ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

# NON- FARM INCOME AND INEQUALITY BY USE OF GINI-DECOMPOSABILITY TECHNIQUE

## A CASE STUDY IN RURAL TIGRAY

By:

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**"Non – Farm Income and Inequality by Use of Gini – Decomposability Technique: A Case Study in Rural Tigray."**

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## Abstract

The study viewed the impact of non- farm income on income inequality in rural Tigray by decomposing the rural households income in to farm income, non- farm income, remittance, rental income and other incomes.

As a method of data analysis, the study used Gini- decomposability technique and Probit regression.

The result indicated non- farm income particularly of wage employment as inequality reducing income source; implying the greater importance of wage employment sources to rural poor households than rural rich households. The study result has also indicated Age (elders) of an individual, Illiteracy, Primary and Secondary education and Distance to transport facility (individuals at farthest distance) positively related to the probability of being non- farm self employed while Gender (being female) and Marital status negatively related. The result also explained, though education required in some self employment activities, illiterates have higher participation because the majority of these activities were found marginalized/ inferior, generating lower income and did not attract educated.

Therefore, in order to minimize the existing income gap in rural Tigray Government should design appropriate policy and programs such as investment policy and productive safety net programs in the area so that rural poor households will be benefited from employment. Moreover, Government should work on modernizing the traditional self employment activities so as to increase their earned income and also promote migration to increase remittance.

# CHAPTER 1

# Introduction

## 1.1 Background of the Study:

Non- farm activity plays an increasing important role in sustainable development and poverty reduction in rural areas (FAO,1998). It can be considered as an important way to increase overall rural economic activity and employment. In many developing countries, non-farm activity often accounts for as much as 50% of rural employment and a similar percentage share of households income (Lanjouw, p 1999a). Average non-farm income share of the total is about 42% in Africa, 40% in Latin America, and 32% in Asia (World bank 2000,quoted in Nong Zhu and XubeiLuo 2006 ).

Earnings from non- farm activity can't only significantly increase total household income, but also function as a safety net through diversifying income sources. Participating in farm activity enhances household's capability of overcomeing negative shocks and investing in farm activity. It mitigates income fluctuation and enables the adoption of more profitable but "risky"agricultural technologies, which encourages the transformation of traditional agriculture to modern agriculture (Bright et al.2000 and Islam 1997), quoted in Nong Zhu and XubeiLuo2006) and this can be explained by the use of high yielding varieties, fertilizer, pesticides irrigation techniques and farm implements etc by the rural households' (Tassew.W, 2006).

Non- farm income may also prevent rapid or excessive rural-urban migration, because it makes the rural household stay in their places, as well as prevent natural resource degradation through over exploitation. The non- farm sector can hence function as a route out of poverty through reducing the pressure on the demand for land in rural areas and through breaking the vicious circle of "poverty, extensive cultivation and ecological deterioration"(Nong Zhu and XubeiLuo2006).

There has been a debate on the role of non- farm income in rural inequality. Some studies show that although non- farm income increases total rural income, it worsens income inequality because it is more unequally distributed than farm income and it has an entry barrier for the poor (Escobal.J,2001, Tassew.W,2006).

According to Adams,Jr. (1999), the share of non- farm income varies inversely with size of land owned. Studies made in countries where land is abundant and evenly distributed to rural households, the majority of the rural households obtain their income from agriculture and non- farm income is received by few large land owners who had the capacity. However, studies made in Pakistan and much of Latin -America where land is inadequate, the scarcity of land may "push" Poorer households out of agriculture and into non- farm sector i.e. non- farm income inequality improving (Adams, Jr.1995). Similarly, in some activities where rural poor households have a higher participation rate (eg. Casual wage activity) than rich households, non-farm income can reduce rural inequality (Adams, Jr.1994, dejanury and Sadoulet, 2001, quoted by Nong Zhu and Xubei Luo, 2006).

Thus, taking the above contribution of non- farm income to rural poverty reduction into consideration, the researcher tried to evaluate the Impact of Non- Farm Income on Rural Income Inequality: A case in Households of Rural Tigray, Ethiopia.

## 1.2 Statement of the Problem

3,694,000 people were living in Tigray region in the year 2000. Of these 3,072,000 were in rural areas (CSA, 2005). The majority of the rural's livelihood depend on agriculture which is rain fed.

Despite agriculture the mainstay of these rural households, the output obtained from the sector is found to be declining. The reasons can be:

-Agriculture is rain- fed which is untimely and uneven.

-Agriculture is traditional, input utilization is low as a result its productivity is Very minimal.

-Agricultural land is over exploited and soil nutrients are depleted.

- Livestock productivity is very low since forage development is very poor and livestock disease prevalence is very high.

Moreover, the crop land size was too low and fragmented, i.e. 1.03hectare per household as compared to the average household size in the study area- which was 5.2 persons (CSA, 2000). This implies either the produce is not enough to cover the yearly food requirement of the family or a little is left for sale after satisfying the consumption requirement of the household. Study made by CSA (2000) on welfare monitoring survey confirms this idea, i.e. only for 2% of a farm household in the study area the produce was enough for a year.

Thus, inadequate income from agriculture opt for the recognition that rural households should receive income from a diverse sources. The most important of these is income from non- farm sectors (Ellis,1998).

Rural [1]households of tigray have started participating in non- farm activities and earning their income to fill the gap. The study made by Tassew agrees with this fact. Tassew (2006) in his study farm/non-farm linkages in Northern Ethiopia explained the importance of non- farm activities as a diversifying income sources for rural households of tigray though the sector is at infancy. He has also indicated the importance of non- farm activities especially on their role in developing the farming sector, the contribution of rural income sources to income inequality.

However, his study is found limited in area coverage (2 districts were covered) and also failed to explain the following which this paper tried to assess.

-whether the non- farm income sources undertaken in the area are participating and benefiting the majority of rural poor or not.

[1] According to CSA definition, Rural kebele (farmer Association) is the lowest administrative unit in a settled areas with its own jurisdiction. It is an association of rural dwellers formed by the inhabitants of a given area whose members are engaged either in agricultural and/ or non- agricultural activities.

- whether the non- farm income improves the total income inequality that exists between the rural poor and the rural rich households.

-what determines the rural households participation in non- farm income sources.

## 1.3 Objectives of the study

In general, the researcher examined the impact of non- farm income on income inequality in rural Tigray. However, the specific objectives are:

1. To identify the percentage share of each income sources of the total income for the rural households of the study area in general and rural poor in particular.
2. To determine the percentage contribution of different income sources (Farm income, Non- farm income, Remittance, Rental income and Other incomes) to income inequality and there by identifying which sources are inequality decreasing/ increasing.
3. To decompose the non- farm income sources and identify which sources are in equality decreasing and which are inequality increasing.
4. To identify factors that determine participation of individuals in non- farm activities.
5. To make the necessary recommendation based on the out come of the study.

## 1.4 Significance of the study:

Besides raising total income, non- farm income plays a role in alleviating poverty via Contributing to the redistribution of income. Therefore, the study:

- Provide indicative information on the most important income sources of the rural households in general and rural poor in particular and also identify intervention areas from which the majority of the rural poor are benefited. Thus, policy makers design appropriate policy or Government intervene directly to improve the livelihood of poor households and there by reduce income inequality in the study area.

## 1.5 Limitation of the study:

The most important variables required in the study were land size of households, proximity to market, proximity to towns, and access to credit. Unavailability of data of these variables in HICE 2000 survey limited the researcher not to see their effects on variability of farm income, and participation on non- farm self employment. Moreover, Timely unrelease of HICE 2004/05 data were also mentioned as the study limitations. Thus, all results obtained in the study and recommendations made restricted to the year 2000.

## 1.6 Organization of the Study:

The study in all has five chapters: Chapter one, introductory. Chapter two, dealt with review of literature. Chapter three, dealt with study methodology. Chapter four, also dealt with study result obtained from HICE 2000 data. Finally, conclusions and recommendations made are presented in chapter five.

# CHAPTER 2

## Review of Related Literature

### 2.1 Role of Non- Farm Activities in Developing Countries

There has been an increasing recognition recently that the rural economy is not confined to the agricultural sector. For most rural people in developing countries, rural non- farm activities are part of a set of livelihood activities.

Since 1970s, a large number of studies have investigated the role of non- farm activities for rural development. Evidence from the developing world Suggests that economic diversity in the countryside has the potential to foster local economic growth and alleviate the rural- urban income gap and rural poverty.

Inaddition, rural non- farm activities:

- Absorb rural surplus labor and there by reduce rural- urban migration.
- Offer additional income that supplements agricultural income.
- Provide a means for the rural poor to cope with or survive. When farming fails.
- Foster agricultural growth.
- Improve the overall quality of life.

i.e. in general, they are a potential vehicle for poverty reduction in rural areas( R.H. Adams, JR. (1994), R.H. Adams, JR. (1999), Junior R. Davis and Dirk J. Bezner (2004) ).

According to studies made, the rural population in developing countries derive an important share of income from rural non- farm activities, though the percentage varies among nations. Ellis (2000a) as in Junior R. Davis and Dirk J. Bezner (2004) states that 30-50% is common in sub- sahran Africa. In Asia and Latin America, FAO estimates the figure to be 32% and 40% respectively (Junior R. Davis and Dirk J. Bezner (2004)). In Ecuador, its share is 40% which is very close to farm income i.e. 46% (P. Lanjouw, 1999). World bank (2000), quoted by P. Lanjouw (1999), also stated that the average non- farm income share of the total is about 42% in Africa, 40% in Latin America, and 32% in Asia- which agrees the above studies made.

Other studies made in rural Egypt and Pakistan by R.H. Adams, JR. (1994, 1999) respectively also explains the largest share held by non- farm income of the total income especially for rural poor landless households of the two countries. However, in countries like Burkinafaso, Nigeria, and Tanzania , non- farm income contributes less to total income as compared to farm income ( Reardon, Delgado and Matlon (1992) ; Collier, Radwan, and Wangwe (1986) and Matlon(1979) quoted by R.H. Adams, JR. (1999)). Part of this inconsistency is perhaps due to difference in study cites. i.e. in land scarce and labor rich countries like Taiwan, Ecuador and much of Asia, small and inadequate land holdings may tend to push poorer households out of agriculture and into the non- farm sector. In land rich and labor scarce countries such as Africa where the majority of the rural poor engaged in agriculture, only richer households are joining the non- farm sector (P. Lanjouw (1999) and R.H. Adams, JR. (1994)).

Another important contribution of rural non- farm activity is its role in providing employment opportunity for rural population. The employment opportunity provided by these sector is growing overtime and this is expressed by the rural labor force participating in the sector. In computing the rural labor force countries use different definition of the term "rural". Some include rural towns where agricultural activity is not the major occupation in the area while others exclude. For instance, P. Hazell and S. Heggblade, as in P. Lanjouw (1999), indicated that in Latin America 47% of the labor force in rural settlements and rural towns is primarily employeed in non- farm activity. On the other hand, Dennis Anderson and Mark W. Leisserson (1980) explained the share of rural labor force primarily engaged in non- agricultural activity as 30-40% when rural towns are included and 20-30% when they are excluded.

House hold participation in non- farm activity depends on its " **incentive and capability ".** Households are motivated to undertake rural non- farm activities by either " demand pull " or " distress push" factors. If the non- farm sector has high returns, the "pull factors" will be strong; if farm activities can't provide enough income for households ( i.e. if farm out put is inadequate due to drought, flood or insufficiency of land etc ) or households need to diversify their income sources the "push factors" may kick in (Junior R. Davis and Dirk J. Bezner (2004), Nong Zhuo and Xubei luo 2006).

Poor households are less capable of weathering negative shocks and are more risk averse. In order to have additional income as well as to diversify and undertake activities with returns that may have low or negative correlation with those of farming, poor households may have stronger incentive to participate in non- farm activities while rich households may have better capacity to do so thanks to their better endowments in physical and human capital (FAO, 1998). It is distress push factors which usually makes the rural poor households of most developing countries to participate in non- farm activities.

In most rural areas of developing countries the credit and insurance markets are not well developed; infrastructural facilities are very poor,and rural markets are unavailable in the vicinity, for most rural areas are far from towns. Inaddition to these, most of the rural poor are either uneducated or less educated and are not provided with technical training. All these and other factors determine the rural households, especially of the poor participation in rural non- farm activities.

Studies made by P. Lanjouw (1999) and NongZhu and XubeiLuo (2006) indicated that relative to the uneducated, those with education are generally more likely to find employment in the non- agricultural sector. The studies further explained that the rural labor with primary school completion are more likely to participate in self- employment activities while secondary school and above completion is required for participation in wage- paying activities. Entry barriers interms of education are higher for wage- paying activities; for instance, the study result of P. Lanjouw (1999) reveals a person who has completed primary , secondary, and university education in rural Ecuador earns 31%, 46%, and 258% more than a person who has not. The study made by NongZhu and XubeiLuo (2006) also shown the importance of technical training to participate in non- farm activities i.e. the higher is the percentage of the household members that have some technical training, the higher is the participation rate in self- employment activity.

According to income obtained from rural non- agricultural activities, the activities can broadly be divided into two groups of occupations, namely : high labor productivity and low labor productivity[2]. The latter activities are mainly occupied by rural poor and especially of women, for they don't require much education and entry barrier is almost nill. For example, study by P. Lanjouw (1999) in rural Ecuador, suggests rural poor are participating mainly in non- agricultural wage- employment activities as primary and secondary occupations. The activities include fishing, manufacturing, construction, and community work and they are very close to low labor productivity activities. With respect to gender, P. Lanjouw (1999) explains of the rural women in Ecuador nearly 50% of them are employed in low labor productivity wage- employing activities as primary and secondary occupation as compared to male which comprises 37%.

Similar to wage- employing, self- employment activities are also another non- agricultural activities in which rural poor are working. Of the rural labor force in Ecuador, 60% are engaged in self- employment. Out of these self- employed, 55% are rural poor. The major activity in which rural poor are working is small petty- trade which requires less capital to start and doesn't require much education. In general, non- farm activities are an important route out of poverty especially for the rural poor in many developing countries.

[2] According to P. Lanjouw (1999), high labor productivity and low labor productivity activities are defined if the annual earnings of wage employment activities fall above or below resp., the average annual per capita income from agricultural wage labor for persons primarily engaged in agricultural wage labor occupations.

## 2.2 Rural Farm and Non- Farm Linkages:

Rural development policies often neglect the role of rural non- farm activities and their link with agriculture. This might be because the role of rural non- farm sector is the least understood component of the rural economy; its role in the broader development process is not well known (Lanjouw and Lanjouw, 2001).

Though there is a knowledge gap in the policies of developing countries, the existing linkage between farm and non- farm linkage is very great. Haggblade (2002), quoted by Junir R. Davis and Dirk J. Bezner (2004), stated that one reason as to why the rural non- farm economy should be actively encouraged is because, when agriculture grows, the rural economy benefits from powerful income and employment multipliers. However, in many developing countries descrimination against small rural non- farm activity constrains the effects of these multipliers.

The forward and backward link between farm and non- farm sector can be explained by production and consumption linkages. **Production linkages** could develop where by, for instance, demand from agriculturalist for farm implements and machinery repair would stimulate non- farm activities via " backward" linkages, or where agricultural goods requiring processing in spinning, milling, or canning factories prior to sale would stimulate non- farm activities through forward linkages. **Consumption linkages** could emerge as rising agricultural income fed primarily into increased demand for goods and services produced in near by villages and towns. Inaddition, rising agricultural productivity could release labor for employment in non- agricultural activity and also promote hiring of farm labor (P. Lanjouw (1999) and Tassew. W (2006)).

Though these two sectors mutually reinforce, the different linkages (production and consumption) have been found to vary in their influence. According to Alain de janvry and Elizabeth Sadoulet (1993), quoted by P. Lanjouw (1999), while consumption linkages exerted the strongest influence in Asian countries, production linkage exerted the strongest influence in Latin America. The difference is due to unequal distribution of land and income in Latin America and as a result the rich who are benefiting from agriculture consume more of luxurious items. Tassew (2006), in his study also explained consumption linkage as the strongest type of linkage in rural Tigray, Ethiopia though the commodity composition of demand varies.

The direction and causality of growth in non- farm and farm activities is far from clear as a result the effects of non- farm income on total farm households income are found to vary both among developing countries and among regions in the same country. For example in Kenya, regions with higher non- farm incomes also tend to have higher agricultural income levels. In Taiwan, non- farm income was the principal source of rising rural real incomes in the 1970s and was accompanied by very small increase in real farm income despite significant increase in agricultural productivity (J.P. Leones and S. Feldman, 1998). In Ethiopia, Tigray region, income diversification results in a higher agricultural output per unit of land. On average, when off- farm income increases by 1%, agricultural productivity increases by 0.34%. This is because households learn managerial skills through experience in various activities and initiate better farming practices (Tassew.W, 2006).

On the contrary, in Southern Africa, increasing rural non- farm opportunity in some communities has been accompanied by a decline in agricultural production and income. Similarly, in Bicol, a resource poor region of the Phillipiness, a rapid increase in non- farm income in absolute and relative terms accompanied a decline in both agricultural and total income in the late 1970s and early 1980s (J.P. Leones and S. Feldman, 1998). Studies also indicated on how agricultural growth promote the non-farm sector. During the 1970s and early 1980s, Mellor and Lele (1972), Mellor (1976) and Johnston and Kilby (1975), quoted by R.H. Adams, JR. (1999), emphasized the growth linkages effects of agricultural growth. According to this literature, technological change in agriculture boosts production, there by increasing incomes of land owning households. In turn, these land owning households use their new income to buy more labor- intensive goods and services which are produced by the poor working in small scale- firms in the rural non- farm sector. Thus, accelerated growth in agriculture produces second- and third round effects that benefit the rural economy.

Hazzel and Roell (1983), quoted by R.H. Adams, JR. (1999), explained in certain Asian countries high yielding varieties of rice and wheat have large multiplier effects on the rural non- farm sector. However, in many developing countries these multiplier effects have been quite small. For instance, Dejanvry and Sadoulet (1993), quoted by R.H. Adams, JR. (1999), argue that the unequal distribution of land and income in Latin America and other developing countries (only a hand full of land owners (rich) benefit from the income effects of agricultural growth. Since these land owners prefer to buy luxurious items which are imported, they don't demand the type of labor-intensive goods and services which are produced by the poor in the rural non- farm sector. Therefore, in land constrained countries like Latin- America, certain Asian and Middle- East countries focusing directly on the rural non- farm sector might provide a better way of increasing the income and employment opportunities of the poor.

## 2.3 The Decomposition of Income Inequality:

At the start of any decomposition exercise, the question arises: what measure of inequality should be chosen for the analysis? Several different inequality measures have been proposed in the literature. Following Foster (1985) and others, the chosen measure should have five basic properties, namely:

1.Pigou- Dalton transfer sensitivity: holds if the measure of inequality increases whenever income is transferred from one person to someone richer.

2.Symmetry: holds if the measure of inequality remains unchanged when individuals switch places in the income order.

3. Mean independence: holds if a proportionate change in all income leaves the measure of inequality unchanged.

4.Population homogeneity: holds if increasing or decreasing the population size across all income levels has no effect on the measured level of inequality.

5. Decomposability: allows inequality to be partitioned either over sub- population or sources.

There are several inequality measures such as Theil's entropy index T, Theil's second measure L, Coefficient of variation and Gini- coefficient. The two Theil measures, however, are not decomposable when sources of income are overlapping. While the need for non- overlapping groups is not restrictive when inequality is decomposed. This restriction limits the use of the two theils for measuring inequality, for many of the survey households receive income from several different sources. The other measure of inequality i.e. coefficient of variation satisfies all properties except mean independence. It requires inequality to be variant when there is a proportionate change in all incomes (R.H. Adams, JR, 1994).

The only inequality measure which meets the five preceding properties is Gini-coefficient. Gini allows total inequality to be partitioned in to a weighted sum of inequality by various income sources (farm income, non- farm income, etc).

According to R.H. Adams, JR (1994) and R.H. Adams, JR (1999), the source decomposition of Gini- coefficient can be developed as follows:

Assume that with the chosen group there are 'n' households deriving income from 'k' sources. Using notation similar to Shorrocks (1983:311), let $y_i$ denote the total income of households i from source k, where k=1,...K. Also let the distribution of total household income be represented by Y= $(y_{1...}y_n)$ and the distribution of income component k be represented by $Y_k$= ( $y_{ik...}y_{nk}$). Using this, the Gini- coefficient (G) for the distribution of total income with in the group can be defined as:

$$G= \frac{2COV(Y, F(Y))}{\mu} \qquad (1)$$

where $\mu$ denotes the mean household income of the sample and F(Y) the cumulative distribution of total household income in the sample

(i.e $F(Y) = (f(y_1)....,f(y_n))$ where $f(y_i)$ is equal to the rank of $y_i$ divided by the number of observations (n). (Stark etal.1986: 259 quoted by R.H. Adams, JR 1999).

Equation (1) can be rewritten and expanded into an expression for the Gini- coefficient that captured the" contribution to inequality" of each of the K components of income:

$$G = \frac{2}{\mu n} \Sigma ( y_i - E(y_i)) (f(y_i)-E(f(y_i))) \qquad (2)$$

$$G = \frac{2}{\mu n} \Sigma \Sigma ( y_{ik} - E(y_{ik})) (f(y_i)-E(f(y_i))) \qquad (3)$$

$$G = \frac{2}{\mu} \Sigma \, COV (Y_k , F(Y)) \qquad (4)$$

$$G = \Sigma \; \frac{(COV (Y_k , F(Y))}{(COV (Y_k , F(Y_k))} \cdot \frac{(2 \, COV(Y_k , F(Y_k))}{\mu_k} \cdot \frac{\mu_k}{\mu} \qquad (5)$$

where $\mu_k$ is the sample mean of income from source k and $F(Y_k)$ is the cumulative rank distribution of income from source k (i.e $F(Y_k)= f(y_{1k})...., f(y_{nk}))$ , where $f(y_{ik})$ is equal to the rank of $y_{ik}$ divided by the number of observation (n).

Using the notation of Starketal (1986:725), quoted by R.H. Adams, JR (1999), the gini- coefficient can be written as:

$$G = \Sigma R_k G_k S_k \qquad (6)$$

Where :

$R_k =$ the gini-correlation of income from source k with total income

i.e $R_k = \dfrac{COV(Y_k, F(Y))}{COV(Y, F(Y_k))}$

$G_k =$ gini-coefficient measuring the inequality in the distribution of income component k with in the group and

$S_k =$ the share of source k of income in total group income

i.e. $S_k = \dfrac{\mu_k}{\mu}$

Equation (6) shows the contribution of each income source k to overall income inequality. The larger the product of these three components, the greater will be the contribution of income from source k to overall income inequality. However, it should be noted that while $S_k$ is always positive and less than one, $G_k$ is always positive and may exceed one (if many of the source incomes are negative), and $R_k$ can fall any where on the interval [-1,1]. When $R_k$ is less than zero, income from source k is negatively correlated with total income and thus lowers the gini measure for the sample.

Assuming that additional increments of an income source are distributed in the same manner as the original units, it is also possible to use this decomposition to ask whether an income source is inequality increasing or decreasing on the basis of whether or not an enlarged share of that income source leads to an increase or decrease in overall income inequality.

On the basis of eq$^n$(6), $$g_k = \frac{R_k G_k}{G} \qquad (7)$$

where, $g_k$ is the relative concentration coefficient of income source k in overall inequality.

From equation (7), it follows that income source k is inequality increasing or decreasing according to whether $g_k$ is greater than or less than unity respectively (R.H. Adams, JR (1999), R.H. Adams, JR (1994)).

## 2.4 Non- Farm Income and Inequality

### 2.4.1 Foreign studies :

Various studies in different countries are made regarding the impact of non- farm income on income inequality. In all these studies the role of non- farm income in rural inequality is debateful. Some studies show that although non- farm income increases total rural income, it worsens income inequality, for it is more unequally distributed than farm income. However, some other studies suggest that, if the households have a higher participation rate (in particular in casual wage activity) than rich households, non- farm income can reduce rural inequality. Study made by NongZhu and XubeiLuo on 742 households is based on data obtained in periods 1995 and 1997 from living standard measurement survey made in two provinces of china. The authors examined the impact of non- farm income on income inequality in two ways. First by assuming non- farm income as exogenous transfer to total income to decompose Gini- index. Second by assuming non- farm income as a potential substitute of farm income and making comparison between observed income and simulated household income. The study result based on first assumption indicated that though the largest portion of rural households income came from farm activity, non- farm income is found inequality reducing while farm income is inequality raising. Uneven distribution of land, low entry barriers to non- farm sector, high population density on agriculture and its low productivity favored rural poor to participate greatly on non- farm activity and get the majority of their income out of it. The simulation result also confirmed the substitutability of farm activity by non- farm in a case where marginal productivity from farming is low and land is scarce. They concluded by suggesting the development of rural infrastructures, creation of nearby rural markets, establishment of credit and insurance institutions to support poor households get out of poverty.

Richard H.Adams, JR.(1999) on their study non- farm income, inequality, and land in rural Egypt also explained similar results to that of Nong Zhu and Xubei Luo. Adams, Jr.used data from 1997 household budget survey covering 1,301 rural households. Total income decomposed into five income sources and analyzed by use of Gini-Decomposability technique to determine the impact of each income source to income inequality. Regression analysis also used to determine the correlation between different income sources and land size. The result revealed that non- farm income is inequality reducing while farm income is inequality raising for the rural poor. Moreover land size is statistically and positively correlated to agricultural income while it is negatively correlated to non- farm income. Uneven distribution of land is cited as a cause.

In a similar study made by Adams, Jr.(1994) and Adams and Jane J. He (1995) on rural Pakistan, a three year data spanning from 1986/87-1988/89 is used. The data collected from 727 households sampled from three provinces of Pakistan. Gini - Decomposability technique is used and the result indicated non- farm income and livestock income are found inequality reducing where as agricultural income, transfer income and rental income are inequality raising for rural poor, for land is unevenly distributed as in rural Egypt. Moreover, the result also shown educational difference, lack of training centers, weak development of credit institutions, and absence of near by markets as a root causes of income inequality in rural Pakistan. As the study evaluated, the sampled households are not representing the whole rural Pakistan so generalization can't be made.

Ayal Kimhi(2005) also studied on off- farm income in rural Georgia. Data collected in periods March-April 2003 in four districts of rural Georgia covering 2,520 households were used. Total income decomposed into farm and non- farm income. In addition to Gini- decomposability used by other studies, the author used Lorenz curve to compute the contribution of each income source to inequality. The result has shown that non- farm income is inequality reducing while farm income is inequality raising, a result which is similar to other studies. Uneven distribution of land cited as a reason. Generally, all the above studies used the same methodology, achieve the same objectives and reach on the same result.

### 2.4.2 Ethiopian studies:

Tassew (2006) in his study, Farm/ Non- farm Linkages, has tried to address impact of non- farm income on income inequality, the types of linkage that exist between farm and non- farm activities, and the social, cultural and economic problems for the development of non- farm activities. For the study, he used 402 rural households chosen randomly from astratified sampled areas of Enderta and Adigudom districts of Tigray. Decomposability technique used. The result explained non- farm income as inequality increasing while farm income as inequality decreasing, for less attention given to rural poor to participate in non- farm activities and as a result the majority of non- farm activity except food for work is found occupied by rural rich of the study area, a result which is against other studies by Adams,Jr. NongZhu and Xubei Luo, and Ayal.

In addition, Tassew study concentrate only on two districts and failed to show determinants for participation in non- farm activity. Besides, it failed to show the impact of additional source incomes to inequality. Thus, this paper will study by adding this variables and taking sampled households from all districts of rural Tigray.

# CHAPTER 3

# METHODOLOGY

## 3.1 Sources of Data:

The researcher used data from **HICEs** [3] **(1999/2000) and WMS**[4] **(1999/2000)** undertaken by **CSA**[5], Ethiopia. HICE covered 17,332 households in both urban and rural areas of the country. Out of these, CSA coverage of rural tigray comprises 564 households on which the researcher is interested to make his study. The 564 households are distributed through all districts of tigray.

CSA used a two stage stratified random sampling with **Enumeration Areas** [6]as a primary sampling unit and Households as a secondary sampling unit. To select the sampled households from a fresh list of households in each enumeration areas CSA used Systematic random sampling technique. The researcher, based on data obtained from these households, has made generalization about all households in rural tigray. To make the generalization a raising factor/ weight already prepared by CSA is used (CSA, 2001 report on calculation of weight).

[3] HICEs refers to Household Income, Consumption and Expenditure survey.

[4] WMS refers to Welfare Monitoring Survey.

[5] CSA refers to Central Statistics Agency.

[6] According to CSA definition enumeration area in rural parts of the country is a locality that is less than or equal to a farmer's association area and usually it consists of 150-200 households.

## 3.2 Method of Data Analysis:

To analyze data obtained from 564 households, SPSS version 12 for Descriptive and STATA version 9 for Probit regression analysis were used. Gini- Decomposability Technique also used. Though various inequality measures can be used, decomposability is found the best of all in a case where inequality is partitioned either over sub- population or sources (Adams,1999 and Robert I. Lerman; Sholmo Yitzhaki (1985)).

In this paper, income is computed from households expenditure on consumption and non- consumption items. In HICE survey of many countries income is usually computed from households expenditure, for income data collected directly from households is under estimated (Robert I. Lerman; Sholmo Yitzhaki (1985).

Therefore, the definition for the decomposed sources given as follows explain how income is computed based on expenditure approach:

Farm-Income:- Includes expenditure made from sale of owned crop, crop by products, livestock and livestock products plus imputed values for home consumed crop and livestock products.

Non- farm Income:- Includes expenditure made in cash from wage and self employment plus imputed values of home consumed from non agricultural and in kind obtainees in the form of wage.

Wage employment :- includes wage obtained from being employed in activities like: community work, casual agricultural employment, servant, guard, teacher, heads of village/traditional chiefs and finance.

Employing organizations are: government, non-government, private organization and households.

Self employment :- Refers non- agricultural activities owned by a member of household. Activities include: participation on pottery, weaving, black smith, handicraft works in wood, textile, leather, mining of gold, whole sale trade, retail trade, sales on shop, sale of fuel wood, trade broker street vendor and shoe repair.

Remittance:- Includes expenditure made by use of in cash or in kind obtained from domestic or foreign residing households in a regular basis plus imputed values of home consumed and in kind obtained.

Rental income: - Includes expenditure made from rent of house[7], rent of other household asset including livestock.

Other incomes: Includes expenditure made from gift, donation, sale of household asset. Imputation is made for home consumed.

[7] Imputed values of freely obtained houses cannot be used, for most values are unreliable.

Therefore, to examine the contribution of each income source to income inequality the selected technique (gini- decomposability) is found to be appropriate for the study.

### 3.2.1 Gini- Decomposability Technique:

Suppose that $y_1, y_2, \ldots, y_k$ stand for the k components of household income and $y_0$ the total income, i.e. $\mathbf{y_0} = \sum_{k=1}^{K} y_k$

The Gini index of the total income, $G_0$ can be decomposed as follows:

$\mathbf{G_0} = \sum_{k=1}^{K} R_k G_k S_k$ where:

$\mathbf{R}_{k}=$ the gini-correlation of income from source k with total income

$$\text{i.e.} \quad \mathbf{R}_k = \frac{\mathbf{COV}\ (\mathbf{y_k}, \mathbf{r})}{\mathbf{COV}\ (\mathbf{y_k}, \mathbf{r_k})}$$

where, r and $r_k$ are rank of total and source income respectively.

$\mathbf{G_k}=$ gini- coefficient measuring the inequality in the distribution of income component k with in the group.

$$\text{i.e} \quad \mathbf{G_k} = \frac{\mathbf{2}}{\mathbf{n}\,\boldsymbol{\mu}_k}\ \mathbf{COV}\ (\mathbf{y_k}, \mathbf{r_k})$$

$\mathbf{S_k}=$ the share of source k of income in total group income

$$\text{i.e.} \quad S_k = \frac{\mu_k}{\mu}$$

The sum of the product of these three components for all sources provide total gini while the product of these three components for each source explains the percentage contribution of each income source to income inequality but not income sources are inequality reducing or increasing.

According to Adams 1994 and 1999, determination of which income sources are inequality reducing or increasing requires use of the following formula.

$$g_k = \frac{R_k G_k}{G_0},$$

where $g_k$ is relative concentration coefficient of income source k to overall income inequality. If $g_k > 1$, a given source income increases inequality and if $g_k < 1$, a given source income decreases inequality.

### 3.2.2 Probit Regression Model:

It is known that participation of individuals in non- farm income sources is determined by different variables such as educational level, age, gender, access to credit, proximity to market, transport facility and towns etc. In this study, it is tried to find the determinants of individuals participation in non- farm self employment or wage employment. The dependent variable used (participation in non- farm income sources) is dichotomous taking a value of 0 or 1. In a case where the dependent variable is dichotomous, probit and logit models are widely applicable (Feder et. al (1985) quoted by Daba Moti(2003) and Gujarati, 2003).

These models specify a functional relation between the probability of the dichotomous dependent variable and various explanatory variables. In this study for simplicity probit is used and the general expression for the model given as follows:

$$(NFE) = F\ (GDR, illT, PRM, SECD, AG, MRT, DSTF, €_i)$$

**Description of variables**

| Name | Description | Expected sign |
|---|---|---|
| NFE | Dependent variable =1 if individuals participate in non-farm self employment and = 0 if participate in wage employment | |
| GDR | Gender =1 if female and = 0 otherwise | Gender is expected to have positive sign |
| ILLT | =1 if illiterate and =0 other wise | Illiterate is expected to have negative sign |
| PRM | =1 if primary and = 0 other wise | Primary education is expected to have positive sign |
| SECD | =1 if secondary and = 0 other wise | Secondary education is expected to have positive sign |
| AG | Age in years | Age is expected to have positive sign |
| MRT | =1 if married and =0 other wise | It is expected with negative sign |
| DSTF | Distance to transport facility in kilometer | It is expected to have negative sign |
| $€_i$ | Error term | |

Thus, the probability of participation in non- farm self employment in relation to different explanatory variables is explained based on the sign of coefficients. Parameters tell the change in the probability of participation in self employment as the explanatory variables change.

# CHAPTER 4

# RESULT AND DISCUSSION

## 4.1 Descriptive Results:

### 4.1.1 Total Income by Source & Quantile Group:

In this chapter an attempt has been made to explain total households income of rural Tigray as farm, non-farm, remittance, rental income and other income sources (see definition of each income source in chapter 3).

In some African and Asian countries such as Egypt and Pakistan where most of the rural households are landless, the percent of households and the proportion of income obtained from farm sector was too low in comparison to non- farm income (RH. Adams, 1999). However, the situation is different in Ethiopia, where more than 80% of rural households are engaged and earning the proportion of their income from farm. The study result in table 4.1 have indicated this fact, 99% (almost all) of the rural households of Tigray have identified obtaining their income from farm while 52% obtaining from non- farm. 46%, 5%, and 82% were from remittance, rental and other sources respectively. In terms of income share, farm income contributing the largest portion 82%, followed by non- farm and remittance 8.2% and 2.8% of the total households income respectively. The Share of rental has found insignificant 0.4% while the share of other sources significant 6.6%. [8] The result indicated that, non- farm income as the second largest source of income in rural tigray. However, the percentage figure low as compared to the result of some of the African and Asian countries.

[8] Other income sources includes largely of food aid (donation) received by households from government and non government , for three years prior to HICE survey period Tigray was severly affected by drought.

In those countries the share of non- farm income ranged between 13-72%, for non- farm income played the leading role and acts as a route out of poverty especially for rural poor (RH. Adams,1999).

It is evident from table 4.2 households ranked by quantile based on their total income. As indicated in the table, in all quantile groups, farm income has been identified as a dominant source of income though its degree of importance at different quantile varies. This fact strengthen what has been stated in the previous table. As we move from lowest to highest quantile groups[9] in table 4.2, the percentage contribution of farm income to total income has raised from 64.1%to 87.1% respectively. On the contrary, the percentage contribution of non- farm income and remittance have seen declining from 12.6% to 6.4% and from 9.3% to 1.5% respectively as one moves from lowest to highest quantile groups. In general, the result obtained from the data has indicated the relative importance of farm income to rural rich and non- farm income and remittance to rural poor, while rental income more or less equally important.

[9] households in the lowest quantile are considered as relatively poor and households in the highest quantile as relatively rich,

**Table 4.1**

**Percent of households and Mean Annual Income Share by Source of Income**

| Sources of income | Percent of households* | Mean annual income in birr** | Percent share of total mean income | Standard deviation |
|---|---|---|---|---|
| Farm income | 99 | 3,406.93 | 82.0 | 3,210.05 |
| Non-Farm income | 52 | 344.24 | 8.2 | 734.40 |
| Remittance | 46 | 119.53 | 2.8 | 344.60 |
| Rental income | 5 | 15.82 | 0.4 | 118.76 |
| Other incomes | 82 | 288.53 | 6.6 | 500.69 |
| Total | | 4,175.05 | 100 | 3,124.92 |

Source: Author's computation from HICE 2000 data of CSA.

Note:

n=564 and raised to total households in rural tigray i.e 643,840.

*Percent of households can't be summed up to give 100. A household is counted in more than one source as he gets income from different sources.

** All income figures are mean annual incomes given in Ethiopian currency "birr" and the figures are raised to all rural households of tigray.

- To get per person income figures divide mean income by average household size in the study area which is 5.2 person.

Table 4.2

**Mean Annual Household Income by Quantile and Income Source**

| 564 households ranked by total income quantile groups | Mean Annual Income in birr* | Percent of Farm Income | Percent of Non-farm Income | Percent of Remi-tance | Percent of Rental income | Percent of Other incomes |
|---|---|---|---|---|---|---|
| Lowest 20% | 1,564.75 | 64.1 | 12.6 | 9.3 | 0.4 | 13.6 |
| Second 20% | 2,661.72 | 75.3 | 10.8 | 5.2 | 0.9 | 7.8 |
| Third 20% | 3,548.72 | 77.4 | 10.3 | 4.9 | 0.1 | 7.3 |
| Fourth 20% | 4,712.16 | 85.9 | 7.8 | 1.4 | 0.3 | 4.6 |
| Highest 20% | 7,856.55 | 87.1 | 6.4 | 1.5 | 0.4 | 4.6 |

Source: Author's computation from HICE 2000 data of CSA.

Note:

n=564 and raised to total households in rural tigray i.e 643,840.

* All income figures are mean annual incomes given in Ethiopian currency "birr" and the figures are raised to all rural households of tigray.

## 4.1.2. Contribution of Income Sources to Inequality:

Gini- decomposition provides two ways of measuring contribution of income sources to overall income inequality. First, it provides how much of total income inequality is due to a particular income source. Second, it provides whether inequality in an income source increase or decrease total income inequality.

By analyzing table 4.2, it is possible to tell the presence of overall income inequality among households in the study area, though it is an informal method. It tells of the total households income only 7% earned by households at lowest quantile while 39% earned by households at highest quantile. Which sources contribute greatly to this overall income inequality?

It is clear from table 4.3 the contribution (absolute and relative) of income sources to overall income inequality. The result obtained from the data revealed farm income as the largest contributor to total income inequality 93.2% followed by non- farm income 4.1%. The remaining three sources shared 2.7%. This implys the largest portion of total income inequality came from sources having the largest income share- which agrees what literatures usually say.

The percentage contribution of each source to inequality can further be explained by analyzing mean income share ($S_{k)}$, correlation coefficient ($R_{k)}$ and source gini ($G_k$) given in table 4.3. In the case of farm income though source gini relatively found the smallest implying the most equally distributed source of income, share of income and correlation with total income have found the largest. Thus, smaller source gini dominated by the product of large values of income share and correlation gave rise to the largest contribution to inequality.

However, non- farm income has got a smaller share of income and less correlated to total income but more unequally distributed than farm income (52% of rural households earned their income from non- farm: table4.1) as a result contribution to inequality smaller than farm income. Similarly, remittance and rental income have got the smallest income share and are the least correlated to total income but the most unevenly distributed (only 46% and 5% of rural households have earned their income from these sources respectively: table 4.1) having a net effect least contributors to inequality.

When it comes to which sources are inequality increasing and which are inequality decreasing, the result in table 4.3 has explained, farm income as inequality increasing ($g_{k>1}$) while non- farm income, remittance and rental as inequality decreasing ($g_{k<1}$) implying ceteris paribus, additional increments of non- farm, remittance and rental income will reduce overall income inequality.

The inequality result can also be justified by looking at table 4.2. In this table, comparison of two quantiles income figures have explained the relative importance of farm income to rural rich and non- farm income and remittance to rural poor, for rural rich have obtained the largest mean income share 87% against 64% obtained by rural poor from farm while rural poor obtained 12.6% against 6.4% obtained by rural rich from non- farm and 9.3% by rural poor against 1.5% by rural rich from remittance respectively. Therefore, attention has been given to income sources (non- farm and remittance) from which most rural poor are benefited. But, here one can raise a question why farm income an inequality increasing though almost all rural households livelihood depend on it and moreover identified as the most equally distributed income source relative to other sources? The possible reasons could be: unequal distribution of land size among rural households, utilization of highly productive farm inputs by rural rich, ownership of livestock by rural rich, production of cash crops by rual rich etc. However, to know exactly it requires further study.

**Table 4.3**

**Income Inequality and Decomposition by Source by use of Gini**

| Income sources | Mean income share ($S_k$) | Correlation ratio ($R_k$) | Source-gini ($G_k$) | Absolute contribution to inequality (G) | Relative contribution to inequality (%) | Concentration coefficient ($g_k$) |
|---|---|---|---|---|---|---|
| Farm income | 0.816 | 0.895 | 0.378 | 0.276 | 93.2 | 1.15 |
| Non- farm income | 0.082 | 0.184 | 0.824 | 0.012 | 4.1 | 0.52 |
| Remittance | 0.029 | 0.072 | 0.876 | 0.002 | 0.66 | 0.21 |
| Rental income | 0.004 | 0.258 | 1.015 | 0.001 | 0.34 | 0.89 |
| Other incomes | 0.069 | 0.118 | 0.665 | 0.005 | 1.7 | 0.27 |
| Total | 1.000 | | | $G_T$=0.296 | 100.0 | |

Source: Author's computation from HICE 2000 data of CSA

Note:

- Sum of $S_k$=1
- $R_k$=[-1, 1] and
- $G_k$ usually between 0 and 1 but sometimes exceed 1 when income is zero for many households. Similar reason applied for rental income whose $G_k$>1.

## 4.1.3. Socio- Economic Characteristics of Non- farm Individuals (Aged 10 years and above)

It is evident from table 4.4 that out of rural individuals participating in non- farm income sources, 60.9% were male and the remaining 39.1% female. With regard to Age, the majority of non- farm individuals 91.2% had found in the age of 15-65 years, followed by individuals aged 65 and above which constituted 8.1%. However, those aged between 10 and 15 years were found insignificant –constituting only 0.7%.

With respect to Educational level of non- farm individuals, the study result in this table explained 76.5% were illiterate (couldn't read and write). The remaining 23.5%, who were considered as literate, were found categorized in pre- primary (informal education), primary and secondary education. Out of the literates, non- farm individuals who completed primary education constituted the largest portion 13.7%. Those who attended informal education and those who completed secondary education comprises 8.5% and 1.3% respectively.

When comes to Marrital status, the result has indicated the majority were married 65.1%. Widowed and divorced individuals were found comprising almost equal share ie 13% and 12.8% inorder. However, unmarried individuals have taken the smallest share 9.1%.

Table 4.4

**Socio- Economic Characteristics of Individuals Participating in Non- farm Income Sources (for those aged 10 years & above)**

| Socio- Economic Characteristics | Percentage (%) |
|---|---|
| Gender: | |
| Male | 60.9 |
| Female | 39.1 |
| Age: | |
| 10-15 years | 0.7 |
| 15-65 years | 91.2 |
| 65 years & above | 8.1 |
| Education: | |
| Illiterate | 76.5 |
| Pre- primary | 8.5 |
| Primary (Grade 1-8) | 13.7 |
| Secondary (Grade 9-12) | 1.3 |
| Marrital Status; | |
| Unmarried | 9.1 |
| Married | 65.1 |
| Widowed | 13.0 |
| Divorced | 12.8 |

Source: Author's computation from HICE 2000 data of CSA.

### 4.1.4. Decomposition of Non- farm Income Sources:

In this section an attempt has been made to decompose non- farm income in to wage[10] and self- employment (definition mentioned in chapter 3). Moreover, the percent of households, percent of mean non- farm income share of non- farm sources, the relative importance of each source and their contribution to inequality have also been discussed.

From table 4.5 it is clear to see the percentage of households and mean non- farm income share of each source in percent. As shown in the table, 67.9% of non- farm households generate 50.4% of their mean non- farm income from wage and salary where as 51.4% generate the remaining 49.6% of mean income from self- employment. Alternatively, it means on average a household in rural Tigray has earned an income of 173.39 and 170.85 birr annually from wage and self- employment respectively.

Thus, from table 4.5, we can see that in terms of income contribution the two non- farm income sources have almost equal importance to households in rural tigray.

[10] Wage and salary includes bonus, allowance, over time payments.

Table 4.5

**Percent of Households and Mean Income Share by Non- farm Income Sources**

| Non- farm Income Sources | Percent of Non- farm Households * | Mean Annual Non- farm Income** in birr by Source | Percent of Non- farm Income by Source | Standard deviation |
|---|---|---|---|---|
| Wage and Salary | 67.9 | 173.39 | 50.37 | 453.69 |
| Self- Employment | 51.4 | 170.85 | 49.63 | 574.26 |
| Non- farm Income | | 344.24 | 100 | 734.40 |

Source: Author's computation from HICE 2000 data of CSA.

Note:-

n=564 and raised to total households in rural tigray i.e 643,840.
*Percent of households can't be summed up to give 100. A household is counted in more than one source as he gets income from different sources.
** To make comparison with other tables, households outside the non- farm are included with non- farm income zero.

Table 4.6 depicts sources of non- farm income ranked by income in quantile. As indicated in this table, wage employment has found relatively more important than self- employment to households of lowest and second quantiles while the reverse holds true to households in the third, fourth and highest quantiles. Numerically, this can be explained as households in lowest and second quantiles share the largest portion of mean non- farm income 60.9% & 62.4% respectively from wage and salary. Similarly, the remaining households of quantile three, four and highest have shared largest portion

56.1%, 58.5% and 53.9% respectively from self- employment. However, by simply comparing of the two quantiles (lowest and highest) based on non- farm income source share, households in lowest quantile have earned more income from wage and salary 60.9% of mean non- farm income as compared to income earned by highest quantile households- from wage and salary 46.1%. On the contrary, highest quantile households have earned the greatest share of non- farm income from self- employment 53.9% in comparison to income obtained from self- employment by lowest quantile households 39.1%.

To summarize the result in table 4.6, wage has been identified as a fundamental non-farm income source to rural poor and self- employment to rural rich households of tigray.

**Table 4.6**

**Sources of Non- farm Income Ranked by Total Income in Quantile**

| 564 Households Ranked by Total Income in Quantile | Mean Annual Non- farm Income in birr* | Percent of Wage &Salary | Percent of Self- Employment |
|---|---|---|---|
| Lowest quantile | 196.73 | 60.9 | 39.1 |
| Second quantile | 302.60 | 62.4 | 37.6 |
| Third quantile | 364.24 | 43.9 | 56.1 |
| Fourth quantile | 347.04 | 41.5 | 58.5 |
| Highest quantile | 505.47 | 46.1 | 53.9 |

Source: Author's computation from HICE 2000 data of CSA.

n=564 and raised to total households in rural tigray i.e 643,840.

* Mean income figures are raised to total households in rural tigray.

### 4.1.5 Contribution of Non- farm Income Sources to Inequality:

Non- farm income has been decomposed into sources wage and self- employment. In (table 4.3), it was found that non- farm income as inequality reducing income source. Each non- farm income sources are expected to have different contribution to inequality, but which non- farm source is inequality reducing and which is the larger contributor to inequality?

The analysis in table 4.7 answers the question. In the table, wage and salary identified as inequality reducing source ($g_k < 1$) while self- employment as inequality raising source ($g_k > 1$) implying, ceteris paribus additional increment of wage will reduce inequality because the majority of its share goes to rural poor households than rural rich and these in turn reduce income gap in the area. The converse holds true for self- employment.

Regarding in percent contribution to inequality, table 4.7 has also identified self-employment source as the larger contributor to inequality which is 62.8% against 37.2% of wage. The smaller contribution of wage to inequality came from lower source gini (relatively more evenly distributed source) and lower correlation coefficient- $G_{K} =$ 0.259 against 0.280 and $R_k = 0.123$ against 0.192 respectively.

Smaller contribution, and lower gini together with inequality reducing became indicators of wage source's paramount importance to rural poor households of tigray. This fact can further be verified by analyzing table 4.6. The result indicated the relative importance of wage to lowest quantile households (relatively poor)- 60.9 against 46.1% and conversely, the relative importance of self- employment to highest quantile households (relatively rich): 53.9% against 39.1% respectively.

In general, both tables (table 4.6 and 4.7) have confirmed the need for attention to wage employment source in which the majority of rural poor households of rural tigray are participating and generating their income, for it had greater contribution in minimizing income gap in rural tigray.

**Table 4.7**

**Non- farm Income Sources Contribution to Inequality by use of Gini**

| Non- farm Income Sources | Mean Income Share by Source ($S_k$) | Correlation Ratio ($R_{k*}$) | Source-Gini ($G_k$) | Absolute Contribution to Inequality (G) | Relative Contribution to Inequality (%) | Concentration coefficient ($g_k$) |
|---|---|---|---|---|---|---|
| Wage and Salary | 0.504 | 0.123 | 0.259 | 0.016 | 37.2 | 0.744 |
| Self-Employment | 0.496 | 0.192 | 0.280 | 0.027 | 62.8 | 1.250 |

Source: Author's computation from HICE 2000 data of CSA.

Note:
- Sum of $S_k$=1
- $R_k$ =[-1, 1]

* The values significant at 1%.

## 4.2 ECONOMETRIC RESULTS:

### 4.2.1 Multicollinearity and Heteroscedasticity Tests:

In this part probit regression analysis is made in order to know which variables determine participation of individuals in non- farm self employment. However, prior to interpreting results it is found worth to make tests like multicollinearity and heteroscedasticity to know whether they are problems of the model or not.

As defined by Gujarati (2004), Multicollinearity refers to correlation in between various explanatory variables. Multicollinearity could be a problem of the model if there is strong correlation ie $r>0.8$ among explanatory variables. Heteroscedasticity refers to the non-constant variance of the error term.

The tests result of the study indicated hetero as a problem of the model but not multicollinearity (Appendix I for hetero test and Appendix II for multicollinearity). The presence of hetero in the model implies the need for correction (Appendix IV and Appendix V, Appendix VI and Appendix VII for comparison of results with and with out heteroscedasticity).

Another calculation made in this paper was goodness of fit of the probit regression model to the data. It was made by computing log likelihood ratio index (LRI), like $R^2$ for OLS. The result provided LRI value equal to 0.33 ( Appendix III for details).

### 4.2.2 Estimates of Probit Model and Interpretation by use of Coefficients:

52% of households of rural Tigray have found earning their income from non- farm income NFI (table 4.1). But what determines members of these households to participate in NFI sources such as Wage employment or Self employment? The following section will answer it by looking at some variables.

For this purpose probit model is used. Probit explained the functional relation explanatory variables has with probability of dichotomous explained variable. The explained variable takes a value 0 or 1 if an individual participates in non- farm wage or self employment respectively. The explanatory variables used in the model are Gender (GDR), Age (AG), Marrital status (MRT), Illiteracy (ILLT), Primary complete (PM), Secondary complete (SECD) and Distance to Transport facility (DSTF).

As shown in table 4.8, the sign of coefficients indicated the relation between probability of an individual to be non- farm self employed (dependent=1) and the different explanatory variables. The extent to which the explanatory variables relate to the dependent is given as follows.

Gender is found negatively related to the probability of being non- farm self employed. The sign is opposite to expected. This implies in the study area the probability to be self employed was less to female than male.

Age found positively related and has an expected sign. The relation implies as an individual's age increases his probability to be self- employed will increase. The reverse also holds true.

**Table 4.8**

**Estimates of Probit Model (Hetero Corrected Estimates) for Non- farm Individuals**

| Variables | Coefficient | Robust standard error of Regression | Marginal effect (dy/dx) | Z | P>\|Z\| |
|---|---|---|---|---|---|
| Constant | -8.266615 | 0.6967687 | - | - | - |
| GDR* | -0.8415622 | 0.3048324 | -0.0458495 | -2.76 | 0.006[a] |
| AG | 0.046474 | 0.0123022 | 0.0020165 | 3.78 | 0.001[a] |
| MRT* | -0.1356081 | 0.2868439 | -0.0056724 | -0.47 | 0.636[c] |
| ILLT* | 8.421419 | 0.6815065 | 0.9997536 | 12.36 | 0.001[a] |
| PRM* | 8.591894 | 0.8328634 | 0.2054621 | 10.32 | 0.001[a] |
| SECD* | 5.810569 | . | 0.0204555 | . | . |
| DSTF | 0.0128327 | 0.0074152 | 0.000991 | 2.45 | 0.014[b] |

Source: Author's computation from HICE (2000) &WMS (2000) data of CSA.

* Variable is dummy
a Coefficients are statistically significant at 1% level
b Coefficients are statistically significant at 5% level
c Coefficient is statistically insignificant

When comes to education: illiteracy, primary and secondary complete had found positively related and sign as expected except for secondary. The relation implies illiterates in comparison to literates had more chance to be self employed than wage employed. Similarly, individuals who completed primary and secondary education had also more chance to be self employed. Alternatively, it means both illiterates and literates participated in self employment activities. This result agreed with result obtained by P. Lanjouw (1999) on his study in rural Ecuador. He indicated that education as important for self employment as well as wage employment activities though the level differs for the two, ie lower level is only required for self while higher level is for wage.

Distance to transport facility had positive relation and sign opposite to expected. It means as the transport facility is available in shorter distance (near by) the probability of an individual to become self employed will decrease.

### 4.2.3 Interpretation of Functional Relation ships in the Model by use of Marginal effect:

In the above section 4.2.2 results are explained based on the sign of coefficients. Coefficients didn't tell by how much percent the probability of non- farm self employment would change for a unit change in given dummy or other explanatory variables. For such explanation the use of marginal effect is appropriate. According to Madala (1997), the concept of marginal effect usually important in probit model. Marginal effect (DF/DX) explains in percentage terms the effect of a unit change in explanatory variables on the probability of dichotomous explained variable. However, the interpretation is quite different for dummy and numerically measured explanatory variables. For dummy, marginal effect tell us the effect of change in dummy independent variable from 0 to1 on probability of dichotomous dependent variable. But for numerically measured, it tells the effect of a unit change in independent variables on dichotomous dependent variable. For the study, Gender, Marrital status, Educational levels (Illiteracy, Primary and Secondary complete) are the dummy variables. The other variables are numerically measured ie Age in years, and Distance to transport facility in kilometer (table 4.8). Marginal values are also given in table 4.8, and their interpretation is as follows.

For Gender, marginal effect approximately equals -0.046 implying as gender change from male (having 0 value) to female (having 1 value) the probability of being self employed would decrease by 4.6%. Conversely, the probability of wage employment increases by 6.4% (Appendix VIII). In other words it means female has less chance to be self employed than male counterparts. Thus, one can conclude from the result that in the study area (rural tigray) non- farm self employment in comparison to wage employment activities provided less chance to female than male.

For Age, marginal effect approximately equals 0.0020. It implies as the age of an individual increases by a year the probability of being self employed will increase by 0.20%. Conversely, the probability of wage employment decreases by the same percent. Alternatively it means, aged individuals had a higher probability to be self employed than youngsters. Thus, from this result it would be possible to say that in rural tigray elders as compared to youngsters had got a better chance to participate in non- farm self employment activities.

With regard to education: for illiterates marginal effect approximately equals 0.999. Meaning as an individual becomes illiterate the probability of being self employed will increase by 99.9%. For those who are primary complete, the marginal effect approximately equals 0.205. Implying, for individuals who completed primary education the probability of being self employed will increase by 20.5%. Similarly, the marginal effect for secondary complete approximately equals 0.020. This indicate as an individual is completing secondary education the probability of being self employed will increase by 2%. Generally, one can say individuals at the highest educational level (for the study secondary) had less probability of being self employed as compared to individuals at primary and even illiterate in the study area. Higher level (secondary) found most important for wage employment though it is negatively related (Appendix VIII). The result is true because in the study area the majority of non- farm self employment activities were marginalized which generate lower income and didn't attract educated to engage in them.

For Distance to transport facility, it has a marginal effect value approximately equals 0.00099. The value implies as the distance increases by a kilometer the probability of being self employed will increase by 0.09%. This indicated the fact that, in the study area, self employment activities were chosen more by individuals having less proximity to transport facility than those having higher proximity.

# CHAPTER 5

# CONCLUSION AND RECOMMENDATION

## 5.1 Conclusion:

The paper has attempted to decompose the total income of 564 sampled households of rural Tigray into: farm income, non- farm income, remittance, rental income and other income sources. According to the study result, rural households of Tigray have got the largest share of income from Farm (82%) followed by Non- farm income (8.2%). Remittance, Rental income and other incomes shared the remaining 9.8%.

When households are ranked by quantile, the result indicated the relative importance of farm income to rural rich (highest quantile households) than rural poor (lowest quantile households) i.e 87.1% against 64.1%. On the contrary, the relative importance of non-farm income and remittance goes to rural poor ie 12.6% against 6.4% and 9.3% against 1.5% respectively. Rental income contributed the largest to households of second quantile. These result verified when the contribution of income sources to inequality is determined. The result has also explained, non- farm income, remittance and rental incomes identified as inequality reducing income sources while farm income inequality increasing income source.

As the intention of the paper was to examine non- farm income and inequality, it has been identified that non- farm income, having the second largest income share (8.2%) with a higher source gini (0.824), was the largest contributor to rural income inequality 4.1% as compared to inequality reducing income sources such as remittance and rental incomes whose contribution was 0.06 and 0.03% respectively. On the other hand, farm income, the largest contributor to total households income & the most evenly distributed (0.378) income source was also found as the largest rural income inequality increasing income source with contribution of 93.8%. From this, it is possible to conclude by saying, in rural tigray poor households in comparison to rich households were highly benefited from non- farm income, remittance and rental incomes while rich households highly benefited from farm income. Thus, if it is intended to reduce rural income inequality and there by minimize income gap that existed between rural poor and rural rich households, more work has to be done on income sources where poor households are relatively benefited.

The study has also indicated out of the non- farm income sources (wage employment and self employment), wage employment identified as inequality reducing income source. Meaning rural poor were benefited more from wage than rural rich benefited from it. Thus, to minimize the income gap in the study area due attention has to be given to wage employment activities (community works and casual agricultural labor) where rural poor households are going to be employed.

In an attempt to identify the determinants of non- farm employment, Probit regression has provided Gender, Age, Education: Illiteracy, Primary and Secondary completed and Distance to transport facility as significant determinants. However, Marital status found insignificant. The result also identified Gender and Marital status negatively related to the probability of being self employed where as Age, Illiteracy, Primary and Secondary completed and Distance to transport facility positively related. Thus, we can say in the study area, mostly male and elders were found highly involved in self employment activities. Besides, though educated also involved in in self employment activities, illiterates have a higher participation rate. The reason is most of the non- farm self employment activities in the area were marginalized, never attract educated, and provide less income. On the other hand, we can also infer from the regression result that rural households prefer to be self employed when transport facility was unavailable at near by distance; otherwise they use of the transport facility to be wage employed in other locality or towns.

Generally, we can conclude that in rural tigray non- farm self employment activities should be technologically supported and the transport facility should be improved for inaccessible areas for wage employment.

## 5.2 Recommendation:

The result obtained from HICE 2000 data have identified non- farm income, remittance and rental incomes as inequality decreasing sources while farm income as inequality increasing source. Of the non- farm income sources, wage employment also identified as inequality reducing.

Thus, based on the study outcomes, the following recommendations are made:

1. **Wage employment**:

   Out of non- farm income sources, wage employment is found as inequality reducing source. Implying, it benefited greatly of rural poor households of the area.

Therefore:

-Government should promote productive safety net programs in the area so that poor households could generate additional income from employment.

-Government should work to improve the transport facility in areas where transport is inaccessible so as to increase income from agricultural wage employment in other areas.

- Government should work more on education to increase literacy rate in the rural area and this in turn provide additional income to poor from wage employment as a result of being employed in government or non- government organizations.

**2. Self employment**:

It is revealed from the study that the majority of non- farm self employment activities in the area in which rural poor mainly engaged were inferior/ marginalized, generating lower income. Thus, in order to improve income generated from them and benefit the poor, government should work on **modernizing** them.

**3. Remittance & Rental income**:

Both have been identified as inequality reducing income sources largely benefiting poor households of the area. Therefore,

- Government should create better transformation mechanism which facilitate the transfer of remit and moreover promote migration

- Government should help poor households to acquire asset such as livestock and houses by facilitating credit scheme. Besides, government should provide the right to rent of land so that poor households can rent and get income whenever required.

**4**. Finally, Government should give more emphasis to the development of the non-farm sector in the area which is infant, for it acts as a route out of poverty in the long run and protect ecological deterioration in a case where land is scarce, livestock development is poor, resource depleted due to extensive cultivation and as a result out put from agriculture is very minimal. Moreover, in line with the above mentioned, attention should be given to improve the agricultural sector which provided the largest share of income to rural households of Tigray.

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## APPENDIX I

### Test of Heteroscedasticity

According to Green (1997), one of the important methods used to test the existence of heteroscedasticity in Tobit and Probit models is the log likelihood ratio test (LR). The LR statistic of testing the null hypothesis of homoscedasticity assumption is obtained by :

$\lambda_{LR} = 2\,[\text{Log } L_U^{*} - \text{Log } L_r^{**}]$ , where

Log $L_u$ = the value of un restricted log likely hood function

Log $L_r$ = the value of restricted log likely hood function

$\lambda_{LR}$ has a $X^2$ (n) distribution with 'n' degrees of freedom where 'n' is the number of independent variables. If the data donot support the null hypothesis ( homoscedastic assumption), then the value of the test statistic ($\lambda_{LR}$ ) becomes large and null hypothesis is rejected ;

Ie if $\lambda_{LR} >= X^2$ (n)

In the study Probit model is used and the result of the test is given as follows:

$\lambda_{LR} = 2\,[-47.806525-(-71.2653)]$

$= 23.458775 > X^2$ (7) at 95% level

The test statistics exceeds the tabulated value, implying hetero as a problem of the model. The problem needs to be corrected.

* Unrestricted likelihood obtained by regressing the dichotomous dependent on independent

** Restricted likelihood obtained by regressing the dichotomous dependent

## APPENDIX II

### Test of Multicollinearity

Multicollinearity, as defined by Gujarati (2004), implys correlation among the different explanatory variables used. Multicollinearity is considered as a problem of the model if there is a strong correlation ( r>0.8) among these variables. The test result of the model is given as follows:

Correlate GDR AG MRT ILLT PRM SECD EDCN DSTF

| | GDR | AG | MRT | ILLT | PRM | SECD | DSTF |
|---|---|---|---|---|---|---|---|
| GDR | 1.0000 | | | | | | |
| AG | -0.1629 | 1.0000 | | | | | |
| MRT | -0.5068 | 0.1442 | 1.0000 | | | | |
| ILLT | 0.2543 | 0.2004 | -0.0983 | 1.0000 | | | |
| PRM | -0.1247 | -0.2317 | 0.0525 | -0.7192 | 1.0000 | | |
| SECD | -0.0796 | -0.0927 | -0.0663 | -0.1795 | -0.0395 | 1.0000 | |
| DSTF | -0.0790 | 0.0033 | 0.0753 | -0.0216 | 0.0614 | 0.0552 | 1.0000 |

As shown in the above result, Multicollinearity is not the problem of the model.

## APPENDIX III

### Computation of Goodness of fit

The likelihood ratio index (LRI), equivalent to $R^2$ in a conventional OLS regression model, is used to measure the goodness of fit of the probit model. It is computed using:

$LRI = 1 - [\ln L_u \mid \ln L_r]$, where

$\ln L_u$ = the value of un restricted log likelihood

$\ln L_r$ = the value of restricted log likelihood

LRI value lies in between 0 and 1. If it is one it implies 'perfect fit'. As to Green (1997), values between 0 and 1 have no interpretation but as LRI approaches one it shows improvement in goodness of fit.

The value of LRI for the model is shown below:

$LRI = 1 - [-47.806525/-71.2653]$

$= 0.331$

## APPENDIX IV

### Probit Regression for Non- farm Self Employment

Number of observation =281

Max. Lh = -47.806525

Pseudo $R^2$ = 0.3124

| Variable | Coefficient | Standard error | Z | P>\|Z\| |
|---|---|---|---|---|
| GDR | -0.8415622 | 0.3422756 | -2.46 | 0.014 |
| AG | 0.046474 | 0.0135537 | 3.43 | 0.001 |
| MRT | -0.1356081 | 0.2973946 | -0.46 | 0.648 |
| ILLT | 8.421419 | 0.9438101 | 8.92 | 0.001 |
| PRM | 8.591894 | 0.9735221 | 8.83 | 0.001 |
| SECD | 5.810569 | . | . | . |
| DSTF | 0.0228404 | 0.013421 | 1.70 | 0.089 |
| Constant | -8.266615 | 1.046924 | -7.90 | 0.001 |

## APPENDIX V

### Probit Regression for Non- farm Self Employment with Robust

Number of observation =281

Max. Lh = -47.806525

Pseudo $R^2$ = 0.3124

| Variable | Coefficient | Robust Standard error | Z | P>\|Z\| |
|---|---|---|---|---|
| GDR | -0.8415622 | 0.3048324 | -2.76 | 0.006 |
| AG | 0.046474 | 0.0123022 | 3.78 | 0.001 |
| MRT | -0.1356081 | 0.2868439 | -0.47 | 0.636 |
| ILLT | 8.421419 | 0.6815065 | 12.36 | 0.001 |
| PRM | 8.591894 | 0.8328634 | 10.32 | 0.001 |
| SECD | 5.810569 | . | . | . |
| DSTF | 0.0228404 | 0.0093242 | 2.45 | 0.014 |
| Constant | -8.266615 | 0.6967687 | -11.86 | 0.001 |

## APPENDIX VI

**Probit Regression for Marginal Effects of Non- farm Self Employment**

Number of observation =281

Log likely hood= -47.806525

Pseudo $R^2$ = 0.3124

| Variable | Marginal effect (Df/Dx) | Standard error | Z | P>\|Z\| |
|---|---|---|---|---|
| GDR | -0.0458495 | 0.0250335 | -2.46 | 0.014 |
| AG | 0.0020165 | 0.0008317 | 3.43 | 0.001 |
| MRT | -0.0056724 | 0.0121604 | -0.46 | 0.648 |
| ILLT | 0.9997536 | 0.0003053 | 8.92 | 0.001 |
| PRM | 0.2054621 | 0.0741135 | 8.83 | 0.001 |
| SECD | 0.0204555 | 0.0126103 | . | . |
| DSTF | 0.000991 | 0.0005884 | 1.70 | 0.089 |

## APPENDIX VII

**Probit Regression for Marginal Effects of Non- farm Self Employment**

**With Robust**

Number of observation =281

Log likely hood= -47.806525

Pseudo $R^2$ = 0.3124

| Variable | Marginal effect (Df/Dx) | Robust Standard error | Z | P>\|Z\| |
|---|---|---|---|---|
| GDR | -0.0458495 | 0.0213531 | -2.76 | 0.006 |
| AG | 0.0020165 | 0.0007443 | 3.78 | 0.001 |
| MRT | -0.0056724 | 0.0119994 | -0.47 | 0.636 |
| ILLT | 0.9997536 | 0.0002361 | 12.36 | 0.001 |
| PRM | 0.2054621 | 0.0551863 | 10.32 | 0.001 |
| SECD | 0.0204555 | 0.0106181 | . | . |
| DSTF | 0.000991 | 0.000535 | 2.45 | 0.014 |

## APPENDIX VIII

**Probit Regression for Marginal Effects of Wage employment**

**With Robust**

Number of observation =307

Log likely hood= -56.834124

Pseudo $R^2$ = 0.2580

| Variable | Marginal effect (Df/Dx) | Robust Standard error | Z | P>\|Z\| |
|---|---|---|---|---|
| GDR | -0.0638107 | 0.0264343 | 3.01 | 0.003 |
| AG | -0.0021421 | 0.0006956 | -3.23 | 0.001 |
| MRT | 0.0036588 | 0.016031 | 0.23 | 0.821 |
| ILLT | -0.9999414 | 0.0000615 | -12.27 | 0.001 |
| PRE | -0.1088382 | 0.0328288 | -9.83 | 0.001 |
| PRM | -0.2242041 | 0.0518152 | -10.54 | 0.001 |
| SECD | -0.0313747 | 0.0126927 | . | . |
| DSTF | -0.001332 | 0.0005784 | -2.67 | 0.008 |

## Declaration

I, the undersigned, declare that this thesis is my original work and that all sources of materials used for the thesis have been dully acknowledged.

| | |
|---|---|
| Declared by: | Confirmed by: |
| Tesfaye Gezahagne | Dr. Ch. Paramaiah |
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Department of Economics, February 2007