed to weak domestic policies and protectionism policy of developed countries.

By and large Cornea (2002) concludes that the causes for income inequality in different countries over different time period do vary.

2.5 Empirical Studies on Ethiopia

Dercon (2007) investigates some of the key challenges faced by some of the poorest African countries in beneficially liberalizing their economy and exposing themselves to most industrial countries. The populations of many African countries have not been beneficiaries from the worldwide income growth instead these people have been marginalized. Dercon inspects the challenge faced by one of these countries, Ethiopia, first by highlighting the impact of a first wave of liberalization in the early 1990s, using the evidence from a rural panel dataset. It was found that while liberalization had some positive effects in this particular period, the benefits were largely confined to households with good assets, not least in terms of geography and road infrastructure. Analysis of the subsequent years shows that access to infrastructure seems to have been causing even further growth and poverty divergence within rural Ethiopia. This evidence suggests that access to better infrastructure and communications is crucial to allow households to benefit from further liberalization and engagement with the world economy. Those without good local infrastructure are unlikely to benefit. Finally, some evidence is presented by Dercon (2007) showing that liberalization has shifted the nature of risks faced by households towards a higher incidence of market related risks, such as sudden output price collapses or input price increases. While it is not possible to infer from this that vulnerability to poverty has necessarily increased, one would need to recognize that these shifts in risk require different responses from households themselves and from policymakers.

Using the rich Ethiopian household panel data, Alemayehu et al (2007) find that income inequality and economic growth are highly correlated and pro-poor growth strategies compared to the status quo would bring a dramatic growth for developing countries like Ethiopia. According to this paper, from a baseline in 2000 of a thirty percent poverty share, over ten years at growth of four percent per capita, poverty would decline from forty-four to twenty-six percent for distribution neutral growth (i.e., no change in the aggregate income distribution). In contrast, had the growth increment been distributed equally across percentiles (Equally distributed gains of growth, EDG), the poverty would decline by over half, to fifteen percent, a difference of almost eleven percentage points. Thus, ‘distribution matters’, even, or especially in a poor country like Ethiopia.

Van Den Berg & Ruben (2005), using community and household level data from northern Ethiopia in 1998, scrutinize the distributional consequence of small-scale irrigation. The regression result indicates direct impact of small scale irrigation on expenditures and labour demand; on the other hand it has got an indirect effect on food prices and expenditures of non-irrigation households. Past development of such irrigation stimulates economic growth with out deepening income disparity in Ethiopia.

Abebe (2005) applied regression-based method with the most natural rule of Shorrocks to investigate how changes in income distribution affects the incidence of poverty in the rural and urban Ethiopian households, and the researcher identified the determinants of inequality for the period 1994-2000. In the rural areas the study found that location is by far the major inequality determinant followed by land size, house hold asset and access to markets. While in urban Ethiopia, differences in employment, location, initial asset value and education are the major contributing factors. In this study the effect of trading activities on inequality is overlooked.

Employing Computable General Equilibrium (CGE) micro-simulation analysis, Dejene et al. (2007) investigate how unilateral trade liberalization impacts poverty and income distribution on the Ethiopian households based 2001/02 SAM constructed by IFPRI and on the Ethiopian Household Income and Consumption Expenditure survey of 1999/2000. According to this study, the welfare impact of full liberalization on entrepreneur including informal operators is found to be insignificant, but it affects the wage earner adversely. Concerning inequality, the study found that trade liberalization may not have a significant impact on income distribution (Dejene et al.2007) which indicates that the study doesn't end up with a conclusive result about the impact of unilateral trade liberalization on income distribution Ethiopian context.

CHAPTER THREE

METHODOLOGY

3.1 Data Source

The data for the analysis is drawn from the most widely used longitudinal panel data to conduct such study on inequality decomposition in Ethiopia i.e. the Ethiopian Rural Household Survey which has been collected by the department of Economics, Addis Ababa University in collaboration with the Centre for the Study of African Economies, Oxford University, Ethiopian Institute of Development Research (1995 survey), USAID (1999 survey), International Food Policy Research Institute (1997 survey) since 1989. This comprehensive data consists of about 1470-1480 rural households from fifteen Ethiopian villages and there are fully five year panel data, i.e. 1994,1995,1997,2000 and 2004. Of course the first rural survey was conducted in the year 1989 that only covers six villages and it was not as extensive as that others. Hence I prefer not to include 1989 and also 2004 survey in the study.

The survey has got relatively detailed information on consumption expenditure of each households, asset and land holdings, income (earning) from different sources i.e. farm, non-farm and business activities, and information on the demographic characteristics. For income especially in developing countries may not be properly collected and it is subject to underestimation, in this study household expenditure on food and non-food items will be used as proxy for household income.

3.2 Method of Data Analysis

To clean the data set, STATA 9 is intensively used. STATA 9 will also be used to run the regression model for the income generating function and conduct different econometric tests. While to carry out the Shapley Value Decomposition, WIDER Decomposition software at

WIDER UNU will be employed which is superior to other decomposition software for it enables us to use this new procedure, Shapley Value Decomposition and DAD(Distributive Analysis/ Analysis for Distributive) as well to draw Lorenz curve.

3.3 Review of Decomposition Techniques

In regression analysis the emphasis lies on identifying the appropriate variables that can affect the dependent variable, and estimating the regression coefficients, their standard errors and the ensuing levels of statistical significant. How much of the variation of the endogenous variable is explained by all explanatory variables together can be traced by looking at the adjusted R-squared of the regression. But decomposition analysis gives answer for how much of the deviation of the dependent variable is justified by each of the explanatory variables independently (Fields, 2004). Decomposition enables us to quantify the contribution of the explanatory variables and the stochastic term (especially regression-based decomposition) to the overall inequality.

Coming to the different techniques, income inequality can be decomposed by sub-groups, by income sources and other socio-demographic characteristics.

3.3.1 Decomposition by Population Sub-Groups

Under this decomposition method as given by Morduch and Sicular (2002), the sample is divided first into different categories based on some attributes which are of discrete type (e.g. urban and rural, male and female) followed by calculating the level of inequality within each sub-samples and between the means of the samples. This method, how ever, has got limitations which restrict the application of the methods (Morduch and Sicular, 2002).

- i) The decomposition can only be carried out when the categories are found to be of discrete type but it is difficult to find always such discrete variable for most variables are of continuous type i.e. age
- ii) Dealing with multiple factors is often difficult to manage for the number of groups increases multiplicatively if there are so many variables.
- iii) Sometimes there might be a situation where the variables that are used as explanatory variables for the income inequality may in turn be determined by the inequality. Such kind of causality can not be handled in this decomposition technique.

3.3.2 Decomposition of Inequality by Causal Factors

In order to incorporate the contributions of labour market to inequality decomposition analysis, decomposition by causal factors can be used. The inequality index mostly Theil index will be decomposed on the basis of productivity of workers, employment rate in the country, the rate of productive work force in the country and the dependency ratio. It is usually applicable at global/international level. Following Duro and Esteban (1998) cited in Heshmati (2004), the contribution of each of individual factor to the overall inequality is measured as follows:

$$T(x, p) = \sum_i p_i \log(\mu / x_i) = \sum_i p_i \{ \log(y / y_i) + \log(e / e_i) \log(a / a_i) + \log(w / w_i) \}$$

Where p_i denotes the share of country i in the world population and $\mu = \sum_i p_i x_i$ is the world average per-capita income, y is the productivity per employee worker, e the employment rate, a is active over working age population rate, w is the active total population rate.

But the pattern of income distribution in different countries is some what heterogeneous which leads to difference in subgroups across countries under consideration. Hence, deciding the

appropriate weights for each population or income category need serious attention. The frequent changes in market parameters also require taking into account the adjustment process towards equilibrium income. Knowledge of the determinants, speed and social cost of policy measures is thus of great interest.⁶

The disadvantage of such decomposition technique is its restricted use only in international level and it is rare to find extensive data mostly in developing countries which limits its application.

3.3.3 Regression-Based Inequality Decomposition

To analyze income inequality and its determinants, Deaton (1997) employed non-parametric and semi-parametric methods by imposing of little structure as possible on the distribution. But specifying the structure of the distribution would lead to sound and better conclusion than the parametric and semi-parametric ones. Following this, to study the determinants of inequality across regions, decomposition of summary indices (such as Gini-coefficient, Coefficient of Variations and others) has got a higher credit in the literature of inequality decomposition. Such methodology enables to arrive at simple measure of inequality.

Shorrocks (1982, 1983, 1999), the pioneer in inequality decomposition analysis, examines decomposition by income sources, and by population. Using US data, he investigates the relative influence of each source. Regression-based decomposition technique integrates regression analysis with decomposition by income source. It is more pleasing than other for it overcomes shortcomings associated with the other techniques. The standard income generating function is estimated first; then this is followed by decomposition. Identification as well as quantification of

⁶ Almas Heshmati (2004) reviews the different decomposition techniques in detail.

determinants of inequality is also possible under the regression-based decomposition. Having estimated the income generating function, the conventional inequality decomposition developed by Fields and Yoo (2000), and Morduch and Sicular (2002) was commonly applied by researchers. Nowadays following Wan's (2002) revision of the method, Shapley value decomposition of Shorrocks (1999) with its attractive features is widely used. As outlined by Wan (2002), Shapley value decomposition of Shorrocks (1999) has the following advantages;

- Unlike the other methods, there is no restriction on the functional form of the income generating equation. Shapley value decomposition of Shorrocks (1999) can handle any functional form.

- All families of inequality indices can be used when the decomposition is done using the Shapley value decomposition.

- The contribution of the residual term and the constant term in the regression equation are taken in to account but these terms are usually either ignored or treated incorrectly in the conventional methods (Wan, 2002).

To sum up, regression-based decomposition technique is found to be more convenient compared with any kind of inequality decomposition methods (Morduch & Sicular, 2002; Wan, 2002; Heshmati, 2004). If the included variables are found to be correlated to each other (multicollinearity which is not perfect), the direct role of such variables can be quantified while controlling for the broad array of the remaining correlated variables under the regression-based decomposition method

3.4 Model Specification & Estimation Techniques

To investigate the determinants of inequality at household level in rural Ethiopia (where majority of the population settles), and how trade liberalization (which is mostly reflected in the form price

shocks in agricultural commodity exporting countries like Ethiopia) shape the pattern of income distribution in these rural areas, regression-based decomposition technique is employed for it has attractive features as mentioned above. In regression-based inequality decomposition analysis, the starting point is to estimate the income generating function which might take different forms depending on our convenient specification⁷. The functional form of this consumption expenditure could be specified based on economic theories like the human capital theory which posits that investment in human capital enhances labour productivity thereby raising the earning of the individual. As per this theory, income can be determined by education, vocational training and other skill upgrading activities. Production theory can also explain the rural household income for farmers use different factors of production like land, labour and capital as well (Wan and Zhou, 2004).

Exposure to international trade through the production and export of cash crops could impact the rural farmers' income and consumption behavior. As countries open up their economy, those farmers who are engaged in export oriented agricultural goods could get better market access, and it gives the farmers more incentive to participate in such economic activities. Removal or reduction of export taxes directly affects the remuneration that the exporters and producers of these export oriented agricultural commodities receive (EEA, 2005). Undeniably such trade and financial open up may expose them to severe competition from outsiders. Liberalizing one's trade, therefore, does have impact on the lives of such farmers. But there is a problem of getting the relevant data at household level to assess how trade liberalization on income of such farmers and inequality among these rural household. The best way to tackle this

⁷ Estimating the income generating function under the regression-based decomposition technique enables us to identify the relevant variables and tells us how much of the variation in income/consumption (the dependent variable) is explained by the explanatory variables in the model. If the regression only explains about 30-40% of the variation, it gives an indication that due consideration has to be given to the residual in the process of decomposing the overall inequality (Wan, 2002). In addition, it is based on the income generating function that the Shapley value decomposition analysis is carried out.

problem is to use proxy variable that indicates the interrelation between farmers' consumption behavior and economic activities (depending on the trade policy of the country, the farmers might find themselves in different activities i.e. they participate in cash crop production when the policy makers advocate free trade and free trade is rewarding).

Given the above factors, two rural household may have different income and consumption expenditure because they belong to different geographical area. Some locations are rich in natural resources with fertile soil, and are located to nearby markets and international trade. Such factors can be captured by location dummies.

Family labour composition and proportion of economically active labour force (that ranges from the age of 15-65) to the economically inactive force i.e. dependants in the household (<15 years old and >65 years) could also affect consumption and income. In addition to this, the economic activities that the household members engaged in as primary occupation could have a direct bearing on consumption pattern of each household.

Credit accessibility could also impact household income. Those household with access to credit could participate in other productive activities which could give other source of income than those who don't have the access (Adams and Graham, 1981 as quoted in Iqbal, 1986; Alemayehu et al, 2007)

Thus the variables to be included in this study are listed below;

cons-- for the aforementioned reason annual household per-head consumption will serve as the proxy for the household per capita income. In the income generating function, consumption per-capita will be the dependent variable.

age-- to account for the life cycle impact on the household consumption, age of the head of the household and its square are included.

educ-- educational level of the head of the household as a binary variable is used. [It is a common practice in the literature of income estimation to take the age and educational level of the head of the household head]

maledummy-- dummy variable for female headed and male headed family. [0 for female headed household 1 otherwise]

hhsz--household size to control for the possible economies of scale in the household

mwoa-- composition of the household is represented by the fraction of working age males in the family, and the fraction of working age females in the family (***fwoa***).

depera--dependency ratio as the ratio of adult workers to the numbers of dependents in the family

landsz--to integrate economic resource of each household in to the model, land size per capita in hectare is included.

cash-- proportion of land area devoted to the cultivation of cash crops such as coffee, chat, enset etc to the total household's land size.

credit-- amount of credit obtained

farmp—dummy variable for farming as a primary occupation [1 for farming as primary activity 0 otherwise]

3.4.1 Functional Form of the Regression Equation

.The income generating function is modeled as a semi-log income function with income inequality measured over the level income. Such different specification of the income generating function can only be handled by Shapley value decomposition of Shorrocks (1999). To guarantee non-negative predicted values of income or consumption, semi-log or double-log income generating

function is better than linear form (Wan and Shorrocks, 2004b cited in Wan and Zhou, 2004). Such parametric specification also coincides with the *Mincerian model*.

Hence the income (consumption) generating function takes the following general form;

$$\text{Ln}(Y_{it}) = f(X_{it,1}, X_{it,2}, \dots, D_1, D_2) \dots \dots \quad \text{Equation (1)}$$

Where Y is the dependent variable, Xs are the explanatory variables & D_s are dummy variables. f stands for the standard linear function. Such log-normal specification can highly explain income variable (Shorrocks and Wan, 2004)

Where as the specific functional form takes;

$$\text{Ln}(Y_{it}) = \alpha + \beta_1 X_{it,1} + \beta_2 X_{it,2} + \dots + \beta_k X_{it,k} + \varepsilon_{it} \dots \dots \quad \text{Equation (2)}$$

Computing income inequality from log level does not really indicate the dispersion of household income because the log-transformation brings to the normal distribution. Therefore, income inequality is to be measured from the original income, and the above specification for the income generating function can be transformed to the following form;

$$Y_{it} = \exp [\alpha + \beta_1 X_{it,1} + \beta_2 X_{it,2} + \dots + \beta_k X_{it,k} + \varepsilon_{it}] \dots \quad \text{Equation (3)}$$

$$(i=1, 2, \dots, N; \quad t=1, 2, \dots, T)$$

(N cross-sectional units over T time periods. All in all there are about N*T observation)

To estimate the above linear specification for the income generating functions, the Maximum Likelihood Estimation Random Effects model is employed. For comparison and to have robust standard errors, the *Generalized Linear Regression Model* proposed by Kmenta (1986) which retains both the behavior of cross-section and time-series data is used. The classical normal linear regression model is normally subject to restrictive assumption on the distribution of the stochastic term like homoskedasticity and non-autocorrelation (Cameron and Trivedi, 2005; Wooldridge, 2005). The variance-covariance matrix of this term will also have a fixed form. But the GLR

Model is a relaxed and superior model for it can handle the case where the stochastic term is not necessarily expected to be homoskedastic and non-auto correlated. Hence the Generalized Linear Regression Model corrects both heteroskedasticity and auto correlation of the error term using the appropriate transformation methods.

3.4.2 Measurement of Income Inequality

One advantage of using semi-log specification for the income generating function with Shapley Value Decomposition of Shorrocks is that there is no restriction on the use of inequality measures unlike the linear specification of Morduch and Sicular (2002) which only applies Coefficient of Variation and Theil's L inequality measure correctly. All kinds of inequality measures, therefore, can be used, i.e. Gini-coefficient, Coefficient of Variation, the generalized entropy family of Theil and Atkinson. It is also more advantageous to employ all kinds of inequality measures for comparison since different measures could result even in different qualitative and quantitative result (Morduch and Sicular, 2002). There are some basic principles related inequality indices. These are;

- ***Mean or scale independence:*** inequality measures are invariant in uniform proportional changes.
- ***Population size independence:*** inequality measures are invariant to the replication of population.
- ***Piguo- Dalton principles:*** inequality increases as a result of transfer of income from the poor person to the rich.
- ***Symmetry principle:*** inequality measures are independent of any individual characteristics other income.

- ***Decomposability principle:***

Each index is expected to satisfy the above principles.

Gini-coefficient can be computed in such a way that first incomes are ordered in ascending level as $Y_1 < Y_2 < \dots < Y_n$. Therefore the index denoted as $Ig(Y)$ is;

$$Ig(Y) = 2/n\mu \sum_{i=1}^n (i - (n+2)/2) y_i \text{ ----- Equation (4)}$$

Where n is the number of observations, μ is the mean income, Y_i is the income of the i^{th} individual, and i is the rank of the individual in the income distribution.

The squared CV denoted, $Icv(Y)$, is calculated as;

$$Icv(Y) = 1/n\mu^2 \sum_{i=1}^n (y_i - \mu)^2 \text{ ----- Equation (5)}$$

Where as Theil's first measure, Theil-T i.e. $I_n(Y)$ is

$$I_n(Y) = 1/n \sum_{i=1}^n (y_i / \mu) \ln(y_i / \mu) \text{ ----- Equation (6)}$$

3.4.3 The Shapley Value Decomposition of Shorrocks (1999)

Having estimated the consumption expenditure function, total income inequality will be decomposed in to the included explanatory variables and residual term using the extended regression-based decomposition technique proposed by Wan (2002). To quantify the contribution of each explanatory variable, there will be rigorous process under the **Shapley Value Decomposition of Shorrocks** (1999) technique. To study the determinants of with-in country income inequality and how free trade is linked to it, regression-based decomposition technique is more appealing than others for it ends up with quantitative decomposition of the total inequality for each explanatory variable.

Now let the income equation be given in general form as;

$$y = f(x_1, x_2, \dots, x_k) \text{ ----- Equation (7)}$$

Where Y is income (or proxy like consumption expenditure)

X s are the explanatory variables which might be different for different individuals.

To trace out the contribution of each of the factors to the overall inequality, Shapley value decomposition of Shorrocks (1999) is the best of all the methods for all kinds of specifications, including the semi-log income function with inequality measured from the level income, are easily handled.

According to this technique, the decomposition procedure is as follows;

First, the actual value of one of the explanatory variables, X_k should be replaced by its sample mean which would eliminate any differences in X_k among individuals in the sample. The resulting income, denoted by Y_k differs from individual to individual because the remaining variables in the model other than X_k are different. The inequality in Y_k , $I(Y_k)$, is attributed to differences in explanatory variables other than X_k . Hence the contribution of X_k , CO_k to the total inequality can be calculated as;

$$CO_k = I(Y) - I(Y_k) \text{ ----- Equation (8)}$$

Where $I(Y)$ is the inequality when the actual value of the variables appear as they are

$I(Y_k)$ – the inequality when the variable X_k is replaced by its sample mean.

This procedure will give us what Shorrocks calls ‘first round’. The first round is obtained when only one independent variable X_k is replaced by its sample mean. The second round effect can be computed by replacing two variables X_k and X_j with their sample means. This process continues until all explanatory variables are replaced by their sample means.

There are some general rules that any decomposition techniques should fulfill. One of these rules is that it should be symmetric in the sense that the contribution assigned to any given value should not depend on the way in which the variables are chosen.

First round decomposition, of course, is symmetric but violates the other rule that it should yield an exact additive decomposition. While the second round decomposition is exact but the value of the contribution of the variables depends on the order in which the factors appear in the elimination sequences, hence the technique is against the symmetry assumption. Such path dependence problem can be rectified by taking different combination of possible elimination sequence, and then computing the expected value of the contribution at different round.

This technique treats all the explanatory variables in the model symmetrically and it results in additive decomposition. The contribution of each of the factors can be taken as the expected marginal impact of each of the variables when the expectation is calculated from all possible rounds. This technique is referred to as ***Shapley value decomposition of Shorrocks (1999)***.

When we come across a model that only explains about 30-40% of the variation, relying on the decomposition results while ignoring the residual term may lead to misleading conclusion (Wan, 2002). The estimated random term, of course, does not affect the mean value of the dependent variable for its mean value is assumed to be white noise. But this random term can alter the income density function and the calculated inequality. In order to deal with this problem, Wan (2002) propose a procedure as follows;

Let the equation be;

$$y = \hat{y} + \varepsilon \text{-----Equation (9)}$$

\hat{y} is the deterministic part of the model

ε is the random error

To compute the contribution of the residual term, denoted by $CO \epsilon$, to the overall inequality, we can follow *Shorrocks (1999)*. It is simply the difference between total inequality and the sum of the contribution of the included explanatory variables in the model.

$$CO \epsilon = I(y) - I(\hat{y}) \text{-----Equation (10)}$$

The difference between $I(Y)$ and $I(\hat{y})$ is significant when the explained variation of the dependent variable is less than forty percent. The ranking variable to compute the inequality for $I(Y)$ and $I(\hat{y})$ are respectively Y and \hat{y} . The rankings by Y and \hat{y} would result equivalent value for the inequality measure when the residual term is found to be zero (i.e., when the estimated equation does fit the actual value). The contribution of the residual term will converge to zero when the residual approaches zero.

The other serious problem in decomposition analysis is to disregard the constant term of the equation. As *Wan (2002)* pointed out the presence of a constant is almost a rule rather than an exception in the regression equation even though it is seldom to come up with a constant as a source of income. Based on its sign in the regression equation, the constant term would raise (or lower) total inequality. If, for instance, the same amount of money is taken away from all individual may be in the form of headcount tax, income inequality will go up where as it will be the other way round if the same amount in the form of subsidy is equally distributed to all. To handle the contribution of the constant term we can follow *Wan's (2002)* proposed solution.

$$Y = \alpha + Y^* + \xi \text{-----Equation (11)}$$

Applying the same procedure as we have done for the residual tem, we have the following;

$$I(\hat{y} / \alpha = 0) = I(Y^*) \text{-----Equation (12)}$$

The contribution of the constant, denoted by $CO \alpha$, can be computed as;

$$CO \alpha = I(\hat{y}) - I(Y^*) \text{-----Equation(13)}$$

Generally, the overall inequality can be decomposed into three, i.e. contribution of the residual term, contribution of the constant, and contribution of the explanatory variables. The percentage contribution of each of the three can be put as;

$$PCO_{\epsilon} = 100[I(Y) - I(\hat{y})] / I(Y) \text{-----Equation(14a)}$$

$$PCO_{\alpha} = 100[I(\hat{y}) - I(Y^*)] / I(Y) \text{-----Equation14b)}$$

$$PCO_{Y^*} = 100[I(Y^*)] / I(Y) \text{-----Equation(14c)}$$

When our specification for the income generating function is semi-log with inequality measured over the original income, the constant term in the equation will be no more a constant rather it will be a scalar. Therefore, the contribution of this constant term is zero and the presence or absence of the constant doesn't matter at all.

CHAPTER FOUR

EMPIRICAL RESULTS AND DISCUSSION

In this section, the statistical summary of the households' characteristic and descriptive explanation for the variables and the empirical findings of the regression results, decomposition results are discussed. Besides this, the major findings with the economic rationale are briefly clarified. First the descriptive results regarding the frequency distribution of income by income range and the existing disparities in income between the households in different woredas are presented. Following this the result for the income/consumption/expenditure generating function is discussed. At last section of this part, the Shapley value decomposition end results from the different inequality indices are summarized.

4.1 Descriptive Results

Under the whole study period, higher proportion of the rural household falls in less than 500 Eth.Birr annual per-capita income/consumption range; and on the other extreme, there are few households with higher annual per-capita consumption/income range which also witness the existence of higher inequality among these households.

Table (4.1) Frequency distribution of the rural Ethiopian households' annual per-capita consumption in Eth. Birr

<i>Annual per-capita cons</i>	<i>1994</i>	<i>1995</i>	<i>1997</i>	<i>2000</i>
<=500	616	573	536	733
500-1000	449	542	469	452
1000-2000	273	336	347	349
2000-3000	74	90	87	71
3000-4000	32	21	20	26
4000-5000	12	18	9	18
>=5000	50	19	10	18

Source: author's computation

Table (4.2) Inequality indices in the rural households

<i>Year</i>	<i>Gini-Index</i>	<i>Atkinson</i>
1994	0.49129054	0.19765901
1995	0.46384241	0.17839768
1997	0.43958293	0.15882941
2000	0.55973703	0.29903188

Source: Own computation

The pattern of income distribution in rural households as indicated in the above table is awful (the Gini-index, for example, lies between 0.4396 (observed in 1997) and 0.5597 in 2000). This divulges the fact that, at the status quo, the pattern of income distribution in rural Ethiopia is not equitable.

In some areas like woreda Boloso, mean annual per-capita consumption is as low as 310.557 Eth. Birr. The highest mean annual per-capita is recorded in Kersa woreda which is about 1262.08. This shows that most individuals in rural Ethiopia are highly deprived of basic needs.

Table (4.3) Mean per-capita consumption by Woreda

Woreda	Mean annual per-capita cons
Kersa	1262.08
Bugena	1256.424
Bassa na Worana	1241.438
Adaa	1238.051
Enemayi	880.958
Shashemene	865.2584
Astbi	839.4206
Bule	703.8272
Ankober	650.5678
Daramalo	627.5969
Sebhassahsie	616.6279
Dodofa	599.7002
Kedida Gamela	541.1936
Cheha	456.0833
Boloso	310.557

Table (4.4) Gini and Atkinson indices for selected woredas for the whole period of study (1994-2000)

<i>Woreda</i>	<i>Gini-index</i>	<i>Atkinson-index</i>
Atsbi	0.42394551	0.15036585
Sebhassahsie	0.40248154	0.12972400
Ankober	0.43855156	0.16520438
Basso na Worana	0.41532039	0.13967040
Enemayi	0.36850784	0.11241271
Bugena	0.38398826	0.12097362
Adaa	0.40043954	0.13278079
Kersa	0.43709185	0.16657372
Dodota	0.39665496	0.12713169
Shashemene	0.43691378	0.16332164
Kedida Gamela	0.52762205	0.28695524
Bule	0.57226911	0.29666450
Boloso	0.51407333	0.23670987
Daramalo	0.54702310	0.25343715

Source: author's computation based on the ERHS (1994-2000)

The above table indicates the extent of income disparity between the rural households within the woredas. And it reveals that the income inequality measured by Gini and Atkinson indices within the woredas shows higher variation from woreda to woreda. Higher inequality is recorded in Bule woreda (that is 0.572 of Gini- index); Enemayi with Gini-index of 0.368 did experience relatively lower disparity compared to the remaining sample woredas.

Table (4.5) Statistical summary of the included variables

<i>Variables</i>	<i>Observation</i>	<i>Measuremen t unit</i>	<i>Mean</i>	<i>S. Deviation</i>	<i>Min.</i>	<i>Max</i>
<i>pancons</i>	5701	Birr	870.8803	897.3446	10.6174	16453.67
<i>age</i>	6315	Years	46.96492	15.91823	17	91
<i>educ</i>	4563	Number	1.600044	.9696264	1	5
<i>hhz</i>	5978	Number	6.130646	3.156849	1	31
<i>prim</i>	5864	Number	.6642224	.4723019	0	1
<i>depr</i>	5661	Percentage	119.5303	96.82897	0	375
<i>maldumy</i>	9215	Number	.050255	.5000206	0	1
<i>pland</i>	5440	Hectare	.3207242	0.3729052	0	3.892857
<i>mwoa</i>	5954	Percentage	18.46946	18.23192	0	100
<i>fwoa</i>	5954	Percentage	20.68787	18.93782	0	100
<i>cash</i>	5350	Ratio	.0609218	.127709	0	1

Source; own computation from the ERHS by Department of Economics, AAU (1994-2000)

It can be noted here that the annual per-capita consumption/expenditure in the rural Ethiopia ranges from 10.61 to 16453.67 Eth. Birr; and the mean consumption expenditure is about 870.8. The consumption expenditure constitutes direct expenditure on food (including gift in kind and consumption from own) and non food items exclusive of extraordinary expenditures like ceremonial expenses, taxes, rents, expenditure for building materials, and contribution of the household to church and so on. It can also be inferred from table (4.5) that rural areas in Ethiopia are highly populated with average household size of 6.1; and surprisingly household size is as high as 31 exhibiting the prevalence of extended family⁸ in these areas which has direct bearing on the family labour composition. As a consequence of extended family, it is also highly probable to

⁸ Dictionary meaning of extended family is that the parents and the children live together with their grand papas and mamas, aunts, uncles, cousins, and sometimes more distant relatives

have high dependency ratio. Of course, it is found to be as high as 375% which means one productive individual is expected to feed on average 3.75 other dependent family members in addition to him self. The average age of the household head is about 47 years which is within the age limit of active labour force with maximum age of 91years old. Accordingly the land holding in per-capita level will be adversely affected; and mean per-capita land holding among the rural households is .3207242 hectare. The variable *cash* is computed as the area that the household devote to the cultivation of cash crops (like coffee, chat, oilseeds and tobacco) as a proportion total cultivable land. There are areas where such cash crops are not produced at all especially in Tigray and Amhara regions; on contrary to this, there are households in Oromia and SNNPR region that entirely rely on the production of such exportable items. So the value of variable cash varies between zero and one. The composition of the household in relation to working adults of female and male is reflected by *mvoa* and *fvoa* which are computed by taking the male and female productive labour force⁹ as a percentage of the family size respectively. Relatively the mean percentage of male working adult is somewhat greater than that of female working adult. About 49.75% of the sample households are female headed households. With regard to educational level which is taken as binary variable (for years of schooling as a continuous variable are not available), higher proportion of the household head are illiterate; out of the total sample, 67.36% don't have formal as well as informal school, and 12.85% are able to read and write only. All in all the result implies that there is high illiteracy rate in the rural areas. The primary activity of majority of the head as expected in most rural areas of developing countries is farming or family farm worker i.e. farming is the primary economic activity and main source of livelihood for about 66.4% of the households.

⁹ The productive labour force age to compute dependency ratio, female and male working adults for this study is taken as the age between fifteen and sixty four inclusively.

4.2 Regression Result for the Household Consumption Expenditure

The estimated results for the regression coefficients are presented in table (4.6); and more or less the signs for the estimated β 's are as expected and found to be significant either at 5% or 1% level of significance except for some variables like education level of the head of the household (not as expected), dependency ratio.

The semi-log specification result (as indicated in table (4.6)) for the consumption expenditure function reveals that households' consumption expenditure is impacted on inversely by the family size which is the reflection of economies of scale. The result signifies that household in rural areas do not have the tradition of diversifying income earning activity when the household size goes up; instead it adds to the already marginally unproductive labour force; and the coefficient is highly significant.

When more cultivable land area is allotted to the production and cultivation of cash crops (coffee, chat etc), the per-capita consumption expenditure will be improved. It may be because that these commodities can be traded in international markets and the demand is somewhat better. Therefore, the return from the sale of these commodities for the farmers is higher following the improved export prices compared to the return from other cereal crops. This result is consistent with the widely held belief that farmers can be beneficiary from the improved export earning if they shift their production mix from consumable items to export oriented commodities¹⁰.

Where as, age of the head of the household in level form is negatively correlated with the household's per-capita consumption which is, of course, contradictory to the human capital theory that earning increases with age. At the first glance it seems ridiculous; but this could happen for most economic activities in rural areas (especially in LDCs) are muscular; so when the

¹⁰ Annual Report on Ethiopian Economy by Ethiopian Economic Association

head gets older, he starts losing his physical strength and then the per-capita income will get deteriorate. Hence, *ceteris paribus*, households with younger head have got higher per-capita consumption compared to aged headed households. Where as the quadratic term has positive coefficient even if it is not significant at 5 percent significance level.

The negative coefficient associated with the dependency ratio is self explanatory that high dependency ratio in a household means more dependents relative to the economically active labour force in the family. And this unproductive labour force usually does not participate in any income earning activities and contribute nothing to the household income; instead they rely on the shoulders of other productive family labour for their survival.

If there is higher proportion of working adult in the family whether female or male, obviously the per-capita income goes up. But gender difference is reflected here because the contribution of female working adults is less than that of their male counterpart as the regression estimate indicate (higher regression coefficient for the male working adult compared to the female working adult). Complementary to this, male headed household enjoy higher consumption than female headed family, consistent to most widely held belief that females are not treated equally in the labour market. But in this case, it may be also because of the nature of the farming activity.

But the effect of education on per-capita expenditure is found to be somewhat messy; compared to those who don't read and write those who can read and write perhaps have got higher per-capita income; amazingly the per-capita income decreases as the education level of the head of the family is either primary school or above.

Even though land, the key factors of production in rural areas, is low in per-capita level; it contributes positively to the per-capita income/consumption and it is significant which is

complementary to the existing theories and empirics¹¹. Credit availability to farm households particularly microfinance that requires no collateral is crucial for poverty reduction strategies because per-capita expenditure increase when amount of loan taken by the household increases. This result is consistent with Alemayehu et al (2007) that access to credit significantly reduces absolute poverty; and access to credit has significantly and positively affects permanent consumption.

Location impacts as represented by location dummy on per-capita income are highly significant. Relative to all regions (Tigray, Amhara and South), farm households in Oromia have higher per-capita income. This is may be because the region is endowed with natural resources with much diversified climatic nature which is a flattering and conducive condition especially for farming activity. In addition to this, it may be attributed to the region's central location in the country.

¹¹ But there might be some situations where land may be negatively correlated with income. For example in China, according to Wan (2002), regions that are endowed with cultivable land are usually more backward and heavily involved in farming while land scarce regions are wealthier. Farming has been a loss-making business in China since early 1990s; reports are abundant on farmers deserting land and on cases where rural households are administratively forced to cultivate.

Table (4.6) The Maximum Likelihood Regression result for the semi-log household expenditure function or income generating function

Random-effects ML regression	Number of obs = 3892
Group variable (i): uniqueid	Number of groups = 1739
Random effects u_i ~ Gaussian	Obs per group: min = 1
	avg = 2.2
	max = 4
	LR chi2(18) = 1138.50
Log likelihood = -4393.4586	Prob > chi2 = 0.0000

<i>lpancon</i>	<i>Coef.</i>	<i>Std. Err</i>	<i>z</i>	<i>P> z </i>
<i>age</i>	-0.0052673*	0.0026527	-1.99	0.047
<i>age sq.</i>	.0000337	.000025	1.35	0.178
<i>loan</i>	.0000798*	.0000378	2.11	0.035
<i>cash</i>	.4765691*	.1091009	4.37	0.000
<i>hbz</i>	-.0997229*	.0047415	-21.03	0.000
<i>mwoa</i>	.0034557*	.000811	4.26	0.000
<i>fwoa</i>	.0009438	.0007697	1.23	0.220
<i>depr</i>	-.0000592	.0001727	-0.34	0.732
<i>male dummy</i>	.1260112*	.0375367	3.36	0.001
<i>farmp</i>	.0506138	.0297111	1.70	0.088
<i>pland</i>	.3716002*	.0417562	8.90	0.000
<i>educ1</i>	.1575394*	.0639846	2.46	0.014
<i>educ2</i>	.1706256*	.0690946	2.47	0.014
<i>educ3</i>	.0718639	.0689154	1.04	0.297
<i>educ4@</i>	—	—	—	—
<i>educ5</i>	-.4896738*	.1283383	-3.82	0.000
<i>Tigray@</i>	—	—	—	—
<i>Ambara</i>	.1075274	.0596964	1.80	0.072
<i>Oromia</i>	.1827156*	.0613225	2.98	0.003
<i>South</i>	-.4615951*	.0607805	-7.59	0.000
<i>_cons</i>	6.717457	.1105558	60.76	0.000
<i>sigma_u</i>	.4753992	.0192805		
<i>sigma_e</i>	.6254465	.0104804		
<i>rho</i>	.3661843	.0238044		
<i>Likelihood-ratio test of</i>		<i>sigma_u=0:</i>	<i>chibar2 (01) =</i>	<i>216.93</i>
<i>Prob>=chibar2 = 0.000</i>				

Source: author's computation based on ERHS of Economics department, AAU (1994-2000)

* Significance at 5% level of significance

@Note: Two variables *educ4* and *Tigray* (binary type variables) are dropped as reference point for the other remaining ones.

4.3 The Shapley value Decomposition Results

The Shapley value decomposition of the total inequality in to the explanatory variables¹² and the residual term as indicated in table (4.7a) shows that much of the inequality in the year 2000 is due to the household size, that is, about 24% of the total inequality is explained by this variable. Since the sign associated with household size variable in the decomposition is positive, it has a disequalizing effect on the income distribution in the rural Ethiopia. The result confirms that it is usually the lower quintile in the distribution of income that has more family than the upper quintile. It is also found that per-capita land holding is the second contributor to the prevailing higher inequality. Total income inequality is positively affected by credit which implies that the poor are the one who are marginalized in the credit market; where as the other remaining factors (variables) including cash have got some what modest impact on the overall inequality. Location dummies as a whole contribute about 8% to the total income disparity implying the existence of variation in natural resource endowments among the regions and some regions are located to markets. Therefore, almost all variables have a disequalizing effect on the income distribution with different magnitude. In 2000, the included explanatory variables explain about 65.001% of the inequality while leaving 34.99% for the unobservable factors; where as in 1994, 55.93% of the overall inequality is explained by the variables in the model. For comparison the decomposition results of the first and last time series are presented in table 4.7a and b.

Regarding the subtlety of inequality, it can be inferred that it fluctuates with a certain range and the percentage contributions of each variable to the prevailing inequality do vary from year to year. For instance, in 1994 per-capita land explains much of the variation in income

¹² As mentioned under model specification, the income generating function is semi-log, the constant term will be scalar, and therefore the contribution of the constant term to total inequality vanishes.

relative to the other variable but it is family size that has lion's share in the year 2000 to total income inequality.

Production of cash crops like coffee, chat etc does affect per-capita income/consumption expenditure significantly as the regression result indicates. But in relation to income distribution, it is not as such important variable to determine income inequality even though it contributes adversely to the total inequity. In 1994, the percentage contribution of this variable to the overall inequity (i.e. 4.3%) was higher relative to 2000 which is only 2.2%. It means that cash, at the present circumstances, is cultivated somewhat in a fair manner by peoples in all income quintile. The result reveals that the effect of gender on inequality is found to be fairly low.

Table (4.7) Decomposition of total inequality to the regressors and residual term

<i>Variables</i>	<i>Gini</i>	<i>%age cont.</i>
<i>age & sq</i>	0.0184713	3.3
<i>hbz</i>	0.1365758	24.4
<i>farmp</i>	0.010635	1.9
<i>sexdum</i>	0.0078363	1.4
<i>depr</i>	0.008955	1.6
<i>fvoa</i>	0.017352	2.1
<i>mvoa</i>	0.0111947	2
<i>cash</i>	0.0123142	2.2
<i>loan</i>	0.0335898	6.001
<i>pland</i>	0.0677282	12.1
<i>location</i>	0.0447789	8
<i>total Xs</i>	0.3638346	65.001
<i>residuals</i>	0.1958519	34.99

Table 4.7a (2000)

<i>Variables</i>	<i>Gini</i>	<i>%age cont.</i>
<i>age & sq</i>	0.030656	5.24
<i>hbz</i>	0.056498	11.5
<i>farmp</i>	0.011299	1.3
<i>sexdum</i>	0.009334	1.9
<i>depr</i>	0.010317	2.1
<i>fvoa</i>	0.009285	1.89
<i>mvoa</i>	0.006878	1.4
<i>cash</i>	0.021125	4.3
<i>loan</i>	0.027020	5.5
<i>pland</i>	0.066324	13.5
<i>location</i>	0.026038	7.3
<i>total Xs</i>	0.274778	55.93
<i>residuals</i>	0.216511	44.07

Table 4.7b (1994)

Source: Own calculation

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Applying the regression-based decomposition technique with the Shapley value decomposition of Shorrocks (1999), this study paper attempts to investigate the core causes of income disparity in the rural Ethiopia; and examine whether international exposure of the rural farm households in trade aspect does affect income distribution in such households or not based on the Ethiopian rural household survey of department of Economics, AAU. The total inequality is decomposed in to the explanatory variables and the unobservable using Gini-coefficient. In the decomposition process, the contributions of the unobservable are treated according to Wan's (2002) proposed procedure.

Households in the rural Ethiopia have faced with higher disparity as measured inequality indices indicate. The Gini- coefficient which fulfills almost all principles of inequality indices is observed to be as high as 0.55973703 in 2000. It also shows high variation among different woredas; the lowest inequality index, in relative term, is recorded in Enemayi woreda (located in Amhara region) with a Gini- coefficient of 0.3685 while the woreda under consideration that experienced unfair income distribution between households is Bule woreda of Southern region with 0.572269 through out the study period (1994-2000).

Expenditure per-capita is adversely affected by age of the households' head contrary to the human capital theory which is because of the nature of the farming activity; where as the remaining variables have the expected sign. Gender difference in earning is observed in the rural households; female headed households have less per-capita income compared to male headed family. The family labour composition does affect per-capita income/consumption. Those families with higher productive labour force in proportion to the whole family size have higher

per-capita income. But the contribution of female working adult is found to less than their counterpart. It is also proved that cultivation of exportable items like coffee, chat and oil seeds impacts positively the per capita income of the households. The negative effect of household size implies the existence of marginally unproductive labour force in rural areas as a whole.

The impact of variables on the overall inequality varies from year to year. In 2000, for instance, the percentage contribution of household size has got the lion's share; but it is per-capita land holding which contributed much to inequality in 1994. Surprisingly none of the including variables are found to be equalizing on the income distribution in rural Ethiopia including cash/exportable commodities production with different scales. The cultivation of cash crops does disequalize the income of the rural families, even though, its effect is negligible. For the year 2000, for example, out of the total inequality only 2.2% is explained by the difference in production of internationally tradable commodities. It can be noted here that producers of cash crops are those households at the upper income quintile. Per-capita land holding affects inequality positively; this disequalizing impact entails further the existence of unfair land holding in rural Ethiopia. And access to credit to the lower quintile can promote the per-capita income, and then the number of peoples living under poverty line can be reduced through the provision of credit. Credit access to the rural people benefits especially the poor.

By and large the model in the decomposition analysis explains about 65 and 55 percent of the total inequality in 2000 and 1994 respectively which is good.

5.2 Policy Implications

The implication of the regression as well as the decomposition analysis is that appropriate policies should be formulated to attain higher economic growth with fair income distribution. Government policy makers can play a pivotal role in this respect by:

Expanding family planning program in the rural areas: family guidance program especially to the population in the lower quintile would partially reduce the existing income disparity; because it is this portion of the population that faces higher family size. Such programs would:

- i) enable households to have higher per-capita income as a result of the reduction in family size
- ii) eliminate the problem of disguised unemployment by reducing the marginally unproductive family labour
- iii) reduce income inequality, for it is the poor that have higher family size compared to the rich

Land Distribution and resettlement programs: redistribution of land holding in a fair manner based on efficiency can improve the pattern of income distribution. It can be inferred from the decomposition analysis, that at the status quo, land holding worsen the pattern of income distribution because it is unfairly distributed in favor of the rich. A resettlement program to resource rich areas can improve the pattern of income distribution.

Provision of Credit and promoting cultivation of cash crops: government through its development agents should initiate the farmers and should pave the way for the farmers to shift their production mix from consumable items to those commodities that can be traded at the international markets. Expanding micro-finance institutions in the rural areas can improve both per-capita income of the poor and income distribution.

To sum up, in order to achieve the Millennium Development Goals that people living under the absolute poverty should be halved by 2015, pro-poor policies should be formulated; meaning that such unfair income distribution that exist in the rural Ethiopian households should be at least minimized.

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Appendices

Appendix I Non-parametric distribution of the dependent variable

Kernel density distribution of the log of the annual per-capita consumption

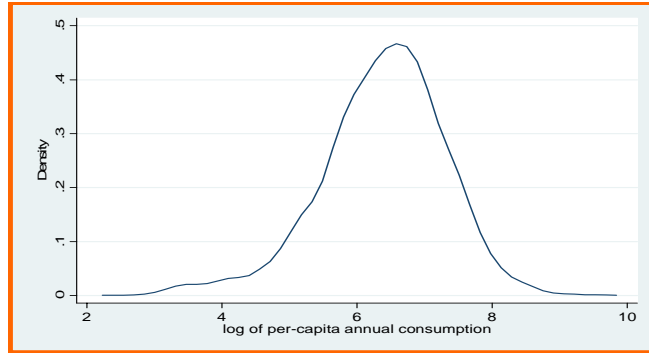
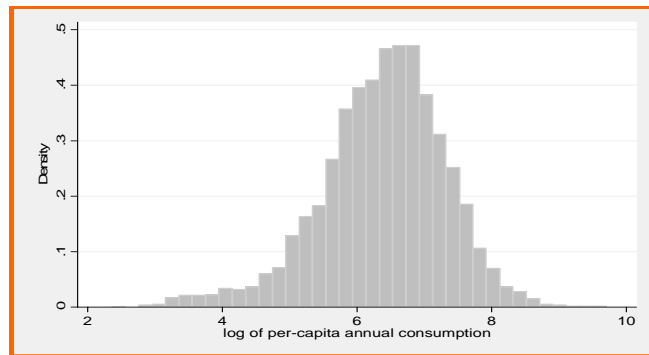


Figure (4.2) Non-parametric distribution of the log of the annual par-capita consumption



Both of the above two figures .i.e. figure (4.1) and figure (4.2), show that the dependent variable (log per- capita consumption) is distributed around its mean

Appendix II The marginal effects of the explanatory variables in the regression result

Table () Elasticities of the explanatory variables excluding dummy variables from the MLE

The fitted value of log of the per-capita consumption is:

$$y = xb(\text{predict})$$

$$= 6.358228$$

<i>lpancon</i>	<i>ey/dy</i>	<i>Std. Err.</i>	<i>Z</i>	<i>P> z </i>	<i>X</i>
<i>age</i>	-0.0008284	0.00042	-1.99	0.047	46.0302
<i>age sq</i>	5.30e-06	0.0000	1.35	0.178	2362.79
<i>hbz</i>	-0.0156841	.00075	-20.96	0.000	6.55653
<i>loan</i>	.0000125	0.00001	2.11	0.035	134.828
<i>cash</i>	0.0749531	0.01716	4.37	0.000	0.057706
<i>mvoa</i>	.0005435	.00013	4.26	0.000	15.9474
<i>fvoa</i>	.0001484	0.00012	1.23	0.220	17.3871
<i>depr</i>	-9.32e-06	0.00003	-0.34	0.732	110.92
<i>pland</i>	.058444	.00656	8.90	0.000	0.313805

Source: Author's calculation

**Appendix III GLS Regression result with robust standard errors for the income
generating function**

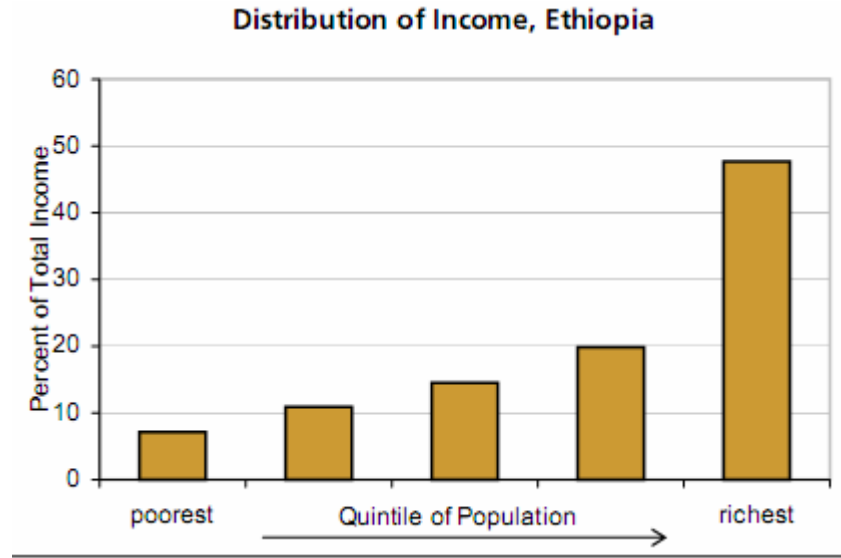
Random-effects GLS regression	Number of obs = 3892
Group variable (i): uniqueid	Number of groups = 1739
R-sq: within = 0.2278	Obs per group: min = 1
between = 0.2985	avg = 2.2
overall = 0.2544	max = 4
Random effects u_i ~ Gaussian	Wald chi2(18) = 1035.77
corr(u_i, X) = 0 (assumed)	Prob > chi2 = 0.0000

<i>lpancon</i>	<i>Coef.</i>	<i>Robust Std. Error</i>	<i>z</i>	<i>P> z </i>
<i>age</i>	-.0048299	.0021997	-2.20	0.028
<i>age sq.</i>	.0000279	.0000199	1.40	0.162
<i>loan</i>	.0000757	.0000314	2.41	0.016
<i>cash</i>	.4057216	.1090185	3.72	0.000
<i>hbz</i>	-.1043781	.0051568	-20.24	0.000
<i>mwoa</i>	.0035893	.0008041	4.46	0.000
<i>fwoa</i>	.0010728	.0007769	1.38	0.167
<i>depr</i>	-.0000532	.0001768	-0.30	0.764
<i>male dummy</i>	.1191253	.0388989	3.06	0.002
<i>farmp</i>	.0646546	.0277652	2.33	0.020
<i>pland</i>	.3523732	.0479702	7.35	0.000
<i>educ1</i>	.141811	.0640989	2.21	0.027
<i>educ2</i>	.1488911	.0686832	2.17	0.030
<i>educ3</i>	.0627262	.0695717	0.90	0.367
<i>educ4</i>	—	—	—	—
<i>educ5</i>	-.4744369	.1508598	-3.14	0.002
<i>Tigray</i>	—	—	—	—
<i>Ambara</i>	.1139427	.0620331	1.84	0.066
<i>Oromia</i>	.1918235	.0640707	2.99	0.003
<i>South</i>	-.4669782	.0685661	-6.81	0.000
<i>_cons</i>	6.744048	.1086545	62.07	0.000

sigma_u | .56195883
sigma_e | .59065803
rho | .47511626 (fraction of variance due to u_i)

Source: Own calculations

Appendix IV Distribution of Income in terms of Income and Population Quintile



Source: Earth Trends Country Profile

Appendix V Lorenz Curve of Rural Ethiopian Households in 1994 and 2000

Note represents 1994
 represents 2000