ADDIS ABABA UNIVERSITY
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THE DETERMINANTS AND IMPACTS OF INCOME DIVERSIFICATION IN RURAL ETHIOPIA: THE CASE OF COMMUNITTIES IN SOUTHERN NATIONS, NATIONALITIES, AND PEOPLES REGIONAL STATE

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Abstract

This study examines the determinants and impacts of rural household income diversification. The analysis of this study is based on data taken from "Ethiopian Rural Households Surveys"(1997 and 1999) conducted by the Department of Economics, Addis Ababa University. To analyse the determinants of household's choice among different livelihood strategies and the level of income diversity, multinomial logit model that corrects selection bias was estimated for five distinct livelihood strategies. The effects of income diversification on rural equity and consumption insurance against idiosyncratic income shock were analysed using Gini decomposition technique and linear regression model, respectively.

The results indicated that the asset endowment of the household has a significant effect on households' choice of livelihood strategy and the level of income diversity. They also show that the effect of asset on livelihood choice and income diversity is dependent on the type of asset as well as on the particular livelihood strategy. Empirical evidences revealed that farm land holding, distant to market, involvement in cash crop production, ox holding, use of agricultural extension and possession of senior secondary education by head lower the likelihood of involvement in livelihood diversification.

On the other hand, labour supply, livestock holding, junior secondary education attainment of head and age of head increase the odds of pursuing livelihood diversification relative to pure-farm strategy. The variation in level of income diversity for more attractive strategies was explained by access to credit, livestock endowment, farmland size, transfer income, involvement in cash crop production, and household composition (number of adult male and female members). Similarly, the variation in level of income diversity for easy entry strategies was explained by laobur supply and frequency of market. Generally, the study shows the importance of liquid assets (livestock, cash crop, credit, transfer income), access to markets,

demographic characteristics (composition, gender, size), and education in choice of different livelihood strategies and their effects on level of income diversity.

The analysis of Gini decomposition technique revealed that the rural equity effect of diversification is dependent up on the type of livelihood strategy, level of income diversity and village characteristics. Regarding the effect of sources of income, wage employment and off farm business have inequality increasing effect as opposed to crop farming and livestock rearing which have inequality decreasing effect. The finding also showed that higher level of income, lower rural inequality, better consumption smoothing could be achieved at higher level of income diversity. Again, the findings indicated that the impacts of diversification on income, rural inequality and consumption smoothening vary across livelihood strategies. Our estimation results for consumption insurance showed that households who involved farm easy off farm strategy are the most vulnerable to income shocks followed by pure-farm strategy.

CHAPTER 1. INTRODUCTION

1.1. Background

Rural households in developing countries live in inherently risky environments. They suffer from various common and idiosyncratic shocks[1] that make these households vulnerable to serious hardship. Dercon (2001) examined risk related hardships faced by rural households in Ethiopia for the last 20 years and explained that climatic risks are the most common cause of shocks (78%). Many households also suffer from other common or idiosyncratic shocks such as policy shock (42% of households), labour problem (39%), oxen problem (35%), other livestock and land problems (17%) and other risks. These events and shocks may highly influence the actions and resource allocation decision of rural households.

As in most developing countries households in Ethiopia operate in an environment characterized by resource or market constraints. Tassew(2000), for example, explained that rural households in Tigary region are not fully integrated into markets. The resource and market constraints may preclude households from expanding their income generating activities to the level that satisfies the basic needs of household members. Rural areas in developing countries are characterized by high price variability, poor infrastructure, low demand, insufficient access to resource which, in turn, lead to market failure for certain products and factors of production (Dunn, 1997; Reardon, 1997;De Janvery, 1995). For example, lack of financial resource (credit) may prevent households from expanding profitable income generating activity. Acute land constraint and absence of well operating land market may prevent households who possess particular skills or abundant labour from exploiting their comparative advantageous position. In Ethiopia, rural land holding of over 65

[1] Common risks are shocks that affect every member of a community while idiosyncratic risks are shocks that affect a particular individual in a community.

percent of farmers fell below 1 hectare and it is cultivated only once a year (Mulat and Teferi, 1996). In such situations, households may allocate its underutilized resources to alternative accessible activity.

Agriculture, the dominant sector of Ethiopian economy, is mainly characterized by rain fed, subsistence oriented, smallholder production system and traditional farming practices. The other factors related to poor agricultural performance are reduced soil fertility, unreliable climatic conditions, poor infrastructure, environmental degradation, and land scarcity have resulted in low crop yields and income variability, on the one hand and high population growth rate on the other. Thus, agricultural production fails to keep pace with population growth rate in the last 3 decades. As a result, quite a significant proportion of population lives in poverty. Although different studies showed various figures for poverty estimates, the National Food Security Strategy document indicated an estimate of 45% of total population in 1995/96. It also revealed that the incidence of food poverty is estimated at 52% in the rural area and 37% in the urban areas. This indicates that food insecurity is more severe in rural areas. Wolday (2002) noted that actual consumption of calories is estimated to be on average 20 percent below minimally accepted nutritional standards in Ethiopia.

Households that are in risky environments and which experiences resource constraint, market failure and low agricultural yield have developed complex ex ante risk management strategies. Dunn (1997) outlines four possible motivations for income diversification, which is one of the risk management strategies. These motivations include poverty, risk reduction, expansion and intergenerational lunching motivations. Households engage in several distinct income generating activities to smooth their income, consumption, labour allocation, and to cope with shocks and to solve liquidity constraints (Reardon, Delgado and Matlon, 1992;

Rosenzweig and Binswanger, 1993). Diversification smoothes the flow of income of households by combining activities which give returns at different time and by diversifying portfolio of economic activities that are not perfectly covariate (Valdivia et. al, 1997). Households that engaged in different activities collect their income and wealth from diverse sources and assets. As income smoothening mechanism, income diversification plays an important role in smoothing consumptions when markets for full consumption insurance are absent (Morduch, 1995).

In the past Ethiopian policy makers considered the rural sector as synonymous with agriculture. The rural income was equated with farm income. Policy makers, influenced by these views, focused primarily on industrial and to certain extent on agricultural development as the way to reduce poverty and achieve sustainable economic growth. The Past governments failed to create favorable conditions that promote the development of non-farm rural sector and alternative income and employment opportunities for rural households. Although the Derge regime favored the promotion of rural handicrafts and industrial activities under the cooperative arrangement, the property ownership policy followed by the regime discouraged the development of non-farming activities in rural areas [Mulat and Teferi, 1996].

In recent years, there is an increasing recognition of the importance of income diversification for rural household in Ethiopia. Considering the dominance of the agrarian economy, ADLI (Agricultural Development Led Industrialization), the government's principal strategy for sustainable economic growth, focuses on the development of the rural sector. An important aspect of ADLI is to promote the rural non-farm sector and enable it to interact with agriculture. The main view of ADLI is that agricultural growth, based on technological advancement, leads to indirect growth in non-farm incomes and employment through processing, marketing and transporting services. In addition, both national and regional food

security strategies have emphasized the expansion and development of off farm income and employment generating activities in rural areas as a means to ensure food security, to reduce poverty and to achieve sustainable economic growth.

1.2. Problem statement

High-income risk is part of life in rural areas of developing countries. Seasonality of farming activity results in unemployment and underemployment for a significant proportion of the labour force during most part of the year. The level of unemployment/ underemployment in Ethiopia is estimated at 25 to 40 percent of the labour force (Mulat and Teferi, 1996). This coupled with other economic and natural factors aggravates the problem of food insecurity.

A large proportion of rural dwellers have been suffering from both chronic and transitory food insecurity in Ethiopia. This problem of food insecurity is more severe at local or regional level than at national level. For example, the position of Southern Nation, Nationalities and Peoples' Regional State (SNNPR) registered a poverty incidence estimate of (56%), a figure much more greater than the national average (45%) (FDRE, 2002) and the estimated regional average calorie consumption (1800 calorie) per person per day is below the national average calorie consumption (1965 calories). With in rural households, some households suffer more severely than others and identifying this vulnerable group is important in tackling the problem.

In recent years there has been an increasing emphasis on the rural livelihood diversification. SNNPRS has considered the importance of various rural sectors, on which the regional economy predominantly depends, and where about 93% of population lives. Both the regional development action plans and its food security strategy recommend the promotion and

development of rural micro enterprises and non-farm sectors to achieve the intended development goals.

In rural Ethiopia, where farming is the main means of livelihood, households tend to diversify their income sources due to both push and pull factors.[1] Rural households are usually engaged in multiple activities both within agriculture and across non-farming activities. Some households might depend exclusively on crop farming for their livelihoods. Some households might diversity their income source into wage employment, while others involve in mixed farming. Still others might try to exploit opportunities of rural non-farming activities in the densely populated area.

Until recently, the magnitude and the role of non-farm sector has not been known in Ethiopia. Few empirical studies in recent years have indicated the contribution of off farm sector to employment generation ranging 25.1% to 81% and to total household income with sharing range 18.7% to 59.5% in rural areas (MOSLA.1997; Delil, 2001; Tassew, 2000; Mulat and Teferi, 1996. Most of these studies focus on identifying determinants of occupational diversification, household participation in off farm wage employment and off farm self-employment or both. Few of them try to show the factors that determine the choice of household between off farm self and wage employment e.g. Tassew(2000) and the role of non farm activities on poverty alleviation, farm output growth, and the effect of specific source of income on rural income distribution.

However, many rural households combine simultaneously the base livelihood- farming- with either wage employment, livestock production, off farm business or both to earn income from

[1] To use Readon et al (2000) terms. Pull factors are related to presence of economic and natural risks while push factors are linked with exploitation of new available economic opportunities.

diverse sources. Consequently, majority of rural households diversify their livelihood by taking up diverse income generating activities at the same time.

Most of previous studies fail to consider all household's activities and income sources that reflect diversification behavior of rural household. Therefore, this study tries to fill this gap and considers different livelihood diversification strategies and entry constraints in the analysis. It is suspected that there may be selection bias in sampling and reporting where some households may have reported only one occupation even though they have chance to participate in other occupations. Consideration to selectivity bias created by the joint decision to participate in livelihood strategy and maximizing the level of income diversity is also important.

Few studies attempted to examine the determinants of the level of income diversity. But these studies tried to conflate the different reasons for pursuing different livelihood diversification strategies. In addition, to enhance the gain from rural income diversification, one has to identify the factors that smooth or hinder the capacity of rural households to undertake different activities that generate income from diverse sources.

Although the motives to rural income diversification vary, one needs to consider the interaction of income diversification with rural income distribution and consumption. Rural income diversification may have both negative and positive consequences on distribution and consumption. Since disagreement as to the rural equity effects of diversification is still unsolved, alternative approach to look into the issue become necessary. Our approach differs from previous studies in that it tries to examine the equity effects of

different livelihood strategies across different agro climate and level of income diversity groups. The studies on the impacts of level of income diversification and different livelihood strategies on consumption smoothing are limited. Thus, recognition of the importance of non-farm income is not sufficient. Despite its growing share in total household income and rural employment, the study on the impact of income diversification on rural equity and household consumption smoothening lacks detailed analysis in Ethiopia.

This paper is, therefore, intended to examine the determinants of income diversification and its impacts on the rural income distribution, level of total income and on household total consumption smoothening in SNNPRS.

1.3 Objective and Significance of the Study

The main objective of the study is to examine the determinants of rural household income diversification and its impacts on household consumption smoothening, income and rural income inequality. More specifically the study will: -

- Identify factors that influence household's livelihood choice;
- Examine the determinants of level of income diversification;
- Look into the equity effects of different livelihood strategies, level of income diversification, and diverse income sources;
- Investigate the impacts of level of income diversification and different livelihood strategies on consumption smoothening, and
- Draw some policy implications.

The majority of rural household tend to engage in a number of income generating activities. However, there have been made little attempts to link systematically diversification behavior of rural household to rural development and poverty reduction policies. Neglecting such behavior may result in unexpected outcomes of priority sector due to fungibility of resources to other purposes. The results of this study enhance, hopefully, our knowledge of livelihood diversification strategies that rural households pursue to ensure income security and to smooth consumption.

The identification of factors that influence livelihood diversification and income diversity provides important information to policy makers in designing appropriate policy mix that support the process of livelihood diversification.

Income diversification has a complicated interaction with level of income, income distribution, welfare, vulnerability, gender relation, poverty and other variables. A better understanding and information on the nature of these complex interactions is needed for policy interventions. For example, the poverty reduction policy and sustainable rural development strategies require detailed information on the link between asset endowment and income of rural household, on the impact of income diversification on rural income distributions and household consumption. This study is expected to give a better insight in this regard.

The results of this study are expected to help policy makers in formulating effective policies aimed at alleviating rural poverty and achieving rural development by providing information on the linkage between asset endowments, diversified activities and income generated at rural

household level. By identifying the determinants of income diversification and its impacts, the output of the study is expected to indicate the policy interventions that might improve rural livelihoods. The expected beneficiary of the output of this study includes the SNNPRS, researchers, practitioners, and other users.

1.4 **Organization of the thesis**

The rest part of the thesis is organized as follows. The review of relevant literature on the subject has been discussed in chapter two. Chapter three deals with data sources, methodology and econometric model specification issues. Estimation of the models and empirical analysis of the results has been described in chapter four. The last chapter has been devoted to the summary and policy implications. Supplementary information has also been annexed at the end of thesis.

CHAPTER 2. LITERATURE REVIEW

A number of recent researches examine aspects of income diversification, consumption smoothing and rural income inequality. We review the most relevant literature on these subjects.

2.1 Conceptual Framework

The traditional approach for economic growth and poverty alleviation focused mainly on increasing the productivity of agriculture and on government provision of social services to rural communities through land reform and integrated rural development programs. This approach has ignored not only the contribution made by livelihood diversification to rural communities but also the great degree of heterogeneity of the position across rural households (Ellis, 1998).

Many studies confirm that rural household in Africa and Asia do not normally specialize in specific kind of activity, such as livestock or crop production, to total exclusion of other income generating activates and majority of rural producers have historically diversified their productive activities to include a range of other productive activities (Hussein and Nelson, 1998;Barrett and Readon, 2000).

Recent literature on rural livelihood and livelihood diversification is characterized by many terms and definitions. In this study the concept of livelihoods is defined as the opportunity set afforded to an individual or household by their asset endowments and their chosen allocation of those assets across various activities to generate a stream of benefits, most commonly measured as income (Barrett and Readorn, 2000). This definition implies that the opportunity set of a household is formulated from access to assets and activities. It also shows the

importance of the link between assets, resource allocation and activities in generating benefits. Livelihood diversification can then be defined as the process by which households construct a diverse portfolio of activities and assets in order to survive and to improve their standard of living (Ellis, 1998). In this study livelihood diversification includes both on and off farm activities that are undertaken to generate additional income to that from annual crop production.

The term income diversification has been given wide varying definitions. Ellis (1998) distinguishes income diversification from livelihood diversification by defining the former as the composition of household incomes at a given instant in time while livelihood diversification is considered as an active social process where by households are observed to engage increasing intricate portfolios of activates overtime. Other studies also define income diversification as prevalence of different income sources in household income at a given time (Reardon et al, 1992; Dunn, 1997; Valdivia et al, 1996; Tassew, 2000; Escobal, forthcoming). However these studies differ in measurement of income diversity and categorization of income sources. Some of them use share of non-farm income in total income while others measure income diversity by Simpson's index. These differences in measurements of income diversity may be the sources for some contradicting results with respect to consequences of income diversification. Like Dunn (1997) and Valdivia et al (1996), this study uses the inverse Simpson's index to measure income diversification.

The literature offers two contrasting view on livelihood diversification. While the first view takes livelihood diversification as positive strategy of adaptation, which can lead to accumulation, the other view considers it as a residual sector that offers no more than a bargain basement for distress (Start, 2001). Start (2001) further notes that the major

distinctions between these strategies are based on the kind of technologies in use, size of capital, the motive and sectoral dynamism of the strategy.

Economic studies distinguish between several different categories of income sources in diverse income portfolios. Economic theory predicts that activities with high entry barriers offer high returns while those with low entry constraints generate low returns. Such heterogeneity in returns surely account for some of variation in observed income diversification pattern (Barrett etal, 2000). The reasons for holding different income portfolios and livelihood diversification pattern are associated with labour market segmentation, barrier to entry, location and potential income growth (Reardon, 1997). Barrett et al (2000) attribute these differences to existence of rural market failures (particularly in land and finance), differential market access, quality difference in factors of production, and differences in property rights and endowments of assets.

Barrett et al (2000) identify four distinct rural livelihood strategies offering different returns. Similarly, Dercon and Krishnan (1996) categorize several different rural household activities in to five different income portfolios based on level of entry barriers. This is the approach taken in this study. In this study, rural is any locality that exists primarily to serve agricultural hinterland. Data for this study is collected from farmers association, the lowest administrative unit of settled rural area. A rural household is then a household that lives in the countryside and involves both in farm and non-farm activities.

The term off farm business income refers to net income derived from non-farm self-employment while wage income is net income eared from both farm and non-farm wage employment. Farm income include income from crop production after deducting expenses on

purchased inputs, imputed value of home in-kind consumption from own production and income from land rent and share cropping. Livestock income represents the sum of net income from livestock transaction, income from animal rent, sale of animal products and imputed value of home consumption from livestock products. Transfer (gift) includes pensions, remittance, food aid, other government and nongovernmental gift.

2.2 Empirical Literature On Patterns and Determinants of Income Diversification

Chaplin et al (2002) examined non-agricultural diversification of farm households and corporate farms in Eastern and central European countries. By applying the multi-nominal logit analysis to examine the effect of different factors on diversification decision, the finding of study showed that general education level and availability of public transport have positive and significant effect on diversification, while agricultural education, use of agricultural advice and extension, non labour income, distance to public transport have a significant negative effect on off farm employment. With respect to impediments to enterprise diversifications, the study indicated that the major reasons were a desire to focus on farming, lack of capital or credit, insufficient knowledge and skills, and location characteristics. The study recommended that improvement of education and providing vocational training may help to overcome the impediments, and provision of financial resources with loan guarantees and interest rate subsidies to enterprise start up. The study concluded that there is little evidence that farmers will serve as driver of rural structural change due to small size of household farms, low level of farmers' education, and that diversification might be a feasible

way out of vicious circle of fragmented farms, low productivity and poor profitability by improving the asset base and education of poorest farms.

In their review of broad theoretical and case studies in livelihood diversification, Hussein and Nelson (undated) pointed out that poor people have to diversify sources of livelihood in order to survive in risk prone and uncertain world and hence build up a wide portfolio of activities to provide flexibility among sources of income. They argued that different income portfolio held by households can be explained not by their behaviors toward risk but by the ability of household's access to the means required to pursue such activities such as skills, location, livestock ownership, access to capital and credit. From their review of previous studies Hussein and Nelson (undated) indicated different seasonal coping strategies in India. These include diversifying income source, migrating, stocking up on various supplies, mortgaging or selling assets, sharecropping, borrowing and lending, drawing up on the various forms of social and family relationship, and participating in relief work. The study also summarized the constraints of livelihood diversification as: a low population, no urban center in proximity, market access, restriction on trade and movement, government policy that extract surplus, availability of infrastructure, labor availability, terms of trade, limited availability of education and skill training, shortage of time, norms and religions, lack of credit.

Escobal (forthcoming) shows that the pattern of income diversification between farm and non-farm activities is clearly linked to the assets or endowments of rural household. The study also noted that under the situation of imperfect or missing market, personal and institutional constraints can play an important role in determining participation in non-farm activities. The study further noted the critical role of households wealth, private and public asset

endowments, and regional characteristics in enhancing or hindering the profitability of household asset base.

Based on review of literature, Escobal(forthcoming) pointed out that the changes in composition of rural incomes varies with wealth when analyzed at the individual, household, or regional level, which is conditioned by credit constraints as well as access to infrastructure. Evidence also shows that rural households in developing countries earn more from own farming than other income sources. It is only in a few countries that the importance of non-farm incomes is greater than own farm income. Escoba(forthcoming) indicated, from the survey of literature, that poverty can be explained by the differences in allocation of physical, financial, human and organizational assets, and the endowment of public goods as well as the combination of public and private assets, which may enhance the chance of rural poor to diversify incomes. The study revealed that access to public goods and services together with an adequate endowment of private asset (especially education and credit) can improve access to self employment, non agricultural as well as wage employment income sources in Peru. As they account 51% of net income of Peruvian rural households, activities outside farming, as suggested by study, should not be considered as marginal. The determinants for income diversification in rural Peru are insufficient land, cattle, farm capital, education and skills, credit, access to road and electricity.

Review of studies on non farm income diversification and livelihood strategies in rural Africa by Webb et al (2001), Reardon(1997) identified that skills and educational attainment, greater physical access to market, public services, ex ante endowment of financial capital and other assets (livestock, cash cropping, migration), family size and structure as key determinants of household participation in off farm business and non farm earnings.

Using panel household data from three agro ecological zones in Burkina Faso, Reardon et al. (1992) showed that land constraints did not drive income diversification, but shortfalls in cropping income and changes in terms of trade are found to drive farmers towards diversification strategies; Cash cropping did not appear to be a substitute for non-farm diversification activities. The study further suggested that the role and root of income diversification differ widely by agro ecological zone. They suggest that households have to diversify their incomes geographically as well as sector-wise to compensate for cropping outcome variation and risk. This finding supports that diversification can spring from poverty, stagnation, and instability as well as dynamic agricultural base.

As to the pattern of income diversification, studies found that the existence of substantial entry or mobility barriers (particularly in labor market and financial and credit) to high return niches within non-farm economy and Poor tend to have less diversified asset and income portfolio and enter only into less remunerative activities (Webb et al, 2000; Ellis, 1998; Bezuneh et al, 2001; Reardon et al, 2000). Recent studies emphasized that difference in risk preferences seems insufficient to explain observed difference in income diversification (Dercon and Krishnan, 1996; Barrett et al, 2000). Reardon (1997) explains the difference income portfolios and livelihood diversification pattern are associated with labour market segmentation, barrier to entry, location, potential income growth while Barrett et al (2000) attribute these differences to heterogeneity in incentives and constraints facing rural household in Africa and note that existence of rural missing market or market failures (particularly in land and finance), differential access to market, quality difference in factor of production, and differences in property rights and endowments of assets across households play an important role in diversification behaviors.

From a review of case studies and literature across zones with diverse characteristics such as climate, population density, infrastructure, and distance to town, Reardon (1997) showed several correlations between these characteristics and rural household earnings in the non-farm sector. The findings can be summarized as:

i) There is a negative correlation between agro climate of the zone, and the share of income earned in migration by households in the zone. The result suggests that when the agro climate is unfavorable, migration provides more earning for household than participating in local non-farm activity and the reverse holds for favorable agro climate zone.

ii) There is a positive correlation between the agro climate level of the zone and importance of services and commerce in the local non-farm sector.

iii) Controlling for agro climate, the more dense is infrastructure and population, the greater are earnings from the rural non-farm sector. Density lowers transaction costs and raises absorptive capacity.

iv) Farm sector characteristics affect the size and nature of the non-farm sector. The type of technology applied in agriculture and agricultural product processing and input requirements affect the derived demand for non-farm labor.

v) Forces outside the rural economy influence labor in the rural non-farm economy. For example, booms in the mining and oil sectors, reduction in migrant jobs, cuts in public job and urban formal sector affect the rural non-farm sector not only through labour demand and supply movements but also enterprise diversification.

Bezuneh et al (2001) examined the policy effect on income diversification pattern in Kenya and Cote d'Ivoire. Using both longitudinal and cross sectional data, they observed that households with poor endowment in Cote d'Ivoire were less able to respond to attractive emerging on farm and non-farm opportunities. Due to entry barriers to superior livelihood strategies the benefits of exchange rate reform accrued disproportionately to households that were richer prior to devaluation while food-for work transfers to households in Kenya significantly reduced liquidity constraints enabling participant households to pursue more with lucrative livelihood strategies in farm activities and high return agricultural production. The study concluded that interventions aiming to relieve poor households' working capital, skills and market access constraints are needed in order to overcome entry barriers to diversifications.

Winters and Corral (2001) analyzed household's assets, activities and income generation in Mexico Ejido sector showed that a household's asset position has a significant effect on its participation in specific activities as well as on the level of income earned from those activities. This supports the argument that assets are important in determining the capacity of households to under take certain activities. The result of the study showed not only that partial analysis of income generation can potentially lead to incorrect conclusions about the role of a particular asset in income generation but also the critical role of social and public capital in household participation in activities and the level of income generated from each activity.

Winters and Corral (2001) indicated that the location of the household relative to urban area, lack of formal production arrangements, the type of infrastructure access by households, are important in influencing participation and level of income generated from each activity.

Furthermore, the study examined the role and return of different assets in undertaking various activities. These assets include rain fed land and livestock ownership, irrigation and tractor ownerships, remittance income, education, experience in off farm activities, household composition, credit, migration. They concluded that assets play a variety of roles in generating income in each activity and recommended that in designing intervention policies the government should recognize the potential fungiblity of assets, the role of social and public capital, the social fabric of the community, and the provision of general infrastructure to improve income level of the households.

Reardon et al (2000) recognized the importance of income and asset diversification in Africa for at least the next several decades due to both push and pull factors of diversification. Factors such as high contribution of diversification to total income, the expansion of market access, the shift from production of traditional goods to modern good, the expansion of non farm sector, urbanization and infrastructure improvements were regarded as push factors while market variability, climatic risks, resource constraints which forces household to engage in diverse activities were categorized as pull factors.

Based on survey of evidences and literature, which noted some surprising departures from traditional images of non farm activities, they indicated that high average share of non farm income (45%), high level of non farm wage labor income relative to self employment income, greater amount of non farm earnings as compared to both agricultural wage and migration earning excluding southern Africa, and poor distribution of non farm earning which may indicate the existence of entry barriers and market segmentation. They also identified the determinants of diversification as the existence of market failure such as missing and imperfect market, diminishing or time returns to assets, friction for mobility to entry high return niches, risk management, and the existence of economies of scope for production

Valdivia et.al (1996) tested the effect of the existence of effective ex post loss management mechanisms on the incidence of diversification among a sample of semi-subsistence households in the Bolivian Altiplano. Motivated by the argument that the incentive for ex-ante risk reducing strategies, such as diversification, should be lowered when a household has effective mechanisms for dealing with losses ex post, they find that the hypothesized inverse relationship between liquid asset (number of sheep) and level of diversification was not supported by the regression results. This evidence suggests that the availability of assets in the form of sheep is not associated with a decrease in the incidence of income diversification among households. They argue that extreme high level of risk in the economic and natural environment and the low absolute levels of household income may motivate households to seek diversification.

They also state that the reason for different levels of diversification is variation in access to productive resources. As to the alternative motivations for diversification, they point out that these may include smoothing labour supply for high degree of seasonality of agriculture, holding sheep as means of store of value and source of protein. Another finding of the study is that there is a strong statistical relationship between family cycle (productive household) and diversification.

Ellis (1998) summarized the literature on rural livelihood diversification and household strategies in developing countries. Income sources are primarily grouped into farm, off farm and non-farm income. He identified two reasons behind livelihood diversification: desperation (poverty, lack of assets, vulnerability, disaster) and; choice and opportunities involving proactive household strategies for improving living standards. With respect to the features of income diversification for risk reasons in developing countries, he states that most of the income earning opportunities open to poor households, for example own farm and agricultural

wage labour exhibit high correlation between risks attached to alternative income streams. Diversification into non-farm income, by contrast, can result into low risk correlations between livelihood components.

Ellis argued that some of the main determinants of diversification are seasonality, differentiated labour markets, risk strategies, coping behavior, credit market imperfections, and inter temporal saving and investment strategies. The study suggests some appropriate mix policies include education (human capital investment), provision and improvement of infrastructure, provision of credit, provision of target safety net, and creation of conducive environment for development of grass roots initiatives such as promotion of small-scale enterprises.

2.3 Empirical Evidences on Effects of Income Diversification

Ellis (1999) examines livelihood diversification as a survival strategy of rural households in developing countries. The study indicates both negative and positive effect of diversification. The positive impacts of diversification include labour smoothing for seasonality, risk reduction, generate higher income, improve asset use, provision of environmental and gender benefits. Some negative effects of diversification are disequalising effects on rural income, stagnation on the farm output (for some type of diversification), and adverse gender effects. Ellis argues that on balance the positive effects of diversification appear to outweigh its disadvantages. The study recommends that diversification needs to be placed at high policy agenda and be applied most forcefully in context of high seasonality, high risk, absent market, poor infrastructure, declining farm size and similar adverse effect.

With respect to the effects of diversification on incomes, Ellis (1998) pointed out that diversification might be expected to smooth income by reducing the risk of income. There are

two opposing views with respect to effect of diversification on income distribution. One view is that diversification has broadly equalizing effect on rural income. The other view is that diversification has disequalizing effect on rural income. Ellis noted that this does not have to be inconsistence with critical role of income diversification and suggested important reason for this as lack of access of asset of the poor and their exclusion from more highly remunerated labour market i.e. skill and education.

From their review of various studies Webb et al (200) show the effects of income diversification. Major findings include:

- The existence of widespread non-farm income diversification in rural Africa.
- Strong positive relation between non-farm income share and total household income.
- More income diversification associated with higher welfare measured in both income and nutritional term
- Strong association between greater income diversification and higher wealth and income.
- Non-farm earnings associated with increased income inequality.

Reardon (1997) showed that the distributions of non-farm income over households tend to be more equal in favorable agro climatic zone and/or zones with better infrastructure. In unfavorable agro climate zone, non-farm income increases the inequality of the size distribution of income in the zone. Reardon et al (1992) pointed out that income diversification was associated with those in higher income groups and food consumption, and more stable income and consumption over year.

With regard to the effect of diversification, Reardon et al (2000) pointed out the existence of little controversy as to short term effects on food access by explaining households with greater income diversification enable to finance bad climate driven food deficit and rural non farm income as major source of precautionary saving for household in poor areas.

Disagreements as to the long-term food security and rural equity effects of diversification still continued because evidences were quiet mixed for these points. Although the survey of case studies from different region did not find significant difference of malnourished poor households and non mal-nourished household dependence on non farm incomes, the argument that due to competition between off farm work/cash cropping and food production would lower the level of food availability and hence lead to malnutrition, is still debated. Finally, they suggested that the net distributional effects of diversification pattern depend on the nature of barriers to entry and ex ante wealth conditions.

Mace (1991) tested implications of full consumption insurance using U.S household survey data. The study showed that individual consumption responds to aggregate risk but not to idiosyncratic risk. Cochrance (1991) uses U.S. data on the growth rate of individual food consumption from 1980 to 1983 to test full insurance model. Cochrance showed that consumption changes are strongly related to income changes contrary to Mace's (1991) results. While Mace result is the most supportive of risk sharing, Cohrance result rejects the full insurance model, which is consistent with other findings.

Townsend (1995) discussed the availability of financial institution, market or technologies for insurance and the correlation or insurability of various risks facing people in developing countries. He points out that evidence on actual households from a number of developing countries suggested that the income households in a village or region move together much less than that one might have expected. This is because households earn their income in

different ways subject to different risk, and idiosyncratic shocks are large even across household incomes with in villages or common region. Deaton (1998) finds similar result that common components for particular villages explain very little of variation of household income change within village. With respect to patterns of occupation groups, entrepreneurs have no common fixed effects at all. Idiosyncratic shocks among entrepreneurs loom large, as would the possibility for within group insurance.

The empirical evidence on risk sharing in the three ICRISAT villages in India shows relatively low influence of present household income on present household consumption which is statistically positive and rejecting the hypothesis of full insurance (Townsend, 1994). The regression results based on data from Thailand shows an overwhelming rejection of full insurance. The idiosyncratic income coefficients are relatively high and significant being more or less uniform across regions. The study further indicates that income elasticities for entrepreneur groups (non farm activities) are higher than for all household with exception of some regions, suggesting that less insurance & little pooling of risk among the entrepreneurs in contrast to farmers who do much better.

Morduch (1995) examines the empirical importance & costs of income smoothing and its role in evaluating the functioning of credit and insurance mechanisms. The study notes that the general findings of empirical test for consumption smoothing is real and significant, as household consumption does not track household income, but consumption smoothing is not prefect. Townsend (1995) finds evidence consistent with extensive, but not perfect, risk sharing in villages as discussed earlier. Morduch (1995) argues that when full markets for consumption smoothing do not exist, income smoothing can and should play an important role in dealing with risks.

Morduch also argues that the degree of income smoothing will depend on the amount of risk, the degree of risk aversion, and the extent to which other consumption smoothing mechanisms are available.

Maitra (2001) examines the extent of consumption insurance against income risk by household in rural India and tests a systematic wealth effect on consumption insurance by classifying households on the basis of landholding. The findings show that the null hypothesis of full insurance is rejected both for the population as a whole and for the different land classes. The estimation results also show that consumption tracks income more closely for poorer households-the estimated marginal propensity to consume out of idiosyncratic change in income is significantly higher for the poorer households compared to the richer households.

Jalan and Revallion (1998) examined whether poor are less insured against income risk or not using six year panel of sampled households in rural areas using the data stratified by wealth groups and treating income and household size as endogenous variables. The risk insurance model is estimated by generalized method of moments. The results of regression showed that the null hypothesis of perfect insurance against income risk is rejected for all wealth groups including the riches. The study found that the effect of idiosyncratic income shock on consumption varies cross the different wealth groups, i.e. the lower the wealth, the more closely consumption tracks income and that in both poor and non poor areas household consumption co move with household income more closely for the wealth group. In short, the tests suggest that rural households are not fully insured against idiosyncratic income risk and the rejection of the full insurance model is strongest for the poorest households in terms of wealth. The finding also indicates that the poor seem to be the least well insured against idiosyncratic income shocks. The regression results using lagged non farm income as

instruments indicates that it is only for the poorest group that the coefficient on the change in income variables significantly reduced although the poor are still the least well insured against idiosyncratic shocks. The study concluded that the full insurance model is convincingly rejected and that the lower a household's wealth, the stronger is the rejection, in that the marginal propensity to consume out of current income higher for less wealthy households. This holds for both to total consumption and food consumption, although the latter is better protected. There is little sign, however, that living in a poor area enhances exposure to risk at a given level of individual wealth. The study also stated that the arrangements for consumption insurance in study villages are work considerably less well for the asset poor. The study recommended for public action to provide better insurance in underdeveloped rural economies on both equity and efficiency grounds.

Glewwe and Hall (1998) test the hypothesis regarding the vulnerability of different types of urban household to macroeconomic shocks using panel data set from Lima Peru for years 1985/86 and 1990. The list of reasons for some households to be more susceptible to economic shocks includes less diversified household income, less stable employment and reduced demand for lower level skills. The strategies used by household to reduce the impact of economic shocks include dis-saving and selling physical assets, increasing labour force participation, receipts of inter household transfer, credit for consumption, own production of consumption goods. The findings show that while households with educated heads and female head household are less vulnerable, households with more children are more vulnerable. They argue that households with several income sources can reduce their risk to major drops in income while smaller households are less able to diversify and thus more vulnerable.

Deaton (1998) finds little evidence on co variation between income risks for different farmers in the same location by using Cote d'Ivoire survey data. The results of test for consumption insurance provide evidence against the most extreme hypothesis, that there is complete consumption insurance with in each of villages in Cote d'Ivoire. The regression result of change on consumption on the changing income generates significant positive coefficient. The study suggests the use of dummies for village average income given difficulties in measuring income and the possibility of missing village resources in measuring individual incomes.

Grimard (1997) investigates the hypothesis that households in Cote d' Ivoire take part in spatially diversified risk-sharing arrangements with members of their own ethnic group. The results support the suggestion that households from the same ethnic group may engage in risk sharing with different households living in different regions. The hypothesis of complete risk sharing within ethic groups is rejected. However, there appears to be some partial insurance performed by individual households with other members of the same ethnic groups. The study further lists several possible reasons for the rejection of complete consumption insurance such as problems of moral hazard and enforcement costs, measurement errors and unobservable variables, difficulty in obtaining sufficient data, assumption of ethnic dummies, and unrealistic representation of complete risk sharing frameworks. Similarly, Study undertaken by Rosenzweig and Stark (1989) examined the marital arrangements among Indian household by considering it as implicit inter-household contractual arrangements to mitigate income risks and facilitate consumption smoothing. The evidence supports that marriage cum migration contributes significantly to a reduction in the variability of household food consumption. The study recommends that improvements in formal institutional arrangement

(credit markets) that facilitate consumption smoothing may reduce the role played by risk considerations in marital arrangements and rural migration.

Stark, Taylor and Yitazhaki (1986) analyzed the role of net remittances in village income inequalities and village welfares in Mixco. They found that remittance from international and internal sources has both positive and negative effects on income inequality depending on village migration history, on the degree of diffusion of migration opportunities, on the returns to human capital, and on the distribution of relevant skill and education. The empirical findings demonstrate that in a village with remittances from many internal and few experienced international migrants, the latter have unequal impact on village income while remittances from former have a favorable effect on the village income distribution.

Remittances from international migrants have an equalizing impact on income in a village with long-experienced migrants and unequal effect of internal migrant is related with large returns to schooling and education. The study further indicates that the impact of change in remittances on welfares depends on the weight attached to distributional versus mean income consideration. The result shows that both internal and international remittances have positive welfare impact in two villages.

Reardon, Delgado and Matlon (1992) found, using household survey data from Burkina Faso, that non-farm income has a negative impact on rural income distribution. The comparison of Gini coefficient for own cropping with overall income (sum of crop income and non-crop income) revealed that the inclusion of non-farm income did not reduce the Gini coefficient in very poorer agro climatic zone and even increased in less poor zone. By contrast, the result for favorable agro climatic zone indicated that non-farm incomes reduce the size of

distribution of income. They concluded that the equity impacts of non-farm income differ widely by agro ecological zones.

Adams (1994) analyzed the impact of non-farm income on income inequality in rural Pakistan by decomposing total rural income among non-farm, agricultural, livestock, rental and transfer income sources. Using the decomposition analysis the study found that non-farm income represents an inequality decreasing sources of income despite its largest share in total income. While non-farm income makes relatively small contribution to overall inequality, agricultural income makes the largest contribution to it. Non-farm income is decomposed further into different sources; non-farm unskilled labour income found to have equalizing effect on income distribution and non-farm government income has disequalising effect. Adams attributes the inconsistent results of the impact of rural non-farm income distribution to differences in land and labour endowments of study sites. The study recommended that efforts to improve income distribution in rural Pakistan should focus on expanding non-farm income. He made similar study for rural Egypt in 1999 and found identical results, i.e. non-form income represent the most important inequality decreasing sources of income and agricultural income represents the most important inequality increasing source of income. The marginal effect of non-farm income to Gini coefficient is lower than the contribution of agricultural income the reason for this difference is being related to highly unequal land distribution.

Woolard et al. (1996) examined the relative importance of the major income components in determining overall inequality using a decomposition technique based on the Gini coefficient in South Africa. The findings reveal that wage income is both the most important income component and source of inequality for African income in South Africa. The contribution of

remittance income to overall inequality is small. The result for impact of exogenous increase in particular income component shows that an increase in wage or self-employment income increases inequality while an increase in remittance; capital income, state transfers and agricultural income reduce the overall Gini coefficient. With respect to the effect of increase in particular income component on the welfare, the study demonstrates that wage income has a large effect followed in order by remittance and state transfers although all components affect the welfare index positively. They suggest that an income sources that increase average income and improve the distribution of income will have large net welfare effect.

Dercon (2001) discussed the different strategies that households use to cope with risks and the constraints on their effectiveness by reviewing some of the recent literature on savings as insurance, income diversification and smoothing, and informal risk sharing arrangements. The study reveals that households are constrained in using these strategies. Diversification does not, unlike theoretical predictions, always result in income smoothing. Dercon (2000) mentions several reasons for this. First, the aim of diversification of different activity may focus on other issues such as to smooth labour supply for seasonality of agricultural activity. The second is that shocks may simultaneously affect crop income and non-farm income. The entry constraints may also limit the usefulness of income diversification. The study further explained that self-insurance through asset strategies is constrained by the covariance of asset values and income during common shocks and access to assets and informal risk sharing can also provide limited protection.

Alderman and Paxson (1992) reviewed literature on consumption insurance in developing countries. They classified a wide variety of mechanisms used by household to limit consumption risk into two-risk management and risk coping strategies. While risk

management strategies include diversification (field, crop, occupation...), migration of family member, etc, risk coping can be asset saving, risk sharing arrangement both formal and informal, state transfer, remittance, borrowing and lending etc.

They argued that the use of portfolio diversification to limit income risk vary across households and depend on the degree of risk aversion, and on the ability and availability of ex post consumption smoothing. They state also that complete risk sharing can only protect household from the effects of idiosyncratic shocks to income and that risk sharing arrangements can provide little in the way of consumption smoothing when the share of covariate income risk in total income risk is large.

2.4 Empirical Literature on Ethiopia

Adugna (2002) investigated the determinants of household diversification in rural Ethiopia. The results of the study show that for a representative household most demographic factors, except number of male adults and working adults, lower the number of family members engaged in farming. Similarly, for domestic work, except number of female adults and family size, most demographic factors lower number of household members participating in this activity. The results of the study also indicate that number of family members who can read and write, and agricultural risk factors promote households to engage in skilled professional activities and to send more kids to school. Empirical evidences also show that agricultural activities compete for family labour in trading, schooling and skilled professional activities and unobserved regional factors are the major determinants of schooling, trading, and skilled professional activities.

Carswell (2001) presents evidence from southern Ethiopia that non-farm and off farm activities are carried out by significant proportion of adults and makes an important contribution to livelihoods, showing high involvement of women, high cash income contribution to poorer household and high importance of laboring for others next to trading in highland of Wolayta where livelihood diversification have long history.

Tassew (2000) carried out a survey of random sample of rural household to analyze on farm and off farm employment, the impact of income diversification on farm production and rural income distribution in Tigray region of Ethiopia. The study showed that a substantial proportion of farm household (81%) diversifies their income into off farm activities, which increases farm output directly by increasing their managerial skill and indirectly through purchase of farm inputs. Applying the survey data for relevant variables to simultaneous tobit model and simulating the estimated results showed that 10% increase in off farm income lead to a 1.4% increase of net farm household income and to a 1.2% increase in farm output. And it also leads to a 10.2% and 1.3% increase in purchase of farm labor and variable capital farm inputs respectively.

The study identified participation decision in off farm self-employment is significantly influenced by the level of farm output, wage rate, area of land cultivated, livestock wealth and the value of owned off farm equipment. The multinomial logit regression result showed that the most important factors that determine the choices of farmer between off farm wage and self employment are farm income, ownership of transport animals, area of land cultivated, family size and location. While farm households who have higher farm income and greater number of transport animals prefer working in off farm self employment, households who have a large family size and more livestock wealth prefer off farm wage employment.

Delil (2001) analyzed factors that influence the probability of involvement in off farm employment at household level and the impact of off farm employment on rural poverty alleviation in Oromia region. Based on the survey conducted in 1996 and using logit model, the study found out the sex (male), age of household head, family size, religion (orthodox), own account working, enset land, credit received, proximity to market and road positively affect the decision of involvement in off farm employment while getting married, education, cultivated land, coffee and chat production, fertilizer use and total cattle ownership, affect it negatively. The study indicated 58 percent of sample population involved in off farm employment and the rural income generated from off farm sector account for 18.7 percent of the total. Further, it revealed that farm households who diversified their productive activities to off farm economy are found to be better off as compared to those who confined their operation to farm sector, implying the significant impact of off farm employment and income on poverty alleviation and full time off farm operators are the members of the worst poverty redden groups.

Dercon and Krishinan (1996) analyzed the determinants of occupation diversification of households using survey data from rural Ethiopia and Tanzania. They argued that different income portfolio held by households can not be explained by their behaviors towards risk rather better explained by differences in ability of household to adopt more profitable diversification strategies which depend on access to the means required to pursue such activities such as skill, location, livestock ownership, access to capital and credit. The regression result of multinomial logit for five categories of occupations showed that, after controlling for the effects of location, entering into high return activities is determined by investment in particular skills or access to capital. The study also found that the availability of

higher male labour and larger farm size allow households to take up high return activity such as cattle rearing. The study identified demographic and economic factors as the major determinants of occupation diversification.

Mulat and Teferi (1996) investigated the role, scope, and link between farm and non-farm activities in North Shoa of Ethiopia. Based on primary sample survey data from three districts from North Shoa the study found that farmers are engaged in various off farm economic activities in order to maintain their subsistence income levels.

The study pointed out that even if the non-farm activities viewed as the survival strategies rather than as remunerative sources of livelihood, it accounted for 59.5 percent of total annual cash income of the farm household. After pinpointing the nature and characteristics of both crop production, resource use, livestock sector and non farm activities in detail in the study area, the study identified that the major determinants of involvement in non farm activities and non farm income include low demand for food & services of these activities, primitive technology, shortage of raw materials, lack of skills and training and lack of access to credit, and low and declining levels of rural income. Furthermore, they forwarded recommendation to overcome the problems constraining non-farm employment in the area, emphasizing on macro economic policies that favors the growth of rural income, on promotional effort to remove demand constraints on livestock production such as dairy and wool production, and on conservation and forestry program.

Mulat and Teferi (1996) attribute the probability of participation in the non farm activities to four broad groups: personal attributes, farm income, food balance and land endowment. The ratio of non-farm income to income (cash) is defined as explanatory (dependent) variable. The regression results show that livestock revenue, yield, land-holding size, food balance (food

sale less purchase) and age showed significant role while the effect of sex, crop revenue, family size, education, have become insignificant on generating off farm income.

Kindness (1994) examined proportions of cash income from different sources, constraints to income generation and its geographic, time and household variation in Wolaita, South Ethiopia. Analyzing the survey data from three different agro-climatic sites and wealth based household groups, the study showed that small land holdings, high population density, and small number of livestock forced a large number of farmers to diversify their income sources and non farm income sources (petty trading, trading activities, and craft activities) contribute a large proportion of annual cash income for households in all wealth categories and particularly during bad cropping year. The study also noted that the income from the livestock and crop sales is either none or low for poor household while the income diversification strategies in two sites for the poor are petty trading and craft activities, which generate large proportion of their income. Having relatively large farmland and livestock number, rich households receive large portion of their income from crop sales and livestock products.

With respect to the variation of income level from different sources between sites, the study indicated the key role of infrastructure particularly proximity to road (the site near to Soddo-Shashamane road does not only gets the highest mean annual income for all activities but also grows more diverse cash crops relative to other two distant sites) in generating high income and diversifying activities. Shortage of credit was considered as the major constraint to involvement in non-farm activities.

In Ethiopia, Skoufias and Quisumbing (2002) found that better livestock disease outcomes increase food consumption. Positive rainfall has negative and statistically significant effect in regressions for total consumption and food consumption per capita and better crop outcomes have a significant positive effect on total consumption and nonfood consumption. The regression result suggests that covariate shocks were significant determinants of consumption changes. The estimates obtained using total (food plus non food) consumption also suggest that on average total consumption is not insured from idiosyncratic income change in four countries including Ethiopia. The estimates obtained by separating food and nonfood consumption indicate that in most instance food consumption appear to be better insured (having lower covariance with income) from idiosyncratic changes in income as compared to nonfood consumption. Explanation for this difference is that food consumption is most likely covered by informal insurance arrangements than nonfood.

The study also provides strong evidence supporting the role of partial insurance and community risk sharing in food consumption. The change in the growth rate of average community income seems to have a positive and significant role in the growth rate of food consumption of individual households in all countries except Ethiopia. By contrast, no evidence of risk sharing is found with respect to nonfood, suggesting availability of limited options for nonfood insurance. The analysis of the capacity of household to insure variability consumption shows that the number of male adults increases variability of food consumption with respect to idiosyncratic and aggregate shocks while the number of females decreases it.

Dercon and Krishnan (2000)[•*] test risk sharing within rural households in Ethiopia. Using adult nutrition to investigate the ability of individual to smooth consumption within the households over season, the study shows that households do not engage in complete risk sharing between husbands and wives where women in poor households bear the brunt of adverse shocks in southern Ethiopia. In southern Ethiopia, an average loss of labour due to illness for a female in a poor household results in a loss of 1.6 to 2.6 percent of body weight due to the lack of risk sharing.

Tassew (2000) found that, by decomposing total rural household income in Ethiopia into various sources, livestock and off farm wage incomes reduce rural inequality. However, further decomposition of wage income into various categories arrived at mixed results. The further decomposition results reveal that while non-farm wage, self employment income and non labour incomes have non equalizing effects, incomes from food for work reduces income inequality. The study noted that the marginal effect on income in equality is higher for non-labour income than for non-farm wage and self-employment income. He attributes the reasons for disequalizing effect of non-farm income to existence of an entry barrier (capital and skill requirement) for the poor and availability of transaction cost of searching jobs and rationing in the labour markets. In contrast to Adam (1994) findings in rural Pakistan, unskilled non-farm wage work increases income inequality, due to very high transaction costs in searching for jobs.

[•*] the citation taken from Dercon (2001)

CHAPTER 3. METHODOLOGY AND MODEL SECIFICATION

3.1. Data Sources

The source of data for this study is the Ethiopian Rural Household Survey conducted by the Department of Economics of Addis Ababa University in collaboration with the Center for Study of African Economy, Oxford University. This survey was undertaken in 18 rural communities/sites of the country and sample of clusters of different agro climatic and socioeconomic condition was chosen to obtain relevant data; random sampling was applied within each site; and the number of households selected for interview in each site was proportional to the population of the region relative to national population (see Bereket and Mekonen, 1996).

The survey data contains a detailed information on household demographics, education, household composition, mortality, asset ownership, credit, non food expenditure, non agricultural activities, land and its use, inputs, crop outputs and sales of previous year harvests, land rent, livestock ownership, livestock expenditure and income, health status illness and visits for treatments, consumption habits, food expenditure and consumption, energy, water and household consumables and female business activities, off farm income and business activities, tree crops, soil conservation and crop damage, labour arrangements and costs, adoption of modern input, crops and improved animals and access to extension services.

The survey consists of five rounds covering the period 1994-1999. Out of the 18 rural sites in the survey, five sites were from Southern Nations Nationality People Region State, which is the case area of this study and data on 440 households is available. These sites are Adado

Bule (Dila), Azeoeboa (kembata), Damaa Daramalo (Gamu Gofa), Garagoda (Wolayta) and Imdibir (Guragea). These sites have highly differing agro climatic conditions and varying resource endowments. The detailed description of each of these sites will be discussed in chapter four.

3.2 Theoretical Framework and model specification

3.2.1 Theoretical Framework

The household economic portfolio consists of a set of household resource, households' activity, and the circular flow of interaction between its recourses and activities (Dunn, 1997). Household resources are the basis for a livelihood strategy and include human, physical, natural, financial, household and social capital. These households' resources may be augmented by the receipt of credit, and by the access to public and social capital. Household activities, on the other hand, consist of a set of production, consumption and investment activities.

The household must decide on type, quantity, and intensity of activities in which it participates, given its asset endowment and other exogenous conditions. The household decision process is based on two types of household models: unitary and collective household models.

Proponents of unitary household model assume that a household's decision process is the result of maximization of a single household utility subject to various household level constraints on production, income and time (Doss, 1996). The unitary household model includes separable (recursive) and non-separable agricultural household models. The use of unitary household model has both advantages and disadvantages. The first advantage is that it fits exactly into the familiar consumer choice framework. Another advantage is its flexibility to examine a wide variety of issues (Rola-Rubzen and Hardaker, 2001).

However, there are criticisms forwarded to this type model. The first criticism is that it contradicts the basic rule of neo-classical microeconomic analysis that every individual has to be characterized by his/her own preference. The second problem is that it ignores the intra household inequality and internal decision process (Alederman et al, 1995).

Proponents of collective household models relax the assumptions of unitary model and argue that individual members utility maximization can result into Pareto optimal allocation of resource in the household (Alederman et al, 1995; Doss, 1996). But empirically it needs considerable amount of data on individual household members.

The unitary household models are recommended as the best representative of the household decision process in agrarian rural economies like Ethiopia. This is because it is difficult and costly to collect accurate information on distribution and ownership of the assets and resources within households (Tassew, 2000). It is also because in most cases the income earner is one or two members of households while other members provide supportive services. In this situation it may become unfair to bargain over allocation of the outcome of work (Adugn, 2002). In addition, Ellis (1998) argued that, although unitary household models ignore social institution and risk factors, they yield baseline economic proposition that the household will allocate its labour time in such a way that the marginal returns per unit of labour are the same across different activities; whether on farm, off farm or non-farm. Hence, in this study the unitary model is used to specify the estimation model.

The agricultural household model integrates production; consumption and labour supply decision of household into one unit (Singh et al 1986). The conventional household model has been developed under conditions where perfect market exists, i.e. where all products and factors are tradable and where the opportunity cost of any product or factor held by a household is its market price. Under this condition, recursive property holds, and the producer side of the model can be solved prior to the consumer/worker side, with farm profits serving as the link between the two problems.

One of the earliest models of a farm household was that of Chayanov who provided a theory of peasant behavior at the level of family farm and hypothesized that households act to

maximize utility by striking balance between the satisfaction of consumption and a distaste for labour (Ellis, 1993). Becker introduced the new household economics (NHE) model which assumes that the household acts as a unified unit of production and consumption and aims to maximize utility subject to its production function, income and total time constraints [Ellis, 1993).

The farm household, however, operates in an environment which is characterized by a number of market failures for certain products and for some of its factors due to either high price risk, low access to the labour market or discrimination (De Janvery et al, 1991). One feature of developing country is imperfect or missing input and product markets.

The supply of family labor and demand of farm household labour may be influenced by differences in labor and assets endowment (Tassew, 2000). Market fails when the transaction costs creates disutility exceeds the utility gain. The magnitude of price band may vary depending on transaction costs, shadow local markets, price risks and attitude towards risk (De Janvery, 1995). The presence of transaction costs, and entry barriers in the labor and asset markets, could lead to differing access of farm household to off farm activities. Under this condition, the recursive property of the farm household model fails to hold.

Lopez (1986) developed a non-recursive model thatcan be used for situation where the recursive model is not appropriate. His models allows for inter-dependence of utility and profit maximizing decision of household.

In this study, a non-separable agricultural household model is used for the following reasons. First, subsistence agriculture dominates the farming system in which not only majority portion of their production is used for home consumption but also it is characterized by low level production and productivity. Consequently, the amount that goes to market is small. Second, the division of labour within the household is mostly based by social norms, customs and religion in the society. Family labor is the major form of employment. In addition, as discussed earlier, high job searching time, unfavorable work environment, low wage, shortage of necessary inputs, complete absence and imperfection of input markets lead to select and use of non-separable agricultural household model.

The model is based on the following basic assumptions:

i) The household is considered as a single decision making unit, and has different preferences for on farm and off farm work.

ii) The household has well behaved utility function with assumption of household consumption of various goods and leisure.

iii) Market is assumed to be imperfect and commodities are heterogeneous and farm wage and off farm wages are not identical. The farm wage is determined endogenously.

iv) Land and other capital inputs are assumed fixed.

v) The household allocates its total family time T to a set of productive activities both on farm and off farm as well as home time (leisure).

The income and resource of household in subsequent period will be determined by present selection of a set of activities by a household and by the exogenous and other factors that influence its selection and operation. The activities that compete for family labor are crop production, livestock production, own-business, non-agricultural wage employment, agricultural wage employment. The household must decide on which activities he will participate and the intensity of involvement in that activity given his asset endowments at particular time. Each of these activities require the use a single asset or a set assets. For example, agricultural production may use natural capital in the form of land and water, human capital, physical capital, financial capital for purchase of inputs and social capital in the form of labour assistance by community members. Non-farm wage employment may use human capital.

For the purpose of this study let us denote the resource allocation decision of rural household among various activities as follows.

Activities	Fixed assets and characteristics	Household time	Hired Labor	Purchased inputs
1. Agriculture (j)				
Crop production (f)	Kf	Lf	(-qf)	(-qf)
Livestock (a)	Ka	La	(-qa)	(-qa)
2. Other Activities (n)				
Own business (s)	Ks	Ls	-	-
Farm wage employment (r)	Kr	Lr	-	-
Off farm wage employment (o)	Ko	Lo	-	-
Home time	-	Lh	-	-
Total household time	-	T	-	-

The rural household assumed to maximize its utility function (U) composed of consumption goods (C), home time/Leisure (L^h) and household characteristic (Z^h). The level of utility attainable by a household is subject to constraints imposed by i) agricultural production technology ii) nonagricultural production technology iii) exogenous market price of tradable iv) equilibrium condition for family labour. v) Rationing in the labour market vi) cash (liquidity)

The Household utility function can be written as

$$U= U(C, L_h, Z^h) \quad (1)$$

is subject to :

(j) Agricultural production functions

$$Q_j = q_j(L_j, H_j, X_j, K_j) \quad (2)$$

Where $j = \{f,a\}$,f and a as defined earlier

Q_j = agricultural output

H_j = hired labour

X_j = variable farm inputs

Crop production is a risky activity and uses land, family labour, and variable farm inputs. Land is assumed given and fixed for a household.

Livestock rearing is the most popular productive activity in rural area. This activity offers high returns and requires, in addition to land and labour endowments, a minimum level of capital input for investment in livestock. The financing of the lucrative livestock investment requires substantial own savings or access to credit. Those households who access to this fixed initial input can allocate their labour to livestock as well as cropping to generate income from both activities.

Household labour allocated to agricultural activities is equal to the sum of family labor supplies to crop production and livestock production

$$L_j = L_f + L_a \quad (3)$$

ii) non agricultural production functions

The rural household has also access to off farm activity with low entry constraints and uses only labour input. This activity offers relatively low return and can be considered as less risky than crop production. Given its low returns, risk averse households are expected to engage in this off farm activity. In addition, households endowed with much labour but relatively little land, given other things constant, will apply some of their labour to take up off farm activity.

Access to high return alternative off farm activities such as skilled wage employment, and lucrative self-employed micro enterprises have high entry constraints. Entry to these activities requires the possession of specialized assets (for example, marketable human capital) or a minimum level of fixed capital input for investment. Households who fulfill this requirement are likely to allocate part of their labour to this activity.

For non-agricultural activities using only family labour variable input and fixed assets, production technology has the form:

$$Q_n = q_n (L_n, K_n) \quad (4)$$

Where $n = \{s,r,o\}$ and Q_n = non agricultural output

In these equations, L_n is measured in unit of family labour time with an opportunity cost w* equal to the marginal productivity of labour in agriculture. P_n is measured in effective units of family labour in the corresponding activity, with a price equal to the hourly income in that activity. Note here that units of effective labour in the different activities receive different remunerations, which are higher than shadow wage in agriculture.

The household may allocate its labour to off farm work that include own business, wage employment on farm and non-farm.

The existence of entry barrier (for example, lack of specific skill, absence of credit facilities to set up new high return activities) and of transaction costs such as search, commuting and information costs affect household's access to non-agricultural activities. As a result, labor supply of the household to these activities may be less than or equal to the level of household's labor willingness to supply to off farm works. [Tassew, 2000]

Family labor supply to non-agricultural activities

$$L_n = Ls + L_r + L_o \quad (5)$$

$$L_n \leq L_n w \quad (6)$$

Where Lnw = Family labor willingness to supply to non-agricultural work.

iii) Equilibrium condition for family labour:

The allocation of total time endowment of household among agricultural activities, non-agricultural works, leisure and transacting in off farm activities is written as: (ibid, 2000)

$$L_j + L_n + S_{ln} = T \quad (7)$$

Where S = transacting time cost

iv) The cash constraint of rural household:

$$\Sigma P_j (Q_j + E_j - C_i) + \Sigma P_i (Q_n) + v\text{-}scL_n \quad (8)$$

Where E_j = initial stock and

t = tradable

v = non labour income

sc = transacting cash cost of off farm work

In situations of market failures, the household faces the constraints of balancing the supply and demands of non tradable commodities.

For tradable goods (t) the prices Pm are exogenous effective market prices. For non-tradable, the decision price is the endogenous shadow prices which are determined by equilibrium conditions [De January et al, 1992]. The equilibrium condition, for family labour i.e. family labour allocated across activities under time constraint determines the shadow wage ($\hat{W}$).

V) The exogenous effective market prices for tradable is written as:

$$P_m = \hat{p}_m \quad m \varepsilon t \tag{9}$$

Assuming the existence of interior solutions for all products and inputs including family labor and solving the first order conditions by defining the endogenous decision prices ($\hat{p}$) and shadow wage ($\hat{w}$) for family labor, the system of supply and factor demand function can be represented as follows:-

$$\left.\begin{aligned} q_j &= q(p_j, \hat{w}, k_j) \\ L_j &= Lj(p_j, \hat{w}, k_j) \end{aligned}\right\} j = f, a \tag{10}$$

The maximum level of agricultural profit using optimum levels of products and factors is: -

$$\hat{\Pi} = \sum_j \hat{p}_j q_j - \hat{w} L_j \quad j = f, a \tag{11}$$

The first order condition (see equation 11.6 in appendix) shows the effects of liquidity constraint, transaction costs and rationing on the labour market on the household's willingness to participate in off farm activities. The existence of liquidity constraints transaction cost and rationing in labour market result in between shadow wage and virtual divergence wage*

The marginal product of labor equals shadow wage $\hat{w}$ for non-agricultural activities is given by.

$$\left.\begin{aligned} \hat{p}_n \frac{\partial q_n}{\partial L_n} &= \hat{w} \\ q_n &= q(L_n, k_n) \end{aligned}\right\} \tag{12}$$

$n = \{s, r, o\}$

* see Tassew (2000) for detailed discussion.

The maximum profit from non-agricultural activities can be written as

$$\Pi_n = p_n q_n - wL_n \quad (13)$$

The full income constraint in w & p price can be solved by using equation (7), (8), (9), (11) and (13)(See de Janvry et al, 1995).

$$\sum p_j q_j - wL_j + \sum p_n q_n - wL_n + s + wT = \sum p_k c_k + wL_h$$
$$\sum \Pi_j + \sum \Pi_n + S + WT = \sum p_k c_k + wL_h = Y^* \quad (14)$$

The gross income from agricultural and non agricultural activities is written as:-

$$\begin{cases} p_j q_j = \gamma x_j + wLj + \phi K_j \text{ ---------- (15)} \\ p_n q_n = wL_n + \phi_2, K_N \text{ ---------- (16)} \end{cases}$$

n = non agricultural activity

j = agricultural activity

In order to analyze the role of income diversification, it is convenient to express earned income (y) as sum of income generated from different activities

$$Y_D = p_j q_j + p_n q_n = y_1 + y_2 + y_3 \ldots + y_n \quad (17)$$

Where Y_D = income from diversified portfolio

Diversification reduce risk of shocks when Cov (Y_A, Y_m) ≈ 0 (A≠m)

3.2.2. Model specification for Income Diversification

Following the theoretical model presented in previous section, we can formulate an econometric model of both livelihood strategy choice and income diversification. This is because the analysis of determinants of income diversification requires the identification of factors that influence household's choice of livelihood strategy at a point in time.

In rural area the livelihood diversification strategy available for household can be categorized into five distinct groups. These are: (1) households only involve in cropping, pure farm strategy (indexed pf), (2) Households that combined cropping with cattle rearing, mixed farm strategy (indexed mf), (3) households involved in cropping and off farm activities with low entry constraints, (farm easy entry off farm strategy (indexed fe)), (4) Households involved in cropping and off farm activities with high entry constraints, farm lucrative off farm (indexed

Fl) and (5) Households involved in combining any two or more activities from above four strategies, referred to as agri-off farm strategy (indexed Ao).

The model assumes that in a given period, rural household choose among five mutually exclusive livelihood alternatives.[*]The household problem is to maximize the household utility function given the constraints imposed by each of the household livelihood alternatives. Household budget and time constraints must be modified to reflect the different returns and monetary cost of participation of each alternative.

Five indirect utility functions will result from the maximization. A household compares the level of indirect utility obtainable from various alternatives and chooses the participation status that maximizes the household indirect utility. This specification follows simultaneous household livelihood choice and income diversity maximization. The livelihood strategy choice determined jointly with level of income diversity, and thus selectivity bias precludes using simple OLS technique[**]

In modeling the income diversity equation one needs to consider not only joint household's decision on the livelihood choice and level of income diversity but also the censored nature of household's participation in livelihood strategy. Income diversity from each livelihood strategy is observed only for those households who participate in that strategy. The dependent variable for participation status in a given livelihood strategy is a binary that it takes the value one for participant households in that strategy and zero otherwise.

Following G.S. Maddala (1983), the indirect utility function, V_K is decomposed into non stochastic component, B_K and a stochastic component, U_K.

$$V_k = B_k + U_k \; \forall \; K = Pf, Mf, Fe, FL, Ao) \qquad (1)$$

[*] The assumption of mutually exclusivity implies that a rural household chooses to involve in only one of the five livelihood strategies. This specification rules out the livelihood strategy that only involve off farm activities. Initially, we planned to treat off farm livelihood strategy as additional distinct alternative. But we found quite small. (2.5%) households engaged in this strategy. Because of small size, we included these households either in Farm easy off farm or Farm lucrative off farm based on the type of off farm activities they involved

[**] This model explicitly allows livelihood choice to be related to the level of income diversity that household can make in that livelihood strategy relative to other strategies.

The probability that household i will participate in livelihood strategy K is the probability that the indirect utility yielded in livelihood K is greater than that derived from other livelihood strategies, & say j.

$$P_{iK} = Pr\ (V_{ik} > V_{ij}\ \forall\ j \neq K,\ j = Pf, Mf, Fe, Fl, Ao) \qquad (2)$$

This implies that the probability of household participating in livelihood K is the probability that the difference between the stochastic components is greater than the difference between non-stochastic components.

$$P_{ik}=Pr\ (V_{ik}-V_{ij} > B_{ij}-B_{iK\ \forall}\ j \neq K,\ j=Pf, Mf, Fe, Fl, Ao)$$

Assume that stochastic components U_{ik} have independent and identical weibul distributions, then the difference between the errors (U_{ik}-U_{ij}) has a logistic distribution, and the appropriate technique for estimation of the participation equation is the multinomial logit. We select the logistic distribution because of its ease in computation (Long, 1997; Maddala, 1983; Green, 1997.)[*] In addition, multinomial logit analysis exhibits a superior ability to Predict occupational distribution (Miller and Volker, 1985).

The functional forms that are linear in parameters for computation easiness approximate the non-stochastic component of indirect utility function.

For such polychotomus choice model, we may correct for selectivity bias following Hay's Mill ratio correction for multinomial logit models. [*] (Maddala, 1983)

Then we may correct for selectivity bias by including lamda (λ) Hay's Mill ratio as an additional explanatory variables into corresponding income diversity equation[**].

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[*] Although multinomial logit specification provides computational advantage over probit model, it requires the independence of stochastic errors. Hausman and MCFadden (1984) specify a test for the independence of irrelevant alternative (IIA)
T= (BF-Bc)' [cov (BF)- Cov (BC)]' (BF-BC)
where BF is being the parameter vector estimated on the subset of the full choice set, Bc found by elimination of one of the five alternative in estimation. The test result indicated that we could not reject IIA.

[*] See also Lee for a similar correction and Trost and Lee for a similar application. See Maddal (1983) for detailed discussion of Hay's procedure.

[**] For multinomial logit model the correction is
$h_{ij} = (6/\prod^2)\ (-1)^{J+1} \sum_{K \neq j} (1/J)\ (Pik/(1-pik))\ \log Pik + ((J-1)/5)\ \log Pij$

If we define

$$P_{ij} = 1 \text{ iff } Z_{ij}\,\phi_j > U_{ij} \quad (1)$$

$$= 0 \text{ other wise}$$

$$y_{ij} = x_{ij}\beta_j + e_{ij} \quad (2)$$

y_{ij} is observed iff $p_{ij} = 1$ and $\Sigma\, p_{ij} = 1$ (3)

Where y_{ij} represent income diversification and p_{ij} denotes the probability associated with the five livelihood strategy for rural household i with

j = 1 if the rural household selects pure farm strategy

j = 2 if the rural household selects mixed farm strategy

j = 3 if the rural household selects farm easy off farm strategy

j = 4 if the rural household participates in farm lucrative off farm strategy

j = 5 if the rural household participates in agri-off farm strategy.

The vectors Z_{ij} and X_{ij} are independent variables explaining the outcomes and ϕ and β are the parameter vector. uij and eij are error terms of participation equation and income diversification equation respectively. Uij has independent and identical weibull distribution.

A multinomial logistic model can approximate the unknown function as follows

$$P_{ij} = \frac{\exp(Z_{ij}\phi_j)}{\sum_{j=1}^{j=5} \exp(Z_{ij}\phi_j)} \quad (4)$$

Since each rural household must select one strategy, only j-1 sets of coefficients are defined. For normalization, we set the first (ϕ_1=0) equal to zero; the multinomial logit model can be written as:

$$p_{ij} = \frac{\exp(Z_i j \phi_j)}{1 + \sum_{j=2}^{j=5} \exp(zi\, j \phi j)} \quad \text{and} \quad p_{il} = \frac{1}{1 + \sum_{j=2}^{j=5} \exp(Z_{ij}\phi_j)} \quad (5)$$

The parameters of the discrete model can be estimated using maximum likelihood estimation method.

The income diversification equations including (λ) inverse Mill ratio as an additional explanatory variables can be written as:

$$y_{ij} = x_{ij}\,\beta_j + \hat{\lambda}_{ij}\,\phi_j + e_{ij} \quad (6)$$

The estimation procedure we follow in estimating the models is two stage process. In first step, we estimate multinomial logit equations using maximum likelihood on reduced form of household participation equation. Then we compute the selection variable λ_{ij}.

The second step is to estimate the income diversification equations including inverse mill's ratio as an additional regressor in each of the corresponding income diversification equations using ordinary least squares to give consistent coefficient estimates.

3.2.3 Theoretical framework and model specification for consumption Insurance

The literature on risk and insurance in poor rural economies states that income risks are pervasive in these countries. People in these economies face substantial risk of human illness, sickness or death of plow animal, crop pests and diseases and unfavorable climatic condition. This raises the questions that how well (if at all) are households in poor rural economies able to insure consumption against income shocks? A large volume of literature examined the success or otherwise of household in insuring consumption and identifying different mechanisms used by households to insure their consumption against various kinds of income shocks.

The recent literature of consumption smoothing and risk sharing acknowledges that households may adopt a variety of risk management strategies and instruments in order to protect themselves from risk. Morduch (1995) categorizes the different mechanisms into two groups: ex ante income smoothing and ex post consumption smoothing. Households may take step to protect themselves from adverse income shocks by making conservative production or employment choices and diversifying. Households may use their saving, borrowing, depleting and accumulating non financial assets, and employ formal and informal insurance arrangement (Skoufias and Quisumbing, 2002; Alderman and Paxson 1992; Townsend, 1994)

Income smoothing becomes more important when the capacity of a household to borrow or insure is very weak. Recent literature noted that in the absence of perfect insurance markets, households may undertake actions to reduce the variability of income, and hence income

smoothing can play an important role in dealing with risk (Paxson and Alderman (1992), Morduch (1995).

Different methods are used to reduce income variability in rural areas. Morduch (1995) lists different methods of income smoothing: (1) favoring variability reducing inputs and production techniques (2) postponing making investment for better information on expected weather condition (3) engaging in multiple activity (diversification) (4) using permanent labour contract. Additional strategies include crop and plots diversification, strategic migration of family members and using a variety of production techniques (Paxson et al (1992)

Let us now briefly explain the theoretical framework in this paper. Assume that income risk is the only kind of risk faced by a particular community. Given the existence of complete market for state contingent commodities, households within a given insurance group are assumed to purchase state contingent commodities to maximize expected utility. Perfect risk sharing in this framework will result in every member of community being protected from idiosyncratic risk. In this situation, any observed variation in consumption will be attributed to aggregate risks. The Pareto optimal allocation of consumption within group maximizes a weighted sum of the life time expected utility of the group members.

Assuming separability of consumption and leisure, preferences additive over time and across states, and common rates of time preference,

The problem for the social planner is to

$$\text{Max} \sum_{i=1}^{n} \sum_{t=0}^{T} \sum_{s=0}^{s} \mu_{is} \Pi_s \rho^t u(C_{its}; Z_{its}) \ldots\ldots\ldots\ldots\ldots (1)$$

Subject to the full income constraint

$$\sum_{i=1}^{n} C_{its} = \sum_{i=1}^{n} Y_{its} \quad \forall (t,s) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where Π_s denotes the probability of state natures, S is indexed by 1, ...S, (the probabilities of the states are assumed the same for all households); μ_{is} is the time invariant Pareto weight associated with household i, i=1... n in state s and n is the number of households; ρ is the rate of time preferences, Z_{its} denotes factors that change tastes; u (.) is the period - specific utility

function of household; C_{its} is the consumption of household, y_{its} is household income in period t and state s.

The Langrangian associated with this problem is given by

$$L = \sum_{t}^{-} \rho^{t} \left[\Sigma \mu_{is} \sum_{s} \Pi_{s}\, u(C_{its}; Z_{its} \right] + \psi_{ts} \left[\sum_{i}^{n} (Y_{its} - C_{its}) \right] \text{..... (3)}$$

Where L represents langrange multiplier

Different specification of the utility function will result in different empirical specifications.* Suppose that preferences can be represented by an exponential utility function:

$$u\,(C_{its}; Z_{its}) = -\frac{1}{\sigma} \exp(-\sigma(C_{its} - Z_{its})) \text{.....(4)}$$

Where σ is the Arrow - Pratt measure of absolute risk aversion.

The first order conditions (after manipulations and disregarding the notation for the state) can be written as:

$$\Delta C_{it} = \Delta C_{t}^{a} + (\Delta Z_{it} - \Delta Z_{t}^{a}) \text{.....(5)}$$

Where $C_{t}^{a} = \frac{1}{n} \sum_{i=1}^{n} v C_{it} \quad Z_{t}^{a} = \frac{1}{n} \sum_{i=1}^{n} Z_{it}$

The key prediction of full consumption insurance is that after controlling for the influence of change in time varying taste factors, the change of household consumption between two periods is only affected by the change in aggregate consumption ΔC_{t}^{a}.

Let us also consider the specific utility function having the form:

$$u(C_{its}; Z_{its}) = \frac{C_{its}^{1-a}}{1-a} \exp(Z_{its}) \text{ .....(6)}$$

After manipulations and disregarding the notation for state the first order condition is given by:

$$\Delta Ln(C_{it}) = \Delta C_{t}^{a} + (\Delta Z_{it} - \Delta Z_{t}^{a}) \text{.....(7)}$$

* See Mace (1991), Cochrane (1991) and Townsend (1994) for detailed discussion on preference specifications.

Where $Z_t^a = \frac{1}{n}\sum_i Z_{it}$, $C_t^a = \frac{1}{n}\sum_{i=1} L_n(C_{it})$

Under complete risk sharing, change in individual consumption ΔC_{it} depends only on changes in village average consumption ΔC_t^a.

To test consumption insurance in a decentralized economy, let us assume that there is complete market for state contingent commodities and households within a given insurance group are assumed to purchase state contingent commodities to maximize their expected utility function.

The model specification with the above versions that are commonly used in the literature for empirical consumption insurance tests have the following forms.

For an exponential utility function, the empirical specification can be written as

$$\Delta C_{ivt}^g = \alpha_0^g + \alpha_1^g \Delta C_{vt}^{ag} + \alpha_2^g \Delta Y_{ivt}^g + \alpha_3^g \Delta n_{ivt}^g + \sum_{ivt}^g \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(8)$$

Where ΔC_{ivt}^g is the per capita consumption of household i in village v in period t and for income diversification group g.

ΔY_{ivt}^g denotes change in per capita income of household i; Δn_{ivt}^g is change in the household size; ΔC_{vt}^g denotes change in village average per capita consumption ; $\sum_{ivt}^g$ is error term capturing both changes in the unobservable components of household preferences, measurement error and is distributed identically and independently.

For alternative utility functional form in equation (6), the empirical model can be specified as:

$$\Delta Ln(C_{ivt}^g) = \alpha_0^g + \alpha_1^g \Delta LnC_{vt}^{ag} + \alpha_2^g \Delta Ln(Y_{ivt}^g) + \alpha_3^g \Delta Ln(n_{ivt}^g) + \sum_{ivt}^g \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(9)$$

In equation (8) and (9) the coefficient of change (growth rate) in household income per capita measures the extent to which idiosyncratic income changes or growth rates play a significant role in explaining the household specific consumption change (growth rate). If consumption is insured for idiosyncratic income shocks, then changes in household income will have no

effect on consumption after controlling for common risk effects, i.e., $\alpha_2 = 0$ (See Townsend, 1994; Mace, 1991)

The null hypothesis of full insurance is always rejected (Maitra, 2001; Jalan and Ravallian, 1999; Chaudhuri and Ravallian, 1997). Although the estimated value of α_2 is low, it is observed that the changes in household income generally have a significant effect on household consumption. This result may be interpreted as the indicator of vulnerability of consumption to idiosyncratic income shocks. The higher estimated marginal propensities to consume out of idiosyncratic changes in income or the elasticity of consumption with respect to change in income signifies a higher covariance between income and consumption changes.

To test for systematic inter-household differences in the extent of consumption smoothing, we stratify our sample by the income diversification category. The income portfolio category comprises pure farm, mixed farm, farm-easy off farm, farm-lucrative off farm, and agri-off farm strategy. Households are grouped into these five categories based on their involvement in those strategies. This method of stratification is used because of its importance to identify which type of rural livelihood is more vulnerable to shocks.

It can also be argued that households with well diversified income are more able to reduce the effects of shocks on their income and hence on consumption. The reverse holds for households with less diversified income. To test the level of diversification effects, we stratified our sample on the basis of our income diversification measure irrespective of the income portfolio category. Households are grouped into three strata depending on the size of inverse Simpson measure attained. This method of stratification is used because in diversified economic portfolio the effect of household specific (idiosyncratic) risk will gradually become less and less as diversification increase. Thus the effects of household income shocks will be negligible in well-diversified household incomes.

To examine the robustness of our results to estimation, we use the following regression model, applied by [Jalan and Ruvallign, 1999] for similar test.

$$\Delta C^{g}_{ivt} = \sum_{jl} \alpha^{g}_{jk} D^{jk}_{ivt} + B^{g} \Delta Y^{g}_{ivt} + \Phi^{g} \Delta n^{g}_{ivt} + \Delta e^{g}_{ivt}$$

Where ΔC^{g}_{ivt} is changes in consumption per person of i^{th} household at date t for diversifying group g, D^{g}_{ivt} is village time dummy variable equal to one when J=v and K=T and zero otherwise, Y^{g}_{ivt} represents income per capita, n^{g}_{ivt} is other household characteristics, and e^{g}_{ivt} is unobserved independently and identically distributed random variable. The systematical (collective income shock) risk is handled using village time dummies. These village fixed effects include unobserved soil, climatic, health services and other characteristics, which might be correlated with village prices and wage rates. The change in Y_{ivt} captures idiosyncratic income risk of the household.

The selection of this specification is based on the following reasons. (1) Empirically, it has been widely used for testing vulnerability between consumption and income for different wealth groups in the literature. (2) In the presence of village level component in the household income change, other specification, such as taking deviation from village-mean consumption as dependent on income changes, will result in biased estimates [Ravallion and Chaudhuri, 1997]. (3) For our analysis of income effect on consumption, other unobserved factors can be captured by the error term [Jalan and Ruvallign, 1999].

3.2.4 Framework for Analysis Distribution of Income and Welfare level.

There is ample evidence that the contribution of non-farm income to household total income is substantial. The extent and nature of income diversification of households vary with their asset endowments, household characteristic, and village characteristics. Despite the importance of diversifying income sources in reducing effects of risks in rural area, the impact of different source of income on rural income distribution is ambiguous. Thus it is important to identify the relative importance of major income components in determining over all income inequality.

We use decomposition techniques to pinpoint the contribution of alternative sources to rural overall income inequality [Lerman and Yitzhaki (1985, Adams (1994, 1999), Escobal (forthcoming, Barreit (2000)]. Among the different proposed measures of inequality in the literature, the preferable measure should satisfy the following properties. These are Pigou-Dalton transfer sensitivity, mean independence, symmetry, population homogeneity and decomposability [Adam, 1994].

The source decomposition of the Gini coefficient can be developed as follows. The conventional Gini coefficient of total income, G, can be written as:

$$G = \frac{2\,CoV\,(y, F(y))}{\mu} \tag{1}$$

Where CoV (y, F(y)] is the covariance of total income with its cumulative distribution of income F(y), y is total household income, and μ is mean household income.

Let y_1, y_2 ---y_k represent components of family income and using the properties of covariance we can write as:

$$G = \frac{2\sum_{k=1}^{k} Cov\,(yk, F(y))}{\mu} \tag{2}$$

Dividing and multiplying each component K by CoV (Y_k, F_k) and the mean income source K (μ_k) yields the decomposition by income source as

$$G = \sum_{k=1}^{k} \frac{CoV[y_k, F(y)}{CoV(y_k, F_k)} \times 2 \quad \frac{Cov(y_k, F_k)}{\mu_k} \times \frac{\mu_k}{\mu} \tag{3}$$

$$G = \sum_{k=1}^{k} R_k G_k S_k \tag{4}$$

Where R_k = the Gini correlation between income component K and total income

G_k = the relative Gini of component K

S_k = component K's share of total household income

F_k = cumulative distribution of income from source K.

If in equation (4) the product of three components is larger, the contribution of income from source k to total income inequality will be greater.

Now consider that we want to analyze the effect of a change in particular income source from Y_K to eY_K on overall income inequality, where e is percentage change and close to one.

Taking partial derivative of the overall Gini (G) with respect to a percentage change e in source K yields [Lerman and Yotzhaki, 1985].

$$\frac{\partial G}{\partial ek} = S_k (R_k G_k - G) \tag{5}$$

Dividing (5) by G yields the relative source of K's marginal effect on the overall Gini for total income; it can be written as:

$$\frac{\partial G / \partial ek}{G} = \frac{S_k (R_k G_k - G)}{G} = \frac{S_k R_k G_k}{G} - S_k \tag{6}$$

Equation (6) indicates that the marginal percentage change in inequality resulting from a small percentage change in income component k is equal to component k's share in total inequality minus component k's share in total income (Stark et al, 1986; Woolard et al, 1996).

Based on the monetary change analysis, we can ask what the effect of a small change in income from source k on social welfare would be. Woolard et al (1996) explains two routes through which an increase in source k income affects our over all welfare (1) by increasing average income (positive welfare effect) (2) by altering income distribution within the sample, which has positive or negative effect depending on direction of income inequality movement.

To consider both aspects of welfare, we use Sen's social welfare function (Stark et al (1986); Woolard et al (1996) with the form.

$$W = \mu(1 - G) \tag{7}$$

Where μ denotes the mean household income of the sample and G represents the Gini measure of total income inequality.

Using the measure of social welfare in equation (7), we can examine the impact of a small change in particular income source, from Y_k to (1+e) Y_k on welfare by taking the derivative of W with respect to e. This can be written as

$$\frac{\partial w}{\partial e} = \mu_k (1 - R_k G_k) \quad (8)$$

Equation (8) shows two welfare effects, i.e. positive mean income effects and a distribution effect.

Dividing equation (8) by w gives

$$\left(\frac{\partial w}{\partial e}\right)\frac{1}{w} = S_k \frac{1 - R_k G_k}{1 - G} \quad \text{.....(9)}$$

This expression indicates the marginal effect of small percentage change in income component k on welfare (as measured by the Sen welfare index).

CHAPTER 4. EMPIRICAL ANALYSIS

This chapter has two main sections, namely, data description and model estimation. The first section presents descriptive information about the household characteristics, study sites and relevant variables. In the second section the empirical results obtained from model estimations will be presented and analyzed.

4.1 Description of the Study Areas and the survey data

4.1.1 An overview of the SNNP Regional state

The Southern Nation, Nationality and People Regional State (SNNPRS) is one of the regional states of Federal Democratic Republic of Ethiopia. It is located in the southern and south western part of the country, and is situated between $4^0$27' and 8^0 30' latitude north and 34^0 21' and 39^0 11' longitude east (SNNPRS,(2000)). It borders Kenya in the South, the Sudan Republic in the Southwest, Gambela region in the northwest and Oromiya region in the north and east. The SNNPRS is divided into 13 administrative Zones, 8 Special Woredas and 104 Woredas. Each Wereda is divided into peasant associations at the village level representing specific communities.

The region has diverse ecology and socioeconomic profile. According to the Central Statistical Authority population projection, the total population for year 2002 is estimated to be 13.3 million with almost 1:1 male to female ratio. Out of total population, 92.05 percent reside in rural areas while 7.95% dwell in urban areas. The region is the home of more than

56 ethnic groups.[1] The population growth rate is about 3 percent per annum while the crude population density varies from 3 to 749.

The total land area of the region is estimated to be 118,000 km^2 and accounts for about 10% of total area of the country. According to the national atlas of the country, the region is classified into five agro ecological zones out of which 8.6% of the total area consists of semi desert/harur (the hottest lowland which is below 500 meters above sea level), 48.9% kolla, 33.9% weinadega, 8.4% dega and 0.2% wurch. More than 75% of the total population of the region resides in dega, woinadega and wurch while the remaining population inhabits in Kolla and Harur.

The topography of the region is characterized by highly variable landforms and different altitudes It ranges from flat lowland to rugged and mountain plateau. The altitude variation of the region ranges between 376 meters above sea level at lake Rudolf in the South Omo to 4207 meters above sea level at mount Guge in Gamo Gofa zone. The amount and distribution of rainfall varies from place to place within the region, having mean annual rain fall and temperature ranges of 400-2200 mm and 15^0 c to 30^0 c, respectively.

In terms of natural resources the region has relatively better forestland area than other regions. The total area covered by forest and bush and shrub was estimated to be 17355.3 km^2 and 11,633.8 km^2 respectively. The density and distribution of natural vegetation varies from place to place. The region has high potential for the expansion of tourism industry. Survey identifies the region as homeland for 23 different types of wild lives and 300 kinds of spectacular bird species due to the existence of abundant water and thick forest.There are

[1] The SNNPRS second Five-year Development, Peace and Democracy Programme

three national parks: Nechsar in Gamo Gofa, Mago in South Omo, and Omo in Bench-Maji zones .

There are a number of unexploited water bodies, which can be used for irrigation and hydroelectric power. Lakes like Awassa, Abaya and Chamo are the main sources of fish production in the region, with an annual average of 4500 tons of production in last five years. The large proportions of area in the region are covered by minerals of volcanic and inter volcanic sedimentary rocks. According to regional Food Security and Pastoral Development Office project study (2002), the occurrence of economically valuable minerals such as gold and associated minerals, industrial minerals and construction material are available in the region. The depletion of natural resource base in the search of farmland, for energy and other uses created problem of land degradation, soil erosion and declining fertility.

Agriculture is the dominant sector of the region's economy. It is mainly rain fed, subsistence oriented and smallholder based production system. From the total land area of the region, 23.04% is under crop cover, 18% is under forest, 20.1% is grazing land, 13.56% is unused arable land and 25.3% is for other purposes. Landholdings in most parts of the region are small. Peasants possess up to one- ha, 1-2 ha and greater than 2ha are about 62.9, 21.2, and 15.8 percent respectively. The major traditional farm implements available to the smallholder farmers in most parts of the region are the traditional plow, maresha, and the local hoe. Oxen are the most prominent source of power for plowing, and covering about 70% of farm work. However, 49% of rural population do not own ox, while 27% have only one ox.

Agricultural production is highly dependent on traditional farming practices. Farmers in the region mainly use systems of multiple cropping; inter cropping, relay cropping and crop

rotation. The lowlands are known for its livestock production with shifting and rarely settled cultivation, whereas the high lands are agro-pastoral. Crop production is mainly based on rain fed farming. *Enset*, maize, wheat, *teff* and root crops are among the major food crops. Coffee is the dominant cash crop and grows in different parts of the region. The food production of both crop and livestock in some parts of rural areas is below requirement due to drought, insufficient technology development and dissemination, high population density, and farmland shortage, natural resources degradation, limited use of irrigation, low farm income, and lack of capacity.

The region has a total livestock population of 17,853,559 TLU, out of which 7,534,960 are cattle, 2,411,314 are sheep, 2,196,733 are goat, 697,471 are equine, and 5,013,081 are poultry. This accounts for 20% of the nation's livestock population. Nearly 60% of the livestock population in the region is in GamoGafa, Dawro, Wolayta, Sidama, Silte, and Gurage zones.

According to the regional Integrated Food Security Programme (2001), there are different kinds of risks that affect rural households. Natural factors, such as uneven distribution and erratic rainfall, floods, landslide, pest infestation, epidemic diseases of human and livestock, poor socio economic base and asset endowments of the household have contributed to consumption vulnerability of households. The most rural vulnerable groups include land less and the poor without assets, very small and fragmented landholders, women headed families, families with large size, dislocated and looted pastoral members, drought affected households, and people living in pest affected areas.

The numbers of food insecure Weredas were 18 in 1996 and 60 in 2001. The size of vulnerable people varies depending on coverage and size of drought attack in each year; the

highest insecure people (about 1.5 million) was recorded in year 2001 (SNNPR Integrated Food Security Programme, 2001)

Development of socio-economic infrastructure and services are vital to the livelihood improvement of the society as well as a means to stabilize household food security. In this regard the region is characterized by low coverage of road networking, low access to health and educational facilities, inadequate market facilities and relief outlets, inadequate water supply schemes and limited achievement in gender issues and high population pressure (Regional Integrated Food Security, 2001).

The number of health professionals has been increasing from 2733 in 1995 to 3114 in 2000. As a result the ratio of health professional to population is 1: 3726 and more specifically nurse to population ratio is 1:14650 in 2000 (Health Bureau, 2000).

In SNNPRS, according to the report of water mineral and energy Bureau, about 28.12 percent of regional population had access to portable water in 2000. This shows the majority of population uses unprotected water.

The total length of all weather roads in the region in 1999 was 4949 kms with road density of 43.5 kms / 1000 km^2 and average road-population ratio is 0.37 km per 1000 population. The distribution is limited to cash crop potential areas and on the line to major cities and towns. This exacerbates the inadequate flow of information, movement of people, resources and output, market integration, and other services. In rural areas, rural town centers and market facilities have not yet been strengthened and as a result there would be substantial market failure both for inputs and outputs.

In the year 2002 the region has 12 hospitals with 963 beds, 107 health centers and 443 health stations. According to the regional Bureau of health service report (2002), the proportion of population access to heath services in 2000 was 44%. This indicates low coverage of health services in the region.

The magnitude and growth rate of regional gross domestic product (RGDP) at 1995 constant factor cost is given in Table 4.1. The country in general and SNNPR in particular has agricultural dominated economy.

Based on RGDP estimate (Table 4.1), the average contribution of agriculture and allied activities to regional economy is about 72.4 percent; the share of crop, livestock and forestry sub sector is about 55%, 24% and 18% respectively. The average annual real growth rate of agriculture in the period 1995 to 2000 is about 4 percent.

The contribution of industry and service sector to RGDP is about 13% and 15% respectively. Of the contribution of this industrial sector, more than 66% comes from construction while manufacturing contributes 22 percent. Although agriculture seems the dominant sector in the region, its share shows a declining trend, while that of industry and service sector indicate an increasing trend during the period.

As shown in the table 1.1, the average annual growth rate of regional GDP at constant price is 4.45 percent. The per capita RGDP estimate varies from 704 to 816 Birr, the highest was in 1989.

Table 4.1 Regional (SNNPRS) Gross Domestic Product by Economic Activity at 1995 Constant Factor Cost (1995-2000) (in Million birr)

	Economic Activity	1995	1996	1997	1998	1999	2000
1	Agriculture	5364.57 (73.41)	6229.67 (73.7)	6714.63 (73.55)	6558.47 (72.33)	6158.28 (70.66)	6436.39 (70.83)
2	Industry	904.09 (12.37)	1034.08 (12.23)	1100.75 (12.06)	1208.6 (13.33)	1206.93 (13.85)	1193.09 (13.13)
3	Services	1038.86 (14.22)	1188.78 (14.06)	1313.58 (14.39)	1300.74 (14.34)	1350.62 (15.49)	1457.28 (16.04)
	Total Regional GDP	7307.51	8452.53	9128.96	9067.81	8715.83	9086.76
	Population	10.38	10.81	11.19	11.57	11.96	12.34
	Per Capita RGDP	704	782	816	783	729	736
	Annual growth rate (%)		15.67	8	-0.67	-3.88	4.26
	Cumulative growth rate (%)		15.67	11.77	7.46	4.50	4.45

Source: Regional Bureau of Finance and Economic Development of SNNPRS

Note: Figures in parenthesis are the percentage contribution of sub sector to Regional GDP.

4.1.2 Description of Study Areas

Five different communities were included in the data set, with a total of 440 households. Table 4.2 describes the summaries of some of their characteristics. Adado in Gedeo zone has relatively higher potential in agriculture. The other sites are relatively poorer due to land scarcity as a result of high population density. Except Domaa in Gamu Gofa zone, all other sites have medium altitude climate (Woinadega) and are producers of enset.

As shown in Table 4.2, there are off farm activities undertaken in these sites. There are also variations with respect to access to infrastructure, climatic condition, access to market, farming system and other conditions although they have some characteristics in common. Detailed description of each of these sites can be found from Ethiopian village studies (Addis Ababa Unversity,1996)

Table 4.2 Characteristics of Sampled Communities

Site/PA	Location Woreda/ Zone	Rainfall (mm)	Altitude (meters) altitude zone	Technology & Infrastructure	Major crops produced	Main cash sources	Cropping Status	Dominant Religion (%)
Imdibir	Wolkite Gurage	50-60 inches	1500 - 2300 (Woinadega)	hoe ploughing, access all weather road, midway to 2 towns	Enset, Chat, Coffee, Cabbage, Maize, Potato, Tobacco	Chat, sales of sheep, donkey shoarses, Vegetables, Pottery migration, and trade, Coffee	Food deficit mainly due to land scarcity	Orthodox Christian (67)
Aze-Deboa-Kembata	Kedida Gamesa /AT	1200 - 1350	1700 - 3028 (Woinadega)	hoe (ox) plough, access all weather road, 4km to town	Teff, Barley, Wheat, Dagussa, Maize, Sorgum, Pulses, Enset, Coffee, other tree crops, Chat, Sugarcane, and vegetables	Cattle, Coffee, animal product, Chat, Teff²Kocho, trade migration	Food deficit mainly due to land scarcity	Protestants
Adado-Dilla	Dilla/ Gedeo	Sufficient	2200 (Woinadega)	hoe/ few ox, plough, access to town (5km)	Enset, Coffee Barley, Cow beans, Tobacco, Lin seed, and Jamine	Fruit, enset trade cattle Coffee, Chat, Sugarcane	Self sufficient	Orthodox Christian
Gara Godo-areka	Bolosso sore (Wolayta)	Bimodal	1,730 Woinadega	Ox plough, spade, access to all weather road, 11 km to town	Enset, other root crops, Maize, Teff, Sorghum, and Barley, Tree crops	Livestock, tree crops, trading, weaving, migration food for work, animal product	Vulnerable area mainly due to shortage of agricultural land	Christians protestants and Orthodox
Doma	Dita/Gamo Gofa	500 - 600 mm Unimodal	Kola <1500 Semiarid	Irrigation, ox plough, near wacha town (20 minutes walk), No access to road	Maize, Teff, Sweet potatoes	Weaving, wood works, sales of local drinks, and animal product, cotton, trade, migration, renting field	Recurrent drought affects the area	Christians

Source:- Compiled from Ethiopian village studies by Addis Ababa University and the Centre for the Study of African Economies, 1995-1996

4.1.3 Data and Descriptive Statistics

In this section we describe the data underlying the analysis and discuss descriptive statistics about the livelihood diversification, household characteristics and endowments, income, and its diversification. Data was taken from ERHS particular 4th (1997) and 5th rounds (1999), Department of Economics. The determinants of livelihood diversification, income diversity and income distribution analysis are based on data from 1999 survey and annual figures are used for analysis. The original sample consisted of 440 households. Our analysis is, however, based on 436 households due to incomplete information on the remaining four households.

In these data we have defined five distinct rural livelihood diversification strategies based on household participation in various activities, in addition to annual crop production. The major categories of diversification activities include growing permanent crops, livestock rearing and undertaking off farm activities. Off- farm activities are further categorized into lucrative off-farm and easy off-farm activities. This division is based on the requirement of capital assets with a threshold of one hundred Birr (USD 11.56 Dollar) for lucrative off farm activity and/or special skills. Those activities that require huge initial investment and /or special skill are grouped as Lucrative off farm activity, while those activities that need none or low initial investment and/or simple labour are categorized as easy off farm activity. The five distinct rural livelihood diversification strategies are: Pure-farm, Mixed farm, Farm-easy off farm, Farm-lucrative off farm and Agri-off farm strategy (see TableA7 in Appendix for details).

Income diversification in this study is defined as the presence of multiple income generating activities and sources of income within the household economic portfolio. Empirically, there are several possible measures of income diversity. These measures include number of income

sources, the Simpson index and the inverse Simpson index. Dunn (1997) and Valdivia et al (1996) recommend the use of an inverse Simpson measure of diversity because it captures both the number of income sources and the relative importance or evenness, of these sources.

An inverse Simpson index of diversity is given by the formula

$$d = \frac{1}{\sum_{i=1}^{n} p_i^2}$$

Where d is measure of diversification, n denotes sources of income i = 1.....n, P_i is proportion of household income generated from income source i.

The income diversification measure (d) is affected both by the number of income sources and by the relative importance of each income source. The income diversity index is constructed from data on the amount of in cash and kind income received from each income source using inverse Simpson index formula.

For consumption smoothing analysis, deviations of monthly 1999 data from monthly 1997 data on per capita income, per capita consumption, and household size for 366 households are used. The measure of consumption expenditure includes cash spending, and imputed values of in kind spending, on food, drinks and stimulants, clothing, cultural and social expenditure, education and medical, non commodity expenses etc. In this analysis expenditure on durable or its use value are not included due to lack of data. Consumption from own production and in kind consumption from various sources have been imputed using the Village average price of similar purchased goods. In addition, the recall (reference) period assigned to household consumption component differ from item to item. To make the reference period of items identical, adjustments for food

items are made by multiplying weekly expenditure by 4. Annual consumption expenditure data on less frequent purchase (non food items) are adjusted by dividing it by 12. The income variable includes both cash and imputed values from in kind income from various sources.

The variables included as regressors in the livelihood diversification strategy should reflect the heterogeneity of incentives and constraints facing households across strategies and the differences in household and village characteristics. Age, sex, and educational attainment of household head, household labour supply, and household composition are included to see whether household characteristics affect the household choice of livelihood diversification strategy. Education attainment is measured as three dummy variables categorizing educational level of head into illiterate, primary education (grade 1 to 6), junior secondary education (grade 7 to 8), and senior secondary education (grade 9 and above). The dummy variable is specified in such a way that the latter three dummy variables will take value one for a household head who has attained any higher education level. Three dummy variables are used taking illiterate group as reference education level. Age of head is measured in years representing experiences in rural way of life. Older heads have higher accumulated experience in rural way of life and hence help their households to involve in diversified livelihoods. Male headed households are expected to diversify their livelihood more than female headed households because of cultural differentiation of activities for men and women. In addition, most of women's time is occupied by home activities and do not participate in activities outside the village such as long distance trade and wage employment.

The number of household members in the three different groups (7- 14 years old children, number of adult male 15- 64 years old, and number of adult female 15-64 years old) and sex

dummy for the head are included to proxy for age and gender division of activities. The labour supply variable is measured in adult equivalent and expected to have positive effect on livelihood diversification strategy.

Land holding and livestock ownership are included to proxy for household endowments. Land holding of household is disaggregated into farmland and grazing land (both measured in hectare) to examine their role in livelihood diversification since land is one of the primary assets in rural area. Farm size is hypothesized to decrease the likelihood of being in diversified livelihood relative to pure farm, while grazing land increases it. The proportion of irrigated land is also considered to investigate its effect on the selection of livelihood diversification strategy. The irrigated land holding on level of income diversity is expected to have adverse impact on income diversity, which is explained by the fact that the use of irrigation reduces the effect of climatic risk in particularly drought and variability of total income. Alternative explanation for negative influence of irrigated land holding may be related to shortage of labor forces since irrigated farms requires continuous intensive work leaving less labor to other activities.

Livestock holding (measured in Tropical Livestock Unit) is included to proxy household wealth and is expected to have positive effect on livelihood diversification through different channels: reducing risk aversion of household, relieving liquidity constraints and generating income through sale of its product and services. We also consider number of ox holding as separate variable because of its critical role as input for farming activities. The number of ox holding has negative effect on livelihood diversification because holding of a pair of oxen is expected result in high crop production timeliness and thoroughness of cultivation and allows inflow of land, labour and grain from households who lack draft power to its holders.

Average distance to the nearest largest markets in minutes, dummy variables for use of agricultural extension services and involvement in cash crop production (proxy by coffee and *chat)* are expected to have negative effect on livelihood diversification. Average distance to market is expected to exert adverse effect on diversification due to high transaction cost, lack of information and transport cost for distant households. The use of agricultural extension service may increase farm productivity per hectare and hence higher farm output. In addition, use of extension requires continuous intensive farm work reducing labour time for other activities.

The availability of credit solves liquidity constraints and increases the capacity of household to start off farm business and to purchase farm inputs and hence expected to increase selection of more lucrative livelihood strategy. Transfer income (both in cash and kind) are hypothesized to increase the selection of livelihood diversification. Transfer income includes pensions, remittance, food aid, and governmental and non-governmental gifts.

The location characteristics are expected to influence the selection of livelihood diversification. The number of big markets per week in a village is expected to have positive effect on diversification. In addition, dummy variables for regional fixed effect are included to capture the differences in agro ecological conditions that influence opportunity sets across all households in a village.

Table 4.3 presents the pattern of income across livelihood strategies. Based on livelihood diversification category, the analysis of income generated from each strategy indicates that there is a great difference in generating income among strategies (see Table A7 in Appendix for

definition and category of strategies). Rural households involved in agri-off farm strategy receive the highest, and more than twice of the pure-farm average income. Farm income is the most important sources in both groups. However, the highest mean income is earned by mixed farm participants, followed by farm-lucrative off farm and agri-off farm strategy, in decreasing order. This may suggests that the complementarities existing between farming activities and live stock rearing. Farm-easy off farm group receives substantially more income from off farm business, wage employment and transfer income as compared to other strategies.

For rural households involved in agri-off farm strategy, livestock rearing, off farm business and farm activities are the most important sources of their income. Average income of households in agri-off farm, farm-easy off-farm and farm-lucrative off farm livelihoods receive higher mean income than total mean income.

Table4.3 Mean income of household by livelihood strategy, 1999

Livelihood strategy	Business income	Wage income	Crop/ Farm income	Livestock income	Transfer	Total income
Pure farm	0	0	1235.13	0	53.99	1289.13
Mixed farm	0	0	1609.48	330.50	23.57	1963.55
Farm easy off farm	719.85	376.78	1054.12	0	199.80	2350.65
Farm lucrative off farm	450.97	335.99	1593.57	32.22	50.95	2463.71
Agri-off farm	617.27	120.76	1510.23	309.21	28.08	2585.54
Total income	340.00	141.77	1428.45	155.63	58.40	2124.25

Source: computed from survey data

In addition, a closer look at mean income of households indicates, as expected, that diversification of income sources helps households to increase their income. As Table 4.3 shows, the lowest mean income among the livelihood strategies is of those households who rely

exclusively on crop farming. The highest mean income is enjoyed through diversification of agricultural activities with off farm and high return lucrative off farm activities.

Analysis of reasons given for taking up off farm activities indicated that limited agricultural income was an important factor for more than half of the rural households (53%) in taking up off farm activities in order to maintain their livelihoods. Another important reason for households' participation in off farm activities was to smooth labour allocation. For 17.6% and 9.65% of households who participate in off farm activities, the availability of large family size and the seasonality of farming activities are important reasons for undertaking off farm activities, respectively. While favorable demand for goods and services in off farm activities attracted 7 % households into this sector, 6.35% of households engaged in off farm activities due to availability of these activities. The level of education and proximity to urban area played important role only for 2.3% and 1.5% households in taking up off farm activities respectively. This effect of proximity to urban area and education in the study area may be due to the existence of only few towns, about 60% of household heads have not attain any education and some of the off farm activities may not require any education. These facts are consistent with other findings, showing that both push and pull factors influence household livelihood diversification (Reardon, 1997)

The motives for livelihood diversification can be identified through the analysis of how the households use off farm incomes. Of the households that responded (57 percent of the sample), the majority (88%) used off farm income for the purpose of maintenance of own consumption. Off farm income was also used for investments in business (off farm activities, saving, investment in farm /land /plough animal) by 1.6%) and other expenses by 5.6 percent households.

Similar analysis for remittance income indicated that 89 percent receiving households used part of remittance income for purpose of maintenance and own consumption, while about 11percent receivers used their remittance income for investment in off farm, farm and other expenditures. This evidence might highlight the relative proportions of rural households that use their remittance income for consumption versus investment, suggesting that the majority of households use their diversification income for consumption.

Table 4.4. Household Participation (%) in Livelihood Diversification by sampled communities

Livelihood diversification	Indibir	Durame	Adado	Gara Goda	Domma	T0tal
Pure-farm	6.35	5.41	12.69	10.42	1.45	8.28
Mixed farm	14.29	58.11	21.64	42.71	36.23	33.72
Farm-easy off farm	6.35	.00	8.96	6.25	8.7	6.42
Farm-lucrative off farm	34.92	21.62	43.28	19.79	28.99	30.96
Agri-off farm	38.10	14.86	13.43	20.83	24.64	20.64

Source: Computed from survey data

Table 4.4 illustrates the rural household participation in different livelihood diversification strategies in the study communities. As Table 4.4 shows, there are wide differences in the degree of participation in particular livelihood strategy across sites. The participation rate of households in pure farm strategy is relatively high in favorable agro climate and agricultural potential village

(Adado). Households who live in semiarid village (Domma) seems to be less likely pursue pure farm strategy.

Households who live in cash crop (coffee and chat) producing villages (Imdibir and Adado sites) dominantly pursue farm lucrative off farm strategy. This clearly reflects the role of cash crop production in relieving liquidity constraints. Mixed farm strategy seems to be the most important strategy for households in densely populated and land scarce villages.

Households who live in Imdibir site dominantly engage in agri-off farm strategy. The participation rate in farm easy off farm strategy is equal for households who live in the two extreme agro climates, i.e. in Adado and Domma sites. Similarly, the participation rate in farm-easy off farm is equal among households in Garagoda and Imdibir villages. There was no participant in farm easy off farm strategy from Durame site, where 80 percent of households engage in two attractive strategies, mixed farm and lucrative off farm livelihoods.

Across all sample households, 15 percent of household engage in pure and farm easy off farm strategies, reflecting that low returns from these strategies have attracted fewer households to these strategies. By contrast, about 65 percent of sampled households base their livelihoods on two relatively remunerative strategies. These patterns indicate that the most important livelihood strategy in one area may not be important in another, reflecting the locality specific characteristics of the strategies.

Table 4.5 mean income and share of income source by district

Income sources	Imdibir	durame	Adado	Garagoda	Domma
Mean income	2829.63	2020.29	2225.87	2042.20	1508.52
Off farm business (%)	36.94	5.87	38.17	14.01	5.00
Wage employment %	43.35	8.52	28.13	11.32	8.67
Crop farm activities (%)	13.54	17.56	30.73	23.21	11.75
Livestock (%)	6.13	25.67	15.56	32.21	20.43
Transfer (%)	32.36	34.28	9.04	7.49	16.82

Source: Computed from survey data

Table 4.5 presents the mean income and the activities from which the incomes derived by study site. Within rural areas, mean income in Imdibir is twice as high as the average income in the Domma district. Farm income is relatively more important in Adado where high agricultural potential is available and coffee production takes place. Off farm self and wage employment income is particularly important for Adado and Imdibir households. Income from livestock is mainly important in Durame, Gara goda and Domma communities. As Table 4.5 shows, Imdibir is clearly a better off area, followed by Adado while Domma is the poorest.

The demographic characteristics and resource endowment of the households are among the major determinants of the selection of livelihood diversification strategy. The most important demographic factors include age, sex, education of household head, and family size and composition. Table 4.6 summaries selected social characteristics and economic resource endowments of household across the livelihood diversification strategy.

Since it is directly linked with the supply of labour, household size is expected to affect the choice of livelihood strategy. The fact is that, for a given level of asset endowment, households

with a large number of economically active members are more likely to involve in multiple income generating strategies. The figures concerning family size in Table 4.6 confirm the fact that larger family sizes enables rural households to choose the livelihood strategy with diverse activities. As Table 4.6 shows, there are significant differences in family size across the strategies, the highest size involved in agri-off farm and mixed farming and farm-lucrative off farm, both of which involve cattle rearing. In other words, pure-farm and farm-easy off farm have the lowest family size measured in terms of adult equivalent.

Table 4.6 Summary of household characteristics and endowments by livelihood strategy

Household Characteristics	Livelihood strategy				
	Pure-farm	Mixed farm	Farm-easy off farm	Farm-lucrative off farm	Agri-off farm
Average age of head	52.86(18.81)	49.85(11.42)	44.57(11.12)	47.59(14.58)	47.38(13.78)
Family size (adult equivalent)	4.2(2.26)	5.02(2.39)	4.11(1.99)	5.07(2.27)	5.57(2.45)
Household composition					
Children[a]	1.75(1.38)	1.83(1.73)	1.71(1.36)	1.88(1.41)	2.02(1.64)
Female adult [+]	1.19(.86)	1.67(1.05)	1.25(.70)	1.68(1.18)	1.99(1.19)
Male adult[+]	1.22(1.24)	1.47(.97)	1.25(1.04)	1.57(1.08)	1.76(1.23)
Head Education					
Illiterate (%)	7.34	35.14	7.34	27.80	22.39
Primary (%)	9.6	31.64	5.08	35.59	18.08
Secondary (%)	10.20	36.73	4.08	28.57	20.41
Post Secondary (%)	20.83	33.33	8.33	25.90	12.50
Male head (%)	9.14	33.43	5.43	31.71	20.29
Female head (%)	4.65	34.88	10.47	27.91	22.09
Grazing land (hac.)	.031(.091)	.071(.179)	.043(.17)	.024(.076)	.021(.054)
Livestock (TLU)	.00(.00)	2.44(1.79)	.00(.00)	1.625(1.95)	2.21(1.99)
Farm labour supply	169.25(471.90)	123.78(244.19)	51.61(108.47)	246.37(580.85)	143.09(288)
Off farm labour supply	0.00(0.00)	0.00(0.00)	160.36(179.96)	133.08(129.23)	133.90(161)
Oxen	0.00(0.00)	.497(.666)	.000(.000)	.274(.628)	.3(.549)
Transport animal	0.00(0.00)	.122(.33)	0.00(.00)	.111(.338)	.1(.337)
Transfer (Birr)	67.72(327.41)	32.63(152.53)	20.75(55.72)	34.98(125.41)	140.95(903.54)
Cultivated land (hac)	.339(.298)	.68(.46)	.17(.22)	.51(.648)	.48(.399)
Irrigated land (hac.)	.014(.006)	.11(.28)	.007(.256)	.009(.276)	.01(.279)
Distance market (min)	40.32(29.56)	41.89(22.69)	34.63(19.523)	42.27(23.39)	35.09(19.10)
Credit (Birr)	530.67(1252.64)	248.55(401.83)	177.78(192.90)	488.13(1371.33)	257.56(366.26)

Source: calculated from survey data

Note: + include members 15-64 years. Figures in parentheses are standard errors.

a include family members aged 7-14 years.

The average age of household head indicates that younger head tend to select the livelihood strategy that combines off farm activities with farming. The elderly households with older heads engaged, on average, in pure farm livelihood, followed by mixed farm, while the younger heads pursued farm-easy off farm strategy. With respect to the household composition, households with more children tend to involve, to a large extent, in mixed farming, farm lucrative off farm and agri-off farm strategies. Similarly, households with a large number of adult female and male are tend to participate more in agri-off farm and farm-lucrative of farm strategy. Figures in Table 3 also reveal that the proportion of female headed households engaged in farm-easy off farm and agri-off farm strategies is higher than male headed households while the proportion of male headed households is higher in pure farm and farm lucrative off farm strategies as compared to female headed households.

The role of education in accessing non-manual wage and off farm business is quite clear. Participations in these activities require educated household members. Households with educated head and members have greater opportunities to access more remunerative and diverse activities. Thus, a strong positive relationship between education and lucrative livelihood strategy is expected.

A large proportion of household (59.4%) have not attended any school while among those who went to school 29.35%, 5.74% and 5.5% attended primary, junior secondary, and senior secondary level of education, respectively. A greater proportion of household heads with primary and junior secondary education are able to access more remunerative diversification strategies. From those household heads with senior secondary education, about 59.23 percent participate in

mixed and farm lucrative off farm strategies. In addition, relatively lower proportion of household heads with better education, for example about 10 percent with junior secondary and 21 percent with senior secondary education, are involved in pure-farm strategy. This indicates that there is some relationship between diversification and education level. The discussion reflects that education plays an important role in choosing certain livelihood strategies. For example, household heads with primary and secondary education participate more in farm-lucrative-off farm and mixed farming strategies than households with illiterate heads.

The pattern of livelihood diversification is clearly linked to the asset endowments of rural household. There is strong association between livelihood diversification and higher wealth and income. Greater access to private and public asset may improve access to self-employment, and non agricultural as well as farm wage employment. Different assets can play a variety of roles in generating income, and hence influence the selection of livelihood strategies. The likelihood of being in two livelihood strategies-mixed farm and agri-off farm-increases as the number of livestock, oxen and pack animal, and the size of farmland increases. Greater access to grazing land tends to influence household to engage in mixed farming as well as farm-easy off farm. Those households with higher cultivated land size are more likely to pursue mixed farming, farm lucrative off farm, and agri-off farm strategies in that order. This reveals that livestock endowment is important for livelihood diversification. The use of irrigation is also highly practiced by households engaged in mixed farm, followed by households in pure farm livelihood strategy.

The closer the households to the nearest market, the higher is the likelihood of involving in farm-easy off farm and agri-off farm strategy. With respect to market in the study area, the respondents

explained that low grain price (53.3%), high seasonal fluctuation of market (18.3%), lack of price information (13.7%) and unfair marketing practice (6.1%) are the major market problem in study area. In addition, village studies indicated that the main features of markets in the study areas include few big markets per week; lack of standard measures and weights for majority of commodities; existence of barter system of commodity in some villages; delay in settlement of disputes; existence of various disintegrated buying and selling operation; availability of few or complete absence of rural outlet/distribution centers and dominance of small scale marketing. These features may suggest the existence of market failure.

Agri-off farm diversifiers tend to have higher non labour income (transfers), followed by pure farm strategy. Households with higher mean credit tend to engage in farm lucrative off farm and pure farm strategies. However farm input credits in the form of kind are the dominant institutional credit provided to farmers. The analysis of household access to non-input credit reveals that 21.4% of households have access to this credit, suggesting that the majority of rural households have no access to off farm credit. When we examine the sources of off-farm credit, loans from friends and relatives (59.3), *Iddir* (15.1) and loans from moneylenders (12.8) are the top three sources of off farm credit, implying that formal financial sectors have no role in providing credit to off farm activities in rural areas. In addition, the respondents also pointed out that lack of creditors and high interest rate are the major problems in non-input credit. The investigation of the purpose of taking off farm loans shows that only 18.4% of borrowers want to undertake production activities, of which 3.2% of borrowers want to start off farm business.

Similar analysis for sources of finance for livestock investment indicates that income from farm activities (48.9% of purchasers of livestock), income from sale of livestock (20.3%), income from

sale of other assets and saving (6.8%), income from *equb* (3.5%), loans from relatives and other households (5.3%), and loans from NGO (1.5%). This clearly reveals that neither formal credit nor informal credit markets appear to facilitate the entry of rural households into livestock rearing. Given underdeveloped credit markets to finance non-farm business and livestock investment, own cash income is important to start non-farm enterprises and to purchase livestock. As a result, credit is not expected to play a significant role in household livelihood diversification. This indicates that households with no access to credit, limited own financial saving and liquid assets are constrained to diversify into more lucrative off farm activities. Higher labour supply increases the likelihood of being in diversified livelihood strategy.

4.2 Estimation Results and Discussion

In this section, we present and discuss the estimation results. The determinants of rural households' choice among livelihood strategies are identified using multinomial logit model. The results of sample selection bias correction OLS model for determinants of level of income diversification are discussed for each of the strategies. The regression results of the effect of income diversification on consumption smoothing are also analyzed.

4.2.1 Empirical Results for Determinants of the Level of Income Diversification

A. Participation Equation

The results from estimating the multinomial logit livelihood diversification participation equation are displayed in Table 4.7. The table shows both the coefficients and relative risk ratio of each of

four livelihood choices versus pure farm strategy. The analysis in this study is based on interpreting the odds ratios rather than computing the marginal effect of each variable, which is rarely used in multinomial regression. The problem of marginal analysis is that it shows different changes at different level of variables. In addition, it does not indicate the dynamics among the dependent outcomes (Long, 1997).The definitions of explanatory variables are given in Table A8 in Appendix.

Table 4.7 Determinants of Household Livelihood Diversification Choices: Multinomial Logit Result.

Explanatory Variable	Mixed farm			Farm easy off farm			Farm lucrative off farm			Agri-off farm		
	Coef.	RRR	P>/Z/	Coef.	RRR	P>/Z/	Coef.	RRR	P>/Z/	Coef.	RRR	P>/Z/
graz land	-4.241	.014	0.35	5.037	154.043	0.02	-5.291	.005	.24	-8.024	.000	.09
Head sex	-1.295	.274	0.12	-1.609	.199	0.11	-1.254	.285	.15	-1.208	.28	.16
Head age	0.155	1.167	0.14	0.323	1.381	0.03	.203	1.225	.08	.166	1.180	.15
Mrktdst	-.024	.976	0.04	-.036	.964	0.03	-.023	.976	.05	-.04	.959	.00
Primary	-.392	.675	0.54	-.956	.384	0.23	-.188	.829	.77	-.591	.554	.41
Secondary	7.956	2,854.8	0.02	-10.413	.000	0.11	7.225	1373.8	.03	7.76	2344	.02
Post secondary	-10.412	.000	0.00	-10.578	0.000	0.09	-10.286	.000	.00	-11.079	.000	.00
N female	-.621	.537	0.09	-0.146	.863	0.72	-.471	.634	.21	-.29	.746	.43
N children	-.047	.954	0.82	.049	1.051	0.84	-.087	.916	.69	.064	1.066	.76
N male	.123	1.131	0.72	.542	1.718	.19	.152	1.164	.66	.296	1.345	.40
N oxen	-6.927	.001	0.00	-1.62	.197	.41	-6.65	.0012	.00	-7.254	.001	.00
Extension	-3.426	.033	0.01	-1.156	0.314	.201	-4.358	.0127	.00	-3.349	.035	.01
Irr land	-.018	.982	0.44	.009	1.009	.68	-.025	.975	.28	-.032	.968	.16
Cash crop	-.487	.614	0.66	-2.227	.1077	0.08	-.156	.855	.90	-1.057	.347	.35
Lvstock	17.861	5.71e+7	0.00	5.193	180.08	0.32	16.88	2.15e+7	.00	17.287	3.22e+7	.00
Transfer	-.135	.873	0.535	-.283	.753	.27	.035	1.035	.86	.078	1.082	.71
Cult land	-.583	.558	0.74	-6.664	.0012	.02	-1.925	.145	.26	-2.506	.082	.16
Crdt	-.006	.993	0.96	.195	1.215	.173	.102	1.107	.44	.054	1.055	.68
Labor	.379	.558	.333	.864	2.371	.02	1.776	5.07	.00	1.791	5.998	.00
Agesqre	-.0016	.998	.084	-.004	.996	.02	-.002	.997	.04	-.002	.997	.06
N mrkt	2.99	19.932	0.198	-.381	.683	.88	3.169	23.792	.17	3.327	27.87	.13

log likelihood = -403.06 LR Chi2 (104) = 447.38 Pseudo R^2 = 0.3569

N = 436 Prob>chi2 = 0.0000

Note: P>/z/ indicates the significance level at which the parameter is different from zero. RRR is relative risk ratio. Village fixed effects and constant terms are included in regression but not shown here

Since multinomial logit specification requires a test for independence of irrelevant alternatives property (IIAP), Huasman test is used for this purpose. The test statistic calculated for each specification and subset of a given model indicated that we could not reject IIAP. Another important test conducted was whether two outcomes could be combined or not. The results of pooling restrictions show that we cannot pool any of the groups (see test results TableA4 in Appendix).

Table 4.7 shows that the most important factors that explain household's choice of mixed farm strategy versus pure farm livelihood are distance to nearest market, secondary and beyond education attainment of household head, number of adult female members, number of oxen, use of agricultural extension and advice, and livestock holding. The results indicate that the possession of secondary education by head and increase in livestock endowment increase the odds of having mixed farm strategy relative to pure farm livelihood. The use of agricultural extension, post secondary education attainment of head, number of adult female members, distance to nearest market and number of oxen holding decrease the odds of having mixed farm relative to pure farm.

The household's choice of Farm-easy off farm livelihood relative to pure-farm is significantly influenced significantly by grazing land holding, age of household head, distance to nearest market, post secondary education attainment of head, involvement in cash crop production, farm size (cultivated land area) and total household labor supply. The result shows that increase in grazing land holding, labor supply, head age and attainment of post secondary level of education by head increase the odds of participating in farm-easy off farm livelihood versus pure farm

strategy. On the other hand, involvement in cash crop production, increase in distance to nearest market and farm size (cultivated land in hectare) decrease the odds of being in farm easy off farm relative to pure farm livelihood. For example, for unit increase in labor supply the odds of farm-easy off farm versus pure-farm livelihood increase by a factor of 2.37

The regression results show that total household labor supply, livestock endowment, use of agricultural extension and advice, number of oxen, possession of secondary and post secondary education of household head, distance to nearest market, and age of head are the most important determinants of household's choice of farm-lucrative off farm versus Pure-farm livelihood. As table 4.7 indicates, a unit increases in labor supply increases the odds of having Farm lucrative off farm relative to pure farm by a factor of 5.07. The possession of secondary education by head, total labor supply, age of head, livestock endowment increase the odds of being in farm-lucrative off farm while use of agricultural extension, post secondary education attainment of head, and distance to nearest market decrease the odds of having farm-lucrative off farm relative to pure farm livelihood.

The most important factors in explaining household's choice of Agri-off farm relative to pure farm strategy include grazing land endowment, distance to nearest market, possession of secondary education of head, use of agricultural extension, livestock endowment, total labor supply, and number of oxen holding. Household total labor supply, livestock holding, and possession of secondary education of head increase odds of being in Agri-off farm strategy relative to pure farm while grazing land holding, distance to nearest market, and number of oxen holding decrease it.

Our results reveal that livestock holding increases the odds of having mixed farm, farm lucrative off farm and Agri-off farm strategies versus pure farm livelihood, the effect for mixed farm being larger than others. Apart from serving as accumulation of wealth and social prestige, livestock generate not only income through sale of animal and sale of its product and net value of off spring but also provide different services such as transport, plowing and etc.

Farmland (cultivate land) holding lowers the participation of household in mixed farm, farm easy off farm, farm lucrative off farm and Agri-off farm livelihoods. The negative impacts of farm size (cultivated land) on choice of livelihood diversification strategies are consistent with theoretical prediction and empirical evidences. Households who are endowed with small land size allocate their surplus resource (in particular labour) to alternative accessible opportunities. The negative effect of farm size implies that land constraint drives diversification. But the estimate is statistically significant only for farm easy off farm strategy. By contrast, greater ex ante grazing land holding increases the likelihood of being in farm easy off farm but it decreases the probability of involvement in agri-off farm livelihood.

Household total labour supply (measured in terms of man days) is one of the determinants of livelihood selection. The impacts of labour supply are positive and statistically significant for farm easy off farm, farm lucrative off farm and Agri-off farm. These results suggest that household with abundant labour supply are more likely to be engaged in livelihood diversification.

The results reveal that the greater number of oxen holding and involvement in cash crop production lower livelihood diversification. This suggests that cash crop producers are better in accessing cash incomes through sale of cash crops and hence less incentive to diversification. Since ox is one of key inputs in farming activities, holdings of oxen help the households to be self employed and devote more labour time on farm leaving less time for other activities.

The amount of credit received by the households has positive effects on likelihood of being in farm easy off farm, farm lucrative off farm and Agri-off farm livelihoods relative to pure farm. This implies that credit enhances the capacity of rural household to start and maintain farm and non-farm businesses. But in all cases the parameter is not statistically significant. This implies that credit is not playing significant role in diversification. The reason for low role of credit in diversification choice might be that very little credit is available for activities other than farming.

With respect to the effects of education, the results indicate that the odds of having mixed farm, farm lucrative off farm and agri off farm livelihoods relative to pure farm are higher for household heads with secondary education than illiterate ones. By contrast, the effects attainment of post secondary education of head on odds of having these strategies versus pure farm are negative but the effect is negligible. The negative effect post secondary education may reflect the fact than relatively better educated household heads may not interested in diversification because higher level of education my help households to raise productivity of specific activities.

The use of agricultural extension service lowers the odds of participating in farm lucrative off farm, mixed farm and Agri off farm relative to pure farm. The presumable explanation for negative effect of use of extension service may be that users of extension services are more likely

to be food secure for their ability to produce more due to the fact that extension service would enable higher crop production by raising productivity per hectare. Alternative explanation for negative influence of use of extension on livelihood diversification may be related to the shortage of labour force as extension use requires continuous intensive on farm work leaving less labour time for off farm activities.

The location characteristics include distance to market, number of markets and village fixed effects. The result shows that the presence of nearest and regular local markets have favorable effect on pursuing livelihood diversification although the estimate is not statistically significant. Distance to nearest market exerts negative effect on odds of having diversified livelihoods. This indicates that households far a way from nearest market have limited market information, high transport and transaction costs and less likely to diversify livelihood.

The composition of household (adult members) and age of household head influence the livelihood choice. The grater the number of adult female member the less is the likelihood of being in mixed farm livelihood. The odds of having farm lucrative off farm and farm easy off farm livelihoods relative to pure farm are higher for older households. This may be associated with experience in way of life in rural area.

We also observe that each of the variables has differing magnitude of effect across choices. Labor supply has larger effect on Agri-off farm than other choices. Livestock holding has larger effect on mixed farm than lucrative and Agri-off farm livelihoods. The effect of secondary education attainment of household head on mixed farm strategy is larger than Agri-off farm and farm lucrative off farm strategies. The negative effect of farmland holding (cultivated land) is

significant only for farm easy off farm strategy. The distance to nearest market has similar effect on choice of both mixed farm and farm lucrative off farm livelihoods.

B. Income Diversity Equations

The results from estimating income diversity equations (sample selection corrected OLS results for five livelihood strategies) are summarized in Table 4.8 These equations were estimated using two stage least square methods including the selection correction variable Lamda as a regressor. The Cook-Weisberg test for heteroskedasticity, which is found in Stata software, is used to detect the presence of heteroskedasticity in our data. The result rejects the null hypothesis of homoscedasticity for income diversity equation. A White test is used to identify the variables causing heteroscedasticity (Maddala, 1992). Cultivated land and grazing land are found to be the source of heteroscedasticity. Two steps weighted least square for exponential heteroscedasticity model is used to remedy the heteroscedasticity found (Green, 1997).

Table 4.8 Determinants of Level of Income Diversification: Sample Selection Corrected OLS Results

Explanatory Variable	**Pure farm**	**Mixed farm**	**Farm easy off farm**	**Farm lucrative off farm**	**Agri-off farm**
N Mrkt	-0.283 (1.66)	0.146 (1.44)	0.408^{xxx} (3.08)	0.212 (1.62)	0.206 (1.22)
Labor	-0.088 (0.10)	0.022 (0.34)	0.015^{x} (2.12)	0.093 (1.28)	0.253^{xxx}(3.17)
Crdt	0.0329 (1.54)	0.011 (0.80)	0.003 (0.06)	0.058^{xxx} (2.79)	0.028 (0.85)
Transfer	0.083^{xx} (2.70)	0.072^{xxx} (2.98)	-0.047 (0.60)	0.070^{xx}(2.19)	0.070^{x}(1.77)
Land	11.329^{x} (1.87)	0.516^{x} (1.79)	-	-0.069 (0.19)	-2.46 (0.32)
Lvstock	-	0.227^{xx} (2.16)	-	0.062 (0.53)	0.094 (0.56)
Irr Land	-0.008 (0.08)	0.001 (0.46)	-	-0.002 (0.88)	-0.003 (0.84)
N transport	-	-0.063 (0.52)	-	0.131 (0.82)	-0.032 (0.13)
N oxen	-	-0.018 (0.22)	-	0.116 (1.11)	0.079 (0.37)
N male	0.146^{xx}(2.36)	-0.012 (0.29)	-0.263 (1.69)	0.183^{xxx} (3.98)	-0.020 (0.28)
N children	-0.003 (0.07)	0.030 (1.39)	-	-0.058 (1.48)	-0.072 (1.48)
N Female	-0.144^{x} (1.81)	-0.010 (0.27)	0.246 (1.67)	0.089^{x} (1.77)	0.073 (0.95)
Mrkt dstn	-0.007 (0.33)	0.002 (1.06)	-0.005 (0.89)	-0.003 (1.16)	-0.004 (1.05)
head age	-0.002 (0.47)	0.001 (0.28)	0.004 (0.44)	-0.006 (1.24)	-0.004(0.56)
graz land	2.133^{xx}(2.46)	0.124 (0.63)	-	0.824 (1.32)	3.066^{xxx}(2.32)
head sex	-1.717 (0.76)	-1.070 (0.77)	4.977(1.64)	-0.907 (0.51)	-4.767^{x} (1.93)
Primary	-2.776 (1.56)	0.853 (0.60)	1.543 (0.47)	1.663 (1.00)	5.150^{xx} (2.25)
Junior Secondary	-0.387 (0.18)	-0.700 (0.30)	-12.258^{xx} (2.43)	-1.09 (0.37)	-8.808^{xx} (2.09)
senior secondary	-	-3.036 (1.00)	-	0.887 (0.22)	5.655 (0.90)
Extension	-0.176 (0.10)	-0.279 (0.19)	-	0.403 (0.17)	-2.509 (0.77)
Cashcrop	-4.736^{x} (1.98)	3.574^{x} (1.91)	-5.496^{x} (1.79)	-0.528 (0.19)	-1.720 (0.51)
Lemda	0.168 (0.07)	-0.417 (0.23)	0.851 (0.27)	-1.782 (0.73)	2.555 (0.88)
Constant	24.374^{xxx} (3.46)	3.715 (1.00)	9.111 (1.49)	7.164 (1.05)	11.295^{xx} (2.26)
R^2	0.74	0.99	0.74	0.95	0.53
F. Statistics	2.74	491.81	3.15	98.50	3.42
N obs.	36	147	28	135	90

Note: The absolute value of the t-ratio is in parenthesis.

xxx significant at 1%

xx Significant at 5%

x Significant at 10%

Lamda is test for presence of selectivity bias

The regression results show that the amount of transfer (including remittance, government transfer, food aid, etc), farm size (cultivated land in hectare), the number of adult male and female members in the household, the ex ante grazing land endowment, and involvement in cash crop production (coffee and chat) are the important factors in explaining the variation of level of income diversity for pure farm livelihood strategy. Our test for presence of selectivity bias indicates that the use of OLS estimation does not introduce any bias since neither of the estimates for lamda (λ) is significant.

The involvement in cash crop production and the number of adult female members in the household have significant and negative impacts on level of income diversity while transfer income, ex ante farm land endowment, the numbers of adult male members in the household and grazing land holdings have significant and positive effect on level of income diversification.

For mixed farm livelihood strategy, transfer income, farmland holdings, livestock endowment (in Tropical Livestock Unit) and involvement in cash crop production significantly influence the level of income diversity. The effects of number of local market, household labor supply, the amount of credit received, the number of children in the household and grazing land holding are positive while the use of agricultural extension, number of adult male and female members, education level of secondary and beyond have adverse effects on level of income diversity although the effects are statistically insignificant.

Among households in farm easy-off farm livelihoods, the presence of frequent local markets and higher household labor supply appear to have significant positive influence on the level of income diversity. The possession of junior secondary level of education by the household head and involvement in cash crop production appear to be important determinants of the level of income diversity for this livelihood. They significantly decrease the level of income diversification. The amount of credit received, primary level of education of head, the number of adult female members have positive and insignificant effects on the level of income diversity.

For farm lucrative off farm livelihood, the most important factors that influence the level of income diversity are the amount credit of received, the amount of transfer income, the number of adult male and female members in the household. As discussed earlier, this is the strategy that requires high initial capital investment or/and special skills to generate income from this strategy. The estimates for number of local markets, total household labor supply, and post secondary education of head indicate positive effects on level of income diversity while that of involvement in cash crop production, distance to nearest market, and farm land endowment are negative, although neither of the estimates is significant.

The level of income diversity for Agri-off farm livelihood strategy is highly influenced by the total household labor supply, the amount of transfer income, grazing land holdings, sex of household head, and possession of primary and junior secondary education by household head. Household labor supply, transfer income, grazing land holding and primary education attainment of head have significant and positive effect while sex of head and possession of junior secondary education attainment of head have negative impacts on level of income diversity for this group. For agri off farm strategy, the number of local markets, credit received and number of adult

female members have positive effects on level of income diversity while involvement in cash crop production, distance to nearest market, cultivated and irrigated land size have adverse effect on level of diversity although the effects are not statistically significant.

We observe that each of the variables has differing effect (both in magnitude and direction) across income diversity equations. The farm size (area of cultivated land in hectare) has two opposing effects on rural household income diversification. First, the impact of farmland holding on income diversity is significantly positive for pure farm and mixed farm livelihoods. This reflects that greater farmland holdings allow its holders for crop diversification and integration of crop production with cattle rearing. The result for pure farm indicates that higher farm size allows household to grow different type of crops and hence facilitates crop diversification. This requires additional farmland to be put under cultivation. Extensive land cultivation for crop diversification is not promising because there is critical land scarcity. Intensive farming that increases value of output per hectare should be given priority. Greater farmland holding increases income diversity of mixed farm strategy. There are various explanations for this. Not only can the crop livestock integration help farmers to maintain soil fertility through the incorporation animal litter in the soil, but the animal themselves may provide different services and other products. In addition, they can be used as liquid able assets to solve credit constraints for purchase of farm inputs.

By contrast, the effect of farm size (cultivated land in hectare) on rural household income diversification is negative and insignificant for farm lucrative off and agri-off farm strategies. The adverse impact of farm size on income diversity implies a farmland constraints motivate

households to allocate their surplus resources (in particular labor) to undertake alternative accessible off farm opportunities and hence promote income diversity.

While irrigated land endowment appears to have negative (though statistically insignificant) influence on the level of income diversity (except for mixed farm livelihood), grazing land holding has significant and positive effect on level of income diversity for pure farm and agri-off farm livelihoods. The presumable reason for favorable effect of grazing land on income diversity of Agri-off farm strategy may be that sufficient grazing land endowment stimulates its holder to engage in cattle rearing while the possible explanation for household in pure farm livelihood is that grazing land holding enables it holder to grow and supply animal feeds.

Like farmland endowment, cash crop production where coffee and chat productions are considered as the most important in the region has two contrasting effects on level of income diversity. The first effect is that involvement in cash crop production adversely affects the level of income diversity for pure farm, farm easy off farm, farm lucrative off farm and agri-off farm livelihoods, although the effects are statistically significant only for former two strategies. The most likely explanation for negative effect of cash crop is that cash incomes from commercial crop production may have significantly higher share of total income relative to other income sources and hence lower the level of income diversity for cash crop producers as compare to those of non cash crop producers, for whom virtually all sources have fair share of total income. The second opposing effect is that involvement in cash crop production increases the level of income diversity for mixed farm livelihood. This may suggest that cash incomes from cash crop sales solve the liquidity constraints for households to invest on livestock.

The estimates for livestock holding indicate that livestock endowments have positive impact on income diversity but the impact is statistically significant only for mixed farm strategy. The most likely explanation is that livestock holding helps households to generate cash income not only through direct sales of animal and its products but also through provision of different services such as transport, plowing etc. Alternative possible explanation may be that livestock holding as means of wealth accumulation and social prestige might increase incentive for investment in off farm activities by reducing risk aversion and collateral problems for loan.

While total labor supply have favorable effects on level of income diversity for farm-easy off farm and agri-off farm strategies, household compositions (number of adult male and female members) have significant influence on income diversity of pure-farm and farm-lucrative off farm livelihoods. Increase in total labor supply significantly increase income diversity for farm-easy off farm and agri-off farm strategies implying that households with additional tend to allocate their labor to new income generating activities from these strategies either due to key resource constraints such as credit, high labor to land ratio which pushes households to allocate relatively unconstrained resources (labour) to other opportunities which give positive return or due to seasonality of farming activities. The numbers of adult male and female members of household (aged from 15 to 64 years) have positive and significant effects on the income diversity for farm lucrative off farm strategy. The effects of numbers of adult male and female members on income diversity of pure farm livelihood are similar, but in opposite direction with the effects of number of adult male members' are being positive. The latter outcomes may be the

consequence of gender differentiation of activities in rural area. Majority of farming activities are considered as men's activities in study areas.

The statistical evidences do not support the hypothesized positive relationship between male head and level of diversification. The estimates of sex of head reveal that it has negative (except farm-easy off farm) impact on level of income diversity but the estimate is statistically significant only for agri-off farm strategies. The most plausible explanation for varying effects of head's sex on income diversity may be the consequence of gender differentiation of the activities associated with differences in entry constraints. Most of the activities in study area are gender specific. Women engage in making basketry, pottery, producing and selling food and local beverage such as *tella, areqi,* involving in local and petty trade, and spinning while handicraft, carpentry, migration for wage labor, long distance trade, weaving, blacksmiths, farming and tanning are activities belongs to men. It is evident from the survey data that women dominate many of non-farm activities. Carswell (2001), for instance, indicates that involvement in non-farm and off farm activities is more prevalent amongst women than men in southern Ethiopia. Many activities open to women are less remunerative and less seasonal than those open to men. In addition, activities pursued by men have substantial entry constraints, such as initial capital and skill requirements, relative to those open to women. Thus, men head household seem to have less income diversity than women head households due to existence of substantial entry barriers for men's activities, high remunerative nature of their activities and gender differentiation of activities.

The amount of credit and transfer income received by the household have influence on variation of level of income diversity. The effect of credit appears to be positive on income diversity of all strategies, with its effect being significant only for farm lucrative off farm livelihood. Transfer income has positive and significant effect on income diversity for pure farm, mixed farm, farm lucrative off farm and agri-off farm strategies. This implies that households who get credit and transfer income have the capacity to start up and maintain off farm and on farm business. This is true from our discussion that some households use part of their remittance and transfer income for investment on farm and off farm activities.

The estimates for number of local market and distance to market reveal that they have relationship with income diversity. While the number of local market have positive and significant impact on income diversity for farm easy off farm livelihood, distance to nearest market has negative (though not statistically significant) effect on level of income diversity for most of the strategies. The positive impact of numbers of local market indicates that the presence of regular local market facilities up to date transaction between suppliers and demanders and helps the expansion of micro enterprise to produce more commodities and services and hence generate new employment opportunities. The presence of regular local market also facilitates the flow of information. By contrast, the negative effect of distance to nearest market implies that the existence of transaction costs, lack of information and high transport cost for distant households. This indicates that household in rural areas do not have access to the same technology, input supplies, market outlets, information and asset base. Thus, reducing disparities of transaction costs across rural households is essential.

The impacts of education status of household heads on income diversity are mixed. The possession of primary level of education has significant and positive effect on income diversity for agri-off farm strategy, while the junior secondary education attainment of head has adverse impact on income diversity for farm-easy off farm and agri-off farm livelihoods. As discussed earlier, the attainment of secondary level of education may help household to access diverse income generating activities and increase the number of income sources. However, education mat affect each of these sources differently and returns may vary significantly. Education may contribute for high productivity in some activities while none for others. In such situation higher productive activity generate dominant share of total income and become the primary source of household. Thus the level of income diversity for household with secondary education is less than household head with lower education attainment due to uneven contributions of income source to household total income. The negative and significant impact of secondary education of head may reflect the fact that relatively better educated household are not interested in diversification of low return easy entry activities, for example collecting and selling of fire wood, with high return activities due to variation in returns. A part from generating low returns, the easy entry activities are given low status by the rural communities. Alternative explanation for negative effect may be that higher level of education may enable the household to raise productivity of specific activity and thereby reducing the motivation for diversification (Tassew, 2000)

4.2.2 Empirical results for consumption smoothing effects

We estimated the regression of growth rate in consumption on growth rates of per capita income and growth rates in community average per capita consumption for households in different livelihood diversification strategies. The results of OLS regression are presented in Table 4.9.

Table 4.9 Consumption Changes Regressed On Income Changes (Growth rates)

Livelihood Strategy	Δ Ln C^{ag}_{vt}	Δ Ln Y_{ivt}^{g}	R^2	F Statistics
All Households	0.854* (13.0856)	0.27* (8.051)	.50	119(0.00)
Pure-farm	0.805* (6.126)	0.318* (5.054)	.51	27.88(0.00)
Mixed farm	0.870* (6.826)	0.209** (2.292)	.57	32.64(0.00)
Farm-easy off farm	0.868* (3.196)	0.335* (2.939)	.44	9.78(0.00)
Farm-lucrative off farm	0.632* (2.926)	0.241** (2.600)	.38	12.29(0.00)
Agri- off farm	0.977* (7.761)	0.274* (4.021)	.51	33.85(0.00)

Figures in parentheses are the t-values of the estimated coefficients. In each case, change in household size is also included as additional regressor.

* Significant at 1%

** Significant at 5%

Standard errors are corrected for heteroskedasticity using Huber-whit method

The regression results indicate that the effect of idiosyncratic income shocks on consumption varies across the different livelihood diversification strategies. We find that the estimated elasticities of consumption with respect to change in income are significantly greater than zero and this is true for each diversified group and for all households.

The result shows that households who are involved in pure-farm and farm-easy off farm strategies are the most vulnerable to income shocks as consumption tracks income more closely

for these groups[•]. For example, the elasticity of consumption with respect to idiosyncratic income is 0.335 for household in farm-ease off farm but it is only 0.209 for households in mixed farm livelihood. Households who are involved in farm-easy off farm strategy are relatively more vulnerable than those in pure-farm strategy. As Start (2001) and Hussein and Nelson (undated) point out, this form livelihood diversification can be considered as negative diversification, which is a strategy necessary to ensure survival and a step further into impoverishment. According to Ellis (1998) criteria, mixed farm and farm-lucrative off farm strategies seem to be robust livelihood systems because they display low sensitivity to shocks.

Following the criticism of the above estimation methodology on the ground that it gives biases estimates of the excess sensitivity parameter by Ravallion and Chaudhuri (1997), we re-estimated the model by using the village-time dummy in place of community average consumption change.

The estimated coefficients are presented TableA3 in Appendix. We find similar pattern of results to those obtained earlier. The estimated coefficients suggest that consumption tracks income more closely for households engaged in pure-farm and farm-easy off farm livelihoods. However, the estimated coefficients are higher for regression that include village time dummy.

We also estimated the regression coefficients on income changes to examine whether the level of income diversity have effect on consumption smoothing. Results for each of three diversity groups are presented in Table 4.10. The results indicate that the effect of idiosyncratic income shocks on consumption varies across different level of income diversity groups. The coefficient

[•] Vulnerability is defined as high degree of exposure to risk shocks and stress; and proneness to food insecurity (Ellis,1998)

for idiosyncratic income shock on consumption change is higher for low level of income diversity group. This suggests that more vulnerable households to income shocks are those who have low level of income diversity. Household consumption co-moves with household income more closely for bottom diversifiers.

Table 4.10. Consumption Changes Regressed on Income Changes (Levels), stratified by income diversity

Income diversity group	Δ Ln C^{ag}_{vt}	Δ Ln Y_{ivt}^{g}	R^2	F Statistics
Top Diversifier	0.568* (6.151)	0.216** (2.115)	.28	16.15(0.00)
Middle diversifier	0.662** (2.2)	0.415(1.535)	.16	7.09(0.00)
Bottom diversifier	0.766*(4.46)	0.720*(3.862)	.32	18(0.00)

Figures in parenthesis are t-values of estimated coefficients. In each case, absolute change in household size also included as additional regressor.

Standard errors are corrected for heteroskedasticity using Huber-whit method

* Significant at 1%

** Significant at 5%

Examination of the impacts of level of income diversity consumption change across different livelihood strategies might highlight whether the objective of income diversification is linked with consumption smoothing or not. The estimates for impacts of level of income diversity on consumption variation across livelihood strategies are presented in Table 4.11. The results obtained using predicted income change and predicted household size to account for the existence of relationship between income diversity and income and household size variations.

The level of income diversity has a negative effect on consumption variation for all strategies. This is evidence of consumption smoothing effect of income diversification. However, the consumption smoothing effect is significant for pure-farm and farm-easy off farm strategies.

Table 4.11 the Impact of Income Diversity on Consumption Variation

Livelihood Strategy	Predicted income Change	Income diversity	Predicted household Size	R^2
All household	0.014^{x}(6.70)	-0.180(-1.52)	$-.061^{xx}$(-2.61)	.40
Pure-farm	0.018^{x}(3.20)	-0.653^{xxx}(-1.85)	-.014(-0.24)	.42
Mixed farm	0.014^{x}(3.67)	-0.054(-0.99)	-0.054(-1.14)	.54
Farm-easy off farm	0.017^{xxx}(1.95)	-1.206^{xx}(-2.46)	-0.128(-1.06)	.39
Farm-lucrative off farm	0.008(1.36)	-0.211(.59)	-0.028(-0.47)	.20
Agri-off farm	0.013^{x}(4.35)	-0.235(-0.75)	-0.086(-2.01)	.49

Note: x significant at 1% level

xx significant at 5% level

xxx significant at 10% level

Figures in parentheses are t-statistics

Standard errors are corrected for heteroskedasticity using Huber-White method.

The significant and negative coefficients of income diversity for pure-farm and farm-easy off farm may suggest that the prime motive of diversification in to these strategies is to reduce vulnerability of consumption i.e., to maintain their consumption in order to survive. By contrast, the estimates of both income changes and income diversity for farm-lucrative off farm livelihood are insignificant, implying that idiosyncratic income shock does not affect household consumption. This may suggest that the prime motive for diversification may not be consumption smoothing. The motive of diversification may be related toe accumulation.

The estimates of OLS regression may be biased due to measurement error in income variable and computation errors in home consumption of own production which accounts significant share of income and consumption of households. We used lagged income and family size as instruments. The results of income coefficient estimates using instrumental variable (IV) are presented in Table A9 in Appendix. The instrumental variable estimates reveal some substantial difference from the results obtained OLS estimates. First, the estimates obtained from OLS regression are significantly higher compared to the corresponding IV estimates. This implies that endogensing income reduces the estimates of income coefficients. Second, we find similar pattern of results to those obtained earlier. In general consumption tracks income more closely for households engaged in pure-farm and farm-easy off farm livelihood strategies. The result also reveals that the effect of idiosyncratic income shocks on consumption is insignificant for households who involved in farm-lucrative off farm strategy.

4.3 Diversification, Income and Income Distribution

It is argued that diversification smoothes the flow of household income, by diversifying risks. Thus, diversification of income sources is expected to generate higher income. For the empirical analysis, we categorized the level of income diversity index (inverse Simpson index) into lower, middle and upper diversity group. Table 4.12 indicates the link between level of income diversity and share of income sources.

Table 4.12 Percentage Share and Mean Household Income per Income Diversity group

Income source	Income diversity		
	Lower	Middle	Upper
Off farm business	85.36 (8.35)	364.49 (35.90)	569.97 (55.75)
Wage income	82.28 (19.30)	135.37(31.97)	207.70 (48.72)
Farm income	1769.62 (41.20)	1428.74 (33.49)	1087.00 (25.31)
Livestock	31.23 (6.67)	160.41 (34.51)	275.22 (58.61)
Transfers	4.63 (2.64)	96.43 (55.29)	73.89 (42.07)
Household Income	1973.11 (30.89)	2185.44 (34.45)	2213.79 (34.66)

Source: Calculated from survey data

Note: + figures in the parenthesis are percentage share of the group from respective sources.

As Table 4.12 shows, there is significant difference in the contribution of different source of income across income diversity group. Upper diversity strata receives substantially higher share of income from both sources except from farm and transfer in comes. Notably, off farm business (56%) and livestock production (59%) are taking substantially higher share among the income sources. Figures in Table 4.12 suggest that rural household on average receive about 33 percent of their income from non-crop / farming sources although there is variations in size of non-farm income across livelihood strategies.

Income from crop production represents a large share of income for lower diversity group, with its share of income decreasing sharply as we move up the income diversity strata. In contrast, incomes form off farm business; wage employment and livestock production increase sharply as one move up the income diversity strata.

Households in upper diversity strata enjoyed higher mean income than did the middle and lower diversity groups. For example, the top and middle diversifiers earned 12.20% and 10.76% higher mean income relative to lower groups respectively. This pattern clearly confirms the fact that greater diversification contributes, as expected, to higher level of income.

Households in the lower level of income diversity receive 41.2% percent of farm income, 19.3% percent of wage income and less than 10% from each of the remaining sources. In the middle-income diversity strata, the share of income from income sources similar ranging from about 32 % to 36%. While majority of households in the lower income diversity group try to diversify their income within crop production and wage employment, upper income diversity groups seem to better able to guarantee in come diversification across different economic sectors.

Since the returns from livelihood strategies vary significantly, we are interested to identify the livelihood strategy that helps participant household to achieve higher level of income diversity. Table 4.13 summaries the relationship between livelihood strategy and diversity level.

Table 4.13 Involvement of households (%) in the livelihood strategy by income diversity level.

Livelihood strategy	Income diversity level		
	Lower	Middle	Upper
	%	%	%
Pure-farm	100	0	0
Mixed farm	91.83	7.48	0.6
Farm-easy off farm	60.71	39.29	0
Farm-lucrative off farm	60.00	34.81	5.19
Agri-off farm	50.00	40.00	10.00

Source: Calculated from survey data

As shown in Table 4.13 about 10 % percent of households pursuing agri-off farm strategy attained the upper level of income diversity. Among those who involved in pure farm and farm easy off farm strategies no households entered the upper diversity level. These may be related to entry barrier to high return income generating activities or the contribution of each sources of income to total income may not be even.

Figures in the Table 4.13 also show that 5.19% of participant household in farm lucrative off farm attained the top diversity group while the proportion of household in lower diversity level is relatively low for agri-off farm strategy. This clearly signals that pursuing agri-off farm strategy is preferable to achieve higher average income.

By applying the Gini decomposition analysis to rural household incomes we can examine how a change in the magnitude of income from any particular source affects total income inequality within group across income diversity level.

Table 4.14 presents summary results of the Gini decomposition by income diversity level. The results show that although income from crop production has the largest share in total income (Sk) for all groups, its role decrease as one move up the income diversity strata. By contrast, the shares of off farm business, wage employment and livestock sector increase in level of income diversity. It is also clear from the table 4.14 that these source are much more important to upper diversifiers than lower ones.

The results for decomposing inequality, as measured by the Gini coefficient, indicate that crop production is more important as a share of inequality, but its share dramatically decrease as one

moves up the diversity ladder. For middle and lower diversifiers, this is due to its high correlation and share in total income while it is more or less equally distributed (G=0.43) and G=0.41) with in each groups. For higher diversifiers, the high contribution of crop production to total inequality is due to its high correlation with total income. By contrast, the percentage contributions of off farm business, wage employment and livestock production to overall inequality increases substantially as we move up the income diversity groups. This is due both to high inequality of income with in groups from these sources and their increasing share with level of income diversity. However, unequal distribution of income from off farm business, wage employment and livestock decrease as the level of income diversity increase.

Table 4.14 Comparison of the Decomposition of Rural Household Income By Income Diversity Level

Income source	Share in total income (sk)	Gini coefficient for income sources (Gk)	Gini correlation with total income ranking (Rk)	Contribution to Gini Coefficient of total income (Sk Gk Rk)	Percentage Share in over all Gini
Lower diversifier					
Off farm business	0.043	0.947	0.795	0.033	7.58
Wage employment	0.042	0.988	0.782	0.032	7.50
Crop production	0.897	0.429	0.936	0.360	89.90
Livestock	0.016	0.829	0.316	0.004	0.97
Transfer	0.002	0.935	0.096	0.000	0.05
Total	1	0.429	1	0.429	100
Middle diversifier					
Off farm business	0.167	0.838	0.727	0.102	24.49
Wag employment	0.062	0.959	0.598	0.036	8.56
Crop production	0.654	0.407	0.844	0.224	54.10
Livestock	0.073	0.777	0.387	0.022	5.32
Transfer	0.044	0.972	0.728	0.031	7.53
Total	1.00	0.415	1.00	0.415	100.00
Upper diversifier					
Off farm business	0.258	0.741	0.744	0.142	35.01
Wage employment	0.094	0.863	0.555	0.045	11.10
Crop production	0.491	0.407	0.877	0.175	43.25
Live stock	0.124	0.688	0.402	0.034	8.49
Transfer	0.033	0.882	0.297	0.009	2.15
Total	1.00	0.405	1.00	0.405	100

Source: Computed from 1999 survey data

The decomposition results in Table 4.14 can also be used to distinguish between inequality increasing and inequality decreasing income sources. A one percent increase in off farm business and wage employment, holding all other sources of income constant, results in worsening in the Gini for both diversifiers and hence represent inequality increasing sources of income. While two sources of income, livestock & coop production, improve the Gini for both groups. This means that, ceteris paribus, additional increments of crop and livestock income will reduce overall income inequality. The relative magnitudes of inequality increasing decreasing effect increase with income diversity level for off farm business and livestock production respectively while it decreases for wage employment. This means that wage employment has higher inequality increasing effect for lower diversifier. By contrast, while off farm business has higher inequality increasing effect in diversity level, the inequality decreasing effect of livestock production is higher for upper diversifiers. The effect of one percent increase in transfer income on inequality is mixed. It decreases inequality for middle diversifier but increase it for other two groups.

From these results it appears that the disequalising effects of the off farm business and wage employment may be due to the existence of entry barrier to these source as entry to these activities require initial capital and skills. Thus, only those households who meet these requirements can access to these sectors and generate income from them.

There is no general agreement for findings among previous studies regarding the impacts of diversification on rural income distribution.

While some of these studies pointed out the equalizing effect of diversification, others suggested its disequalising effort on rural incomes.•

These empirical studies are quite different in their definition and measurement of diversification, method of analysis and classification of income sources. In most cases, however, the effect of specific source of income, for example the share of off farm income, is considered as effect of diversification, which is too narrowed view of diversification.

It is clear from the Table 4.14 that there are indeed differences between levels of diversification in terms of over all Gini coefficients. For bottom diversifiers the overall Gini coefficient is 0.429. In case of top diversifiers the measure of income inequality, overall Gini coefficient, is a bit smaller than the Ginis of both bottom and middle diversifier. Taking the bottom diversifier as base, the decrease in overall inequality is 3.3 and 5.6 percent for middle and top diversifier respectively. This analysis shows that as level of income diversity increases rural household income inequality decreases.

Table 4.15 also summarizes the net welfare change in three level of income diversity corresponding to a one percent change in each income sources. The welfare impacts vary greatly among income sources and level of income diversity. The net welfare gains from marginal increase in income from off farm business, wage employment, livestock and transfer increases in level of income diversity but the welfare gains from crop production decrease.

Table 4.15 also indicates that strong income effect is offset by smaller adverse distributional effect to obtain net welfare effect. For both groups, the net welfare gain from crop production is

• see literature review part in this paper for details

larger, followed by off farm business and livestock sources respectively. This result suggest that changes affecting incomes from off farm business crop production and livestock sector seems to be crucial to have higher welfare gains in rural areas.

Table 4.15 Effects of a 1 Percent increase in an income Component on Income Inequality and Sen Welfare Index by Level of Diversity.

Income source	Absolute change per 1 percent change in income source	Percentage change in Gini coefficient per 1 percent change income source	Percentage change in Sen index per 1 percent change income source	Income effect	Distribution effect
Lower diversifier					
Off farm business	0.0139	0.0326	0.0188	0.0758	-0.0571
Wage employment	0.0142	0.0333	0.0166	0.0738	-0.0571
Crop production	-0.0248	-0.0578	0.9404	1.5718	-0.634
Livestock	-0.0026	-0.0062	0.0205	0.0277	-0.0073
Transfer	-0.0008	-0.0019	0.0037	0.0041	-0.0004
Middlediversifier					
Off farm business	0.0324	0.0781	0.1114	0.2850	-0.1736
Wag employment	0.0098	0.0237	0.0452	0.1059	-0.0607
Crop production	-0.0468	-0.1127	0.7337	1.1173	-0.3836
Livestock	-0.0084	-0.0201	0.0877	0.1255	-0.0378
Transfer	0.0129	0.0312	0.0220	0.0754	-0.0534
Upper diversifier					
Off farm business	0.0376	0.0926	0.1943	0.4331	-0.2387
Wage employment	0.0069	0.0172	0.0821	0.1577	-0.0756
Crop production	-0.0238	-0.0586	0.5309	0.8257	-0.2948
Live stock	-0.0160	-0.0394	0.1512	0.209	-0.0578
Transfer	-0.0048	-0.0119	0.0415	0.0562	-0.0147

Source: Calculated from 1999 survey data

We have seen that the income diversification strategies differ widely by agro ecological zone (study sites). It is therefore essential to examine how different livelihood strategies affect the rural income distribution across study villages.

Table 4.16 shows inter household distribution of household total income (Gini coefficient of household income) by livelihood strategies across selected study sites.

Table 4.16 Gini coefficients by livelihood strategies across selected agro climatic area.

Livelihood strategy	Adado	Garegoda	Domma	All sites
Pure-farm	0.3005	0.3895	0.5286	0.3647
Mixed farm	0.3014	0.3239	0.4261	0.3204
Farm-easy off farm	0.3103	0.3648	0.5337	0.4389
Farm-lucrative off farm	0.4234	0.4568	0.4834	0.4326
Agro-off farm	0.4526	0.3370	0.5235	0.4122
All House holds	0.3941	0.3733	0.5387	0.4159

Source: Calculated from survey data.

The equity impacts of income diversification differ widely by livelihood strategies across different agro climates. The comparison of Gini coefficient for pure farm strategy with that for their four livelihood strategies can highlight the equity effect of livelihood strategy,

Diversification through farm lucrative off farm and agro-off farm strategies worsen the rural income distribution) while that of mixed farm and farm-easy off farm strategies have a Gini coefficients that are slightly higher than of pure farm in higher potential and favorable climatic area (Adado).

In moderate agro climatic, densely populated and better infrastructure access site (Garagoda) integration of crop production with livestock, low entry constraint off farm activities and pursuing agri-off farm strategy reduce rural income inequality. By contrast, diversification

through lucrative activities has the Gini coefficient significantly higher than that of pure farm strategy in that site.

The comparison of Gini coefficients in semiarid agro climatic, poor road infrastructure access, and irrigation using site (Domma) shows that pursuing farm easy off farm strategy aggravates rural inequality as opposed to mixed farm and farm-lucrative off farm strategies.

The results show the following important points, As Table4.16 indicates, the size of income inequality for total sample is higher than that of pure farm strategy implying that diversification aggravates rural income inequality. But the result for Garagoda village shows the reverse, i.e. diversification reduces inequality. In addition, in all cases the Gini coefficients for mixed farm strategy are the lowest except pure farm livelihood in Adado. Note that the equity effects of livelihoods strategies differ significantly by region. Note also that diversifying through high entry constrained activities such as pursuing farm lucrative off farm and mixed farm strategies do not always widen the rural income disparities. Further more, the size of inequalities for the poorest and semi arid area are higher than corresponding figures for all cases including total samples. This result might suggest that different livelihood strategies have different equity effect depending on location, level of development, and village resource endowments.

CHAPTER 5. SUMMARY AND POLICY IMPLICATIONS

5.1 Summary of Results

The foregoing analysis attempted to analyze the determinants and impacts of rural household income diversification in Southern Ethiopia. First, an attempt has been made to identify factors that influence the household livelihood choice and level of income diversification for five distinct livelihood strategies using the multinomial logit model that correct for selectivity bias. Second, the Gini decomposition technique and linear regression model are employed to analyze the rural equity and consumption insurance effects of income diversification.

A substantial proportion of rural households (91.74%) are engaged in livelihoods that combine crop production with different other activities implying the livelihood diversification behavior of rural households. Household mean income varies over livelihood strategies. Those households who rely exclusively on crop production (Pure farm strategy) achieved the lowest mean income, while the participants in Agri-off farm strategy enjoyed highest mean income. Similarly, the share of different sources of income in total income varies across the level of income diversity. Majority of households in lower income diversity try to diversify their income within crop production and wage employment while top diversifiers seem to better able to guarantee income diversification across different economic sectors. The pattern of household mean income over level of income diversity confirms that greater diversification contributes to higher level of income.

Empirical multinomial logit estimation was conducted to examine the determinants of rural household's livelihood choice relative to pure farm strategy. Empirical results show that a households' asset position has a significant effect on its participation in particular livelihood strategy as well as the level of income diversity. The results also indicate that the effect of assets varies across livelihood strategies.

Our results reveal that ex ante livestock holding increases the odds of having mixed farm, farm-lucrative off farm and Agri-off farm strategies versus pure farm livelihood. The impact of labour supply is positive and statistically significant for farm-easy off farm, farm-lucrative off farm and Agri-off farm, suggesting that household with abundant labour supply are more likely to be engaged in livelihood diversification.

Farmland (cultivate land) holding and involvement in cash crop production (proxy by coffee and *chat*) lower the participation of household in farm easy off farm strategy. The negative impacts of farm size (cultivated land) on choice of livelihood diversification strategies are consistent with theoretical prediction and empirical evidences. The negative effect of farm size implies that land constraint drives diversification. The most likely explanation for negative effects of cash crop production on odds of pursuing farm-easy off farm strategy may be that cash income from sales of commercial crops is a substitute for income from low return off farm activities. By contrast, greater ex ante grazing land holding increases the likelihood of being in farm-easy off farm but it decreases the probability of involvement in agri-off farm livelihood.

With respect to the effects of education, the results indicate that the odds of having mixed farm, farm-lucrative off farm and agri-off farm livelihoods relative to pure-farm are higher for household heads with junior secondary education than illiterate ones. By contrast, the effects attainment of senior secondary education of head on odds of having these strategies versus pure farm are negative but the effect is negligible. The negative effect senior secondary education may reflect the fact than relatively better educated household heads may not interested in diversification because higher level of education my help households to raise productivity of specific activities.

The use of agricultural extension service and the number of ox holding lower the odds of participating in farm-lucrative off farm, mixed farm and Agri-off farm relative to pure-farm. The presumable explanation for negative effect of use of extension service may be that users of extension services are more likely to be food secure for their ability to produce more due to the fact that extension service would enable higher crop production by raising productivity per hectare. Alternative explanation for negative influence of use of extension on livelihood diversification may be related to the shortage of labour force as extension use requires continuous intensive on farm work leaving less labour time for off farm activities. The number of ox holding has negative effect on livelihood diversification because holding of a pair of oxen is not only make available enough draft power and assure timeliness and thoroughness of cultivation which is critical for high crop production but also allows inflow of land, labour and grain from households who lack draft power to its holders.

The presence of nearest and regular local markets have favorable effect on pursuing livelihood diversification the estimate is not statistically significant. Distance to nearest market exerts

negative effect on odds of having diversified livelihoods. This indicates that households far a way from nearest market have limited market information, high transport and transaction costs and less likely to diversify livelihood.

The grater the number of adult female member, the less is the likelihood of being in mixed farm livelihood, reflecting the existence of gender differentiation of activities in the study area. The odds of having farm lucrative off farm and farm easy off farm livelihoods relative to pure farm are higher for older households. This may be associated with experience in way of life in rural area.

The variation of level of income diversity for more attractive strategies is explained by access to credit, livestock endowment, farmland holding, transfer income, cash crop production, and household composition (number of adult male and female members). Farm size (cultivated land size), livestock holding and involvement in cash crop production have positive and significant effect on income diversity of mixed farm strategy. This result suggests that abundant farmland endowment helps household to undertake higher crop production, part of which can be used for investment in cattle. Similarly, ex ante livestock holding increases income diversity of mixed farm by generating additional income through sale of livestock and its products, providing new offspring, facilitating timely and thoroughly cultivation of farmland, maintaining soil fertility and purchase of farm inputs. This indicates how different livelihood strategies complement one another. The effect of involvement cash crop production, given a constraint on credit for investment in livestock, suggests that income from sale of cash product solves liquidity constraint for households to invest in livestock.

Grazing land endowment has favorable effect on income diversity for pure farm and agri-off farm strategies, suggesting that grazing land endowment generate additional income through renting out land, cattle rearing and growing and sale of grass.

The presence of nearest regular local market has significant positive effect on level of income diversity for farm-easy off farm strategy. This implies that frequent local market facilitates transaction between supplier and demanders through development of petty trade; local trade and food processing and local drink brewing enterprises and help households to start new income generating activities that provide services and product for customers.

The greater the number of adult female and male members in the household, the higher is the level of income diversity for farm lucrative off farm livelihood. But this similar effect moves in opposite direction for pure-farm, farm-easy off farm and agri-off farm strategies. The numbers of adult male have favorable effect for pure-farm but its effect on farm-easy off farm and Agri-off farm is negative. The opposite holds for adult female members. This may suggest the existence of gender differentiation of activities.

Significant positive effect of labour supply, transfer income and credit on level of income diversity can be observed from the results. The availability and increase in credit is particularly important to achieve higher level of income diversity of farm-lucrative off farm strategy. The increase in labour supply increases level of income diversity for farm-easy off farm and agri-off farm strategies while transfer income is important for all strategies except for farm easy off farm livelihood. This suggests that the availability of these resources is essential for higher level of diversity for livelihoods.

Involvement in cash crop production has negative and significant effect on income diversity of farm-easy off farm and pure-farm strategies. The most likely explanation for negative effects of cash crop production on level of income diversity of farm easy off farm and pure farm livelihoods is either cash income from sales of commercial crops may be a substitute for income from low return activities or it has significantly higher share of total income relative to other income sources. Thus cash crop producers have low level of income diversity as compare to those of non cash crop producers, for whom virtually all sources have fair share of total income. Alternatively, cash crop producers have better access to cash income and may allocate less resource for low return and easy entry diversification to generate income.

The results indicate that junior secondary education of head lowers the level of income diversity for Agri-off farm and farm-easy off farm strategies. This may reveal that higher level of education of head helps the household to raise productivity of specific activity and that activity generates the largest share of household income, which lowers income diversity. Another explanation for this result may be that easy entry activities offer low return and better educated household allocates less resource for such occupation to generate income. Apart from offering low returns, easy entry activities are given low status by rural communities. On the other hand, primary education of head promotes income diversity for Agri-off farm.

We have tested for effects of level of income diversity and different livelihood strategies on consumption insurance against idiosyncratic income change. The regression results show that consumption track income more closely for households engaged in pure-farm and farm-easy off farm strategies. These results suggest that households who involved in pure-farm and farm-easy

off farm strategies are more vulnerable to income shocks. Similarly, the estimation results at different level of income diversity indicate that more vulnerable households to income shocks are those who have low level of income diversity.

Examination of the impacts of the level of income diversity on consumption change across different livelihood strategies shows that there are different motivations for livelihood diversification. The results indicate that the prime motive for diversification into pure farm and farm easy off farm livelihoods is consumption smoothing while that of farm lucrative off farm strategy differs from consumption smoothing which may be accumulation.

The results for decomposing inequality indicate that wage employment and off farm business have inequality increasing effects as oppose to inequality decreasing effects of crop farming and cattle rearing. Analysis of the equity effect of income diversification at aggregated sample shows that diversification aggravates the rural income inequality. But the results for disaggregated sample across livelihood strategies, level of income diversity groups and agro climatic areas are significantly different. First, overall income inequality decreases as the level of income diversity increase, implying that the equity effect of diversification depend on the level of income diversity. Second, the equity effect of income diversification differs widely by livelihood strategies. Comparisons of the size of inequality for different strategies at aggregated level show that pursuing farm easy off farm, farm lucrative off farm and Agri-off farm aggravate rural income inequality while mixed farm livelihood reduces it.

However, these equity effects of livelihood strategies vary across agro climate and village resource endowment. Farm-easy off farm strategy worsens inequality in poor, remote and

semiarid climatic village where as it improves the inequality for densely populated, better infrastructure access and moderate climatic area. Farm-lucrative off farm livelihood affects these areas in opposite direction. Pursuing mixed farm livelihood improves inequality in all climatic condition. This suggests that the equity effects of livelihood strategy depend on the location, village resource endowment, level of development and on other factors.

Third, the overall equity effect of diversification varies across agro climatic areas. The size of inequality is the highest for poor, semi arid climatic and remote area relative to other areas. The result also indicate that diversification improves rural income distribution in moderate climatic, densely populated and better infrastructure access village. The equity effect of diversification depends on the livelihood strategy pursued, village resource endowments, agro climatic condition, and agricultural potential of the village.

5.2 Policy Implications

Integrated Rural Development Policy

Following rural growth linkage model approach, the central tenet of ADLI (Agricultural Development Led Industrialization) is that the growth in agriculture through technological advancement provides the stimulus for growth of rural non-farming activities in Ethiopia. However, the evidences suggest that, first, the overwhelming majority (91.74%)of rural households in the study areas have pursued livelihood diversification, combining farming with non farming activities, and 25% to 55% rural household income is derived from non farming sectors. Second, the participation in rural non-farming sectors is motivated by other factors rather than by growth in agricultural productivity. Limited agricultural income, seasonality in farming activities, the existence of large family size and demand push factors are important factors for taking up off farm activities. Third, evidences also suggest that households use part of their off farm incomes and remittance for investment in farm and off farm activities, in addition to maintaining consumption, implying that off farm and remittance incomes relieve the credit constraints of rural households. Fourth, given that rural households engage in multiple income generating activities, the priority sectors of the government may not yield expected results due to the potential fungibility of resources for other purposes.

It is therefore advisable to have integrated rural development programme in the wider sense of integration, which include the entire ranges of rural production activities. Creating government institution that create conducive environment and design effective policy that reduces constraints to and expand opportunities for robust livelihood diversification strategies, is essential. In addition, promoting rural micro and small-scale enterprises and including industrial and non-farm

business extension services in the current agricultural extension program is necessary to encourage non-farm rural business.

The empirical evidences suggest that greater income diversification is associated with higher income and better household consumption insurance. In order to take advantage of diversified livelihood strategies and income diversities offering upward income mobility and better household consumption insurance against income risk, entry barriers to more attractive livelihood strategies must be removed for smallholder households. These constraints can be explained by private resource endowment, access to public resources and other factors.

Creating rural employment opportunities

The regression result indicates that land scarcity is one of the main factors that derive households to diversify into farm-easy off farm strategy. The rapid increase of population in rural areas with growth rate of about three percent per annum has caused not only the shortage of farm land but also expansion into cultivation of marginal land and steeper slopes. It is therefore difficult to increase farm output through increasing land cultivation. Total household labour supply is also significantly responsive to household's choice of diversified livelihood and level of income diversity, suggesting that households with abundant labour forces tend to diversity their livelihoods. The main implication is that measures need to be taken to create employment opportunities rural area in order to absorb increasing rural labour forces due to high population pressure. In addition, emphasis should be given for identification of available diversification opportunities and constraints at community level. Government and NGO need to involve in launching an integrated promotional network, providing technical support, organizing peoples in off farm activities, designing integrated employment creating programme and developing small

scale development strategy. This is because the type of livelihood diversification to be promoted varies across communities depending up on village resource endowment, population density, agro climate, agricultural potential, and rural communities tradition, caste and customs.

Increasing household access to credit

The analysis indicates that the major source of finance for livestock investment comes from own saving and for off farm activities, though limited, are loans from relatives and friends and moneylenders. The respondents also point out that lack of creditors and high interest rate are the major problems in off farm credit. The supply of credit to rural households is near absent for off farm activities and is in crucial needs of the development of rural financial institutions. In addition, credit is found to be determinant of level of income diversity for more lucrative strategy, implying that credit enables household to widen their income earning options. The implication of this result is that measures should be taken to strength and expands rural financial institutions that ensure availability of credit to rural households to encourage investment in livestock and non-farm activities. In addition, measures need to be taken to encourage and strengthen informal financial institutions, group lending to raise credit, saving and establish insurance schemes.

As to low repayment problem, there are many different models that are success in micro credit provision from which to select and adapt the appropriate one. Recent innovations in this regard include group lending scheme and crop tied contract funding loan provision. The joint (group) lending schemes will certainly offer insights into how rural financial systems can orient their lending's to small scale activities of the groups. This means emphasis should be given to

facilitate the spread of long sustaining rural financial system on basis of saving mobilization and loan recovery according to conventional banking criteria.

Promotion of Cash crop production

The results also reveal that cash crop production increases income diversity particularly for mixed farming strategy. Given the credit constraints for livestock investment, this implies that promoting cash crop production helps household to invest in cattle. On the other hand, involvement in cash crop production reduces the likelihood of being in farm-easy off farm strategy and its income diversity, reflecting that either cash income from sales of commercial crops may be a substitute for income from low return activities or it has significantly higher share of total income relative to other income sources. This suggests that measures should be taken to promote cash crop production. However this does not mean that complete replacement of foodstuff production by commercial production.

Besides credit and cash crop production, transfer incomes have positive and significant impacts on level income diversity. This implies that remittances and other transfer income helps household to increase the level of income diversity. Integrating transfer income with development activities and household's capacity improving program may help household to increase the level of income diversity.

Developing Sound Markets

The presence of regular and nearest markets is found to be the determinant of rural household choice of diversified livelihood and level of income diversify. The distance to nearest market adversely affect the household choice of diversified livelihoods, reflecting lack of information and high transport cost for distant household, reflecting the existence of transaction costs across rural households. Reducing disparities of transaction costs for distant rural household is essential. On the other hand, presence of frequent markets in rural areas helps household to increase diversity its livelihoods. In addition, the main features of market in study area reflect the existence of market failure. So developing full operating markets through strengthening the basis for market is necessary. Several steps need to be taken for market development. The suggestions include provision of appropriate legal frame work for smooth conduct of transactions, relevant institutions set up to protect private property and to speed settlement of dispute, developing communication set up, promoting competitive marketing and standardizing local measures and weights for commodities.

Rural Infrastructure

Another key ingredient for market development is the availability of infrastructure. As discussed earlier, distance to nearest markets have negative effect on livelihood diversification.

Economic development in general and rural development in particular is dependent on the development of infrastructure and supportive services. Investments in infrastructure is required to give rural household capacity to increase output by reducing marketing costs, integrating

markets, speeding the flow of information, increasing mobility of people, resource and output, and reducing transaction costs. Resource for construction of new roads; expansion and maintenance of existing roads; improvement of rural travel and transport service may be sizeable. Sharing of initial investment cost with nearest rural communities and covering of complete maintenance cost by nearest rural communities may reduce the reliance on state finance.

Gender Issues

Household composition and sex of head are one of the determinants of income diversity. The results confirm that not only the existence of gender differentiation of activities but also male head households have less income diversity than female head households. These outcomes may be related with the gender differentiation of activities, difference in entry constraints and returns of activities. Gender considerations need to be emphasized in promoting rural employment opportunities. For diversification to benefit women, activities that have equal or better access to women need to be promoted.

Education

The results reveal that education has significant effect on household's choice of livelihood strategy and income diversity. Possession of secondary education by head has positive and significant effect for majority of strategies while post secondary education has adverse effects. This indicates that without substantial improvement in overall rural economic situation the fruit of education beyond secondary levels may be limited. It also highlights the significant of certain level of education for livelihood diversification. The implication is that provision of certain level

of education and training particularly skills formation for labour in working age increase the capacity of rural households to diversify their income sources.

Targeting of vulnerable group

This study has shed some light on who are vulnerable to idiosyncratic income shocks. Households who are involved in pure farm and farm off farm strategies are more vulnerable to idiosyncratic income shocks. It is therefore necessary to focus on adoption of social safety-net program that not only provide support for households in these strategies but also assists them to better manage risk by removing entry constraints to more lucrative strategy.

Rural Equity

The findings reveal that the equity effect of diversification differs across villages, livelihood diversification strategies, and level of income diversity. Differing effects of livelihood strategies across agro climates imply that caution should be taken in promoting rural livelihood strategies at least not to exacerbate the existing rural income inequality. Greatest equity effect of diversification for poorest areas calls for measures that increase household's access to productive assets and employment opportunities through projects and programs in these areas. Inequity reducing effect of mixed farm strategy for all villages implies that steps need to be taken to increase household's capacity in particularly household with no livestock holdings to pursue this strategy.

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Appendix

TableA1 Conversion factors used to estimate Tropical Livestock Unit (TLU)

Type of livestock	TLU
Cow	1
Calve	0.25
Heifor	0.75
Bull	1
Goat	0.13
Mule	1.1
Sheep	0.13
Ox	1.0
Horse	1.1
Donkey	0.70
Chicken	.015

Source: Fifth Round Rural Household Surveys DataBbase, Department of Economics (1999).

TableA2 FAO/WHO Coefficients for Converting family size into Standardize household size

Age Category (Years)	Sex		
	Male	Both	Female
<1		0.4	
1-3		0.4	
4-6		0.6	
7-9		0.8	
10-12		0.9	
13-15	1.1		1.0
16-19	1.0		0.9
20-39	1.0		0.8
40-49	1.0		0.8
50-59	1.0		0.7
60-69	0.9		0.7
>70	0.8		0.6
	0.7		0.5

Source: Daniel (1994)

TableA3 Consumption changes Regressed on Income changes with village levels dummies.

Livelihood Strategy	Income Coefficient	Household size coefficient	R2	F statistics
ALL households	0.310* (8.524)	-0.513* (-5.350)	.51	61.71(0.00)
Pure farm	0.371 * (5.193)	-0.525* (-3.103)	.55	15.31(0.00)
Mixed farm	0.221 ** (2.214)	-0.619** (-2.396)	.58	16.36(0.00)
Farm Easy off farm	0.352* (2.873)	-0.369 (-0.824)	.46	4.89(0.00)
Farm Lucrative off farm	0.239** (2.173)	-0.635* (-3.524)	.38	5.89(0.00)
Agri-off farm	0.330* (4.493)	-0.205 (-0.835)	.54	18.38(0.00)

Figures in parentheses are the t-values of the estimated coefficients.

* Significant at 1%

** Significant at 5% .

Standard errors are corrected for heteroskedasticity using Huber-whit method

TableA4 Testing pooling Restriction in Multinomial logit regressions (CHI-squared Test)

Strategy	X^2	Pooling rejected at
Mf=Fe	1,526.26	1%
Mf=F_L	107.24	1%
Mf=Ao	95.28	1%
Fe= F_L	726.04	1%
F_L=Ao	570.39	1%

TableA5 Testing for effect of variables

Strategy	X^2	null hypothesis of no effect of variables rejected at
Mf	51.02	1%
Fe	47.11	1%
F_L	64.69	1%
Ao	78.67	1%

TableA6 Coefficients for converting household labour in to standardized Labor unit

The most important source of work force for peasant household is determinant by size, age, and gender composition of households. Since the working capacity is different according to the age and gender category, standardized measure is necessary to make comparison. Based on a recent study(Ababe Haile Gebriel,1999) and Daniel(1994), the following conversion factor is used.

Age group (years)	Gender	
	Male	Female
<8 or >75	0.00	0.00
8-13	0.2	0.2
14-16	0.5	0.4
17-50	1	0.8
51-65	0.7	0.5
66-75	0.5	0.35

Categories of livelihood diversification

Data was collected on sizes, sources of rural household income and livelihood diversification activities. For the purpose of the analysis we categorized households in to 5 distinct livelihood diversification strategies based on their participation on various activities. Since these activities are too many and households involve simultaneously in different activities, it becomes necessary to categorizes activities into main groups as:

i. Annual crop production is identified as base livelihood
ii. Growing permanent crops and generate income from it
iii. Livestock holding and generate income from it
iv. Off farm activities categorized into two based on requirements of capital asset and special skills. These are:
v. Lucrative off farm activities requires special skill ± mean capital assets ≥ 100 Birr.
vi. Easy off farm activities requires simple labour ± mean capital assets < 100 Birr.

Livelihood strategy	Components
Pure-farm (Pf)	i + ii
Mixed farm (Mf)	i + ii + iii
Farm-easy off farm (Fe)	i + ii+ vi
Farm-lucrative off farm (Fl)	i+ ii + v (+ iii)
Agri- off farm (Ao)	i + ii + vi +v (+ iii)

TableA7 Details of Diversification activities

Livelihood diversification strategy	Diversification activities
Pure farm	Annual crop production, permanent/tree/ crop production
Mixed farm	Pure farm plus livestock rearing
Farm-easy off farm	Pure farm plus farm worker, unskilled worker, domestic worker, food for work, collecting and selling fire wood, dung, collecting and selling straw and grass, shiruba sira, salt trade, shoe shining, mat making, guard, simple food preparing and selling, local beer brewing
Farm-lucrative off farm	Pure farm plus professional worker, labourer, soldier, driver/ mechanic, weaving, milling, handcraft, trade in grain (General trade), Trade in Livestock, traditional healer, transport service, Livestock rearing, spinning, tannery, basketry, pottery, barber, farm implement maker, hydromel, bakery hamot sale
Agri-off farm	Combine any two or more activities from above four categories

TableA8 Description of variables used in econometric estimation

Variable	Description
garzland	Grazing land holding in hectare
Headsex	Sex of household head (dummy)
Head age	Age of household head (years)
Mrktdst	Distance to market (Average minutes)
Primary	Primary level of education of head (grade 1 to 6) (dummy)
Junior Secondary	Junior level of education of head (grade 7-8) (dummy)
Senior secondary	Grade 9 and above level of education attainment of head (dummy)
N female	Number of adult female members (age 15-64)
N children	Number of children members (age 7-14)
N male	Number of adult male members
N oxen	Number of ox holding
Extension	Use of agricultural extensions and advice (dummy)
Irrland	Proportion of irrigated land
Cashcrop	Producers of coffee and chat (dummy)
Lvstock	Livestock holding in (TLU)
Transter	Remittance and other transfer income
Land/cult Land	Cultivated land in hectare
Crdt	Total credit received by household
labour	Total labour supply in man day
Agesqre	Age of household head squared
N markt	Number nearest market per week

TableA9 Derivation of LaGrange function & interior solutions

The Lagrange function for constrained maximization problem is given by:

$L = U(C, L_h, Z^h) + \eta\,[Q_j(q_j, L_j, H_j, X_j, K_j)] + \phi[Q_n(q_n, L_n, K_n)]$

$+ \lambda\,[\Sigma P_i(q_j + E_j - C_i) + \Sigma P_i(q_n) + v\text{-}scL_n] + \Psi\,[T - L_j - L_n - L_h - SL_n] + \gamma\,[L_{nw} - L_n]$

λ and Ψ are the lagrange multipliers of marginal utility of money and marginal utility of time respectively).

The Kuhn-Tucker conditions for an interior solution except for boundary solution on off farm work, hired labour, specific output,

$$\frac{\partial L}{\partial C_j} = \frac{\partial u(.)}{\partial C_j} - \lambda pi = 0 \text{ ----------11.1}$$

$$\frac{\partial L}{\partial L_h} = \frac{\partial u(.)}{\partial L_h} - \Psi = 0 \text{ ----------11.2}$$

$$\left.\begin{aligned} \frac{\partial L}{\partial q_j} &= \frac{\eta \partial Q_j(.)}{\partial q_j} + \lambda p_i \le 0 \\ qj \ge 0 \text{ and } q_j &\left(\eta \frac{\partial Q_j(.)}{aqj} + \lambda pi\right) = 0 \end{aligned}\right\} \text{----------11.3}$$

$$\left.\begin{aligned} \frac{\partial L}{\partial q_n} &= \frac{\phi \partial Q_n(.)}{\partial q_n} + \lambda pi) \le 0 \\ q_n \ge 0 \text{ and } q_n &\left(\Phi \frac{\partial Q_n(.)}{\partial q_n} + \lambda pi\right) = 0 \end{aligned}\right\} \text{----------11.4}$$

$$\left.\begin{aligned} \frac{\partial L}{\partial L_j} &= \frac{\eta \partial Q_j(.)}{\partial L_j} - \psi \le 0 \\ Lj \ge 0 \text{ and } L_j &\left(\frac{\eta \partial Q_j(.)}{\partial L_j}\right) - \psi = 0 \end{aligned}\right\} \text{----------11.5}$$

$$\left.\begin{aligned} \frac{\partial L}{\partial Ln} &= \frac{\phi \partial Q_n(.)}{\partial L_n} - \lambda sc - \Psi(1+s) - \gamma \le 0 \\ Ln \ge 0 \text{ and } L_n &\left(\frac{\phi \partial Q_n(.)}{\partial L_n} - \lambda sc - \psi(1+s) - \gamma\right) = 0 \end{aligned}\right\} \text{----------11.6}$$

$$\frac{\partial L}{\partial \gamma} \geq 0 \quad Y\frac{\partial L}{\partial Y} = 0 \text{ and } \gamma \geq 0 \text{ -} 11.7$$

$$\frac{\partial L}{\partial \lambda} = \sum pi[q_j + E_j - C_i] + \sum pi(q_n) + \nu - scL_n = 0 \text{ - - - - - - - - --- - - - - - - - -- -} 11.8$$

$$\frac{\partial L}{\partial \eta} = Qj(q_j, L_j, H_j, x_j, k_j) = 0 \text{ --} 11.9$$

$$\frac{\partial L}{\partial \phi} = Q_n(q_n, L_n, k_n) = 0 \text{ -} 11.10$$

$$\frac{\partial L}{\partial \Psi} = T\text{-}L_j\text{-}L_n\text{-}L_h\text{-}SL_n = 0 \text{ -} 11.11$$

∂Q and ∂U are partial derivative functions of Q and U.

TableA10 The Impact of Change in log household per capita Income on log household per capita consumption

Instrumental Variable Estimates

Livelihood strategy	Income coefficient	Household size Coefficient	R^2	F statistics
Pure farm	0.019^x(3.33)	-0.027(-.46)	.40	8.89(0.00)
Mixed farm	$.014^x$(3.54)	-.052(-1.16)	.54	19(0.00)
Farm easy off farm	$.021^x$(2.15)	-.123(-.98)	.27	3.62(0.00)
Farm lucrative off farm	.009(1.49)	-.026(-.45)	.19	2.89(0.01)
Agri-off farm	$.013^x$(4.33)	$-.077^{xxx}$(-1.9)	.48	15.06(0.00)

Note: x significant at the 1% level.

Xx significant at the 5% level

Xxx significant at the 10% level

Standard errors are corrected for heteroskedastcity using Huber-White method

Figures in Parentheses are t-statistics

DECLARATION

I, the undersigned, declare this thesis is my own work and has never been presented in any other university. All sources of materials used for this thesis has been duly acknowledged.

Declared by:

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