

Determinants of Labor Market Participation Choice of Farm

Households in Rural Ethiopia: Multinomial Logit Analysis

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Abstract

This paper examines the determinants of labor market participation decision of farm households in rural Ethiopia using sample household survey data collected from the study area. Factors affecting households' probability of participation in a particular labor market regime were analyzed using descriptive data and multinomial logit model. The overall result of the analysis indicated that farm households in the study area integrate into labor markets as buyers or sellers of labor. Specifically, the probability of a household to choose a particular labor market regime was related to initial differences in resource endowments, household composition and characteristics, farm attributes and location characteristics. The finding that households integrate into labor markets as buyers or sellers has considerable policy implications with regards to the distribution of benefits that may arise from policy interventions, were the rural labor market serves as a mechanism through which the distribution of benefits from such interventions are realized.

Key words: household, labor, labor market participation, multinomial logit, off-farm, rural

1. Introduction

It is well recognized that the labor power is the principal asset of the poor in rural areas of developing countries and that the rural labor market is a key transmission mechanism through which the benefits of most practical interventions may trickle down to the rural poor. In developing countries with well developed food processing and agribusiness activities, the rural labor market may consist of large scale activities that have the capacity to absorb large number of laborers. However, in most sub-Saharan African countries including Ethiopia, the labor market is usually composed of low paid farm and non-farm wage employment activities operated by smallholder farmers. In such countries, the rural labor market was viewed negatively with a general perception that it is a protection or refuge for the rural poor (Lanjouw, 2007; Carlos, 2010). Moreover, the rural labor force is growing at a rate faster than the agricultural labor force thereby limiting the ability of the agricultural sector to absorb rural labor (World Bank, 2008). These along with low agricultural productivity had challenged the potential of agricultural sector employment as a pathway out of poverty (Lanjouw, 2007). As a result, rural labor markets emerged as an alternative to and supplementary for the formal agricultural sector employment.

Many empirical evidences indicated that in developing countries such as Ethiopia, the rural labor market is functioning well and has become an important source of income and employment for the majority of households. It contributes significantly to overall household income, employment and plays an important role in poverty reduction efforts of poor households (Demeke, *et al.*, 2006; Otsuka and Yamano, 2006; Awuor, 2007; World Bank, 2008; Victor and Awudu, 2009; Emmanuel, 2011). Labor market participation decision is related to poverty in that the earnings from such participation are among the main sources of income for households implying that the ability to earn income becomes an important determinant of poverty. However, this ability depends on the functioning of the rural labor market, and the participation decision of poor households in labor markets. Such participation decision could have different policy implications in the context of rural farm households in developing countries.

There are a number of empirical studies that analyzed labor market participation decision of farm households in rural developing countries. Some of the recent studies are outlined as below. Stefania (2012) identify and analyzed the household specific factors affecting labor market participation decision of farmers in South Africa. His finding indicated that liquidity constraint and market imperfections matter in the choice of the labor market participation strategy adopted. The finding concluded that asset endowments and market imperfections had shaped households' labor market participation decisions in the study area. In Nigeria, Babatunde *et al.* (2010) identified determinants of participation in off-farm employment among small-holder farming households in

Kwara State of Nigeria using survey data from small-holder farming households in rural areas of the state. The result of their econometric analysis indicated that factors related to household composition and characteristics, the amount of productive assets and access to different infrastructural facilities significantly influenced participation in off-farm employment. They concluded that given the existing complementarities, well designed policies could promote farm and off-farm income earning opportunities simultaneously, especially for the poorer households. Thomas *et al.* (2008) analyzed different rural labor market participation regimes of Chinese farm households. The result of their analysis showed that household, farm, and location characteristics influenced the probability to select one of the labor market participation regimes. Moreover, Stephan (2007) assessed the dynamics of Chinese rural households' participation in labor markets using farm household data and discrete time hazard approach. His finding revealed that labor market participation decisions were significantly related to several household and farm characteristics.

Farm households in the study area are characterized by differential asset positions and resource endowments that are expected to influence their supply of and demand for labor thereby inducing them to engage in the labor market. Moreover, the labor market to which households relate is imperfect due to many constraints which may lead to divergence between wages received when selling labor and wages paid when hiring labor, creating wide peculiar price bands around the market wage (Tassew, 2000). These may result in differential integration of households into labor markets either as sellers or buyers. Thus, analysis of the determinants of household labor market participation decision is important because households, besides to deciding how much of leisure to consume and labor to use as an input, they decide how much of their labor to supply to the market based on the chosen labor market regime. Moreover, they may choose not to participate in any type of labor market if they are self-sufficient. Such decisions can have policy implications in terms examining the trick down effects of interventions to the targeted poor.

Accordingly, the main purpose of this study is to identify and analyze the determinants of labor market participation choice of households in rural Ethiopia using simple occupational choice model where participation decision is possibly expressed in four regimes as buyers, sellers, simultaneous buyers and sellers and self-sufficient households. The empirical strategy used for estimation of such multiple choice decisions is multinomial logit model. The details of this model are provided in section two. The rest of the paper is organized as follows. Section 2 discusses the theoretical framework and empirical strategy of estimation. Section 3 introduces the data set and the situation of the rural labor market in the study area. Section 4 presents and discusses the estimation results. Section 5 concludes.

2. Theoretical Framework and Estimation Strategy

In a neo-classical approach to analysis of labor markets, farm households are assumed to be fully integrated to the labor market and operate competitively based on many restrictive assumptions (Sadoulet *et al.*, 1991; Tassew, 2000). But practically, in the context of most developing countries, the neo-classical assumptions of labor markets do not hold and thus household production and consumption decisions are likely to be constrained by many factors leading to a failure in the labor market (Sadoulet *et al.*, 1998; Adelman and Talyor, 2003; Kine, 2010). As a result, households in rural developing countries are exposed to labor market imperfections characterized by poor competition and inefficiency which requires non-separability in agricultural household modeling (Adelman and Talyor, 2003). The analysis under this study is based on the non-separability assumption which best characterizes the labor market situation in developing countries.

According to the agricultural household model, household's willingness to hire farm labor and to sell labor off the farm depends on farm characteristics, family composition, location features and socio-economic attributes. For instance, if the household has adequate family labor, the need for farm labor can be satisfied without hiring labor from outside and also the household may sell labor off the farm. Similarly, a household may at the same time sell labor outside but hire farm labor simultaneously provided that the benefit from selling labor is greater than the cost incurred in hiring labor. Such labor exchanges among farm households may arise due to the initial difference in absolute and relative factor endowments.

In order to analyze aspects of households' decision to participate in a particular labor market regime, it is appropriate to specify participation decision as a model of occupational choice (Thomas *et al.*, 2008). The choice model imply that in addition to deciding how much leisure to consume and labor to use as an input, a household decides how much labor to supply to the market (sell) conditional on the chosen labor market regime. Thus, we can classify labor market participation choice of households in to four regimes such as sellers, buyers, simultaneous sellers and buyers and self-sufficient.

Regime 1: Households that only supply (sell) labor (regime s);

Regime 2: Households that only hire (buy) farm labor (regime h);

Regime 3: Households that simultaneously supply and hire labor (regime sh) and;

Regime 4: Households in autarky or self-sufficient households (regime a).

We can extend the basic agricultural household model by adding the dummies for labor market participation regime as given below. According to the model, households are assumed to maximize utility derived from consumption of goods and leisure subject to production, time, and budget constraints as given below:

$$\text{Max } U(C; Z_U) \quad (1)$$

Subject to;

$$G(x, r; Z_G) = 0 \quad (2)$$

$$T_l + X_l + D_l^h X_l^h - D_l^s X_l^s - C_l \geq 0 \quad (3)$$

$$P_m C_m \leq P_c X_c + P_v X_v - D_l^h g(X_l^h; Z_g) + D_l^s f(X_l^s; Z_f) + E \quad (4)$$

where U is household's utility function, C is a vector of consumption goods consisting of market commodities (C_m) and leisure (C_l), and Z_U represent exogenous utility shifters such as household characteristics. G is a well-behaved production function, where x represents a vector of produced goods, r is a vector of quasi-fixed factors, and Z_G is exogenous production shifters such as household and farm characteristics. The farm household is assumed to produce agricultural products ($X_c > 0$) using variable inputs (X_v), labor (X_l) and the fixed factors (equipment and land). The household faces a time constraint, where T_l is the total time available and $|X_l| = X_l^f + X_l^h$ is total on-farm labor time subdivided into family labor time (X_l^f) and hired labor (X_l^h). Furthermore, X_l^s indicates the amount of family labor supplied to off-farm work.

Farm household's budget constraint indicated in Equation 4 states that the household's expenditures (left-hand side) must not exceed its monetary income (right-hand side), where P_m , P_c and P_v are the exogenous consumer and producer prices. The regime dummy variables in the budget and the time constraint equations indicate the four respective labor market participation regimes. For example if $D_l^h = D_l^s = 1$, then the household participates on both the market for hired farm labor and the market for off-farm labor and so on. Due to labor market imperfections, the optimal solution cannot be found by simply solving the first order conditions of each alternative regime. The solution is thus decomposed in two steps: first finding the optimal solution conditional on the market participation regime and then choosing the market participation regime that leads to the highest internal wage rate.

The choice of a particular labor market participation regime is determined by comparing the internal wage rates obtained for the four participation regimes. Because all the four regimes can be formally written as similar optimization problems, the endogenous labor price of each regime can also be formally written as the same shadow wage function, W_l^j (Thomas *et al.*, 2008). Thus, we have:

$$W_l^h = f(p, r, T_l, E, Z_u, Z_G, Z_g) \quad (5)$$

$$W_l^s = f(p, r, T_l, E, Z_u, Z_G, Z_f) \quad (6)$$

$$W_l^{hs} = f(p, r, T_l, E, Z_u, Z_G, Z_g, Z_f) \quad (7)$$

$$W_l^a = f(p, r, T_l, E, Z_u, Z_G) \quad (8)$$

where p is exogenous output price, r is a vector of fixed factors of production, T_l is total time available, Z_u is household characteristics, Z_G is exogenous production shifter such as household and farm characteristics, Z_f is family labor supplied and Z_g hired labor used. It is clear from the expressions that labor supply shifters can only affect the internal price (wage) if households supply (Z_f), hire (Z_g) and simultaneously supply and hire (Z_f, Z_g) labor. The farm household chooses the labor market participation regime j that leads to the highest internal wage rate as indicated below (Eq. 9).

$$W_l^j = \max(W_l^h, W_l^s, W_l^{hs}, W_l^a) \quad (9)$$

For the actual estimation of the choices, multinomial logit model is applied as elaborated follows. Let W_{lk}^j is the internal wage rate for household k if it chooses regime $j = (h, s, sh, a)$, a function of explanatory variables such as farm, household and regional characteristics. This internal wage rate is not actually observable, but it is possible to define an observable dichotomous variable Wo_{lk}^j equal to 1 if $W_{lk}^j = \max(W_{lk}^h, W_{lk}^s, W_{lk}^{hs}, W_{lk}^a)$ and Wo_{lk}^j is equal to 0 otherwise. The probability that the k^{th} household selects the j^{th} alternative regime may then be written as:

$$Pr_k^j = Pr(Wo_{ik}^j = 1) = Pr[(\beta_j' - \beta_i') Z_k > e_k^i - e_k^j] \text{ for all } i \text{ different from } j. \quad (10)$$

If we assume cumulative distribution for this expression (Eq.10), the difference $(e_k^i - e_k^j)$ will have a logistic distribution and the choice model will be multinomial logit. However, the multinomial logit model does not allow analyzing the probability of being allocated to a specific labor market regime, rather only the relative probabilities can be distinguished because of identification restrictions. So it is necessary to normalize by assuming one of the alternatives (self-sufficient regime in this case) as a reference category so that each regime will be compared against this base category. This normalization implies that the estimated model reduces to three log-odds ratios of the following form:

$$\ln \frac{Pr_k^j}{Pr_k^a} = \beta_j' Z_k; j = h, s, hs \quad (11)$$

The estimated coefficient (β_j') could be interpreted as the marginal change in the logarithm of the odds of each possible alternative over the reference regime caused by a marginal change in the explanatory variables.

3. The Data Set and Household Labor Market Participation in the Study Area

3.1. The data set and variables used in the analysis

This study used the data collected from 324 randomly and proportionately selected sample households in three districts (namely, Guto Gida, Gida Ayana, and Jima Arjo) of Western Ethiopia. These districts were selected based on their diversity in terms of access to off-farm work opportunities and experience and exposure to labor market participation (particularly, variations in the nature and extent of participation). Moreover, they represent broad climatic condition comprising high and low land farming systems. In order to account for the problem of heterogeneity stratified sampling technique was employed and sample households were selected randomly and proportionately. Sample households were interviewed using structured questionnaires that require short recall period. The data were collected in three round surveys following the main agricultural seasons in the study area so that seasonal variations in household time allocation, income and consumption expenditure could be captured appropriately.

The variables included in the analysis are, age (and age square) of the household head measured in years, education level of the head in school years completed, share of educated adult members in the family at different levels (elementary, secondary, high school and above), sex of the household head (dummy variable), family composition variables (number of dependents, number of adult laborers in the family and family size), farm related factors (like land cultivated in hectares and value of variable farm inputs in Ethiopian Birr (Birr is Ethiopian local currency unit (1USD=18.12 Birr in November (2012).)), the estimated value of annual farm income and amount of credit in Birr. Moreover, animal wealth in Tropical Livestock Unit (TLU), non-labor income and location dummies were included in the model.

3.2. Household labor market participation in the study area

Farm households in the study area were seen to participate in different types of farm and non-farm labor markets. About 73.5 per cent of sample households reported that they participated in off-farm activities of which 77 per cent were participants in wage labor market and the remaining 23 per cent in off-farm self-employment activities. One important aspect of the rural labor market in the study area is households' participation in different labor market regimes. Accordingly, households' participation can be categorized into four regimes as: only sellers, only buyers, simultaneous buyers and sellers and self-sufficient. Most farm households were actively involved in each participation regime. For instance, out of 324 total sample households, about 35 per cent participated as only sellers, 21 per cent as only buyers, 17 per cent as simultaneous buyers and sellers and 27 per cent are self-sufficient households. This indicates that farmers in the study area integrate into labor markets as sellers or buyers of labor. Almost all of the employers and hired laborers were smallholder farmers themselves located within the same administrative kebele (Kebele is the lowest official administrative unit in Ethiopia.).

4. Results and Discussion

4.1. Differential factor endowments and labor market participation

The rural labor market analysis requires examining how households integrate into labor markets and identifying the factors that influence their choice of participation in different labor market regimes. This section first provides descriptive analysis of how initial differences in factor endowments induce households to participate in the labor market followed by discussion of multinomial logit estimation result. Table 1 indicates the distribution

of household resource endowments across farm size class. As shown in the table, there are differences in absolute and relative resource endowments among households across farm class size. The indicators of relative resource endowments such as land owned and land cultivated per working family member (land-labor ratio), farm implement per working family member and number of oxen owned per unit of land owned all increased with an increase in farm size. There are also differences in absolute factor endowments among different farm sizes. For instance, the amount of labor bought (hired-in farm labor), total family labor used on the farm, the size of land cultivated and owned and the value of farm implement owned all increased with farm size reflecting existence of differences in the initial factor endowments among farm households. Such differences are expected to bring differences in marginal productivity and induce households to participate in the labor market as sellers or buyers.

Table 2 also reports the descriptive statistics of the use of labor and land and their returns across farm size classes. Obviously, households with small farm size involved more in selling labor. For instance, the percentage of sample households that cultivated less than 2 hectares of land is about 50 per cent. Furthermore, the percentage of households involved in only hiring farm labor increased with an increase in farm size, but those who engaged in only selling labor decreased as farm size increases. Among self-sufficient households, the largest proportion (about 39 per cent) cultivated 2 to 2.99 hectares of land.

Similarly, among simultaneous buyers and sellers, the largest proportions (about 38 per cent) are the medium size farmers who cultivated 2 to 2.99 hectares of land. This entails that the medium size farmers are relatively liquidity constrained and thus involved in working off-farm in order to finance the expense of the hired farm labor. The data has also indicated that the probability of participation in farm labor market changes with farm size. Particularly, labor hired per unit of land cultivated and per adult family members increased with an increase in farm size. The final point is that the existences of differential resource endowments create difference in the marginal productivity of labor across farm size as a result of which advantageous transaction in the labor market is expected to occur. Therefore, differences in factor endowments and the resulting difference in marginal productivity provoke farm households to engage in labor transactions.

2.1. 4.2. Determinants of labor market participation choice of households

In addition to the descriptive analysis of how initial differences in factor endowments induces households to participate in the labor market (labor exchange), multinomial logit model was fitted to identify factors that affect labor market participation choice of households. According to the agricultural household model, the decision to choose a particular labor market regime depends on factors that affect both the shadow wage and the market wage such as family composition and household characteristics, farm attributes, location characteristics and farm income.

The multinomial logit estimation result is presented in table 3. The estimated model with LR χ^2 value (393.12) significant at 1 per cent or less indicates the overall significance of the model. We know that the multinomial logit analysis works if the decisions between multiple alternative regimes are truly made simultaneously indicating independence of the regimes. Thus, it is necessary to test the assumption of Independence of Irrelevant Alternatives (IIA). The Wu-Hausman test for IIA was conducted to test the null hypothesis that the odds are independent of other alternatives. The Hausman test statistics (χ^2 values) computed are given in table 3 for each participation regime. The χ^2 values for each regime are insignificant at any reasonable level which indicates evidence in favor of the null hypothesis. This shows that the alternative participation regimes are mutually exclusive or the odds are independent of other alternatives.

In general, the multinomial logit result presented in table 3 reveals that the labor market participation choice of a household is significantly related to a number of factors that represent household composition and characteristics, farm attributes including farm income and location attributes. To begin with, age and age square of the household head carry the expected signs in all of the participation regimes. But they do not significantly affect households' participation as a buyer only (regime h) and as a simultaneous buyer and seller of labor (regime sh). Their effect on the probability of participation as a seller (regime h) is significant. The positive (negative) sign for age (age square) indicates that the probability of participation as seller increases (decreases) with age at younger (older) ages.

With regards to education level, the result reveals that households with better educated head and with more number of educated members show a higher tendency to participate in labor markets as compared to self-sufficient households. This is in line with some previous empirical studies (Kimhi, 1994; Zhang *et al.*, 2008). Education of the head has a positive and significant impact on participation as a buyer and as a simultaneous buyer and seller, but not as seller only. Furthermore, households with more number of educated family members choose working outside the farm (regime s) or supplying and hiring on farm at the same time (hs). This may be

supported by the fact that an increased education leads to an increased heterogeneity between on-farm and off-farm labor, as a result of which farmers tend to substitute hired labor for family labor on the farm and family labor in off-farm employment as long as the marginal cost of hired labor is lower than marginal off-farm income.

With regards to household composition indicators family size, number of dependents and number of adult members in the family affect the labor market participation choice in different ways and also they carry the expected sign in influencing the participation regimes. Family size and number of dependents have significant effect on probability of participation as buyer as compared to self-sufficient households. However, their effect on other regimes is not statistically significant. The availability of adult laborers (those aged 15-64) in the household has positive and significant impact on the probability of selling labor and involvement in both simultaneous selling and buying of labor.

Most of the variables representing farm resource endowment such as land cultivated, animal wealth, annual farm income and the value of variable farm inputs affect the probability of participation in different market regimes differently and most of these variables carry the expected sign. An increase in the size of land cultivated encourages the probability of hiring labor (regime h) and involvement of households in both hiring and supplying of labor. As a result, it shows positive and significant effect in both regimes. However, the size of land cultivated has negative significant impact on participation as seller (regime s) because households with very small fraction of cultivated land mostly participate in selling labor. The animal wealth measured in TLU has no any significant impact on any of the participation regimes, whereas, the value of variable farm input has positive and significant effect on hiring and both hiring and selling but its effect is not statistically significant in labor selling regime.

The likelihood of a household to hire labor and to simultaneously hire (h) and sell labor (regime sh) significantly increases with an increase in the amount of credit obtained, but credit does not have significant effect in participation as a seller. Similarly, the result indicates that high annual farm income significantly reduces households' tendency towards working outside the farm (regime s) and increases their likelihood to use hired labor when compared with self-sufficient households. Its impact on the probability of simultaneous selling and buying is not significant. Finally, with regard to location characteristics, there are significant location differences in the probability of participation. Specifically, the opposite sign with significant coefficients for participation as a seller (regime s) in Gida Ayana and Guto Gida districts indicate the effect of location differences. The probability of selling labor outside is higher for households in Guto Gida district, perhaps attributed to availability of better off-farm work opportunities in the district as compared to Gida Ayana.

5. Conclusion and Policy Implications

In this paper efforts were made to analyze the determinants of labor market participation choice of households in rural Ethiopia using descriptive data and multinomial logit model. First, existences of initial differences in factor endowments among households were examined using descriptive analysis of the data. Then, multinomial logit model was employed for empirical estimation in order to identify factors that influence households' probability of participation in a particular labor market regime. The overall result indicated that farm households in the study area integrate into labor markets as buyers or sellers of labor in response to initial differences in factor endowments, household composition and characteristics, farm attributes and location characteristics. The existences of such differential factor endowments create differences in the marginal productivity of labor across farm size, as a result of which profitable transaction in the labor market is expected to occur. Therefore, initial differences in factor endowments and the resulting differences in marginal productivity induce farm households to participate in labor transactions.

Besides to descriptive analysis of how initial differences in resource endowments induce households to participate in the labor market, multinomial logit model was fitted to identify factors that affect participation choice of households in different labor market regimes. The result of multinomial logit analysis revealed that the probability of a household to choose a particular labor market regime is related to a number of factors that affect both the shadow wage and market wage rates. Accordingly, variables related to household composition and characteristics, farm attributes and location characteristics were found to be important factors that determine the likelihood of a household to choose a particular labor market participation regime. In this regard, education which captures the human capital factor is important in that, in general, households with better educated heads and with more number of educated members show a higher tendency to participate in labor markets as compared to self-sufficient households. Specifically, households with more number of educated family members choose to work outside the farm (regime s) or supply and hire labor (regime sh) at the same time. Household composition factors such as family size, number of dependents and number of adult members in the family also affect the

labor market participation choice of households differently with expected sign. Finally, farm attributes such as per capita land cultivated, variable farm inputs, annual farm income and amount of credit are also important factors related to labor market participation decision of farmers. For instance, an increase in land cultivated increases the probability of hiring labor (regime h) and involvement of households in both hiring and supplying of labor (regime hs), whereas higher annual farm income significantly reduces the tendency of the household towards working outside the farm (regime s) and increases their likelihood to use hired labor when compared with autarky. Finally, the study revealed that the labor market participation choice of households' difference significantly across locations.

Generally, the findings in this study concluded that farm households in rural Ethiopia integrate into labor markets as buyers or sellers of labor in response to initial differences in factor endowments. The study underlines the importance of factors related to human capital, household composition and characteristics, farm attributes and location characteristics in influencing the labor market participation decision of farm households in the study area. These conclusions have considerable policy implications with regards to the distribution of the benefits that may arise from rural and agricultural investment interventions. For instance, participation in the labor market is expected to even out the returns to labor and land across farm size classes implying the role that participation in the labor market plays in realizing the trickledown effect of policy interventions to the poorer households. Moreover, since most farmers are sellers of labor, this may contribute towards reducing the differences in factor endowments and marginal productivity of labor among households. Therefore, measures taken to improve basic education of working family members will promote choice of selling regime and simultaneous selling and buying regimes there by creating heterogeneity between farm and off-farm labor. This will enable substitution of labor in accordance with its relative advantage and thus promote efficient use of labor by the household.

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Table 1: Factor endowments across farm size classes (absolute and relative factor endowments)

Indicators of factor endowments	Farm size class (area of land cultivated)					
	0-0.99	1-1.99	2-2.99	3-3.99	4-4.99	≥ 5
Total land cultivated in hectares	0.77	1.62	2.55	3.62	4.58	6.14
Total land owned in hectares	1.13	1.76	2.83	3.59	4.82	6.02
Total number of adult laborers in the family	4.27	4.13	4.06	3.84	3.39	3.95
Value of farm equipment owned	322	387	396	415	458	443
Number of oxen owned	1.06	1.13	1.07	1.17	1.13	1.09
Land cultivated per working family member	0.21	0.47	0.76	1.13	1.22	1.74
Land owned per working family member	0.27	0.53	0.86	1.16	1.27	1.69
Value of farm equipment per working family	114	115	114	118	123	135
Number of oxen owned per unit of land owned	0.27	0.48	0.47	0.84	0.89	0.87
Value of farm equipment owned per unit of land	756	254	154	116	100	73
Hired-in farm labor hours	17	29	106	222	289	414
Family labor used on the farm in hours	583	950	1155	1613	1287	2311
Total labor used on the farm in hours	601	980	1261	1835	1576	2725
Family labor supplied to off-farm work in hours	2780	1444	673	554	304	191

Source: Own computation, 2012

Table 2: Percent of households in each farm size class, the use of farm labor and the returns to labor across farm sizes

Indicators of factor endowments	Total sample (average)	Farm size class (area of land cultivated ³)					
		0-0.99	1-1.99	2-2.99	3-3.99	4-4.99	≥ 5
Percent of farm household (total)	100	10.2	40.7	21.3	13.8	8.1	5.9
Percent of farm households only hiring farm labor	21	0	3.8	30.4	51.2	51.2	52.6
Percent of farm household only selling labor	35	75.8	52.3	17.4	7.0	7.8	8.1
Percent of farm household both hiring and selling	17	9.1	13.6	37.7	19.6	16.3	17.7
Percent of autarky households	27	15.2	34.1	39.1	16.3	17.4	5.3
Hired-in farm labor hours per unit of land cultivated	57.7	16.5	17.8	38.5	61.2	61.8	64.9
Hired-in farm labor hours per working family member	31.5	3.08	7.6	30.7	70.8	74.5	116.9
Hired-out labor hours per unit of land cultivated	813.3	6289.5	962.9	296.7	263.9	150.8	198.4
Hired-out labor hours per working family member	375.2	766.05	411.2	326.1	328.7	165.0	186.5
Family labor use on the farm per unit of land cultivated	685.5	762.4	592.8	454.2	448.7	277.8	287.8
Total labor use on the farm per unit of land cultivated	743.2	779.9	609.6	492.7	409.9	339.7	442.7
Value of all crop output per unit of land cultivated ⁴	8593.4	9997.9	6466.2	5845.0	5333.5	5545.0	5866.9
Value of output per labor hour used	12.3	10.6	10.44	12.34	14.1	16.1	14.7

Source: Own computation, 2012

Table 3 Multinomial logit estimation result for household labor market participation decision

Dependent variable: Labor market participation choice (1=only hire, 2 =only supply, 3 =hire and supply, 4 = autarky)

Explanatory Variables	Labor Market Participation Regimes					
	Hire(h)		Supply (s)		Hire and Supply(hs)	
	Coeff.	St.Er	Coeff.	St.Er	Coeff.	St.Er
Age of the head	0.052	0.116	0.083*	0.042	0.032	0.081
Age Square of the head	-0.354	2.262	-2.006*	1.017	-0.441	1.628
Education of the head in schooling years completed	0.534 ***	0.136	0.011	0.078	0.402***	0.108
Sex of the household head(1= male;0=female)	-0.963	1.524	1.334	1.070	-0.440	1.433
Share of laborer with primary level of education	1.124	1.617	3.399***	1.003	0.208**	0.105
Share of laborer with secondary level of education	0.145	0.468	1.817**	0.866	1.165*	0.571
Share of laborer with high school and education	-2.405	1.692	0.848*	0.238	-1.471	1.436
Family size	-0.945**	0.423	0.128	0.200	-0.306	0.321
Number of dependents	1.421***	0.469	-0.149	0.201	0.355	0.479
Number of adult laborers(aged 15-64 years)	-1.254	0.581	0.266**	0.123	0.281*	0.149
Land cultivated in hectare	5.935***	0.910	-1.874***	0.722	2.863**	0.844
Animal wealth in TLU	0.195	0.362	0.067	0.252	0.240	0.347
Amount of credit obtained in Birr	0.298***	0.115	0.153	0.091	0.225**	0.112
Ln (Value of variable farm input ³)	1.512***	0.303	0.407	0.204	1.382***	0.353
Ln (Non-labor income)	-0.019	0.116	-0.020	0.072	-0.014	0.084
Ln (Annual farm income)	0.625**	0.287	-0.185*	0.102	0.308	0.284
Dummy for Gida Ayana	-0.601	0.677	-0.366*	0.191	0.388	0.634
Dummy for Guto Gida	0.961	0.787	0.414*	0.216	1.640*	0.677
Constant	-21.441*	12.685	-12.813*	7.878	-11.450	9.536

Wu-hausman test statistics⁴

LR $\chi^2(57) = 393.12$, Prob> $\chi^2 = 0.000$, Log pseudo likelihood = -240.97, Pseudo $R^2 = 0.4682$,

Note: ***, **, * indicate significance at 1%, 5% and 10% respectively. Autarky is base category

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