Non-farm Diversification and Its Impacts on Income Inequality and Poverty: Evidence from Rural Ethiopia

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Abstract

This research investigated whether non-farm income diversification increases overall income equality and decreases poverty in rural Ethiopia or not. It used a four-wave panel data from the Ethiopian Rural Household Survey over the period 1994-2009. The impacts of non-farm income on inequality and poverty were analysed using Gini-coefficient decomposition, fixed, random, and probit models. The results revealed that in general, non-farm income has a positive impact on rural households' welfare with an inequality reducing effect. These results have important policy implications and suggest that the non-farm sector can provide a feasible option to tackling rural poverty and vulnerabilities in Ethiopia, especially at a time when agriculture is increasingly becoming precarious due to the changing climate.

Keywords: *Non-farm diversification, inequality, Gini-decomposition, rural Ethiopia*

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Introduction

The benefits of diversification have since long been stressed in the development studies literature (cf. Ellis 2000; Barrett *et al.* 2001). The literature asserts that diversification of income Sources benefits the rural poor in terms of reducing risks and stabilising income flows and consumption and thereby leads to improvements in quality of life, wealth accumulation and food security (Barrett *et al.* 2001; Mutenje *et al.* 2010). However, these benefits are likely to vary across contexts and the link from livelihood diversification to poverty reduction is particularly not certain and remains contentious.

There are two broad views about livelihood diversification in sub-Saharan Africa. These views are largely expressed by 'agriculture optimists' and agriculture sceptics(see Ellis 2005:1-2). Agriculture optimists argue that African agriculture is dominated by smallholders and it is possible to increase their productivity and achieve the goals of raising income and food security (Gollin *et al.* 2002; World Bank 2007;Byerlee *et al.* 2009). Some writers in this camp view non-agricultural alternatives, such as the non-farm sector in Africa as dominated by informal, risky and low-remunerative activities with low impact on reducing poverty (Thirtle *et al.* 2001, cited in Tubiana 2012).

On the other hand, the agricultural sceptics view livelihood diversification as a manifestation of the failure of agriculture to generate sufficient and secure livelihoods in Africa and argue that diversification out of the agricultural sector is needed to create employment and income

opportunities (Ashley and Maxwell 2001; Ellis 2005). Some even consider supporting smallholder agriculture as inefficient use of reSources and incompatible with economic development since the sector offers little opportunity for supporting decent livelihoods (Collier 2008). Ellis (2005; 2007) also argues that agricultural optimist strategies, such as the Agricultural Development-Led Industrialisation (ADLI) strategy in Ethiopia failed in theirattempt to increase smallholder productivity and instead "trapped" people in unproductive agriculture.[1]

This paper broadly subscribes to the agricultural sceptics' argument and views non-farm diversification as largely having a positive outcome for rural livelihoods as risk-managing as well as an accumulation strategy. However, following Barrett *et al.* (2001), it argues that depending on the underlying motives and determining factors, non-farm diversification has different implications for reducing poverty and rural inequality. For example, the existence of entry barriers indicates that the benefits of non-farm diversification could largely accrue to the rich rather than the poor (see Nega *et al.* 2009). This in turn raises the question whether diversifying into non-farm activities has any impact on reducing poverty and inequality. In this paper, the impact of non-farm diversification on poverty and inequality is investigated using a panel data from rural Ethiopia.

Literature Review

There is an extensive literature on diversification and its impacts on household welfare and poverty (Webb and Reardon 1992; Reardon *et al.*

2000; De Janvry *et al.* 2005;Van Den Berg and Kumbi 2006; Kijima *et al.* 2006; Abdul-Hakim and Che-Mat 2011;Himanshu *et al.* 2013; Akaakohol and Aye 2014; Scharf and Rahut 2014). In both the theoretical and empirical literature, the positive impacts of diversification are emphasised and are said to include smoothing consumption, reducingrisk of income failure confronted by households, more effective use of available household labour and skills, and cash generation for investment in human or physical capital. Thus, by reducing the risk of income failure confronted by a household, diversification can help to maintain a household's consumption, especially during harvest failures in rain-fed agriculture. In this regard, Webb and Reardon (1992), in their study of drought impact and household responses in East and West Africa, note that diversification may simply achieve higher income than it is possible by specialising in the *single occupation of farming* (emphasis added). According to them, the capacity of households in Burkina Faso to cope with drought shocks is strongly associated with the extent of their non-farm diversification pattern. Thus, when crops fail or livestock die, households are forced to reallocate labour to other pursuits, whether employment in off-farm (e.g. agricultural wage labour), or non-farm activities (e.g. weaving, brewing and petty-trade). This may suggest that diversification can play an important role at household level in achieving the objectives of reducing vulnerability and raising income (Webb and Reardon 1992).

In the following paragraphs, studies that specifically focus on the effect of non-farm diversification on poverty and inequality in Asia, Africa and Ethiopia are reviewed in respective order.

With regards to Latin America, several studies show that the non-farm sector is fast-growing and has a poverty alleviating effect in the region (Berdegué *et al*. 2001;Deininger and Olinto 2001; Escobal 2001; Ferreira and Lanjouw 2001;Ruben and Van Den Berg 2001). Reardon *et al.* (2001) summarised these and other rural household income studies from 11 Latin American countries that have used data from the 1990s to show that the rural non-farm income was about 40% of total rural incomes in the region. However, the Latin American studies may paint a different picture from the empirical studies from South Asia and Sub-Saharan Africa that are reviewed in this study. This is because the Latin American region has the least rural population share in the world (see World Bank 2013)[2] and, except for Haiti, most countries in the Region have reached middle income status. Thus, any reduction in poverty due to the non-farm sector is likely to be located in urban centres and associated with expansion of the manufacturing sector rather than being undertaken by rural households. Moreover, agricultural production in many countries of Latin America is organised differently than in Africa or South Asia as it is marked by the prevalence of large landlord estates, or *Latifundia* that has implications for income inequality and welfare (see Conning 2003). Regardless of this, we have chosen to review a few Latin American studies that have similarities with the context of smallholder agriculture system in Sub-Saharan Africa while at the same time highlighting the peculiarities of the region as discussed above.

Ferreira and Lanjouw (2001) studied non-farm activities in relation to poverty profile in Northeast Brazil applying a probit model on two data sets from 1996 with 6589 rural residents. They found that non-farm

diversification complements the budgets of the poor and serves as a way of self-insuring against shocks. Moreover, non-farm enterprise income shares are strongly related to growth in per capita consumption than wage labour.

Lazarte-Alcala *et al.* 2012.used data from the Measurement of Living Conditions in Latin America and the Caribbean (MECOVI), for the period 1999–2002 to study remittances and income diversification in Bolivia's Rural Sector. Using binary endogenous variable model on a sample of 2,108 rural households, they found that the receipt of remittances (part of non-farm income) largely supports consumption for the small poor farmers located mainly in the Altiplano region in the west, who practice subsistence farming. In the other regions, however, the existence of a capitalist farming sector, oriented to the domestic and foreign markets, offers alternative Sources of income; and remittances are being used as a Source of liquidity.

Studies from Asia

Adams (1994) uses a three-year panel data and decomposition analysis to study the impact of non-farm income on overall income inequality in rural Pakistan. The study finds that non-farm income largely signifies an inequality-decreasing Source of income. Importantly, the study also indicates that the components of non-farm income can have different effects on inequality. For instance, unskilled labour income has the most equalising effect on income distribution, while non-farm government income has a dis-equalising effect.

De Janvry*et al.*(2005) studied the role of non-farm income on reducing rural poverty and inequality in china using data collected from Habei

province in China on 7,333 households. The results from counterfactual and two-step Heckman procedures show that non-farm activities and income positively relate to farm production and enhance investment in the farm activities. Their results also indicate that non-farm activities have inequality- and poverty- reducing effects.

Another study from china by Zhu and Luo (2005) on the distribution of non-farm income in rural China using Gini index decomposition also found that non-farm activities reduced rural income inequality. Their study used data from the Living Standards Measurement Surveys for the years 1995 and 1997, consisting of a sample of 787 rural households from two provinces.

A study from Malaysia by Abdul-Hakim and Che-Mat (2011) examined if farmers' diversification into non-farm activities reduces the likelihood of poverty. Based on a survey of 384 households and estimating a logit model, they found that non-farm employment decreases the probability of a household being poor.

Himanshu *et al.* (2013), based on a combination of national data on the non-farm sector in India from early 1980s to late 2000s and village surveys, found that non-farm diversification is increasingly pro-poor. Their village level analysis also showed the non-farm sector is reducing poverty while at the same time significantly increasing income inequality.

Finally, a recent study by Scharf and Rahut (2014) investigated the well-being and distributional effects of non-farm employment using a survey data collected from 520 rural households in the Himalayas, west Bengal, India. With a system of structural equations and instrumental variable

regressions, they found that low-return nonfarm employment is associated with lower income inequality, while high-return nonfarm activities have a dis-equalising effect on income distribution.

Studies from Africa

Adams (1999) examined the impact of five Sources of income, including non-farm income, on rural income inequality in Rural Egypt using Gini-coefficient decomposition. The results showed that nonfarm income is highly important for the rural poor in Egypt as it accounts for almost 60% of their total per capita income and reduces income inequality. However, not all Sources of nonfarm income have equal impact on income distribution. Thus, unskilled labour represents an important inequality-decreasing Source of rural income.

Canagarajah *et al.* (2001), using data from Ghana and Uganda, found that non-farm earnings contribute to rising inequality, but that lower income groups also benefit due to strong overall growth in non-farm earnings. Self-employment income has inequality-increasing effect while wage income reduces inequality. They also found that among female-headed households, self-employment is important than wage employment.

Using panel data from 894 rural Ugandan households in 2003 and 2005, Kijima *et al.* (2006) examined the role of non-farm employment in poverty reduction. Their findings indicate that asset-poor households tend to increase supply of labour to low-return activities to respond to idiosyncratic shocks while the non-poor engage in self-employed business, thereby increasing the income inequality.

Olugbire *et al.* (2011) investigate the impact of non-farm employment on household income and poverty in Nigeria. They used propensity score matching approach to evaluate the differences in income using participation in non-farm activities as a treatment variable. Their results show that non-farm wage-employment has a higher impact on welfare than non-farm self-employment.

Studies from Ethiopia

A study by Block and Webb (2001) based on a survey of 300 households from rural Ethiopia found that wealthier households tend to have more diversified income Sources. Moreover, those with more diversified incomes also had a greater increase in both income and calorie intake. This highlights that differential access to non-farm income is likely to have inequality-increasing effect.

Van Den Berg andKumbi (2006) analysed the relation between non-farm income, poverty, and inequality in Oromia region, Ethiopia. They used econometric estimates of household income from the nonfarm sector and Gini-decomposition of income inequality by Source for a sample of 1,704 households. They found that entry barriers to non-farm activities in the region are low, and growth in the non-farm sector is favourable to the poor. Nega *et al.* (2009) studied income diversification, social capital and the level of inequality using a micro level data from 385 rural households in Tigray, Northern Ethiopia. Their findings highlight that non-farm income generally has an inequality-increasing effect due of barriers to entry. Moreover, certain types of activities within the non-farm sector, mainly own business and wage income, are found to have un-equalising effect.

Sosina and Barrett (2012) explored rural employment transitions in Ethiopia between farm and non-farm employment and found that initial asset holdings and access to saving and credit services are important factors for transition into high-return rural non-farm employment. These factors are likely to act as entry barriers and have inequality-inducing effects.

In another study,Sosina *et al.* (2012) using the Ethiopian Rural Household Survey (ERHS) data for the years 1994, 1999 and 2004examined whether nonfarm employment leads to higher consumption expenditure growth in Ethiopia.Their findings indicate that households' consumption expenditure growth has a positive correlation with the initial share of nonfarm income; for wealthier households, the growth elasticity of nonfarm income share is higher; and human and physical capital contribute to higher rates of return for nonfarm participants.

Generally, the empirical evidence from Asia mostly shows that non-farm income has a poverty- and inequality-reducing effect. It also demonstrates the merits of disaggregating non-farm income/activities to enhance our understanding of the effects of non-farm diversification's on welfare. The studies from Africa, on the other hand, largely seem to indicate that non-farm income has an inequality-inducing effect. Most of these studies used Gini-coefficient decomposition and highlight that the self-employment part of the non-farm income has a much greater effect in increasing inequality. This in turn seems to reflect the lack of non-farm income-generating opportunities in rural Africa and the existence of substantial entry barriers

that make the relatively wealthy farm households to dominate the lucrative self-employment activities.

The studies from rural Ethiopia give mixed evidence with regards to the relationship between non-farm income, poverty and inequality. Some regional studies indicate that the non-farm sector is favourable to the poor having low entry barriers for participation (see Van Den Berg and Kumbi 2006) while others show that non-farm diversification is constrained by considerable entry barriers which disproportionally affect the poor and therefore increase income inequality (Block and Webb 2001; Woldenhanna and Oskam 2001). Moreover, the evidence is not clear and conclusive as to whether non-farm income increases or decreases the likelihood of poverty. Thus, the present study aimed to fill this gap by examining the impact of non-farm income on poverty and assessing its distributional effect. In doing so, it looked into specific components of the non-farm diversification as the welfare and distributional impact of non-farm income depend on the specific type of non-farm activities and the capacities of households to access these activities as highlighted in the literature (De Janvry*et al.*2005).

Data and Methods

Data Source

The data used in this study came from the Ethiopian Rural Household Survey (ERHS) for the period 1994–2009. It is a panel household survey that included 1,477 households in 15 districts of rural Ethiopia. The survey covered four major regions (Amhara, Tigray, Oromya and Southern Nations, Nationalities and Peoples Region) wherein the country's largest

proportion of settled farmers are found. In this paper, data from the four rounds of surveys from the years (1994, 1997, 2004 and 2009) were used consisting of a total of 1,240 households. Although the information contained in these surveys is fairly consistent, there are modules present in the 2004 and 2009 rounds that are not included in previous surveys. These modules mainly include questions about shocks and public works and the results of our analysis could be limited by their absence.

Methods

For the purpose of this paper, income was categorised into three major parts: farm, non-farm, and off-farm income. Following the main distinction made in the literature, the non-farm income was divided into two sub-categories—non-farm self-employment income and non-farm wage income. Farm income refers to the sum of the income earned from crop production converted to monetary value including value of crop residue, income from the sale of animal products, and income earned from the sale of livestock (excluding distress sales). Non-farm income aggregates a range of activities that span from regular salaried work to self-employed activities, such as trading. Moreover, income earned from renting land and oxen (rent income) as well as remittances was categorised as non-farm income. A full list of these activities and their composition is provided in Annex 3.

This study investigated the effects of non-farm income on poverty and inequality using two methods (1) Gini-decomposition of income inequality by income Sources; and (2) Econometric estimation of welfare/poverty as a function of household and community characteristics. Following Van De

Walle and Cratty (2004), the probability of being poor (if consumption per capita is less than the poverty line) was used as a binary response dependent variable.

Decomposition of Income Inequality by Income Source

The Gini-coefficient decomposition technique is often used to analyse income inequality and has been applied extensively to examine the effect of non-farm diversification on income inequality (Adams 1999; Zhu and Luo 2005).

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

Following Lerman and Yitzhaki (1985), the Gini index of the total income, G can be given as:

$$G = \sum_{k=1}^{K} R_k G_k S_k \qquad (1)$$

where:

S_k is the share of income from Source k in total group income

G_k is the Gini-coefficient of income inequality for income from Source k or the pseudo-Gini coefficient of an income Source; and

R_k the correlation between income Source k income and the distribution of total income.

R_k can be defined as:

$$R_k = \frac{\text{cov}\left[Y_k, F(Y)\right]}{\text{cov}\left[Y_k, F(Y_k)\right]} \quad (2)$$

Where, $Cov[Y_k, F(Y)]$, is the covariance between Source income amount and total income rank.

Gini-decomposition can be used to determine the contribution of a particular income Source to total income inequality by estimating the effect of a 1% change in income from Source *k* on total income inequality (Feldman 2009). This effect is given by:

$$\frac{S_k G_k R_k}{G} - S_k \quad (3)$$

Econometric Estimations

If Y_{it} is per capita consumption for household *i*at time *t*, then Y_{it}can be defined as a function of non-farm income diversification (Nd_{it}) and other explanatory variables X_{it}, which can be stated as:

$$Y_{it} = \alpha Nd_{it} + \boldsymbol{\beta X}_{it} + \boldsymbol{\mu}_i + \boldsymbol{\varepsilon}_{it} \quad (4)$$

Where:

X represents household characteristics, such as gender, age, education, household size, size of farmland, asset index, livestock holding, land quality index and access to credit;

$\mu_i$captures unobserved effects,

$\varepsilon_i$is a random error term; and

α, and$\boldsymbol{\beta}$are the parameters to be estimated.

This study used a random effects probit model to examine the relationship between the likelihood of poverty and non-farm diversification.[4]

The standard unobserved effects probit model's main assumption can be expressed, following (Wooldridge 2002), as:

$$P\left(y_{it} = 1 \middle| \boldsymbol{X_i}, u_i\right) = P(y_{it} = 1 \middle| \boldsymbol{X_{it}}, u_i) = \Phi(\boldsymbol{X_{it}\beta} + u_i),\ t = 1,....T \quad (5)$$

Where, u_i is the unobserved effect, and X_i contains X_{it} for all t. The first equality indicates that X_{it} is strictly exogenous conditional on u_i: once u_i is conditioned on, only X_{it} appears in the response probability at time t. This controls for any influence of lagged dependent variables in X_{it}, as well as certain kinds of explanatory variables whose imminent actions are contingent on current and past outcomes on y. This is a strict exogeneity condition.

Another assumption of the model is that the outcomes: $y_{i1}; \ldots; y_{iT}$ are independent conditional on $\left(X_i, u_i\right)$.

Additionally, the traditional random effects probit model adds the assumption:

$$u_i \middle| X_i \sim \text{Normal}\left(0, \sigma_u^2\right) \quad (6)$$

This assumption entails that u_i and X_i are independent and that u_i has a normal distribution. These assumptions are strong and may not be attainable given the nature of the data used in this estimation. According to Wooldridge (2002, 2010) these assumptions can be relaxed by observing:

$$P\left(y_{it} = 1 \middle| \boldsymbol{X_i}\right) = P(y_{it} = 1 \middle| \boldsymbol{X_{it}}) = \Phi(\boldsymbol{X_{it}\beta}), \quad (7)$$

Where, $\boldsymbol{\beta}_u = \boldsymbol{\beta}/\left(1+\sigma_u^2\right)$

Thus, it is possible to estimate $\boldsymbol{\beta}_u$ from pooled probit of y_{it} on $\mathbf{X}_{it}$, $t = 1,...,T$, $i = 1,....N$. This involves direct estimation of the average partial effects. If u_i is truly present, $\{y_{it} : t = 1,....T\}$ will not be independent conditional on X_i, with robust standard errors to deal with the requirement of robust inference to account for serial dependence (see Woodridge 2002: 486).

Woodridge (2002) citing Ruud (1986) discusses how to consistently estimate the slope parameters with some restrictions imposed on the distribution of X_i , mainly that at least one element of X_i with non-zero coefficient is continuous. Since we are only interested in estimating the directions and relative sizes of the partial effects, and not the response probabilities, it is possible to consistently estimate $\boldsymbol{\beta}$ up to scale under very weak assumptions using semi-parametric estimators.

Results and Discussion

Results of our analysis of the data showed that consumption per capita growth was very strong between 1994 and 1997 rounds (Dercon *et al.* 2012). This seems to have some effect on reduction of poverty from 47 per cent in 1994 to 33 per cent in 1997 (see Table 1). However, this reduction in poverty rate reversed between 1997 and 2004 partly due to the 2002/03 drought that affected 13.2 million people (it had been considered the worst drought since 1984 – De Waal *et al.* 2006). Between the latest survey

rounds (2004 and 2009), another fundamental change that shaped the rural economy was the high food-price inflation, which occurred both before and after 2004 (Nigussie *et al.* 2012).

In terms of overall income diversification measure, the households in the ERHS sample have increased their diversification index, as measured as a reverse of the Herfindal index of income concentration (see Figure in Annex 2).

Table 1. Consumption and poverty indices, 1994–2009

Year	Mean consumption per capita	Median consumption per capita	Poverty head count	Poverty Gap	Squared Poverty Gap
1994	70.37	51.86	47.50	0.2084	0.1181
1997	87.65	70.38	33.14	0.1158	0.0566
2004	91.43	64.69	35.73	0.1304	0.0667
2009	58.80	47.36	52.78	0.2093	0.1111

Source: Computed from the ERHS (1994; 1997; 2004; and 2009).

The poverty head count is determined by using the Poverty line of 50 Birr/adult equivalents per month in 1994 prices. This poverty line was set using the cost-of-basic-needs approach following Dercon *et al*. (2012). Since food represents the larger share of the consumption basket for the surveyed households, consumption was deflated by a food price index calculated as a Laspeyres index, based on Peasant Association prices and using average shares in 1994 as weights. This was used to compute the food poverty line using a bundle of food items that would provide 2300Kcal per adult per day. To have a poverty line that reflects the costs of purchasing both food and non-food items the non-food bundle is added to

the food poverty line using the method suggested by Dercon and Krishnan (1996). To make comparison across time possible, all incomes are expressed in real terms using 1994 prices and the poverty line is set at 50 Birr so that it represents the same purchasing power year after year (i.e. absolute poverty line). This helps to evaluate the effects non-farm diversification on poverty (see also Dercon *et al*. 2012; Sosina *et al*. 2012). By decomposing the Gini-coefficient (Equation 1) and the coefficient of variation (Equation 2), it is possible to measure the contribution of a particular Source of income to overall income inequality as demonstrated by a number of studies (Adams 1994; Escobal 2001; Zhu and Luo 2005).

The share of each income component to total income, the Gini coefficient by components of income, the contribution of each component to the overall Gini coefficient, and the contribution to overall inequality in percentage change are presented in Table 2.

Table 2. Inequality decomposition by income Source for all rural households, 2004–2009

Income Source	S_k	G_k	R_k	Share	% Change
non-farm	0.124	0.873	0.625	0.122	-0.002
off-farm	0.021	0.923	0.289	0.010	-0.011
farm	0.850	0.589	0.964	0.868	0.018
public transfers	0.003	0.967	-0.255	-0.001	-0.004
others	0.002	0.991	0.384	0.001	-0.001
Total income	1.000	0.556			

Source: Computed from ERHS(1994–2009)

Notes:
S_k=Share in total income
Gini coefficient for income Source (G_k
Gini-correlation with total income (R_k)
Share = (Rk*Gk*Sk)/G
% change= (Rk*Gk*Sk)/G-Sk = Contribution of the income Source to overall inequality

The results from Table 2 show that farm income contributes the largest share of income (85%) for households. This income Source is followed by non-farm income, contributing 12.4%. Throughout the period from 1994 to 2009, non-farm income has an inequality-reducing effect in which a 1% change in non-farm income is likely to reduce inequality by 0.2%. Although this impact of non-farm income on inequality is very low in magnitude, it is still suggestive of the positive role of non-farm income on equitable income distribution in rural Ethiopia. This positive effect of non-farm income remained constant in all the years except for 1997, in which it had inequality-increasing effect (see Annex 1).

Table 3 presents five income Sources with non-farm income further decomposed into two of its components— non-farm wage employment and non-farm self-employment income. The results show that non-farm self-employment has a tendency to increase income inequality while non-farm wage employment has the opposite effect on inequality. This result may reflect the separation of the RNFE, in which the rich engaged in self-employment (own-business) while the poor were more likely to participate in wage-employment as the activities in the self-employment require higher initial capital, which acts as an entry-barrier for the poor. This result is consistent with what has been found so far by a number of studies in Africa, such as by Adams (1994) for Egypt; Canagarajah *et al.*(2001) for

Ghana and Uganda; Kijima *et al.* (2006) for Uganda; and recently Senadza (2012) for Ghana.

Finally, it is important to note that the results from the Gini-decomposition may reflect some limitations of the data set employed. Accordingly, the number of households who participated in 2004 in non-farm wage labour was only 66, which may not provide enough information to decompose income inequality between self-employment and wage-employment categories of non-farm income for the year 2004.

Table 3. Inequality decomposition by income Source for all rural households, 1994–2009

Income Source	Sk	Gk	Rk	Share	%Change
Non-farm self-employment	0.074	0.935	0.654	0.081	0.007
Non-farm wage	0.036	0.953	0.515	0.031	-0.004
Off-farm	0.022	0.923	0.283	0.010	-0.012
Farm	0.864	0.589	0.968	0.878	0.014
Public transfers	0.003	0.967	-0.252	-0.001	-0.004
Others	0.002	0.991	0.376	0.001	-0.001
Total income and Gini	1.000	0.561			

Source: Computed from ERHS(1994–2009)

The results of the probit estimations show that non-farm income has a negative and significant relationship with the probability of being poor (Table 4). These results suggest that non-farm diversification can play a positive role in poverty reduction and confirms the findings in other studies from Ghana and Uganda (Canagarajah *et al.* 2001), Nigeria (Akaakohol and Aye 2014) and Ethiopia (Van Den Berg and Kumbi 2006; Sosina *et al.* 2012). This negative association between non-farm income and the

likelihood of being poor, however, does not necessarily imply that poverty reduction can be attributable to the growth of participation in the non-farm sector (see Lanjouw 2007). Moreover, the poor are mostly limited to the low-return end of the rural non-farm sector in their participation, which means that any growth and expansion in the non-farm sector may not benefit the poor right away. However, as evidenced in India, non-farm earnings can still "contribute to poverty reduction even in cases in which the poor are not directly employed in the rural nonfarm economy" (Lanjouw 2007:79). This is mostly because earnings from non-farm activities act as a safety-net and play critical role in protecting the poor from further declines in income.[5]

Table 4. Impact of non-farm income on poverty headcount (likelihood of being poor)

Dependent variable=poor (=1)	Probit RE marginal effects at means	Probit population averaged
Ln non-farm income	-0.118***	-0.104***
	(0.0246)	(0.0220)
Age of household head	0.00412	0.00371
	(0.00231)	(0.00211)
Male household head(=1)	0.00935	0.00675
	(0.0786)	(0.0718)
Highest grade completed	-0.0212	-0.0191
	(0.0114)	(0.0109)
Dependency ratio	0.622***	0.565***
	(0.161)	(0.149)
Access to credit dummy	-0.0394	-0.0325
	(0.0692)	(0.0634)
Death of a working member	-0.0322	-0.0295
	(0.0760)	(0.0690)
Tigray region dummy	0.785***	0.700***
	(0.131)	(0.111)
Amhara region dummy	-0.251*	-0.226*
	(0.102)	(0.0944)
South region dummy	0.822***	0.734***
	(0.102)	(0.0916)
Access to electricity (=1)	0.00235	-0.00508
	(0.0860)	(0.0751)
_cons	0.364	0.323
	(0.250)	(0.221)
lnsig2u_cons	-1.422***	
	(0.293)	
No. observations	2158	2158
No. groups	1022	1022
Log likelihood	-1284.9	
chi2	280.5	346.84
Prob> chi2	0.000	0.000

Standard errors in parentheses

*p< 0.05, **p< 0.01, ***p< 0.001

Source: Computed from ERHS (1994–2009)

Notes:

Conditional marginal effects coefficients are estimated for year-intercepts of 1997, 2004 and 2009 and all have negative and significant coefficients when compared to the reference year 1994.

Standard errors adjusted for clustering at household level for the GEE population-averaged model

Conclusions and Policy Implications

This paper examined the effects of non-farm diversification on income inequality and poverty in rural Ethiopia. The results from Gini-decomposition, fixed and random effects models, and probit estimations, show that non-farm income diversification largely exhibit a favourable effect on income distribution and poverty. These positive contributions confirm, and lend support to, the widely held view that the non-farm sector can offer a viable option to reduce rural poverty in countries like Ethiopia where agricultural growth is weak and too often stalled by climatic hazards, such as the recent country-wide El Nino induced drought that affected the livelihoods of millions. Thus, policy-makers can use the rural non-farm economy as an additional option to mitigate such challenges and help the rural poor move out of poverty. Despite this, however, the promotion of non-farm diversification needs to take cautious steps as the benefits of the non-farm economy depend on strategic choices in terms of investing in key sectors, such as rural infrastructure that create multiplier effects. This would help the rural poor to gain access to markets and facilitate the rural-urban linkages that is clearly stipulated as one

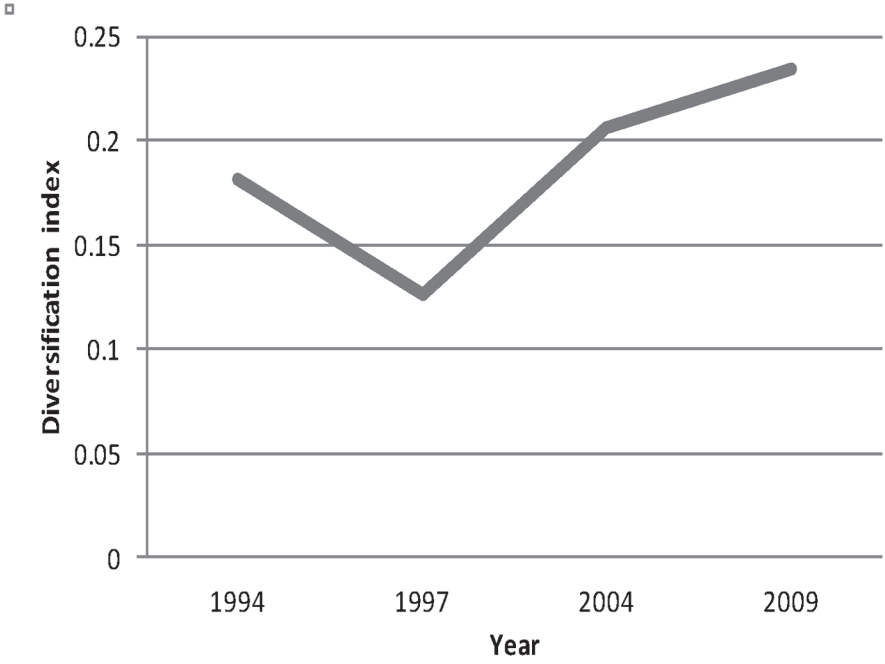
mechanism to achieve rapid structural transformation in the recent GTP of the government.

Annexes

Annex 1. Contribution to income inequality by income Source for all rural households,2004–2009

Income Source	Year			
	1994	1997	2004	2009
	% Change	% Change	% Change	% Change
Non-farm	-0.014	0.03	-0.006	-0.02
Off-farm	-0.014	-0.008	-0.01	-0.007
Farm	0.041	-0.021	0.02	0.03
Public transfers	-0.013	-0.001	-0.003	-0.002
Others	0	0	-0.001	-0.001
Total income Gini	0.58	0.59	0.496	0.528

Source: Computed from ERHS (1994–2009).



Annex 2. Income diversification using the Herfindal index, for all activities, 1994–2009

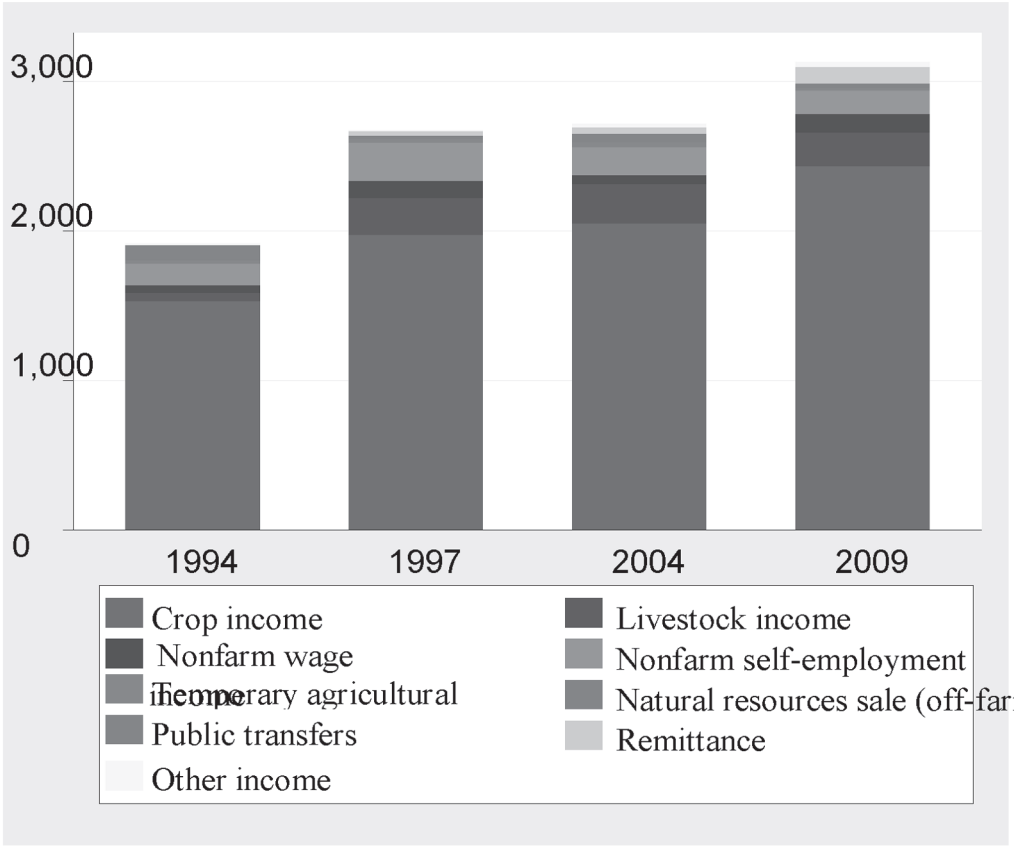
Source: Computed from ERHS, 2004–2009

Notes:

The diversification index (DI) is calculated as the inverse Herfindahl index as:

$$DI_i = \left[\frac{I}{\sum a_j^2} \right]_i$$

where each $a_j$represents the proportional contribution of each livelihood activity j to household i's overall income. If total income is distributed equally among the different Sources, the maximum possible value of the index will be close to 1 and the minimum possible value is 0, which refers to the situation when all income is earned from a single Source (Anderson and Deshingkar 2005).



Annex 3. Mean Income Composition from Various Sources, 1994–2009

Source: Computed from ERHS, 2004–2009

Notes:

- Income is expressed in mean annual terms based on 1994 prices. Crop income includes the monetary value of all crops produced in *Meher(the main rainy season from mid-June to mid-September)* and *Belg(the short rains from March to April*).
- Livestock income includes income earned from the sale of live animals (not because of distress sale that has adverse effect on asset holding) and income from animal products such as milk, cottage cheese, meat, hides and skins, etc. The 1994 round does not include income from the sale of animal products as it was not reported in the data.
- Nonfarm wage income is composed of income earned from the following Sources as reported in the data: Professional (Teacher, government worker), skilled labourer (Builder, Thatcher), Soldier, driver/Mechanic, unskilled non-farm worker, domestic servant, and guard. Nonfarm self-employment largely constitutes income earned from own-business activities such as Weaving/spinning, milling, handicraft, including pottery, trade in grain/general trade, income from services such as traditional healer/religious teacher, transport (by pack animal), selling *injera* (a staple food in many parts of Ethiopia. It is a sourdough-risen flatbread usually made out of teff, millet and/or sorghum) and *wott* (stew) (food), barbary and tailoring. It also includes the making and selling of local drinks, carrying goads (porter), builder (masonry), making roof for houses, rock splitting, and fruit and vegetable vending.

- Income from the sale of Natural reSources is aggregated from the making and selling charcoal and Collecting and selling firewood or dung-cake.
- Temporary agricultural labour includes income earned from engaging in someone's farm in return for in-kind income (in terms of sharecropping) or in daily wage. In order to control for locational effect, only activities reported within the village were used.

Endnotes

1. From the late 1990s, Ethiopia followed an "agriculture-first" policy with a focus on smallholder agriculture. This has changed recently with the launching of the Growth and Transformation Plan (GTP) that gives equal attention to stimulating growth in the non-agricultural sectors.

2. According to the World Bank's figures, the rural population share for Latin America and the Caribbean was 21% in 2013. This figure is much lower than South Asia's (68%) and Sub-Saharan Africa's (63%) and makes Latin America a highly urbanised region not only among the developing regions but also compared to other regions, such as the Euro area (see World Bank 2013).

3. The data were collected by the Economics Department of Addis Ababa University (AAU), the Centre for the Study of African Economies (CSAE), University of Oxford and the International Food Policy Research Institute (IFPRI).

4. A conditional fixed-effects estimate does not exist as there is no sufficient statistic to permit the fixed effects to be conditioned out of the likelihood. Unconditional fixed-effects can be estimated using indicator variables for the panels; but such effects are likely to be biased (see Wooldridge 2010). The results of the probit estimates are compared to fixed and logit estimations. The Hausman test favours the FE logit over the RE. The results of the FE estimations have the expected sign for the ln non-farm income, but does not have a statistical significance. The Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) for model comparisons were also used to choose

between the different models. However, these tests were not valid since the number of observations used in the estimations differbecause time-invariant regressorswere dropped fromthe fixed-effectslogit model. Thus,the paper only used the AIC and BIC tests to choose between the random-effects logit model vs. the random-effects probit.

5. Although the main interest in this analysis lies in identifying the conditional effects, which does not require strictly following the exogenity criterion, some income and asset related variables were excluded in the models. The robustness of the estimated models was checked by including these variables in a different set of estimations. The results showed that most other covariates in the probit models are significant and have the expected signs. Accordingly, the probability of being poor declines with education, higher crop income, livestock holding and with access to credit while poor land quality and larger household size increases the household's likelihood of being poor. Estimation that included climate shocks index (a composite index that includes drought, flood and frost experiences by households) for the years 2004 and 2009 showed that the likelihood of poverty also increases statistically significantly at less than 1%.

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