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1. Introduction

Even though agriculture remains the main source of income and employment in most rural areas in developing countries, the rural non-farm sector has gained increasing importance over the past decades. At the start of the new millennium, roughly 25 percent of rural full-time employment and 35-40 percent of rural incomes was attributed to the rural non-farm economy in developing countries (Haggblade, *et al.*, 2002). Many smallholder farm households complement their farm income with income from non-farm sources. This strategy has several advantages, especially for poorer households. Their agricultural resources are often too limited to allow efficient use of all household labour, and non-farm activities can offer an alternative remunerative allocation, especially during the lean season. Moreover, income from agriculture is subject to high risk due to climatic factors, price fluctuations, pests and diseases. Earnings from non-farm employment may help to buffer the resulting income fluctuations and improving household security (Lanjouw and Lanjouw, 1995).

These advantages for the rural poor do not necessarily imply that this group benefits most from a growing non-farm economy. In much of Africa, the share of non-farm income in total income is higher for wealthy households than for the poor due to entry barriers (Reardon, *et al.*, 2000). As a result, the nonfarm economy does not reduce poverty but increases inequality instead. Evidence for Ethiopia is, however, mixed: using a sample of rural households spread over the country, Jayne, *et al* (2003) found that the share of nonfarm income is highest for the poor, whereas Woldehanna (2000) found that non-farm employment worsened income distribution for a case-study of Tigray in northern Ethiopia. These contradictory results are not inconceivable, as determining factors, such as the development of markets and institutions and the biophysical environment, can vary strongly within a single country. Reardon and Taylor (1996), for example, found that non-farm income had an

unequalising effect in Northern Burkina Faso (a poor and risky agricultural zone) and an equalizing effect in Southern Burkina Faso (a favourable agro-climatic zone with dynamic agriculture).

The present paper analyzes the relation between poverty, inequality and participation in the nonfarm economy in Oromia, the largest state of Ethiopia both in terms of area and population size. Most Oromia households rely on rainfed agriculture for their livelihood, but population growth has led to fragmentation of available arable land, and average farm size has dropped below one hectare. The traditional development approach of providing technology and infrastructure to increase agricultural production has not succeeded in curbing the trend of increasing poverty, and alternative sources of productive employment must be sought in order to support the additional workforce created by population growth. The question is whether the focus of policy should be on improving access of the poor to existing nonfarm activities or on improving the profitability of these activities.

We will search for an answer to this question using two complementary methodologies. First, we do econometric estimates of household participation in the non-farm sector to directly test for the presence of entry barriers. Second we do Gini decomposition of income inequality by source. If everyone can participate, the non-farm sector will have an equalizing effect on the income distribution, although the returns may be low. The results indicate that the poor in Oromia actively participate in the nonfarm economy and that growth in the non-farm sector will not increase income inequality. This contradicts most (but not all) previous evidence from Africa and even from other regions in Ethiopia, and therefore provides a warning against generalization of empirically found relations to other contexts.

The structure of the paper is as follows. Section two presents the methodological framework of the study. Section three describes the empirical results for both analyses. Section four concludes.

2. Analyzing the relation between non-farm income and inequality

2.1. A household model including farm and non-farm activities

In order to analyze the relation between poverty and participation in the non-farm economy, we developed a stylized household model that covers the most relevant characteristics of rural Oromia. The majority of rural households in the Oromia region are subsistence-oriented smallholder households. Labour markets are virtually absent and most households depend on self-employment on or off their farm using own labour resources. The proportion of farmers that has access credit facilities is very small. The productivity of agriculture is low and a lion share of produce is used for consumption.

The model household maximizes the utility of consumption of agricultural goods (X_f), market goods (X_m) and home time (X_ℓ). The precise form of the utility function depends on household characteristics such as family composition and education (Z):

$$\text{Max } U = (X_f, X_m, X_\ell; Z) \quad (1).$$

The household can choose between two types of activity: farm and non-farm production (subscripts *f* and *nf*, respectively). Production output (Q) in either activity depends on the input of labour (L), other variable inputs, such as fertilizers and biocides (V), (physical and human) capital (K), and –for agriculture– land (A):

$$Q_f = Q_f\left(A, L_f, V_f, K_f\right) \quad (2a)$$

$$Q_{nf} = Q_{nf}\left(L_{nf}, V_{nf}, K_{nf}\right) \quad (2b)$$

As there is no labour market, the sum of labour allocated to the two types of activity and home time equals the total time endowment of the household (T):

$$X_{\ell} + L_f + L_{nf} = T \tag{3}$$

Consumption expenditures cannot exceed the sum of income from both activities:

$$X_m = p_f^q \left(Q_f - X_f\right) - p_f^v V_f + p_{nf}^q Q_{nf} - p_{nf}^v V_{nf} \tag{4}$$

where the prices of market goods are used for normalization, p are prices, and superscripts q and v refer to output and variable inputs, respectively.

Finally, expenditures on variables inputs are subject to a liquidity constraint, where the total amount of liquid assets available from own resources as well as credit (K_l) is a function of household land and other capital endowments:

$$p_{xf} V_f + p_{vnf} V_{nf} \leq K_l(A, K_q, K_{nf}) \tag{5}$$

The Lagrangian of this maximization problem is:

$$\begin{aligned} L = [&X_f, \{p_f Q_f(A, L_f, V_f, K_f) - p_f X_f - p_{vf} V_f + p_{nf} Q_{nf}(L_{nf}, V_{nf}, K_{nf}) - p_{vnf} V_{nf}\} \\ &, T - L_f - L_{nf}; Z_h] + \lambda[K_l - p_{vf} V_f - p_{vnf} V_{nf}] \end{aligned} \tag{7}$$

After some rewriting, this results in the following first-order conditions:

$$\frac{\partial U}{\partial X_f} / \frac{\partial U}{\partial X_m} = p_f \tag{8a}$$

$$p_f^q \frac{\partial Q_f}{\partial L_f} = p_{nf}^q \frac{\partial Q_{nf}}{\partial L_{nf}} = \frac{\partial U}{\partial X_\ell} / \frac{\partial U}{\partial X_m} \tag{8b}$$

$$p_f^q \frac{\partial Q_f}{\partial V_f} = p_f^v \left(1 + \lambda / \frac{\partial U}{\partial X_m} \right) \tag{8c}$$

$$p_{nf}^q \frac{\partial Q_{nf}}{\partial V_{nf}} = p_{nf}^v \left(1 + \lambda / \frac{\partial U}{\partial X_m} \right) \tag{8d}$$

where $\lambda=0$ if the credit constraint is not binding, positive otherwise.

Equation (8a) gives the standard microeconomic result that household allocate consumptive expenditures between agricultural and market goods according to the price ratio of the two types of goods. As we shall see below, however, market prices alone do not govern the allocation of household resources to the different productive activities. This is the result of imperfections in the markets for labour and capital.

Equation (8b) reflects the optimal labour allocation between farm production, non-farm production and home time: the marginal value product of farm employment and non-farm employment are equal to the value of the marginal utility of leisure. This implies that household characteristics affecting consumption preferences will influence decisions on labour allocation (and thus the allocation of other inputs) in productive activities. That is, the household does not simply maximize profits and production and consumption decisions are non-separable.

Equations (8c) and (8d) give the first-order optimality conditions for variable farm and non-farm inputs. The equations indicate that the optimal amounts of variable inputs are such that the marginal value product equals the price. However, if the liquidity constraint is

binding, the actual amounts used will be lower, and the marginal value products will be above the market price.

What does this model reveal about the relation between poverty, inequality and non-farm income? That is, who will engage more in the non-farm economy according to the model: the poor or the rich? Poor households are generally those with low asset endowments. As non-farm activities in the study area are in general capital extensive, we will focus on agricultural capital, *i.e.* A and K_f in the model. Agricultural capital has two functions. On the one hand, more agricultural capital implies a higher productivity of labour and liquid capital in agriculture and thus a lower use of these resources in the non-farm sector. On the other hand, more agricultural capital implies a higher liquidity, which facilitates engagement in the non-farm sector. Hence, the model illustrates two opposing factors at work. On the one hand, poverty pushes households into the non-farm sector, as they cannot profitably employ all family labour in agricultural production. On the other hand, liquidity constraints resulting from low asset levels may inhibit the poor to participate in the non-farm sector, whereas the rich have sufficient access to liquidity to satisfy not only the requirements of agriculture but also of non-farm production. Depending on which factor is more important –the labour surplus or the liquidity constraint– either the poor or the rich will engage more in the non-farm sector. If it is the poor who participate more because they are pushed out of agriculture, non-farm income will decrease inequality. If it is the rich who participate more because they have the means to do so, non-farm income will increase inequality.

While risk is not included in the model, it is easily understood intuitively that inclusion of risk would strengthen the push effect of limited agricultural resources. The poor generally display more risk-averse behaviour than the rich. If farm and non-farm income are not perfectly positively correlated, which is likely to be the case, diversification to non-farm activities will decrease income variability and thus be most attractive to the poor.

2.2. An empirical model of participation in the non-farm sector

From the above analytical model, we can directly derive the reduced form equations for labour use non-farm production:

$$L_{nf} = L_{nf}\ (p_f^q,\ p_{nf}^q, p_f^v, p_{nf}^v,\ T, A, K_q,\ K_{nf}, Z) \tag{9}$$

After estimation, the sign of the coefficients for land and (agricultural) capital gives direct information on the relation between poverty and participation in the non-farm sector.

The data distinguish three types of non-farm activities: handicrafts, food & drinks and trade. As liquidity requirement, risk and labour productivity may differ between activities, we decided to estimate separate equations for each activity. Unfortunately, the data only give information on the presence and income from non-farm activities and not on labour hours. Hence, we used dummies of participation as dependent variable. Assuming linearity of the labour supply functions and a multivariate normal distribution of the errors terms in the labour supply equations, this gives the following multivariate probit model:

$$\begin{aligned} L_{nf1} &= \beta_1' X + \varepsilon_1, \qquad P_{nf1} = 1[L_{nf1} > 0] \\ L_{nf2} &= \beta_2' X + \varepsilon_2, \qquad P_{nf1} = 1[L_{nf2} > 0] \\ L_{nf3} &= \beta_3' X + \varepsilon_3, \qquad P_{nf1} = 1[L_{nf3} > 0] \end{aligned} \tag{10}$$

.

where $X = p_f^q,\ p_{nf}^q, p_f^v, p_{nf}^v\ , A,\ T, K_q,\ K_{nf}, Z$.

In the estimation, we use distance from the residence to the nearest all weather road and distance from the residence to the nearest rural market place and number of pack animals as proxies for prices. Proximity to a road and a rural market facilitates access to raw materials and output markets and is thus likely to increase the profitability of non-farm production and

services. On the other hand, closeness to a road may imply greater competition from urban or imported products, which may bring down the price of locally-produced non-farm goods. Hence, the coefficient for market distance is expected to be negative, while the coefficient for road distance is ambiguous.

Household characteristics include age, marital status, religion, and sex of the household head, family size and dependency ratio. The latter two variables also reflect the household labour endowment. Three education dummies –informal education, primary education, and junior secondary school and above– serve a dual purpose as household characteristics affecting consumptive preferences and indicators of human capital available for both farm and non-farm production. Physical capital is assumed of minor importance for non-farm production. Only the number of pack animals is included, as these are frequently used by traders. Physical capital for farm production is operationalised as a dummy for the use of irrigation, the number of cattle owned, and a dummy for coffee production. We explained above that the coefficients for these variables are ambiguous: a larger endowment of farm assets may facilitate participation through access to cash for non-farm activities, whereas on the other hand more agricultural assets mean a higher productivity of labour and variable inputs in agriculture and thus a lower incentive to engage in the non-farm sector.

2.3. Assessing the relation between non-farm income and inequality through Gini decomposition

Besides through estimating the impact of wealth on participation in non-farm activities, we can analyze the relation between non-farm income and inequality more directly using Gini-decomposition by income source (Lerman and Yitzhak, 1985). In this approach the contribution of income from source k to total inequality can be derived as a product of three items: (i) the share of income from source k in total income (S_k); (ii) the Gini coefficient of

income inequality for income from source k (G_k); and (iii) the correlation between income source k income and the distribution of total income (R_k).

The common expression of the Gini coefficient (G) is given as:

$$G = \frac{2Cov[Y, F(Y)]}{\overline{Y}} \tag{11}$$

where Cov[Y, F(Y)] is the covariance of total income (Y with mean $\overline{Y}$) with its cumulative distribution (F). By decomposing total household income into K sources, the overall Gini coefficient can be expressed as:

$$G = \frac{2\sum_{k=1}^{K} Cov[Y_k, F(Y)]}{\overline{Y}} \tag{12}$$

This can be rewritten as:

$$\begin{aligned} G &= \frac{\sum_{k=1}^{K} Cov[Y_k, F(Y)]}{Cov[Y_k, F_k]} \times \frac{2Cov[Y_k, F(y_k)]}{\overline{Y}_k} \times \frac{\overline{Y}_k}{\overline{Y}} \\ &= \sum_{k=1}^{K} R_k G_k S_k \end{aligned} \tag{13}$$

In order to examine how changes in a given source of income will affect overall income in equality, let us proceed as follows. Consider, a change in e_k per cent in income source k. The partial derivative of overall Gini with respect to this change is given by:

$$\frac{\partial G}{\partial e_k} = S_k (R_k G_k - G) \tag{14}$$

Then the income source elasticity of inequality, *i.e.*, the percentage effect of a one percent change in income from source *k* on the Gini coefficient for total income inequality is:

$$\frac{\partial G}{\partial e} \times \frac{e}{G} = S_k (R_k G_k - G) \frac{1}{G} = \frac{S_k R_k G_k}{G} - S_k \tag{15}$$

This is equal to the difference between source *k*'s share in total income inequality and its share in total income. Note that the sum of income source elasticities of inequality should be zero. That is, if all income sources changed by equal percentage, overall inequality (G) remain unchanged.

3. The non-farm sector and income inequality in Oromia

3.1. Data and preliminary analyses

In 1996, the Ethiopian Ministry of Labour and Social Affairs (MOLSA) conducted a survey called "Agricultural wage employment and rural non-farm employment in Ethiopia" with the financial and technical support from UNDP and FAO. The survey covered the sedentary rural area of five regions in Ethiopia. We used only the data collected in Oromia region, which includes 1,704 households in 60 kebeles (lowest administrative unit). Only about 11 percent of these households pursue non-farm activities as their main source of livelihood. However, many rural households are engaged multiple activities, and 25 percent derived some income from the non-farm sector: 13 percent practiced handicrafts and related activities, 8 percent was involved in trade, 7 percent undertook food and drink activities, and less than 1 percent

was engaged in power-driven grain milling. In total only 8 percent of income was earned in the non-farm sector.

Data on land endowment and credit use provides weak support for the hypothesis that the non-farm economy is open to the poor. Landless and small-farm households are overrepresented among participants in the non-farm sector and only 25% of households uses credit for non-farm activities. This is not surprising, given the relatively low average initial capital investments of about 280 Birr compared to an annual per capita income of 892 Birr.

3.2. Econometric estimates of household participation

Table 1 presents the result of the participation estimates. As indicated before, the signs of the coefficients for agricultural assets are crucial for the relation between poverty and non-farm employment. The coefficients for irrigation and coffee are not significant, possible due to the small number of farmers engaged in these types of crop production. Households owning more pack animals were more likely involved in trade activities. These animals assist in transporting traded goods/items to the consumers' site or rural towns. There is no significant impact of pack animals on participation in the other two types of non-farm activities. The coefficient for by far the most important productive asset –own cultivated land– is negative and significant for all three activities, indicating that poorer households are more likely to be engaged in the non-farm sector. This shows that entry barriers are of limited importance and that non-farm activities are a means to use surplus labour from agriculture productively. The positive, significant effect of family size and the negative effect of dependency ratio for food/drink activities provide additional support for this hypothesis.

Table 1 Multivariate probit estimates for participation in non-farm activities (N=1704).

Explanatory Variables	Averages	Handicrafts	Food/drink	Trade
Assets				
Own cultivated land (ha)	1.13	-0.124***	-0.301***	-0.204***
	(1.14)	(0.045)	(0.074)	(0.057)
Irrigation (yes=1)	0.07	0.144	0.273	0.056
	(0.25)	(0.163)	(0.178)	(0.235)
Number of cattle	3.83	-0.001	0.0002	-0.013
	(11.38)	(0.01)	(0.012)	(0.014)
Coffee producer (yes=1)	0.13	-0.037	-0.106	-0.285
	(0.33)	(0.133)	(0.183)	(0.186)
Number of pack animals	1.74	-0.071	-0.167	0.141*
	(1.24)	(0.068)	(0.109)	(0.082)
Household characteristics				
Age head (years)	41.92	0.005*	-0.001	-0.001
	(15.63)	(0.003)	(0.004)	(0.004)
Sex head (1=male)	0.82	0.063	-0.033	-0.0295
	(0.39)	(0.128)	(0.154)	(0.147)
Marital status head (1=married)	0.47	0.012	-0.265**	-0.260*
	(0.50)	(0.11)	(0.133)	(0.134)
Religion (1=orthodox)	0.86	0.031	0.548***	-0.487***
	(0.35)	(0.087)	(0.119)	(0.116)
Family size	5.40	-0.004	0.085***	0.035
	(2.40)	(0.022)	(0.03)	(0.031)
(Children+elderly)/adults	1.20	-0.058	-0.183*	-0.021
	(0.95)	(0.072)	(0.109)	(0.093)
Adult women/total adults	1.10	0.044	0.344***	-0.105
	(0.68)	(0.099)	(0.124)	(0.104)
Informal education (1=yes)	0.12	-0.05	0.327**	0.274*
	(0.32)	(0.14)	(0.157)	(0.155)
Grade 1-6 for head (1=yes)	0.17	0.24**	0.181	0.012
	(0.38)	(0.119)	(0.145)	(0.150)
Grade >6 for head (1=yes)	0.08	0.065	-0.087	-0.119
	(0.27)	(0.172)	(0.234)	(0.218)
Price proxies				
Distance to road (hours)	2.48	0.038***	-0.067**	-0.002
	(3.05)	(0.014)	(0.029)	(0.016)
Distance to market (hours)	1.67	-0.058***	-0.049	-0.008
	(1.73)	(0.022)	(0.055)	(0.029)
Constant		-1.285***	-1.660***	-0.871***
		(0.226)	(0.30)	(0.255)
R(01,02) = 0.156**(0.079); R(01,03) = -0.076 (0.087); R(02,03) = -0.024 (0.106)				

Notes: Standard errors are in parentheses.
* Significant at 10% level, ** significant at 5% level, *** significant at 1% level

The other household characteristics present few surprises. Households headed by older persons tended to be involved more in manufacturing as the skills required for this type of activities is are developed through time. Besides experience, primary education enhances the

probability of engagement in handicrafts. On the other hand, food-/drink and trade activities do not seem to require formal education, whereas informal education significantly and positively influences the participation in these activities. Higher education appears to be irrelevant for the participation decision of all three types of activities. Unmarried heads of household were more likely engaged in food/drink and trade activities than their non-married counterparts (single, divorce, widowed). Similarly, orthodox households were more likely to participate in food/drink activities, as the preparation and selling of alcoholic drinks are prohibited for other religious groups such as Muslims and Protestants. On the other hand orthodox Christians were less likely to be involved in trade activities. The statistical significance and positive coefficient of the variable female-adult ratio reflect the traditional female domination of these activities. Other than this, we find no evidence of a gender bias in the non-farm sector.

The coefficients for the price proxies seem at first contradictory, a possibility that we discussed in the model section. As expected, households that live closer to market sites are more likely to be engaged in handicraft activities. The significantly positive relationship of distance to the nearest all weather road and the likelihood participation in handicrafts seems to contradict this observation. However, as we argued before, the availability of good road may bring severe competition from urban areas, which results in the replacement of locally produced handicraft products by items with superior quality from cities or abroad. In contrast, households who live closer to an all weather road are more likely to participate in food/drink activities, which are less affected by urban competition.

3.3. Gini coefficients for income inequality

The results from the participation estimates indicate that the poor are more likely to participate in non-farm activities, which suggests that non-farm income decreases total inequality. Gini decomposition confirms this finding (Table 2). The overall Gini coefficient

for total rural household income was 0.66, which is somewhat higher than the overall Ethiopian Gini coefficient of 0.59 reported by Jayne et al (2003). When we decomposed total rural household income inequality between the two composite income sources, we found farm income to be the major contributor to overall total rural income inequality in Oromia, accounting for 90 percent of total rural income inequality. This result is not surprising, since farm income had a high share in total rural household income. When we examined the influence of both income sources on total income inequality, we found farm income to be increasing total income inequality whereas non-farm income reduced inequality. A 10 percent increase in non-farm income would have lead to a 0.07 percent decrease in overall rural income inequality. The same increase in farm income would have resulted in a 0.07 percent increase in total inequality.

Table 2 Gini decomposition by income source (N=1704)

	Income source		
	Non-farm	Farm	Total
Correlation between income source and the distribution of total income (R_k)	1.616	0.969	
Gini coefficient for income source (G_k)	0.381	0.685	0.659
Share of income from source in total income (S_k)	0.104	0.896	
Share of income from source to total income inequality (R_k*G_k*S_k)/G	0.097	0.903	
Elasticity of total inequality with respect to income source (R_k*G_k*S_k)/G-S_k	-0.007	0.007	

4. Conclusion

Rural poverty remains a key development challenge for Ethiopia in general and Oromia in particular. Even though agriculture is the backbone of Ethiopia's economy, it no longer provides sufficient employment for the growing rural labour force, and the share of people below the poverty line has increased over time. Hence the promotion of non-farm activities in addition to farm activities seems indispensable to alleviate rural poverty. However, empirical evidence from various parts of Africa indicates that often only the relatively well-off households are able to engage in the non-farm economy, such that non-farm development

increases inequality and has only a limited impact on poverty –at least in the short run. In some cases, however, it is the poor who participate most actively in the non-farm economy.

In this study, we use two different methods to analyse that impact of non-farm income on poverty and inequality for Oromia, the largest state of Ethiopia both in terms of area and population size: i) assessment of the existence of possible entry barriers through analysis of the major factors influencing participation in rural non-farm activities; and ii) direct measurement of the impact of non-farm income on inequality through Gini decomposition. The results for both analyses point in the same direction: the non-farm economy is relatively easily accessible for the poor and non-farm income decreases inequality, although only slightly. This suggests a limited need for policies geared at overcoming entry barriers to non-farm activities, such as credit programs, and a more general focus on the development of the non-farm economy through increasing access to markets, competitiveness with industrial products, and development of specific knowledge and skills. These programs will stimulate growth without compromising equality.

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