Analyzing the determinants and the effects of income diversification in rural Ethiopia.

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List of Acronyms

AAU	Addis Ababa University
ERHS	Ethiopian Rural Household Survey
ESRC	Economic and Social Research Council
ETB	Ethiopian Birr.
FAO	Food and Agriculture Organization
FD	First difference
FE	Fixed effect
GDP	Gross Domestic Product
GLS	Generalized least squares
HDI	Herfindahl index
HH	Household
IFPRI	International Food Policy Research Institute
IGAs	Income generating Activities
NGOs	Non-Governmental Organizations
OLS	Ordinary Least Square
PA	Peasant Association
PSNP	Productive Safety Net Programme
SIDA	Swedish International Development Agency
SNNPRG	Southern Nations and Nationalities peoples Regional Government
UK	United Kingdom
USAID	United States Agency for International Development

Abstract

This study analyses the determinants and effects of income diversification in rural Ethiopia using data from various rounds of the Ethiopian Rural Household Survey. The survey incorporated four big regions of the country which represent the majority of the country's population. A double censored Tobit model is applied to analyze the initial determinants of income diversification in rural areas. To examine changes over time a fixed effect model is applied. Finally, an indirect approach was used to explore the effect of income diversification on total income of the household. Based on the results of the analysis human capital, education, access to credit and other private assets helped increase the engagement of the household in income diversifying activities. The existence of access to credit and savings are the other variables that have an impact on household's ability to diversify income. The impacts of household characteristics and farm size are also analyzed. In a nutshell, polices that aim to enhance income diversification need to consider these different factors that affect the lives of rural household by affecting their income diversification strategy.

Relevance to Development Studies.

Rural households in Ethiopian rely on rain fed agriculture as a principal source of their income. This often leads to income insecurity. The scope to increase real incomes of the rural household and bring sustained improvement in their wellbeing, solely through farming operations is seriously constrained. Therefore, income diversification is necessary. An analysis of the determinants and effects of income diversification is needed as it is a way of smoothing income and reducing consumption variability.

Keywords

Farm household, income diversification, non-farm activities and income, IGAs, Tobit, fixed and random effects, rural Ethiopia

Chapter 1: Introduction

1.1 Background

In developing countries the issue of income diversification among rural households is getting more attention particularly in the development economics literature (Ellis 1998). Several studies suggest that income diversification is a way of dealing with both an ex ante risk and ex post coping when shocks occur. (For instance Reardon et al. 1992, Barrett et al. 2001).

Similarly other studies on the importance of income diversification justify that it has positive link with accumulation of household assets and in the time of exogenous shocks such as droughts and floods income diversification gives the household the capability of withstanding these exogenous shocks (De Janvry et al. 1991). That means income diversification is one of the path ways to smooth both idiosyncratic and covariate shocks. Besides contributing to the total family income of the rural household, in the long run income diversification leads to structural shift in rural employment away from agricultural sector to the industrial sector (Beyene 2008). According to Alasia et al. (2009) income diversification can arise from different motivations. First, income diversification may be considered as a self-insurance mechanism particularly for households that have small farm land and large family size in order to stabilize net farm part production. Second, when the household farm income does not cover all the family expenses, income from other source is the pathway to deal with such a constraint.

There are two major levels of diversification in rural areas: macro and micro or farm level diversification. At the macro level the notion of diversification implies a shift from the agricultural sector to the industrial sector and the service sector as a source of employment and income. At the micro level or the farm level particularly in the subsistence farming of most developing countries, diversification is a coping strategy for risk reduction. However in commercialized agriculture income diversification is a tool for household asset accumulation (Pingali and Rosegrant 1995). Even though there are macro and micro level, the focus of this paper is on the micro or farm level income diversification.

Among others things one benefit of income diversification is reducing household income insecurity and food insecurity. Food security is the main public policy difficulties in the developing countries. Based on the world wide data, around one billion people are malnourished; many more suffer from micronutrient deficiencies and the problem is more in Sub-Saharan Africa where there is high population growth and less growth of GDP (Godfray et al. 2010). While it is agreed that the development of agriculture is very important in the process of poverty alleviation in rural areas, the growth of income diversification is important as well (Diao et al. 2007). Particularly for African

countries with strong population growth and increasingly scarce agricultural resources, the importance of income diversification to reduce household income insecurity and support their livelihood deserve particular consideration (Barrett et al. 2001).

Similarly in Ethiopia about 80 to 85 percent of the population is rural and agrarian and depends directly on agriculture and livestock for sustaining their livelihood. Accordingly agriculture is the foundation of the economy as a whole. Agriculture accounts for 45 percent of the country's GDP[1]. These farming activities include crop production, livestock raising and mixed farming. Amongst these activities mixed farming which includes both cultivation of crops and livestock raising dominates. The principal type of farm input is labor and in almost all rural areas of the country the source of labor is family members. Even though there are various measures taken by the government to lead the economy to industrialization, the country's economy still relies mainly the on agriculture sector which has a lot of limitations such as a decreasing farm size (an average of one hectare per household), low productivity of labor , high soil degradation, farming for survival (subsistence farming),imperfect agricultural markets and poor infrastructure, seasonal and inadequate rainfall and tenure insecurity are some of them (Ethiopian Economic Association 2000).These are some reasons why income diversification is important in rural Ethiopia as a means of tackling some of these problems.

Also because of the aforementioned problems in some rural area poverty is high. As a result households living in rural Ethiopia often face under nutrition and health problem, have little or no literacy and live in environmentally degraded areas. This is the main focus of the government, donor agencies, NGOs and other actors. Specially the government has been formulating and implementing various policy interventions and programs that are in one way or another related to the reduction of rural household income insecurity.

Even though there is an increase in non-farm income share since the last two decades, income insecurity is common in rural areas[2]. To combat this problem government is implementing poverty alleviation programs such as the Productive Safety Net Programme (PSNP) in which there is provision of social safety nets and public works.[3] The emphasis given to income diversification

[1] http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/0,,contentMDK:21072837~menuPK:1804110~pagePK:146736~piPK:146830~theSitePK:258644,00.html accessed on 22/05/2014

[2] See Fig 3 to confirm the improvement of non-farm income share

[3] Slater, R., S. Ashley, M. Tefera, M. Buta and D. Esubalew (2006) 'PSNP Policy, Programme and Institutional Linkages', *ODI/IDL Group/Indak* . can give more clarification on PSNP

is still less even though it is important for enhancing rural household employment and an important device for consumption smoothing and risk management. More attention is usually focused on agricultural production and its income and rural households tend to concentrate on on-farm activities. This is the key issues that this paper deals: - what are factors that influence the engagement of rural households in to diversified income sources?

According to portfolio theory, households may be expected to diversify their income because of two reasons: when they face returns from different income generating activities gave them opportunity for asset accumulation that is premeditated diversification and when they face risks such as idiosyncratic shocks. And in turn this diversification in the rural areas is hindered by different factors. For instance some factors that hinder income diversification of a given household in the rural Ethiopia comprises: household characteristics such as labor force, education, access to credit, low rainfall, farm size, house hold size, and low crop productivity. Besides desire and capacity to diversify are derived by various factors specific to the household himself and the agro ecology. Therefore in rural Ethiopia due to differences in availability of various incentives such as location and access to different infrastructure, the households have dissimilar opportunities from one region to the other (Hazell 1983).

As already mentioned about 80% of the total population in Ethiopia lives in rural areas and almost all these rural households rely on rain fed agriculture as a principal source of their income and as a foundation for their livelihoods. Food insecurity occurs in some areas occasionally and high occurrences of pests as well as animal and human disease affect their livelihood as well (Dercon 2004). As a result engaging in income diversification is important in order to cope these agriculture related shocks. Therefore, understanding factors affecting income diversification has significant implication for the socio-economic improvement of the rural household and the policy that supports this goal (Beyene 2008). In light of this background this paper focuses on analyzing the determinants and effects of income diversification in rural Ethiopia.

1.2 Problem Statement and Objectives

The traditional view of considering rural areas as a solely agricultural arena is outdated. Farmers in developing countries are obtaining an increasing share of their income through non-farm sources. This is shown in a case study which comprises some African counties[4]. Therefore in developing countries, particularly in the rural areas, income diversification is getting more consideration in the development economics research than ever before. The share of non –farm income is increasing in most developing countries as a

[4] See Table 10 in the Appendix for more detailed information about the case study.

result of push and pulls factors (Ellis 2000). There are multifaceted reasons for increasing attention. First, governments, donor agencies and policy makers all need to increase the real income of the rural household. Second, due to population growth and idiosyncratic and covariate shocks, income constraints and poverty are common in most developing countries. These are some problems that force scholars to investigate income diversification as pathway to move out of these constraints across regions and countries.

Similarly in Ethiopia increasing income of the rural household receives the attention of the government and policy makers in particular through agricultural productivity. However the determinants and effects of income diversification which is one way of smoothing income and consumption are not given much attention. Besides the range of increasing real income of the rural household and bringing continued improvement in their standard of living, only through farming is extremely constrained.

Accordingly, this study has two objectives. First, what are the driving forces of spatial and temporal income diversification in rural Ethiopia? And second, how does income diversification affect the total income of rural households?

Finally this paper is organized as follows. The next chapter deals with literature review. Chapter three provides review of income diversification in rural Ethiopia. Chapter four presents methodology which comprises data and descriptive statistics, modeling and estimation strategy respectively. And chapter five is devoted to a discussion of empirical results. Finally chapters six concludes and present policy implications.

Chapter 2. Literature Review

2.1 Theoretical and Empirical framework

2.1.1 Measurement issues and Concepts.

Several studies on rural income diversificaion are overwhelmed by vague definitions. Therefore in this sub-section we will deal with some conceputal issues to develop a common view. Even though the purpose of this research paper is not to harmonize these ideas, it is better to clarify concepts related to rural household income diversification.

To begin with measurement issues of income diversification, different literatures recommend different methods of measuring income diversification. According to Barrett et al. (2001) income based mechanism is used as measure of income diversification. The assumption of this mechanism is that the higher the share of non-farm income the higher income diversification of the household and the less exposure of the household to various idiosyncratic and covariate shocks. Therefore share of non-farm income is used as a measure of income diversification. The second approach is a time based approach. The share of time spent on different activities such as time spent on farm or non-farm are used as the measure. In this way the assumption is that if the rural household spends more of its time on non-farm income generating activities, then there is more income diversification (Nghiem 2010). Besides others scholars use Herfindahl index (HDI) measurement approach. The higher the HDI, the higher the income diversification of the household (Barrett et al. 2005). This paper focuses on the first two approaches as the Herfindahl index is mostly appropriate for measuring industrial concentration (Ersado 2006).

Turning to the concepts (Nakajima 1986) defines *rural household* as a rural firm that engages in the production of agricultural outputs by using its own household labor force and sometimes by hiring laborers. These households get its income either in cash or often in kind.

With respect to rural diversification two words seem to be synonymous though they are different. These are income diversification and livelihood diversification. *Income diversification* is not the same as *livelihood* diversification[5]. Livelihood diversification is the process by which rural household build a diverse portfolio of activities and social support capabilities in their struggle for survival and in order to better their living standards. So *Livelihood* is more than income. *Income* refers to the cash earnings of the rural household and payments in kind that can be decided at market prices. In rural area the cash part of income comprises livestock sales, wages, rents and remittances. On the other hand the in-kind part of income implies the farm produce which is consumed

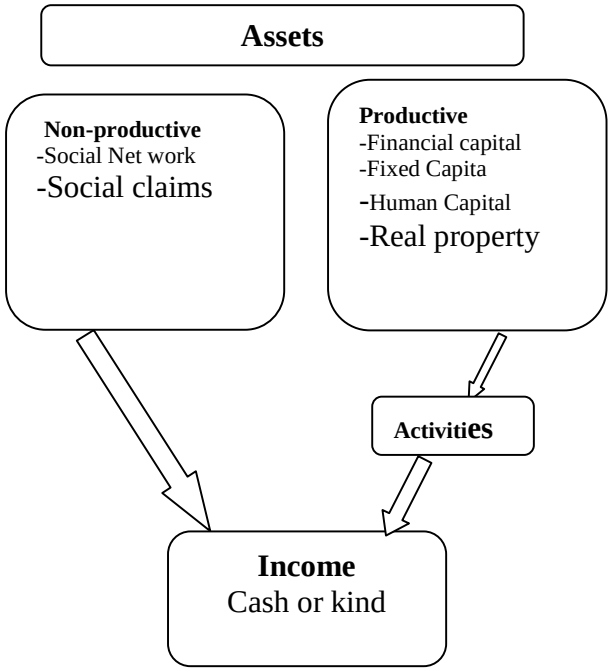
[5] (*Sadangi and Singh, 1993*) used ' occupational diversification' to imply income diversification

by the house hold, payment in kind such as food, and transfers of exchange of consumption items which is done between the rural households (Ellis 1998). Also according to Bryceson (1996) *livelihood* comprises both parts of income; cash and in kind, social institutions such as family, kin, village and so on, and property rights that are required to facilitate the standard of living in the rural area. These networks; social and kinship networks are important for smoothing the process of diverse income portfolios.

Livelihood strategies is also another concept related with livelihood that comprise agricultural intensification (such as farming, livestock rearing etc.) and livelihood diversification to other dimensions out of agriculture which includes income diversification itself (Scoones 1998).

Similarly diversity is different from diversification. Income *diversity* refers to income composition of the rural household at a given time and *diversification* implies an active social process in which the rural household is observed to participate in portfolios of activities over time (Reardon 1997). Ellis (2000) articulate *income diversification* as increasing the range of income generating activities outside farm operations by allocating existing household resource to such activities. The rural households expand its income generating activities in order to increase farm income or cope fluctuating income and consumption of the household. These concepts are framed in fig. 1 which shows the bases of income.

Figure 1 Present the link between income diversifying activities, asset, and incomes earned from different sources.



Source: From Barrett and Reardon (2000)

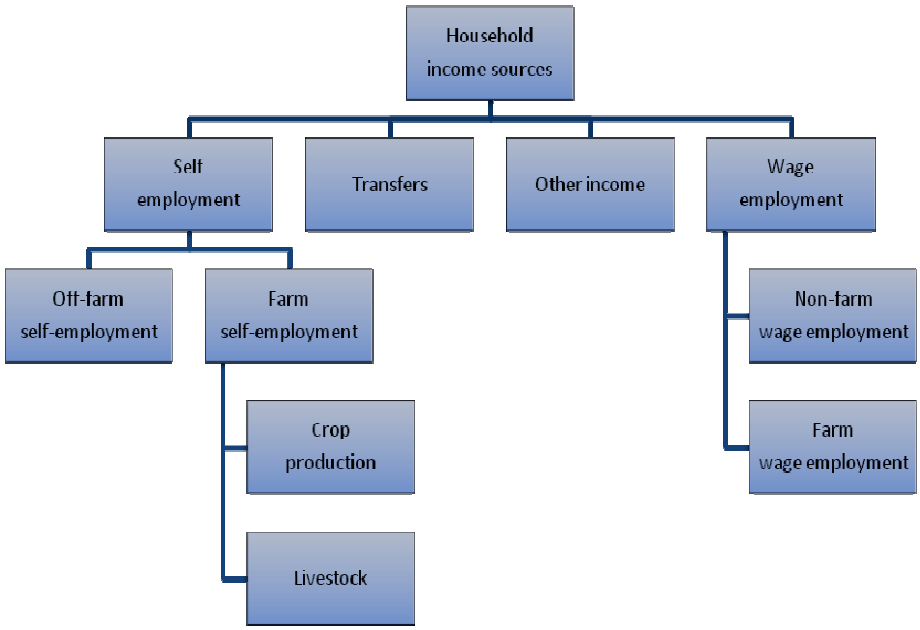
As indicated in the figure *asset and activities* are foundations of household income which the household obtain in the form of cash or kind.

Barrett and Reardon (2000) define asset as: "*Assets are stock of directly or indirectly productive factors that produce a stream of cash or in-kind returns (or what economic theorists typically call "endowments"). Common examples include bank deposits, human capital land, livestock, machinery, stores, transport equipment, etc..."* According to these authors individual assets are categorized in to productive or non-productive assets. Productive assets are those utilized during production process such as financial capital, fixed capital, human capital and non-productive ones include those that generate income through remittance or transfers such as social net work and social claims. On the other hand when productive assets are put to some use we call them *activities* and these activities are suitable intermediary measures which connect both income and productive assets.

The other side of income diversification is it sources. Studies identify different categories of income source in rural areas when referring to diverse income sources. The variation in income source is because of differences in household characteristics, location, market features, education, asset holdings and others. That means various income source exist as different households are likely to have various potential access and access to different opportunity (Reardon 1997). Also a study by Deininger and Olinto (2001) indicate that in rural household level diversification, income sources includes engaging in different income generating activities such as production of crops, livestock rearing, and other non-farm income generating activities. From these activities a set of revenues are generated with diverse level of risk and anticipated profits. Most of the time the process of generating income from these activities comprises the allocation of household assets with in various activities.

Barrett et al. (2001) categorized these income sources of rural household in to three major divisions. Their classification was by sector, function and distance. Sectoral base classification categorizes rural income in to farm and non-farm income. The functional base classifies rural income as self-employment or wage employment. The third classification by distance includes remittances and transfers. Also Nghiem (2010) identifies different income sources through which households earn revenue. According to him the household obtains income from *two* types of employment, that is, self-employment and wage employment and through transfers and other income.

Figure 2. Classification of household income sources



Source: From Nghiem (2010) page no 28

Based on this sketch the rural household has two employment opportunities: wage employment and self-employment. In turn these two types of employment are further divided. The households are self-employed in off-farm self-employment or farm self-employment. Besides farm self-employment is sub divided in to crop production and livestock. Similarly wage employment is sub-dived into non-farm wage employment and farm wage employment. The definition by Nghiem (2010) is that farm self-employment is an income generating activity done by the household in its own personal farm which is related to the production of crop and livestock rearing. Contrary to this off-farm self-employment is an income generating activity (IGA) carried out by the household out of its own personal farm such as producing any kind of good for sale. On the other hand non-farm-wage employment includes the employment of the household in small enterprises and farm wage employment is when household carries income generating activities on farm other than his own personal farm.

2.1.2 Why income diversification?

Income diversification is common in rural areas as very few rural households obtain their income from only one source, or carry out only one activity. Basically there are two reasons that encourage or force rural households into income diversification. First, income diversification is carried out for household asset accumulation which is driven by pull factors. This type of diversification is mostly carried out by wealthier households as they have more access to capital recourses. Second, diversification is risk management or coping idiosyncratic or covariate shock. This diversification is done by poor households and driven by push factor[6]. Accordingly the outcomes of these two types of diversification are different. While accumulation of household asset is related with income diversification driven by pull factors, bringing poor households from poverty is related with income diversification driven by push factors (Reardon et al. 2007).

Some time income diversification is considered as a kind of self-insurance through which households cope diminished income by choosing a portfolio of income generating activities which have low or negative correlation of earnings. Here the idea of self-insurance is related with an *ex ante* risk minimization strategy. If the households are exposed to risk one way is income diversification that they can mitigate the risk. So pursing both farm and non-farm income generating activities can reduce the income insecurity of rural household (Alderman and Paxson 1992). This implies the poor households become more sensitive than the rich if the risk aversion minimizes income insecurity. This led the poor to show the need for diversification in order to mitigate *ex ante* risk. *Ex ante* risk management is using mitigation measures by portfolio selection where as ex *post* is managing risk by adapting to shocks as coping strategy. Even though there is specialization as a result of comparative advantage, in the area where profits of productive assets such as land and livestock vary over time or between individuals in the household or with in household in the area they live income diversification is the key. On the other hand the function of income diversification is to cope *ex post* when income of the household is shocked. For instance when crop loose occurred, livestock die. As the result the household must move the labor to another activity (Barrett 1997).

Also income diversification may be the result of anxiety or of successful opportunity. Associated with the first one worrying about risk plays a key role but it is not compulsory circumstance for the rural household to prefer to diversify. Diversification may often be associated with declining returns to household labor or fixed assets such as land. Beside some diversification is related with credit market failure (Stark 199 and Davies 1996). On the other hand diversification may be carried out as a premeditated strategy of a rural

[6] More detailed discussions on pull and push factors are given in the subsequent section.

household or it may be an unintentional response to the declining economy as it can serve as a means of security for the poor households and as a way of wealth accumulation for the rich households (Zoomers and Kleinpenning 1996 and Hart 1994).

Likewise based on portfolio theory, particular rural households with small land size and non-land assets such as food stocks, livestock and savings would be more risk averse than the wealthier. Therefore households with small land size and non-land assets are more sensitive to diversify and lower the instability of returns than rich. As a result the reduction of absolute risk aversion requires the poorer households to diversify their income source than the wealthier household. Compared to their wealthier counter parts the poorer rural households face various risks with very small insurance mechanism to rely on. Besides the poor households devote much of their resource to food self – sufficiency while the wealthier households are more likely to focus on cash crop production (Fafchamps 1992). One vital way to secure the livelihood sustainability involves the prevention of long term dependence on only one income source. As a result income diversification is one of the path ways through which rural household diversity their income. This diversification of income has been revealed to be positively correlated not only with the wealth accumulation (Bryceson 1999), but also increasing the capacity of the household to resist exogenous shocks, it helps in smoothing consumption at least to some extent (DeJanvry et al., 1991).

Particularly in the remote areas wheres the price of physical infrastructure become more costly causing failure to the household products and factors of production, the rural household diversify their production to generate income only for diversifying their consumption composition. As the result the household demand for some goods and services can be fulfilled by the household own production (Omamo 1998).

In the area where there is no credit market but access to engage in the non-farm employment is very easy, the participation of the household in nonfarm employment become important in order to solve the constraint of working capital. Even in North America there is a proof that farm families are motivated to work on non- farm income generating activities because of its access? Therefore, in the rural area where there is no credit market, households are normally unable to smooth their consumption even if they have the desire. But when there is a complete credit market, households are encouraged to save their extra profit gained from income diversification while consuming their original income (Weersink et al. 1998).

As mentioned above engagement of the rural household in income diversification is a rural insurance method to help them to secure the household income to some extent (Alasia et al. 2009). But the ability to diversify income not only relies on the accessibility and availability of the job

itself, but it also depends on farm and household related factors. Also it depends on the combinations of these factors. These means if we analyzed households of the same area, some farm households might get more income due to individual specific factors than the others like location opportunities (Matthews 2004).

2.1.3 Determinants of income diversification

Determinants of income diversification are associated either with incentives to diversify or capacity of the household. The "incentives" to diversify comprises two sets: the set of incentive "levels"[7] and the set of comparative risk of different income generating activities and in the analysis of income diversification the literature identify two classification of incentive that push or pull the rural household to diversity their income (Reardon et al. 2007). These concepts imply households and individuals are forced to engage in income diversification by different determinates in order to diversify assets or incomes. The first set of determinants are what are conventionally called "push factors" :reducing risk, combating the diminishing factors returns in any given use such as in household with land constraints, the family labor which is driven by population pressure plus fragmented landholdings and response to crises or liquidity constraints (Barrett et al., 2001). According to Dercon (2002) rural households are pushed by either idiosyncratic shocks (individual specific shocks) such as illness or death of income generating household member, ill health of livestock or covariate or aggregate shocks such as drought in the community and flood in PA.

Also Alderman and Paxson (1992) suggested that there are strategies in which rural household respond to push factors. Fist households use risk management strategies which comprises the selection of different portfolio that is profitable overtime in order to smooth the household income and consumption variability. Secondly, the household respond to the push factor by engaging risk coping mechanism. The response is done after the occurrence of the shocks and involves possession of saving, arranging formal or informal insurance and other mechanism.

Seasonality and risk are also other factors that push rural household in the income diversification. Due to these problems households move outside of farm occupations as a way of smoothing their income and consumption because farm occupations are surrounded with a lot of uncertainty (Barrett et al. 2001). Further particular "push" factors that impose rural households to move in to income diversification especially to non-farm income generating activities are mostly variability in agricultural output which may happen because of harvest loss due to problems such as weather or occurrence of shocks (Reardon et al. 2007).

[7] Set of incentive "levels" which a household face comprises relative prices of outputs and inputs (see Reardon et al. 2007 for more clarification)

Unlike the "push" factors the second set includes "pull factors": which is the understanding of strategic complementarities between activities. For instance the integration between crop production and livestock, specialization based on the comparative advantage supported by technologies, skills or endowment. Pull factors are desired opportunities that rural households get in order to diversify their income. These are related with better infrastructure, commercialized agriculture, and the location of the household, distance of rural area from urban center, the existence of financial institutions and access to credit. Rural households with sufficient property and access to various infrastructures have higher incentive to diversify their income than those without (Barrett 2008).

Therefore "pull" factors comprises the higher profits accompanied with lower risk to the rural non-farm income generating activity compared to farm income profit. This revenue from non-agricultural activity permits households to accumulate assets. Again the reinvestment of their assets on new technology will enhance the farm system. This association implies the indirect effect of income diversification on total income and consumption. In general these micro level determinants of diversification activities, which are engaged by the households in order to diversify their income, are shown at more comprehensive levels in terms of total household income and consumption (Barrett et al., 2001).

As discussed above rural income diversification is thought as smoothing household consumption expenditure fluctuations by choosing a portfolio in order to coup declining income of a household. That means if the households are exposed to risk it is through income diversification that they can mitigate it. So pursing both farm and non-farm income generating activity can reduce the income fluctuations in the household (Alderman and Paxson1992). This implies income diversification is related with minimizing risk and the idea is supported by empirical study of different scholars. For instance a study by Rosenzweig and Stark (1989) who use sample of rural farm households from rural India shows that the poorer household are more sensitive than the rich in engaging in income diversification as coping strategy. However the poor select income diversification path which is less risky.

Similarly the study of Sub-Saharan Africa by Barrett et al.(2001) shows that instead of being more risk-averse most of the poor rural household have less income diversification. This is because of various constraints. These authors suggested that if the household come across constraints such as access to credit, market failure and other environmental challenges such as idiosyncratic shock, income diversification purely happened because of dissimilarity in household's portfolio choice with respect to risk they face. This creates heterogeneity among the rural households.

Hence, even though households have internal interest to diversify, the existence of these barriers may hinder them (Reardon et al. 1992). These authors observe the determinants and effects of rural household income

diversification using four years data from three different zones in the Burkina Faso. In the paper two econometric models: level regression model and variation regression model are applied. The study found that the loss in the harvest and terms of trade drive the rural household in to income diversification. However in Burkina Faso having less land is not found to be a driving factor. In addition this research suggests that income diversification is related with higher household income and food consumption.

In fact, different statistical and econometric mechanizes applied support the positive association between household consumption and income diversification. To commence with Dercon and Krishnan (1996) examine various income portfolio of the rural households in rural Ethiopia and Tanzania using household survey data. Accordingly the study suggests that access to credit, geographical location of the household and capacity of the household are more important variable in determining the characteristics of income diversification when they face risk. They used logit analysis as its methodology in the process of estimating the results. The result confirms that household will engage in profitable activity if they have specific skill or access to capital for their investment.

Other researches show that diversification in to non-farm income activity made 45 percent of the rural Africa and the drivers of this income diversification are still push and pull factors (Barrett and Reardon 2000). Focusing in rural Peru the paper by Escobal (2001) presents the recruitment of the rural household outside of agriculture is increasing in the past decade. The result show the abut 51 percent of the total income is obtained from the non-farm activities. The paper used Tobit model in order to estimate the expected result. According to this author there are several factors for the rural households to diversify. These factors include access to credit, infrastructure and education level. The existence of these variables help the rural household diversity their income both in farm and non-farm activity.

Unlike to the above other researchers reveal as the growth in the agriculture has indirect impact on the growth of non-farm income diversification in the rural areas (Hazell and Röell 1983). According to this paper these agricultural effect is due to the rise in the use of agricultural inputs and then processing the raw data and commercializing the output. In particular these effects emerge from the increase in the household consumption as the result of the increased income in the agricultural sector.

In summary, in the case of "push side perspective", income diversification is driven by risk minimization strategies. Besides in the area where financial systems are weak and market is incomplete, rural income diversification create a pathway to select various ranges of activities which assure the household income flows and consumption. On the other hand from the "pull factors" perspective, local engines of growth such as commercialized farms or proximity of the rural area to urban may create good opportunity to engage in income diversification. Besides it generate opportunity for income

diversification in production and expenditure linkage activities (Reardon et al. 2007).

As mentioned earlier, in addition to pull and push factors, rural income diversification is determined by "capacity variables". The "capacity variables" allow the rural household to engage in non-farm activities and consist of various capital assets such as human, financial, social, organizational and physical capital. Again this capital may be public such as roads or personal. Also the capital may be related to a single household or a group of households such as associations (Ibid).

Finally as it is discussed in the above theoretical and empirical works and country specific review of income diversification in Ethiopia which is discussed in subsequent chapter (chapter 3), the literatures are confirming synonymous findings with respect to the determinants and effects of income diversification in the rural areas. So from these points of view this paper will focus on the determinants and the effects of income diversification in the rural Ethiopia.

2.1.4 Effects of Income diversification

The effects of income diversification may be short term or long term. Most of the time the short term effect deals with supplementing food expenditure gap. For instance Reardon and Matlon (1989) carried out a case study in the Burkina Faso and found that households with more diversified income have capacity to fill their food gap during the time of drought in 1984. Hence in the short term the effect of income diversification may manifest in the form of family food expenditure filling their food gap. Contrary to this the long term effect is when income diversification affects the food security of the household.

The comparative contribution of non-farm income to the total income of the household is often known (Reardon 1997). When a household starts to diversify its income, the household consumption expenditure in particular and the overall household welfare in general may be affected. As mentioned earlier, the presence of access to various income sources and its convenience determine the level and type of income diversification. In turn the level and type of income diversification may rely on the household's characteristics, labor resource, location and other factors (Ersado 2006).

Several works of scholars confirm income diversification has a positive and significant impact on per capita consumption and total income of the household. The review of Reardon (1997) found there is a strong association between the share of non-farm income and total earnings of the household in the rural Africa. This is because households that engage in diversifying its incomes may have increased total earnings. In turn the increase in total income affects household consumption positively. Accordingly there is an even more definite association between them. The same positive association occurs

between landholdings and total income of the household. In the area where there is unequal distribution of landholding and earnings from farm activity, poor households with less income encounter entry barrier in starting non-farm income generating activities. Because they cannot offer the required capital as initial investment in non-farm income generating activities. This implies the effect of income diversification on the total income of the poor is less than that of the rich.

Also a study by Block and Webb (2001) in rural Ethiopia found that, when households diversify its income more and more, household asset in terms of both earnings and nutritional measures enhanced over time. Conversely, those households with less diversification struggle to diversify their income. Again according to Lanjouw et al. (2001) in Tanzania the share of non-farm income increases with the food consumption per capita quintiles. All these studies contain evidence to show that there is a positive association between income diversification and total income of the household.

However there is a positive relationship between them, the problem of reverse causality while estimating the effect of income diversification on the total incoem of the household is what we have to deal with. As discussed above income diversification causes total income to increase. But when it is analyzed empirically, this lead to endogenity problem when effect is analyzed. As a result this problem needs the application of alternative econometric mechanism which is discussed in Section 5.3.

Chapter 3. Income diversification in Rural Ethiopia

3.1 Overview of Income diversification

Smallholder agriculture dominates the rural economy and comprises around 80 percent of the labor force employment. In addition to this agriculture contributes 50 percent of GDP and 67 percent of the country's export earnings and 90 percent of the total crop land and agricultural product in rural Ethiopia is accounted for by small farmers (Bollinger et al. 1999).

Also in rural Ethiopia the major type of agricultural system is mixed farming and this system basically includes the production of crops and livestock rearing. The most important source of labor input in this farming system is the family member. Even though various measures are taken by the government, the rural economy of the household depends on agricultural sector which is characterized by low productivity, decreasing landholding due to population growth, environmental degradation due to erosion and flooding, insufficient and fluctuating rainfall, inadequate and poor infrastructure (Ethiopian Economic Association 2000). As a result of these problems most rural farmers produce agricultural products which are solely for subsistence which in turn forces them to participate in non-farm income generating activities to fill the family consumption gap. Particularly these problems push landless households which completely relied on non-farm income generating activities compared to those households with more access to landholdings.

Besides the usual livelihood means in rural Ethiopia comprises the production of crops and livestock raising, non-farm income sources of income such as petty trading, daily wage labor, and sometimes rural urban migration. These characteristics are mostly seen in the highland areas where there is mixed farming system. However, in the rural areas where the landholdings are not favorable for agricultural products particularly in the low land areas the main livelihood strategy is animal husbandry. Therefore, in these areas rather than focusing on agricultural policy intervention, the encouragement of non-agricultural income generating activities is important opportunities (Devereux and Sussex 2000).

Turning to contribution, in rural Ethiopia the contribution of non-farm total income is increasing overtime. As reported by Barrett and Reardon (2000) the share of non- farm income in rural Ethiopia in 1989/90 was 36 percent. However, according to the study of Reardon et al. (2007) cited Deininger et al.(2003) the share of non-farm income in rural Ethiopia in 1999 was 20 percent[8].

In 2001 a study showing the progress of non-farm income share was done by Woldehanna and Oskam. According to these authors in 2001 35 percent of

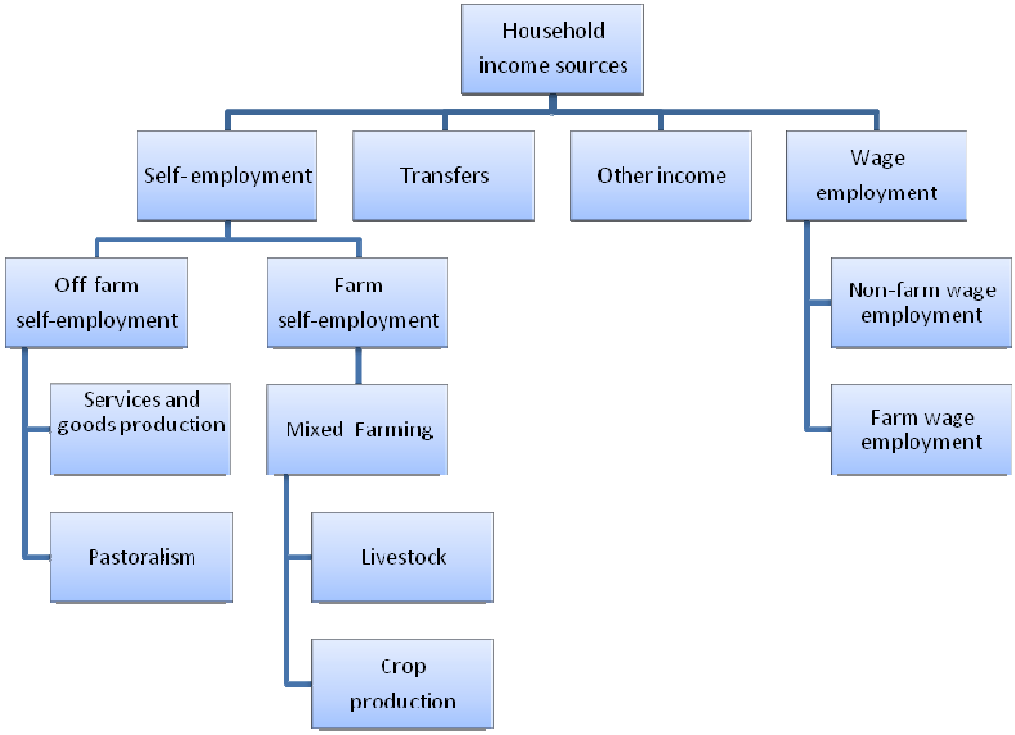
[8] See Table 8 in the appendices for more details

household income in rural Ethiopia derived from non-farm income source. Again in line with the study of Reardon et al. (2007) the study by Davis (2004) confirmed that in 1999 20 percent of the household income comes from non-farm income generating activities which contradict the result of Woldehanna and Oskam (2001)

Also another study by Worku (2007) found in year 2007 31 percent of household income in rural Ethiopia comes from non-farm income sources. Following this the result of this paper shows that in 2009 33 percent of the household income derived from non- farm income sources. However these results tell us there is no uniformity among different literature about the contribution of non-farm income in the rural area, there is an increase in the contribution overtime which is accompanied by fluctuation.

The following figure present different income sources in the rural Ethiopia.

Figure 3 .Classification of household income sources in Rural Ethiopia



Source: Modification of Fig2 in Ethiopian context.

All income sources have the same conceptual explanation as discussed in the 2.1.1 except pastoralism. Pastoralism is the life style of pastoralists that are lowland people who use their domestic livestock as sole source of their income. It is an income source in areas where rainfall is unreliable for the production of crops and where environment is not favorable for farm or mixed farm (Pratt et al. 1997). Among these sources the major rural income sources in Ethiopia is mixed farming which comprises crop production and livestock rearing.

As indicated in the above figure, some rural Ethiopians engage in self-farm employment which is mixed farming of crop production and livestock rearing. But others combine this self –farm with farm wage or non-farm wage employment. Still those who are land less rely on non-wage or non-farm self-employment. However the contribution was increasing, non-farm income generating activities have limitations. For instance, they are not available sufficiently and their income bearing potential is very small. A rural household survey by the Ministry of Labor in 1996 present that only 44 percent of the total household surveyed confirm as they have access to the non-farm income generating activities and the contribution of these income is only 10 percent (Befekadu and Berhanu 2000).

3.2 Patterns of income diversification in rural Ethiopia

In this sub -section we will deal with the household income diversification by share of income and expenditure quartiles using quintile regression analysis. The purpose is to preset patterns of income diversification over different quartiles based on the share of different income sources as shown in Table 1 below.

Table 1. Household income diversification by share of income and expenditure quartiles

	Income Quartiles			
	Q1	Q2	Q3	Q4
Share of Farm self-employment Income	0.0631	0.0454	0.0132	0.0047
	(0.0029)	(0.0097)	(0.0027)	(0.0028)
Share of Farm wage employment income	0.0141	0.0291	0.0246	0.0331
	(0.0110)	(0.0119)	(0.0308)	(0.0061)
Share of Non-farm Employment income	0.0236	0.2875	0.5007	0.8731
	(0.3704)	(0.1160)	(0.1669)	(0.1307)
Share of Non-labor income	0.5439	0.4386	0.2964	0.2374
	(0.0252)	(0.2623)	(0.9522)	(0.9754)

Standard errors in parentheses

Source: Own computation from 2004/2009 ERHS

Table 1 presents the percentage of income shares in farm and non-farm income generating activities per expenditure quartiles. The estimated result show that share of income from farm self-employment, which is subsistence in most cases and include crop production and livestock rearing, show decreasing trends as the quartiles increases. The decline in the percentage implies household with less expenditure earn most of its income from farm income generating activity. Probably this may be related with the finical constraints that poor household face. This is confirmed by estimated coefficients of share income from non-farm employment which increases over quartile expenditure. This increase implies households in higher expenditure quintile (non-poor) earn their income from non-farm employment because rich households has more access to both physical and financial resources. Similarly, the share non-labor incomes such as transfer and remittances exhibit a declining trend over quartiles. Hence poor households are more dependent on these non labor income.

Chapter 4. Methodology

In this chapter the source of data and descriptive statistics accompanied with variable specification is discussed in the first part. Then after modeling of income diversification and estimation strategies are discussed in the subsequent parts.

4.1 Source of the Data

To explore the two objectives of this research paper, two rounds of ERHS are used. Accordingly, the data is taken from the Ethiopian Rural Household Survey (ERHS). Ethiopia is a country which is subdivided in to different regions. Regions in turn are subdivided in to Zones and Zones in to Woredas. The woredas also divided into Kebles (peasant Associations) which is the lowest administrative level in Ethiopia[9]. The survey is a longitudinal household data set which includes rural households from four regions of the country: Tigray, Amhara, Oromiya and SNNPRG where the largest percentages of country's rural farmers live. This is why ERHS is considered as wide representative sample of households in non-pastoralist agricultural system as these four regions represent large percent of the total population.

ERHS data collection was started in 1989 by IFPRI for the first time when a team visited 6 agricultural villages in Central and Southern Ethiopia. In 1994 the survey was expanded to include another nine communities from the aforementioned regions. These new villages were chosen giving a sample of 1477 households. The reason for expanding the survey communities was to account for the diversity of agricultural system in the country consisting of the grain-plough areas of the Northern and Central highlands, the enset-cultivating villages and the sorghum-hoe communities. There after the survey was also conducted in 1995, 1997, 1999, 2004 and 2009. The survey was conducted in collaboration with Department of Economics in Addis Ababa University (Economics/AAU) and the Center of the Study of African Economies (CSAE), University of Oxford. It was funded by four different organizations: Economic and Social Research Council (ESRC), Swedish International Development Agency (SIDA), United States Agency for International Development (USAID) and the World Bank.[10] In general the survey addressed issues such as household characteristics, income from different sources, expenditure and consumption of households, livestock, agriculture, shocks, household labor resource, household non-labor capitals and other community level data. From this data set the last two waves: 2004

[9] See Map 1. For the location of surveyed villages.

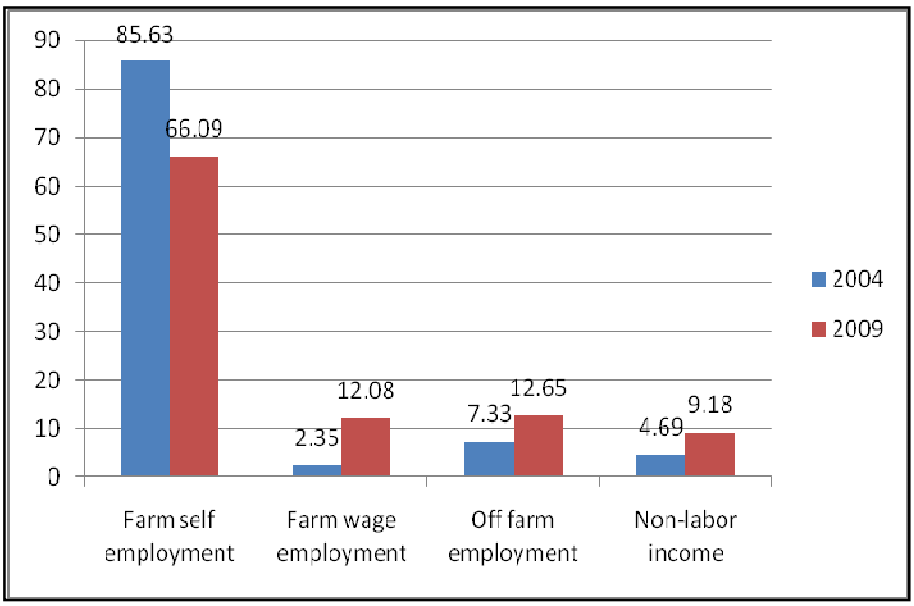
[10] http://www.ifpri.org/dataset/ethiopian-rural-household-surveys-erhs accessed 24/10/2014

and 2009 are used. Only these two waves are taken because of the time pressure associated with data cleaning and preparation for analysis. As a beginner the processes of data cleaning and identification in order to create a panel data which comprises exploring so many Stata files for variables identification, dealing with duplicate observations, appending, merging, hierarchal merge, collapse, renaming, coding and other techniques were very challenging.

4.2 Descriptive statistics

Based on the theoretical and conceptual frame work which were discussed in chapter two the sources of rural household income are categorized into farm self employment, farm wage employment, off-farm employment, and non-labor income (Fig 4). Therefore a household could be self employed on its own farm, hired on another household farm or participate in off-farm activity. In the figure transfer and remittance form non-labor income of the rural household.

Figure 4 Classification of household income sources in Rural Ethiopia



Source: own computation from 2004 and 2009 ERHS

Actually not all the rural households obtain income from four sources in the table 4 and there is a significant change in the contribution of different income sources to the overall income. The contribution of farm self-employment declines from 85 percent in 2004 to 66 percent in 2009. Specifically the contribution of income from farm wages employment, income

from off-farm employment, and income from non-labor increases from 2 percent to 12 percent, 7 percent to 12 percent, and 4 percent to 9 percent respectively. Regarding the share of non-farm income in rural Ethiopia different literature's result show there is difference among them as discussed above in chapter 3. These results tell us there is no uniformity among different literature about the contribution however there is change over time.

4.3 Variable specification

This sub-section will give descriptions on the variable of interest and explain the reason why the variables are included in the model plus the bearing they have on income diversification and total income of the house hold. The summary of these variables are presented in table 7 in the appendices. Based on the sketch of section 2.1.1, the empirical analysis basically uses the share of non-farm income and the share of time spent on non-farm activites in the process of analysis. Table 2 in the appendices gives Summary Statistics of dependent variables for 2004 and 2009. The statistics show there is a change over time between the two waves.

4.3.1 Dependent Variable

Income diversification: as discussed in the literature section, the best ways of measuring diversification are either through the time spent on different activities or through the share of non-farm income. Therefore income diversification is a proxy variable measured through these ways. Method of quantifying income diversification differs with in literature. But most of the literatures related with the rural areas measure income diversification through the share of non-farm income. This approach assumes that the higher the share of non-farm income out of the total household income, the higher the income of the household is diversified (Barrett et al. 2001). It is income based approach of measuring diversification. The second way is through the share of time spent on different IGAs. This is what Nghiem (2010) call one of the most appropriate way of measuring income diversification other than income based measure. But in this research we use both time based and income based approaches. Accordingly the present analysis use the share of time spent on non-farm employment and the share of non-farm income as the dependent variables.

4.3.2 Independent variables/Control Variables

The analysis includes various factors that have bearing on the dependent variable. These variables comprise household characteristics, labor of the household, wealth index and other variables as clarified below.

Age of household head: Even though it is not easy to expect that this variable is very significant in the specified model, it helps us to predict how

income diversification will go against the age of the household. It is expected that to some extent the age of the household helps to diversify income through experience and after some maximum point the effect will start to decline. That means age has negative effect on income diversification i.e. as the age of the household increases the probability of his/her participation in nonfarm wage employment is very low.

Sex of head: This gender variable is included in the model to see whether male or female households engaged in income diversification. It is a dummy variable that is assigned one if the household is male and 0 otherwise. It is expect that being male has positive relationship with income diversification for the reason that in most developing countries females engaged in farm self-employment.

Marital status of head: is controlled to see whether the married or the single household are more engaged in income diversifying activity. It is a dummy variable where one is assigned to married and zero is assigned to single. It is expected that because of low labor resource that the unmarried household has, their engagement in income diversification is lower than that of marred ones.

Education of the household: This variable has three categories such as household with no education, household with primary education and house hold with secondary and above. The theory claim that the more educated the household, the less commitment to engage in farm employment. According to (Davis 2003) education is decisive since well paid local jobs need some education level of the household such as completion of secondary and education facilitate migration. Therefore completion of formal education helps rural households not to spend much of their time on farm activities. However, most of the rural households are uneducated and the absence of education hinders the employment of the household even in the semi-skilled non-farm income generating activities. And this is intensified by the health and nutritional condition of the household which resulted in low productivity of labor. Also a study conducted by the save the children UK in the rural Ethiopia found that three vital determinants of income: education of the household, the presence of household labor, and the power to resist drought (Devereux and Sussex 2000).

Therefore education is included as one key variable.

Household size, No of adults and No of children: These are controlled in order to assess the effect of the working force on income diversification. The expectation is that more the labor force in the household, the higher the probability that the house hold engaged in different income generating activities.

Farm size: The total amount of farm land that the household possess and this farm size is measured in hectare. It is a variable that represent the physical capital of the household. From ERHS data set the average land holding in 2004 was 0.92 hectare per household. But in 2009 the average land holding was declined to 0.32 hectares per household. As land declines the household is forced to work on alternative income generating activities. Therefore land constraint is one of the push factors that forces rural household diversify their income in order to smooth their consumption and total income variability.

Access to credit: This is a dummy variable assigned one if the household has access to credit from formal or informal institutions zero otherwise. It is expected that those who have access to either formal or informal credit have a higher probability to diversify their income than those who do not have access.

Saving: this is a dummy variable given one if the household have saving that is generated between the two waves otherwise zero.

Own House: In rural Ethiopia particularly with respect to accessing micro finance credit owing a house is used as collateral. Therefore households who have their own certified land holdings with built house has the possibility of accessing formal credits which help diversify. It is a dummy variable assigned one for those who have their own house zero otherwise.

Idiosyncratic shock index: This index variable is included to capture specific shock to the rural household such as drought, death of income earning member of the household , illness of wife who support the family, land redistribution in the PA, death of husband(income earner), frosts or hailstorm, theft of livestock, too much rain or flood, erosion and others. This variable pushes the household to engage in non-farm income generating activity for the survival of the member. With respect to index computation all shocks reported in 2004 are used as a base for computing changes over time. And in the subsequent wave 2009 the index is computed using the incidence of idiosyncratic shocks based on the reported data in ERHS.

Region: from all parts of the county the ERHS included four regions which comprised largest percent of the total population. Therefore in this paper the variable region implies the selected ones: Tigray and Amhara region from the northern part, SNNPRG from South and Oromiya which cover most of West, Central and some eastern parts country. In order to include these regions, a dummy variable is created for all of them because the variations existed between the regions as a result of resources.

In general the dependent variable income diversification which is measured through the share of non-farm income or the time spent on non-farm income generating activities is a function of these independent variables listed above. In the following section we will deal on how to model this functional relationship between the control and the outcome variable.

4.4 Modeling income diversification

The overall asset of the rural household and its consumption steadiness are affected by income diversification. Therefore to protect against their entitlement failure and chronic food insecurity the poor needs diversification rather than wealthier. Also because of incomplete markets that hinder their entry into more compensating livestock and non-farm activities they are least able to diversify (Reardon et al. 2000). This implies income diversification is determined by different factors like household characteristic, farm characteristics and location characteristics.

As indicated in the literature review income diversification affects the pattern of consumption and total household welfare. The level and type of income diversification relies on access and availability of income sources and the risk that the rural household faces. This may in turn depend on the location of the household, access to labor and factor market, human and social capital. (Ibid)

Hence, the determinants of income diversification in rural areas comprises a range of variables such as household characteristics, household labor resource, their capital endowment, access to credit market and other public goods as included in various studies (Lanjouw 2001). In some case the work may need specific knowledge. At this time education and training become necessary. In general most of the rural households generate its income from farm activities. However as discussed earlier there are two reasons why went out of this agricultural activity. The first one is agricultural shock i.e. push factors and the second is pull factors i.e. wealth accumulation.

Some empirical studies show that access to infra-structure and educational attainment is strong determinates of diversification. (See Barrettet al. 2000, Block and Webb 2001). All these determinants are captured in different models through functional relationship among dependant and control variable.

Therefore, following the work of Abdulai and Corle Rees (2001) a simple model of income diversification which incorporate few variables such as household labor and capital. The most important elements that the model incorporates are:

1. The rural households are assumed to have land(L) and labor(H) as production input; the source of labor can be either family member or hired,
2. All households are involved in crop production, livestock rearing or mixed farming.
3. Entrance in the new activity is not cost free; it needs certain level of capital for investment or specific skill
4. The rural household might work on other activities to diversify income risk

Given these assumptions, each household is assumed to maximize a time separable utility function of the form:

$$U_t = E_t \sum_{\tau=t}^{T} \beta^{\tau-t} u(C_\tau)$$

where *Et* is the expectations operator given the information set at age *t*; β is the subjective discount factor; *C* represents the consumption of the household; and *T* is the number of periods. Every rural household encounters endowment constraint, intertemporal budget constraint and non-negativity constraint. Now assuming the returns to the activities outside food-crop production is denoted as $P_{tn}\, g(H_{tn}|M_n)$, where P_{tn} and M_n represent the output price and entry constraint such as investment capital or skill respectively and H_{tn} represent labor allocated to other activities and the relationship between the expected marginal utilities can be expressed as:

$$E\left[U'(C_t)P_{tf}\frac{\partial h}{\partial H_{tf}}\right] > E\left[U'(C_t)P_{tn}\frac{\partial g}{\partial H_{tn}}\right], \text{ with } H_{tf}>0 \text{ and } H_{tn} = 0$$

where $U'(C_t)$ indicate marginal utility of consumption; H_{tf} and H_{tn} stand for labor allocated to food-cropping and other activities, respectively; and P_{tf} represents output price of food crops. In marginal utility equation household does not need to undertake any other activity besides food-cropping ($H_{tf}>0$ and $H_{tn}=0$), since the marginal utility of allocating labor to food-cropping is larger than the marginal utility of engaging in non-food cropping activities, the household does not need to undertake any other activity besides food-cropping ($H_{tf}>0$ and $H_{tn}=0$). This simple model tells us income diversification is a function of household resources such as labor and capital in a simplest form. That means labor and capital are variables that determine diversification of income. However, Nghiem (2010) categorize the potential variables

determining income diversification more broadly in to two categories: the variables that are related with the household capacity to carry out nonfarm activity and that variable that affects the incentive to diversify. Amongst the different ways through which income diversification is measured, measuring through share of income earned from different sources and the time spent on the different activities are the most suitable measures of diversification. These two ways are focused in the following estimation strategy.

4. 5 *Estimation* strategy

As discussed in the theoretical framework income diversification is expressed as a function of the aforementioned variables: household characteristics, household labor resource, their capital endowment, and access to credit market, savings, and ownership of house and regional variables. Based on this structure, this research follows the work of Nghiem (2010) to specify functional relationship between income diversification and its determinates. As the result, non-farm income share in total household net income and the share of time spent on different activities are used as dependent variables in the empirical models.

I began by using a Tobit model to examine the effect of various characteristics on income diversification. The Tobit model is an extension of the probit model in which our interest is finding out the amount of time spent by the rural household on non-farm wage employment and the share of non-farm income. The Tobit mode is also called censored regression model. Because it comprises a sample (censored sample) in which information on regressand (the amount of time spent and share of income) is existing only for some observations. Some writers call the Tobit model a limited dependent variable regression models**.** This because of the limit put on the values taken by the dependent variable. (Gujarati 2004)

We can express the Tobit mode statistically as:

$$Y_{it} = \beta_1 + \beta_2 X_{it} + u_{it} \text{ if RHS} > 0$$

$$= 0 \text{ otherwise}$$

where RHS = right-hand side and Where Y_{it} is the share of time spent on farm-self employment or the share of non farm income in the total income , *Xit* is a vector of explanatory variables, β is a vector of parameters to be estimated, and u_{it} is the error term. The subscripts *i* and *t* index the households and time.

Because the two measures of income diversification: share of non farm income in the total household earning or share of time spent on different activities by the rural household cannot be less than zero or above one, a double censored Tobit model is used for estimation in analyzing the determinants of time spent non-farm employment or the determinates of the

share of non-farm income following the work of Nghiem, L. (2010). Accordingly, the double censored Tobit model is used in the analysis.

$$S^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + u$$

$$S = \begin{cases} 0 & if \quad S^* \le 0 \\ 1 & if \quad S^* \ge 1 \\ S^* & if \quad 0 < S^* < 1 \end{cases}$$

In the equation X1, X2,…,Xn represent the independent variables which have an effect on time spent on different income generating activities. *S** is the unobservable variable which indicate the preferred/desired share of time allocated on various activities that the rural household would like to spend on the income generating activities. On the other hand S is the actual share of time spent on one type of income source. This double censored model is used only to analyze the initial determinants of income diversification. However the central attention of the paper is not only analyzing initial determinants but also focus on the temporal determinants of income diversification and the effect of income diversification on total income of the household.

To analyze temporal determinants I used a panel data to estimate a fixed effects model. The advantage of this approach is that it allows me to control for time-invariant unobservable characteristics of the household that may affect income diversification. (See Wooldridge 2003 and Gujarati 2004).

The equation for the fixed effects model becomes:

$Yit = \beta 1 Xit + \alpha i + uit$……..... [eq.2]

Where Yit is the dependent variable (DV) which represent share of non-farm income or share of time spent on non-farm where *i* = entity and *t* = time. , *X*it is independent variable (IV) which represent vector of household and other exogenous characteristics , β1 is the coefficient for that IV, αi (*i*=1….n) is the unknown time-invariant term for each entity (*n* entity-specific intercepts), and uit is the error term.

Finally the effect of income diversification on the overall income of the household is analyzed. The specification treats log of per capita consumption as a function of household characteristics and other variable. The function can be specified as:-

$Yit = \beta_0 + \beta_1 NFit + \beta 1 Xit + \varepsilon it$ ……..... [eq.3]

Where Yit is the outcome variable refers to log of per capita consumption of individual i at time t, NF_{it} is the measures of income diversification of individual i at t period, Xit stands for a vector of household and other exogenous characteristics and *ε*it is the error term.

Chapter 5. Empirical Results and Discussion

In order to understand the empirical results easily this chapter is sub-divided in to three sections. Part one deals with initial period determinants (2004) of income diversification. In this section cross-section data is used from 2004 ERHS to identify initial determinants of income diversification. The estimation result of this sub section is presented in table 1 and both measures of income diversification: the share of non-farm income and share of time spent on non-farm activities are used as dependent variables. Part two analyzes the overtime determinants of income diversification between the two waves of household survey. Unlike part one; this section uses panel data from 2004 and 2009. The panel data is used to analyze the dynamic relationship between income diversification and the driving factor. This is because panel data allows us to control for unobserved factors and account for individual heterogeneity (Wooldridge 2003). Similar to the above section in this part both measures of income diversification are used for analysis. The notion of using the share of non-farm income as the measure of income diversification is related with (Barrett and Webb 2001). According to the study of Barrett and Webb (2001) the greater the non-farm share, the less likely that the household will be a victim of shock. Part three deals with the estimation of the effect of income diversification on the total income of the rural household. It is the reverse process of what we have seen in the above two parts.

As already mentioned in methodology part a two limit Tobit model or Tobit double-censored model is used in the cross sectional analysis and Fixed and Random effect are used in the panel data analysis. The set of variables included in the model are household characteristics such as age, gender and marital states, house hold labor resource such as number of adult member, agricultural related assets: land size (in ha), asset related with nonagricultural activities (wage labor), financial assets such as access to credit and finally idiosyncratic shock and own housing are included.

In the next section we start by estimating and analyzing initial period determinants of income diversification by using 2004 ERHS cross section data set. Then after we will continue our discussion on by investigating over time determinants of income diversification using panel data of 2004 and 2009 ERHS data.

5.1. Determinants of Income diversification

5.1.1. Initial *period determinants* in 2004

Table 3 below provides the marginal effects of both push and pull factors: household characteristics, household labor resource, and capita and other variables on income diversification which is measured through both non-farm income share and the share of time spent on the non-farm employment. The coefficients are transformed into marginal effects in order to simplify the interpretation of the result. And these marginal effects are estimated at average of the dependent variable by controlling other factors. Besides it shows the number of observations that are right or left censored observations in each equations and a likelihood ratio as a goodness of fit implications (indicators). Also an important number of observations that means more than two-third are either right or left censored.

Table 3 Household characteristics and other factors marginal effects on measures of Income diversification

	Non-farm income share		Share of time spent on Non-farm employment	
VARIABLES	Coeff	Effect	Coeff	Effect
Age of Household head	-0.0021	0.0007	-0.1305	-0.0011
	(0.0081)	(0.0023)	(0.00408)	(0.0034)
Age squared	-5.04e-05	-0.0018	6.40e-06	5.25e-06
	(7.26e-05)	(0.0012)	(4.38e-05)	(0.0016)
Sex Male =1	0.125***	0.0418***	0.0132***	0.0108***
	(0.0543)	(0.0178)	(0.0308)	0.0253
Marital status Married =1	0.0167***	0.0056***	0.00650***	0.0053***
	(0.0228)	(0.0076)	(0.0131)	(0.0108)
No Education	-0.0543	-0.0181	0.0608	0.0499
	(0.0966)	(0.0323)	(0.0565)	(0.0464)
Primary education	0.0406	0.0136	-0.0967	-0.0794
	(0.124)	(0.0415)	(0.0681)	(0.0558)
Secondary and above	0.0710***	0.0237***	0.0983***	0.0306***
	(0.118)	(0.0396)	(0.0659)	(0.0541)
Family Size	-0.0297**	-0.0099**	0.0019***	0.0005***
	(0.0272)	(0.0091)	(0.0169)	(0.0138)
Number of Adults	0.0276	0.0092	0.00795	0.0065
	(0.0313)	(0.0105)	(0.0199)	(0.0163)
Farm size	-0.0049	0.0051	-0.000127***	-0.0014***
	(0.0016)	(0.0006)	(8.17e-05)	(0.0067)
Access to Credit (yes)	0.0094***	0.0027***	0.00620***	0.0050***
	(0.0607)	(0.0203)	(0.0374)	(0.0307)
Saving	0.232**	0.0775**	-0.0277	-0.0227
	(0.111)	(0.0377)	(0.0852)	(0.0698)

Own House	0.0281	-0.0094	-0.0103	-0.0084
	(0.0590)	(0.0197)	(0.0366)	(0.0300)
Idiosyncratic shock index	0.162***	0.0539**	0.0646**	0.0529**
	(0.0437)	(0.0154)	(0.0334)	(0.0274)
Region1[11]	-0.256	-0.094	0.0333	0.0273
	(0.155)	(0.0433)	(0.0807)	(0.0661)
Region4	0.224***	0.0487***	0.0416**	0.0141**
	(0.135)	(0.0345)	(0.0556)	(0.0456)
Region7	0.4162***	0.0855***	0.2960***	0.0421***
	(0.0828)	(0.0062)	(0.2991)	(0.0927)
Constant	-0.605***		0.409*	
	(0.338)		(0.214)	
Sigma	0.517***		0.396***	
	(0.0270)		(0.0151)	
Observations	1,455		1324	
- Left-censored (at zero)	773		1049	
Uncensored	525		220	
- Right-censored (at one)	157		55	
Pseudo R2	0.305		0.4013	
Log pseudo likelihood	-311.50254		-291.63071	
Pr(0<S*<1)	0.2382		0.0000	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The estimated result confirms that the age of the household does not affect income diversification significantly and it marginal effect is negative. This implies controlling for the other variables, the effect of the lifecycle of the rural household is insignificant in order to spend much of their time on non-farm activities.

The gender of the head is statistically significant in both measures. Male headed households spend more of their time on non-farm income generating activity than female headed member of the household. Perhaps this may be because in Ethiopia and other developing country mostly females spent more of their time on domestic tasks such as cooking, fetching water, firewood collection, cleaning, child care etc. The estimated result show that if the household head is male, then it increases share of non-farm income by 4.18 percentage point and the share time spent on nonfarm employment by 1.08 percentage point at a 10 percentage point level of significance.

The estimated coefficients of marital status suggests that households that are married have positive and significant effect on both measures of income

[11] Note: In this table and the others region 1 represents Tigray region, Region 4 represents Oromia and Region 7 represent SNNPRG.

diversification. This is because in rural Ethiopia most of the time marred household has more members who can participate on non farm income generating activity and children who can supplement their work.

Turning to the different levels of education, education of the household particularly in the secondary and above has positive and significant relationship with the share of time spent on non-farm employment and share of non-farm income. The estimation indicates that if a household member has education more than secondary this increases the time spent on non-farm employment and the share of non-farm income by 2.37 and 3.06 percentage points respectively. The result is not surprising as education give opportunity to engage in non-farm activities. The opportunity created for those educated may be working as an employee or creating own enterprise. This is also confirmed by the study of Minot (2006). Therefore education is substantially important in case of both measurements in rural Ethiopia. That means education of the household; particularly in post-secondary level, the adult family members all have significant effect on the measurement of income diversification. Also this positive impact of education on income diversification is similar to the finding of (Barrett and Reardon 2000) and Block and Webb (2001) which confirms access to educational attainment is one of the strong determinates of diversification.

Again human resource is another factor affecting the share of non-farm income and time spent on non-farm wage employment. With regard to the household labor resources the estimated result show that household size is found to have negative and significant effect on the non-farm income share and insignificant but positive impact on the share of time spent on non-farm employment. Also the number of adults has significant impact. Holding other variables constant, an extra member of the household decreases the share of non-farm income by 0.99 percentage point. However it is not significant there is positive association between household size and the share of time spent on non-farm employment. That means the inclusion of an additional household member in the family exacerbate the pressure on the share of non-farm income than enhancing it. This is what (Lanjouw and Ravallion 1995) confirms. According to these authors as number of the household member increases, the per capita income of the household declines. Therefore among the household characteristics family size with large member has negative influence on the share of non-farm income and this in turn imply the quantity of the household without quality has negative impact.

As the estimated result shows in rural Ethiopia the size of the land has negative relationship with the share of time spent on non-farm activity and share of non-farm income. Because as land holding decreases the probability that the household to participates in non-farm activity increases. In addition to this, family farm size and the share of non farm income associated negatively. The result is synonymous with study of (Norman 1973) which is studied in Northern Nigeria. The finding stats that due to land constraints rural

households are forced to start non-farm income generating activities. On the other hand the work of Taylor (1987) in Mexico contrasts this finding. According to his study land constraint has no significant impact on the migration of the household as migration is viewed as an element of income diversification which has direct relation with remittance received by the household. Similarly idiosyncratic shock index is also another determinant that plays a key role in determining the share of non-farm income time spent on the non-farm activity. The estimation result indicate that the occurrence of idiosyncratic shock such as illness or death of bread winner household member, illness or death of livestock increases the share of time spent on non-farm activity by 5.39 percentage point and the share of time spent on non-farm by 5.29 percentage point.

Finally the regional effect is observed to identify whether regional difference causes differences in income diversification. As the result the marginal effect of regional dummy show that households live in the Oromia and SNNPRG region has more diversified income than Amhara region. The inclusion of regional dummies explains the reality of variance in both measures of non-farm income share and share of time spent on non-farm employment models which is due to location difference. The implication of this variation is that the region where the household lives affect the share of non-farm income and share of time spent on non-farm employment in different manner. This may be due to availability of some physical infrastructure and access to credits that facilitates to some household to have better income source.

To conclude this section, we have seen spatial income diversification determinates using year 2004 cross-section data. The estimated result shows that there is some resemblance in the variables affecting both measures of income diversification: non-farm income share and share of time spent on non-farm employment. Even though it is not significant the increasing age of the household has negative impact on both measurements of income diversification. Other household characteristics gender and marital states has positive impact. The post-secondary education has positive effect on both measurement of income diversification. This implies the educational status of the household below secondary has no effect on the share of non-farm income. This positive impact of education on income diversification is similar to the finding of Barrett and Reardon (2000) and Block and Webb (2000) which confirms access to educational attainment is one of the strong determinates of diversification. Conversely, family size affects the share of non-farm income negatively and the share of time spent on non-farm employment positively. However regional effects are likely to have equal influence on both measures of income diversification.

5.1. 2. Over time determinants of income diversification.

In the previous section 5.1.1 initial determinants of rural income diversification are estimated and analyzed by using 2004 cross section data. That means it deals with the spatial determinants of income diversification which concentrate only on initial period drivers of rural diversification. However this does not tell us what about the changes over time. Therefore in this sub-section panel data are used to answer this question and analyze the association of the same household characteristics and other factors with the changes in the share of non-farm income and share of time spent on non-farm employment. Hence we start to see how different variables in the model jointly affect the two measures of income diversification used between 2004 and 2009.

In this sub-section prior to analyzing the overtime determinants of income diversification, we have to deal with attrition between the two waves. After the data cleaning the total observations of 2004 is about 1,593. From these total observations 255 observations dropped. Then new households are selected and added to the existing ones that has continuing roster card as a substitution. Again in 2009 the ERHS data set indicates there are 225 drop outs which are about 3 percent per year. This is low. Accordingly the regression which incorporates this observation unlikely to lead to biased estimates.[12] Table 4 in the appendices also give detailed illustration on household left or died, new HH substituted, and continuing households.

As mentioned above, we have examined the initial determinants of share of time spent on farm and share of non-farm income generating activities by using 2004 cross-section data. But this does not explore what drives the dynamics of income diversification between the two waves. And to analyze the over time determinants of income diversification Tobit model with random effects are estimated and reported in Table 8 in appendices and pooled OLS, fixed effects and random effects model are also estimated and reported in Table 4 below. These two estimations use 2004/2009 panel data. The purpose of using these different ways are to examine whether results are robust to the methods used. After estimating the result a Hausman test[13] is applied to check which model (Fixed effect or Random effect) is suitable to accept. The test confirms that the fixed effect model is appropriate to explain the outcome. Even though pooled OLS present inconsistent estimator as it ignores the heterogeneity or individuality between individual households it is included in the estimation outcome as an output for comparison. Accordingly substantial part of the following discussion focuses on the output the fixed effect model which presents the estimation result of [eq.2].

[12] The attrition is based on The Ethiopian Rural Household Surveys 1989-2009: Introduction http://www.ifpri.org/dataset/ethiopian-rural-household-surveys-erhs

[13] A Hausman test result shows that Prob>chi2 = 0.0253 which is significant and hence we use Fixed effect model.

Table 4. Over time Determinants of income diversification, 2004/2009
(OLS, fixed and random effects models)

Independent Variables	Dependent variable: Non-farm income share (NF)			Dependent variable: Share of time spent on Non-farm employment		
	OLS	FE	RE	OLS	FE	RE
Age of Household head	0.00218	0.00247	0.00303	0.000294	-8.43e-05	-0.000337
	(0.00196)	(0.00219)	(0.00199)	(0.000873)	(0.000799)	(0.000769)
Age squared	-3.01e-05	-2.79e-05	-3.62e-05	6.63e-07	2.88e-06	5.12e-06
	(2.19e-05)	(2.43e-05)	(2.21e-05)	(9.76e-06)	(8.90e-06)	(8.57e-06)
Sex	0.0513	-	0.114	-0.00130	-	0.00242
	(0.0135)	-	(0.0113)	(0.00607)	-	(0.00443)
Marital status Married =1	0.00157	-0.00310	-0.00164	0.00415	0.0109***	0.00913***
	(0.00584)	(0.00647)	(0.00597)	(0.00262)	(0.00240)	(0.00233)
No Education	-0.0221	-0.0617**	-0.0578**	0.00807	0.0183	0.0176
	(0.0245)	(0.0309)	(0.0271)	(0.0110)	(0.0115)	(0.0109)
Primary education	0.0136	0.0798**	0.0565*	-0.0293**	-0.0230*	-0.0257**
	(0.0293)	(0.0340)	(0.0309)	(0.0131)	(0.0128)	(0.0123)
Secondary and above	0.0258***	0.0149***	0.0256***	0.00508	0.0152***	0.0154***
	(0.0285)	(0.0321)	(0.0298)	(0.0127)	(0.0120)	(0.0117)
Family Size	-0.00451***	-0.00365***	-0.00209*	0.000367***	-0.00643***	-0.00261
	(0.00763)	(0.00867)	(0.00794)	(0.00211)	(0.00191)	(0.00311)
Number of Adults	0.00554	0.0117	0.00653	-0.00224	0.00277	-0.00265
	(0.00919)	(0.0104)	(0.00951)	(0.00413)	(0.00386)	(0.00373)
Farm size	-7.56e-05***	-3.62e-05***	-2.69e-05***	9.17e-06	3.31e-05	2.91e-05
	(7.59e-05)	(7.67e-05)	(7.42e-05)	(3.33e-05)	(2.84e-05)	(2.82e-05)
Access to Credit (yes)	0.0251	0.0243	-0.0196	0.00795	0.0152**	0.0116*
	(0.0164)	(0.0185)	(0.0171)	(0.00739)	(0.00701)	(0.00679)
Saving	0.0269	0.0348***	0.0317***	-0.00746***	-0.00566	-0.0122***
	(0.0298)	(0.0349)	(0.0313)	(0.0133)	(0.0127)	(0.0122)
Own Housing	-0.0119	0.0645***	0.0448***	-0.00222	-0.0334***	-0.0265***
	(0.0159)	(0.0179)	(0.0165)	(0.00716)	(0.00661)	(0.00642)
Idiosyncratic shock index	0.125***	0.175***	0.171***	-0.00203***	-0.0121**	-0.0127***
	(0.0143)	(0.0130)	(0.0120)	(0.00653)	(0.00483)	(0.00470)
Year (2009)	0.0135***	0.0625***		0.00331	0.038***	
	(0.00407)	(0.0124)		(0.00458)	(0.343)	
Region1	-0.0265			-0.0366**		
	(0.0252)			(0.0152)		
Region4	-0.193***			0.0188**		
	(0.0335)			(0.0109)		
Region7	0.048***			0.0234***		
	(1.639)			(0.951)		
Constant	0.0346	0.0597	0.0757**	0.0277	0.0597	0.0757**
	(0.0959)	(0.0366)	(0.0359)	(0.0388)	(0.0366)	(0.0359)
Observations	1,461	1387	1,387	1,387	1,387	1,387

rho[14]	0.4306	0.2819	0.6481	0.5586

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As mentioned before fixed effect model is appropriate to explain the outcome more properly and the estimates of this fixed effect model are quite synonymous with the estimates of cross section analysis and Tobit random effect model Table 8 in the appendices.

The fixed effect model presents the impact of age which is negative on both measurement of income diversification. The gender variable is dropped from the fixed effect model as it is time invariant. Pre- secondary level of education has negative association with both measures while secondary and post-secondary association is positive and significant. The estimates indicate that each additional year of schooling above primary education increases both non-farm income share and time spent on non-farm income by 1.49 and 1.52 percentage point respectively. This implies as the educational level of the household become higher and higher, the lower commitment to get income from farm employment. As the result the household labor moves to spend more time on non-farm income generating activity.

Similar to the previous result, again the variable farm size has negative association with both measures of income diversification. This implies those households which possess more hectare of land spent much of their time on farm employment. As a result of this the share of non-farm income becomes smaller than share of farm income. In contrast household with less land holdings become risk averse and seek to diversify in order to smooth their income and consumption instability. The work of Walker and Ryan (1990) also attest there is an inverse relationship between landholding and the non farm income. In Ethiopia particularly densely populated areas are victims of the land constraint. As this land constraint is translated in to lack of basic needs the household is forced to engage in non-farm income generating activities.

Access to credit, savings and idiosyncratic shock index are also other key determinants as they have positive effect on both measured of income diversification. The estimated result indicate that a household that has access to credit are more likely to increase its time spent on non-farm employment by 1.52 percentage point compared to those do not have access to credit. Likely in rural Ethiopia savings between the two waves and idiosyncratic shock index

[14] 'rho' is known as the intra-class correlation and implies 43% of the variance is due to differences across panels in non-farm income share model and 64% in other model. (For more detail see Gujarati 2004).

are associated positively with non-farm income share and negatively time spent on non-farm positively.

Besides time effects are also incorporated in these models. The reason for allowing time effect is that the income diversification function shifts over time because of factors other than household characteristics, household labor resource, location of the household such as changes in the government policy, changes in technological environment, changes in government tax policies and other external factors like ethnic conflict and wars(Gujarati 2004). Accordingly the coefficient of time dummy variable implies that due to the aforementioned changes other than changes in the control variable the share of non-farm income and time spent on non-farm increased in 2009 by 6.25 and 3.88 percent respectively compared with year 2004. Therefore due to these other changes the Ethiopian rural households are also enhancing their non farm income share and their time spent on non-farm income generating activities.

Likewise the Tobit model with random effects is also estimated and reported in Table 8 in the appendices for the purpose of comparison. The marginal effects of the household characteristics and other factors are presented. The estimated result shows that some initial variables have positive power in explaining changes in both measurements of income diversification. Being male, having post-secondary education level, the number of adults, own housing and Idiosyncratic shock index all have positive association and effects on share of non-farm income growth and the growth of time spent on non-farm IGAs. On the other hand education below secondary level, marital states of the head, increase in the family size, land holding of the household are related by decreasing non-farm income share.

In general as the age of the household increases it reduces undertaking non-farm employment. Human capital is key asset which affects income diversification. The impact of education is very clear. As the level of education increases, there is lower initiative for the household member to generate income from farm employment. As the result they committed themselves on non-farm activities. Access to credit and savings are another key determinant to the non farm income. As the result of changes in these variables return to income diversification was significantly increased.

5.3 Effect of income diversification- indirect approach

As indicated in the theoretical and empirical framework when rural households face shocks such as harvest shortfall they move from agricultural operations to non-agricultural activities such as petty trade in order to smooth their income and consumption. Furthermore income earned from non-farm activities sometimes becomes a source of savings and the savings in turn are used to smooth household income insecurity. Accordingly this sub section deals with the effect of income diversification on the total income of the household through estimating [eq.3] stated under section 4.5. The result of estimation is presented in Table below. As we have seen in fig 4 the contribution of non-farm income to overall income is increasing over time.

The purpose of this sub topic is to estimate the effect of income diversification on measures of household consumption expenditure. However, it is quite likely that these two variables are endogenous as income diversification may determine consumption but consumption (poverty) may in turn determine income diversification because of reveres causality.

A common way of solving such problem of endogeneity is the use of instrumental variables estimation such as a two –stage lest squares estimation (2SLS). Because 2SLS assumes that suitable instrument exist. That means the instruments are applicable if they are correlated with supposed endogenous variable but uncorrelated with the error term (Ersado 2006). Also according to Gujarati (2004) when such problem occurs the methods of two stage least squares (2SLS) will give estimators that are consistent and efficient than OLS estimator. Because 2SLS assume the existence of appropriate instrument and in the process estimation the 2SLS replaces the endogenous variable with the predicted value of this endogenous when regressed on the instrument.

Even though using instrumental variable may solve problem of endogeneity , it is not easy to get variables that affect the two measures of income diversification but not likely to affect consumption expenditure of the household. Therefore, indirect approach is used as an alternative way to examine the link among income diversification and household consumption (Nghiem 2010). Accordingly this sub section will continue with this insight. Following the work of this author the two measures of income diversification and household consumption expenditure are included in the specification of indirect approach and estimated using common set of covariates. After estimation "common causation"[15] and trade-off are examined. Particularly the

[15] "common causation is identified by exogenous explanatory variables having the same sign in regressions for both escaping poverty and diversifying while the trade-off is indicated by opposing signs" (Nghiem 2010) cited Walle and Cratty (2004),

examination focus on identifying covariates that causes an increase on two measures of income diversification and household consumption.

Table 5 shows the estimation of household income diversification and consumption expenditure. Besides the FE estimates of income diversification, RE estimations are included in the output for comparison. However, note that in this approach as mentioned above problem of reverse causality is not explored. The examination only focuses on the effect of income diversification on consumption expenditure which in turn indirectly justifies the effect on total income of the household.

Table 5 Household income diversification and consumption expenditure, panel sample 2004/2009

Independent Variables	Dependent variable: Non-farm income share (NF)		Dependent variable: Share of time spent on Non-farm employment		Household consumption	
	FE	RE	FE	RE	FE	RE
Age of Household head	0.00247	0.00307	0.04305	0.0881	-0.0106	-0.00763
	(0.00219)	(0.00199)	(0.00079)	(0.0025)	(0.00414)	(0.00376)
Age squared	-2.79e-05	-3.65e-05*	2.88e-06	2.97e-06	0.0048	0.00114
	(2.43e-05)	(2.21e-05)	(8.90e-06)	(8.90e-06)	(4.61e-05)	(4.20e-05)
Sex		0.115***		0.00300		-0.0759***
		(0.0113)		(0.00457)		(0.0215)
Marital status Married =1	-0.00310	-0.00130	0.0109***	0.0109***	0.0293**	0.0284**
	(0.00647)	(0.00596)	(0.00240)	(0.00240)	(0.0122)	(0.0113)
No Education	-0.0617**	-0.0566**	0.0183	0.0178	0.102*	0.0776
	(0.0309)	(0.0271)	(0.0115)	(0.0115)	(0.0579)	(0.0509)
Primary education	0.0798**	0.0578*	-0.0230*	-0.0234*	0.0551	0.0928
	(0.0340)	(0.0309)	(0.0128)	(0.0128)	(0.0640)	(0.0581)
Secondary and above	0.0149***	0.0243	0.0152***	0.0157**	0.0115***	0.0301
	(0.0321)	(0.0297)	(0.0120)	(0.0120)	(0.0606)	(0.0562)
Family Size	-0.00365***	-0.00206***	0.00366**	0.0036**	0.00636***	0.00245***
	(0.00867)	(0.00794)	(0.00321)	(0.00191)	(0.0163)	(0.0150)
Number of Adults	0.0117	0.00625**	0.00277	0.00266	0.010	0.0119**
	(0.0104)	(0.00951)	(0.00386)	(0.00386)	(0.0197)	(0.0180)
Farm size	-3.62e-05	-0.000107***	-3.31e-05	-9.54e-06	0.0470***	0.00452***
	(7.67e-05)	(3.24e-05)	(2.84e-05)	(1.25e-05)	(0.000143)	(0.000139)
Access to Credit (yes)	0.0243**	0.0214**	0.0152**	0.0159**	0.0439***	0.0317***
	(0.0185)	(0.0170)	(0.00701)	(0.00697)	(0.0348)	(0.0322)
Saving	0.0348	0.0338	-0.00566	-0.00652	-0.645***	-0.505***
	(0.0349)	(0.0312)	(0.0127)	(0.0127)	(0.0659)	(0.0591)
Own Housing	0.0645	0.0449	-0.0334***	-0.0335***	-0.0305	-0.0376
	(0.0179)	(0.0165)	(0.00661)	(0.00661)	(0.0340)	(0.0312)
Idiosyncratic shock index	0.175***	0.172***	0.0121**	0.0121**	-0.355***	-0.341***

	(0.0130)	(0.0120)	(0.00483)	(0.00483)	(0.0247)	(0.0227)
Constant	-0.169*	-0.149*	0.0597	0.0619*	6.632***	6.306***
	(0.0999)	(0.0903)	(0.0366)	(0.0365)	(0.189)	(0.171)
Number of Observations	1,461	1,461	1,387	1,387	1,439	1,439
R-squared	0.312	-	0.065	-	0.328	-

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A relative examination of our fixed effect model as shows, age of the household, gender and marital status are not significant in the covariates estimate. However education of the household in post primary education level positively affects both measures of income diversification and consumption expenditure of the households and other level of education below secondary did not bear impact on both measures of income diversification and consumption expenditure. Also the estimated result indicated that post primary education increases non-farm income share , share of time spent on non-farm , and consumption expenditure by 1.49, 1.52 and 1.15 percentage point respectively. Unlike education the size of the household affects non-farm income share negatively and the share of time spent on non-farm employment and consumption positively. There is a trade-off between two effects.

Likewise access to credit increases both measures of income diversification and consumption positively. A 10 percentage point increase is related with a 2.43 percentage point increase on the share of non-farm income, a 1.52 percentage point increase on the share of time spent on non-farm income generating activity and a 3.17 percentage point increase in consumption expenditure. Besides idiosyncratic shock index is another variable that affect both measures of income diversification and consumption expenditure in common causation. In nut shell, the main point of indirect approach is that the same variable that drives rural household income diversification also drives increase in household consumption expenditure. Therefore based on these findings we can infer that there is a positive effect of income diversification on over all income of the rural household in rural Ethiopia.

6. Conclusion and policy implications

6.1 Concluding Remarks

In this paper we have examined the determinants and effects of income diversification in rural Ethiopia. The analysis shows that in rural Ethiopia the contribution of income diversification is increasing overtime. According to the study of Reardon et al. (2007) the share of non-farm income reported was 20 percent in 1999. The figure increased to 33 percent in 2009 as it is displayed in figure 4. This shows on average 33 percent of the household income comes from non-farm income diversification and the remaining is from agriculture. There are different reasons for the rural household to diversify their income. Some household diversify to solve the problem of insufficient land because of family size pressure, others to compensate crop or livestock loss. The result of this research in general shows that there is an obvious association among rural income diversification and living standard of the household. However there was an increase in the contribution of non-farm income to the total income during the two waves, non-farm income generating activities have limitations.

For empirical analysis panel data was used from the two recent waves of 2004 and 2009 ERHS. In the course of the analysis two objectives were explored. First, what are driving forces of spatial and temporal income diversification in rural Ethiopia? And second, how does income diversification affect the total income of rural households? In order to analyze the initial determinants of income diversification double censored Tobit model is used. Again to analyze the temporal or overtime determinants of income diversification three models: OLS, Fixed effect and Random effect models are estimated. However fixed effect is supported by the Hausman test. The effect of income diversification is analyzed through indirect approach through covariate estimates which includes both measures of income diversification and consumption expenditure.

To examine the determinates of income diversification both cross-section and panel data are used. The cross-section data set of 2004 is used to analyzed initial period determinants while 2004/2009 longitudinal data is used to examine the overtime change. In this case time-invariant variables are eliminated as fixed effect estimation is applied. Besides the analysis only show the effect of time -variant variable on the growth of income diversification.

Basically the panel data is used to control the effect of unobserved time-invariant variables such as capacity and motivation of the household. Hence it is used to analyze the effect of overtime change in the control variable on changes on the two measures of income diversification (Nghiem 2010). Unlike the cross- section data, the panel data result suggests that there is a change in both measures of income diversification not because of unseen fixed effect variables such as household motivation but it is due to time variant variables. In the analysis of initial determinants the estimated result suggested that there

is some resemblance in the variables affecting both measures of income diversification: non-farm income share and share of time spent on non-farm employment.

Even though it is not significant the increasing age of the household has negative impact on both measurements of income diversification and income diversification relies on the household labor resource. Other household characteristics gender and marital states has positive impact in the initial period. However the effect of gender is omitted in the fixed effect estimation. Similarly post secondary education of the household is found to have positive effect on both measurement of income diversification. The positive impact of education on income diversification is similar to the finding of Barrett and Reardon (2000) and Block and Webb (2000) which confirms access to educational attainment is one of the strong determinates of diversification. In contrast family size affects the share of non-farm income negatively and the share of time spent on non-farm employment On the other hand the presence of land constraint is one of the determinants that push household to diversify their income and access to credit, idiosyncratic shocks, and owning house are also found to drive the rural household in to non-farm income generating activity. However regional effects are likely to have equal influence on both measures of income diversification.

The Fixed effect results indicate the considerable similar positive influence of changes in education, human capital, and access to credit; savings and idiosyncratic shocks are other key determinants of income diversification. Changes on family size pressure reduce the share of non-farm income and landholding is found to have negative effect on the both measures of income diversification. Also the econometric analysis proof that the income diversification has positive and significant effect on the total income of rural household. The two modes also show the rural households have different capacity to engage in diversification. Education of the household, access to credit and remittances increases income diversification levels by providing an opportunity to commence their own business. In general the panel data result put forward higher non –farm income diversification causes higher income and higher household consumption.

Finally to analyze the effect of income diversification on the overall income of the household indirect approach is used and the finding of indirect approach is that the same variable that drives rural household income diversification also drives increase in household consumption expenditure. Therefore based on these findings we can infer that there is a positive effect of income diversification on over all income of the rural household in rural Ethiopia.

6.2 policy implications

Although it is not easy to make fundamental conclusion solely based on this analysis, some insights can be made from the findings of our investigation for the future policy intervention with respect to income diversification. So, what are the policy implications of this analysis? Or is it necessary to encourage income diversification in the rural Ethiopia? In deed the response is positive because the scope of increasing real income of rural households and bringing sustained improvement in their standard of living , solely through farming activities is seriously constrained. However the difficulty arises in building opportunities of non –farm income generating activities to the household that have less education, no access to financial institutions, and other commune problem. Therefore it is better to improve education in the rural area, financial institutions and financial systems plus other commune infrastructures as the finding indicated.

However to what extent does income diversification is needed? With regard to its extent economic theory suggests that instead of income diversification specialization permit households to exploit the comparative advantages and scale of economies providing profit and household income. But this is when the market works appropriately. If the market works in an appropriate way, diversification is related with the forgone earnings of the household. And also when there is failure in the market, these forgone earnings can be regarded as an informal insurance payment that the rural households are willing to pay (Babatunde and Qaim 2009).Therefore, the scope of income diversification is determined after analyzing whether the market is working properly or not. As markets in developing countries are imperfect due to factors such as information gap, focusing on income diversification is still mandatory.

Finally this research paper focuses on determinants and effect of income diversification at national level which is aggregated analysis. Therefore further study can be done focusing on regional income diversification in rural Ethiopia.

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Appendices

Table 6. Attrition between the two waves.

Year	Number of Household in the sample	2004		2009	
		HH Left/ died	Continuing HH	HH Left/ died	Continuing HH
2004	1,593		1,593	225	1,368
2009		255	1,593	255	1,338
Almost Balanced					

Source: Own calculation from 2004 and 2009 ERHS data

Table 7 Summary Statistics of dependent variables 2004 and 2009

Variables	2004		2009	
	Mean	S.d	Mean	S.d
Non-farm Income share	0.1239	0.2870	0.4239	0.7058
Share of Time spent on non-farm employment	0.4215	5.8224	0.6215	0.8224

Source: Own calculation from 2004 and 2009 ERHS data

Table 8 Summary Statistics of independent variables in the panel sample, 2004/2009

Variables	Observation	Mean	Std. Dev.
Age of Household head	988	0.1239824	0.2870585
Age squared	2487	1376.206	1728.453
Sex Male =1	2509	0.6365086	0.8214858
Marital status Married =1	2509	1.734954	1.31346
No Education	2509	0 .5898764	0.4919539
Primary Education	2509	0 .3567158	0.4791254
Secondary and above	2509	0.1841371	0.3876732
Family Size	2509	1.124352	1.682919

Number of Adults	988	1.277328	1.868529
Number of Children	988	0.4311741	0.9529562
Farm size	988	30.56654	194.2826
Farm size squared	988	38641.84	569217.4
Access to Credit (yes)	2509	0.63611	0.7837994
Farm Income	2509	405.4124	1206.96
Remittance	544	1.569853	0.4955522
Idiosyncratic shock index	2509	0.1992826	0.5585206
Own House	2062	0 .7652764	0.7961558

Table 9 . Over time determinants of income diversification panel 2004/2009 (Tobit model with random effects)

VARIABLES	Non-farm income share (NF)		Share of time spent on Non-farm employment	
	Coeff	Effect	Coeff	Effect
Age of Household head	0.0115	0.0051	0.00190	0.00013
	(0.00440)	(0.0019)	(0.00863)	(0.00061)
Age squared	-0.000131	-0.000058	-1.34e-05	-9.45e-07
	(4.84e-05)	(0.000219)	(9.47e-05)	(6.71e-06)
Sex	0.411***	0.1836***	0.0505***	0.0036***
	(0.0294)	(0.0149)	(0.0492)	(0.0035)
Marital status Married =1	-0.00939***	-0.0042***	0.0943***	0.0067 ***
	(0.0139)	(0.0062)	(0.0240)	(0.0022)
No Education	-0.165***	-0.0737	0.122	0.0086
	(0.0621)	(0.0279)	(0.127)	(0.0093)
Primary education	0.169**	0.0754	-0.322**	-0.0227
	(0.0741)	(0.0333)	(0.154)	(0.0117)
Secondary and above	0.0909***	0.0406***	0.328**	0.0232***
	(0.0714)	(0.0319)	(0.150)	(0.0112)
Family Size	-0.0104**	-0.0046**	0.0303**	0.0021**

	(0.0178)	(0.0079)	(0.0347)	(0.0024)
Number of Adults	0.0294	0.0131	-0.124**	-0.0088
	(0.0215)	(0.0096)	(0.0523)	(0.0039)
Farm size	-0.000277***	-0.00012***	0.00221**	0.00016**
	(0.000192)	(0.000086)	(0.00105)	(0.000069)
Access to Credit (yes)	0.0621**	0.0278**	0.0882**	0.0062**
	(0.0381)	(0.0170)	(0.0832)	0.0061
Saving	0.0390**	0.0174**	0.0434**	0.0031**
	(0.0693)	(0.0309)	(0.160)	(0.0113)
Own Housing	0.0918**	0.0410	-0.339***	-0.0239
	(0.0368)	(0.0165)	(0.0798)	(0.0075)
Idiosyncratic shock index	0.364***	0.1626***	-0.171**	-0.0121**
	(0.0261)	0.0146	(0.0561)	(0.0045)
Constant	-1.065***		-1.220***	
	(0.203)		(0.464)	
sigma_u	0.427***		0.906***	
	(0.0398)		(0.115)	
sigma_e	0.460***		0.448***	
	(0.0154)		(0.0390)	
Observations	1,461		1,387	
Number of hhid	188		181	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10. Rural nonfarm Income: case study evidence from the 1990s and 2000s in Africa

Country	Year	Composition of Non-farm earnings (% of total income)				
		Nonfarm Income share of total income	Local (%)	Transfers and remittances (%)	Ratio of local external non-farm income	Source
Ethiopia	1989-90	36	-	-	-	Webb an Von Braun(1994)
	1999	20	-	-	-	Deininger et al.(2003)
Ghana	1992	31	31	0.3	102.7	Winters et al.(2006)
	1998	42	42	0.1	417.0	Winters et al.(2006)

Ivory Coast	1993-95	7	-	-	-	Barrett et al. (2005)
Kenya	1994-96	29	-	-	-	Barrett et al. (2005)
Kenya, West	1993	80	53	27	2.0	Francis and Hoddinott (1993)
Malawi	1990-91	34	26	9	3.0	Peters(1992)
	2004	64	58	5	13.2	Winters et al.(2005)
Mail Southern	1994-96	6	5	1	5.0	Abdulai and Corle Rees (2001)
Mozambique	1991	15	14	1	25.0	Tschirly and Webber (1994)
Namibia, Unfavorable Zones	1992-93	93	16	78	0.2	Keyler (1996)
Namibia, favorable Zones	1992-93	56	37	19	2.0	Keyler (1996)
Nigeria , Unfavorable Zones	1989-90	52	33	19	1.7	Hopkins and Reardon (1993)
Nigeria favorable Zones	1989-90	43	38	5	7.8	Hopkins and Reardon (1993)
Rwanda	1991	15	-	-	-	Barrett et al. (2005)
	1999-2001	20	20	-7	-	Dabalen,Paternostro, Pierre(2004)
Tanzania	1990	11	10	1	10	Eliis (1999)
	2000	46	46	-	-	Eliis and Freeman (2004)
Uganda	1996	34	25	9	3.0	Canagarajah,Newman, Bhattamishra(2001)
	1999-2000	54	-	-	-	Balihuta and sen(2001)
Zimbabwe overall	1990-91	38	26	12	2.2	World Bank(1996)
Zimbabwe poor	1990-91	31	17	14	1.3	World Bank(1996)
Africa average		37	26	11	2.5	
Africa, excluding Namibia		34	28	6	4.7	

Source: Reardon et al.2007

Map 1. Ethiopian Rural Household Survey Villages.

Ethiopian Rural Household Survey Villages