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Determinant of Smallholder Farmer Labor Allocation Decisions in Uganda

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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ABSTRACT

Although there is growing evidence of the increasing role of nonfarm activities in rural livelihoods, there is still relatively little empirical evidence regarding the factors that influence smallholder farmers to diversify into nonfarm activities. This study analyses the factors that influence household labor allocation decisions and demand for farm labor in Uganda. Data were collected from 660 households in three banana-based production zones with divergent production constraints and opportunities. The determinants of demand for hired labor were estimated with the Tobit model. Linear regression was used to estimate reduced-form equations for the time-allocation decisions of household members. Our findings show that household members respond positively to increases in wages, suggesting that they respond to economic incentives. Increased wage rates negatively affect the use of hired labor, but household size has no effect on the use of hired labor, indicating that the economic rationing of labor hiring has more to do with the market wage than family size or composition. Education and road access have positive effects on the amount of time allocated to off-farm activities. Access to off-farm opportunities, however, takes away the most productive labor from farm production. These findings suggest that investment in road infrastructure and education suited to smallholder production needs could help alleviate bottlenecks in labor markets and improve resource allocation between farm and nonfarm sectors.

Keywords: Smallholder farmers, labor demand, nonfarm employment

1. INTRODUCTION

Development policies for the rural sector have always targeted improvements in farm productivity, rather than productivity in the nonfarm sector, in an effort to combat rural poverty. Despite this bias, growing evidence suggests that the rural sector in developing countries reflects more activities other than farming (Reardon et al. 1998). Most studies have focused on understanding how the labor supply of farm households responds to changes in economic opportunities (Abdulai and Regmi 2000; Jacoby 1993; Skoufias 1994). Little is known about the factors that influence diversification into nonfarm activities, particularly in Africa (Woldehanna and Oskam 2001). Understanding the factors that influence labor allocation decisions between farm and nonfarm activities is crucial in order to formulate policies that can improve the welfare of smallholder farmers.

A typical agricultural household in a developing economy is hypothesized to make decisions between farm and nonfarm employment, and engage in a number of production activities aimed at both subsistence and the market. The household supply of labor to farm and nonfarm sectors is depicted as a function of the economic returns to farm and nonfarm activities, the household's preferences, and its capacity to undertake the activities, which is determined by access to public assets (e.g. roads) and private assets (e.g. education and credit). Economic returns to these activities are characterized by uncertainty. Rural household members are motivated to enter the nonfarm labor market due to pull factors (e.g. the potential to earn high incomes from the nonfarm sector) and push factors (e.g. risk in farming, poorly functioning financial markets, and missing insurance markets) (Reardon et al. 2001).

However, households may fail to join the nonfarm sector due to the high entry costs of migration, low education levels, and limited access to information. Where markets do not operate in a competitive way, personal and institutional constraints play an important role in determining participation in nonfarm activities (Reardon et al. 1998). Transaction costs (in the form of search and relocation costs) and work preferences can inhibit farmers from supplying labor to the nonfarm labor market. Households with poor endowments are less able to respond to attractive offers of off-farm employment. Furthermore, some household members are not able to work outside the household for reasons of age, gender and customs (Udry et al. 1995).

The households that are considered to be well off in Uganda tend to be those that engage in diverse nonfarm activities (e.g. trading, milling, shop keeping, brick making, lodging, and bar keeping) (Ellis and Freeman 2004; Newman and Canagarajah 2000).

The objective of this paper is to analyze the factors influencing labor supply and demand among smallholder farmers in Uganda. Farm labor supply and demand functions are estimated. Specifically, the link between exogenous and endogenous factors is exploited to determine the impact of market wages and road access on the labor supply decisions of smallholder farmers. The paper also analyses the factors that influence individual household members' choices between on-farm and off-farm work labor supply. Since labor is one of the major inputs to smallholder farm production in Uganda and other developing economies, analyzing the factors that influence its use can give us a better understanding of farm household production decisions in general. Our findings have implications for policies to support agricultural production and employment, and contribute to ongoing debates on the response of poor households to market incentives in developing economies.

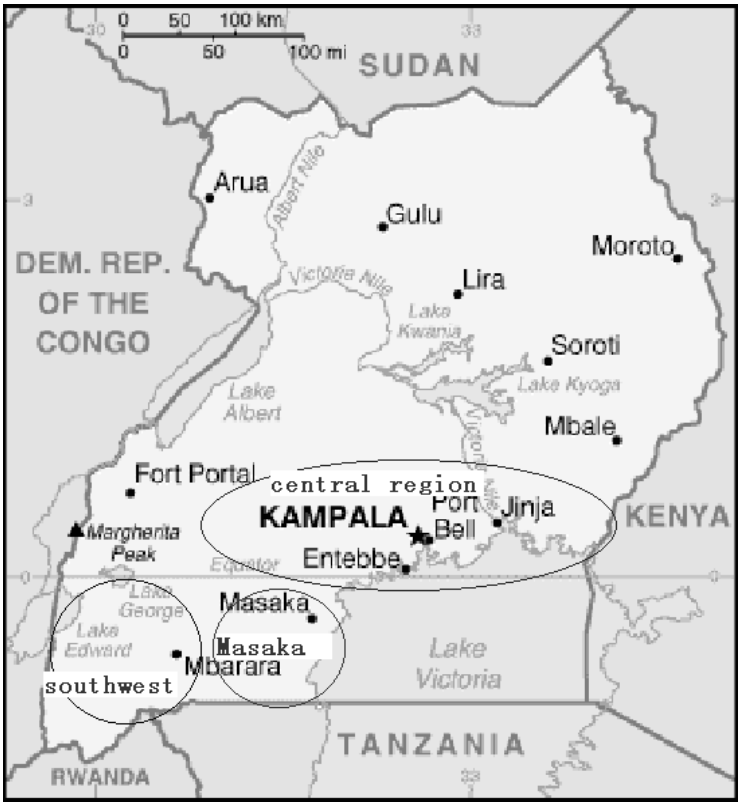
The paper is organized as follows. Section 2 presents background information on the study areas. Theories on smallholder household labor allocation decisions are reviewed in section 3. Section 4 provides a brief description of the model specification and estimation procedure, and a description of the data used in the analysis. Estimation results are presented and discussed in section 5. Finally, some concluding remarks are given in section 6.

2. STUDY AREA AND THE CONTRIBUTION OF NONFARM ACTIVITIES

Study Area

This study was implemented in three regions of the banana-based production system of southern Uganda (central, Masaka and southwest). These regions are characterized by varying levels of productivity and divergent production constraints and opportunities (Figure 1). In particular, the three regions differ in resource availability (land and labor) and use, contributing to differences in production systems. Access to land is highest in the central region and lowest in the southwest, while the on-farm use of hired labor is highest in Masaka and lowest in the central region (Bagamba 2007).

Figure 1. Map of Uganda showing study regions

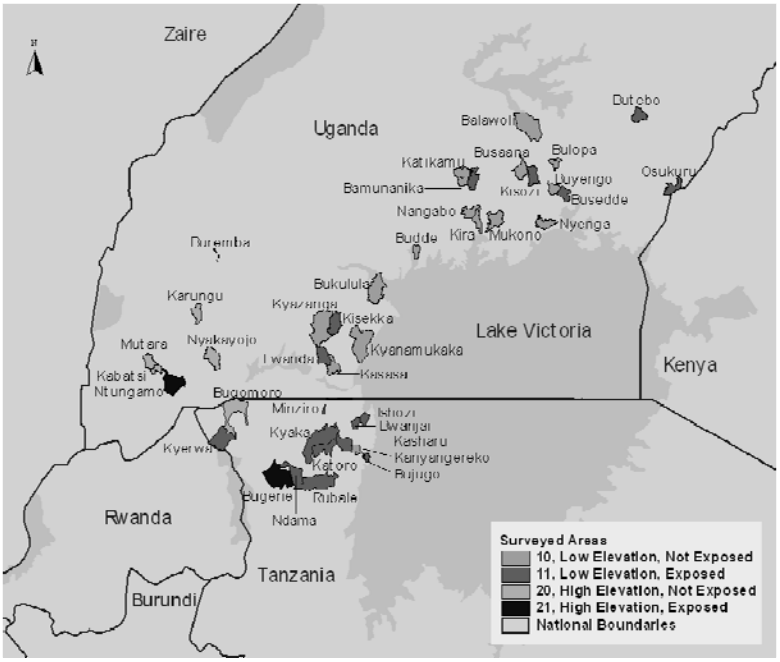


Between late 1970 and 1996, management of major perennial crops (coffee and banana) in the central region declined and most farmers diversified into production of annual crops and nonfarm employment. In the southwest, banana production increased through both acreage expansion and output per unit area, whereas production of traditional annual crops (millet and cassava) decreased during the same period (Gold et al. 1999). At present, crop production is fairly diversified in the central region, where a significant proportion of farmland (53.2 percent) is allocated to the most important annual crops in the country (maize, millet, cassava, sweet potato and beans), while 29.6 percent is allocated to the main perennial crops (bananas and coffee) and the rest (17.2 percent) is allocated to other crops (Bagamba 2007). In Masaka, the majority of land is allocated to bananas and coffee (53.9 percent) while 35.7 percent is allocated to the main annual crops and 10.4 percent to other crops. The southwest is the least

diversified in terms of crop production, with bananas, millet and beans collectively accounting for 85.1 percent of the land allocated to crops.

The data used for this study were collected for an IFPRI/NARO/INIBAP project implemented in 2003-2004. The population domain, which was selected to cover banana-producing areas, corresponds roughly to the central and southwest geographical zones in Uganda, and the Kagera region of Tanzania (Figure 2).

Figure 2. Sites sampled for survey



Source: (Smale et al. 2006)

In this study, the sample was post-stratified based on differences in regional production characteristics. The final sample comprises three regions. The first, herein termed "central," is largely located in the central region of Uganda, which is the historic locus of banana production. The region lies north of the equator, borders Lake Victoria in the south, extends to Lake Kyoga in the north, and borders Kenya to the extreme east. The region is part of the bimodal rainfall region, and receives an annual rainfall of 1100 mm. Its topography is that of the Central African Plateau; the elevation averages 1050 m, with summits ranging from 1000 to 1400 m. The vegetation is mainly broad-leaved savannah dominated by species of Combretum.

The second region, referred to here as "Masaka," consists of the Masaka and Rakai districts; it is located south of the equator and borders Lake Victoria in the east. The summits of this region reach up to 1800 m. The soil is deep, with excellent porosity, good permeability and high infiltration rates. The vegetation is acacia savannah, with a grass layer dominated by *Themeda triandra* and *Cymbopogon afronardus*.

The third region, herein called the "southwest," represents the southwestern portion of the western region of Uganda, where banana production has recently become a focus. Most of the area is above 1400 m, with the exception of the dry cattle corridor, where the altitude ranges from 1000 to 1500 m. The southwestern region borders the Kabale district in the south, the Masaka district in the east, the Masindi district in the north, and the Democratic Republic of Congo in the west.

Nonfarm Activities

A study by Canagarajah et al. (2001) showed that nonfarm activity in Uganda had grown although agriculture remained the main occupation. Households considered to be well off were those that engaged in diverse nonfarm activities (Ellis and Freeman 2004; Newman and Canagarajah 2000).

Two pertinent features of wages in the study region are highlighted in Table 1. First, farmers in the central region pay higher wage rates than those in the southwest. Second, farmers in the central region pay lower farm wage rates than the going off-farm casual wage rates[1], while those in the southwest pay wages that are higher than the off-farm casual wage rates in their region. Casual wage rates reflect the market wage rates determined by labor supply and demand in both the on-farm and nonfarm sectors. The difference between the off-farm casual wage and the farm wage reflects differences in labor productivity between the nonfarm and farm sectors. The high casual wage rates found in the central region imply that the nonfarm sector for unskilled labor in this region is more remunerative than the farm sector. However, high transaction costs, risks and rationing in the labor market limit the poorly endowed households from accessing the high-return niches in the nonfarm sector.

Table 1. Wage rates paid by farmers and earnings per hour from the nonfarm sector

Variable	Central	Masaka	Southwest	Overall
Wage rate (casual)	466.0	343.3	218.5	399.8
	(13.3)	(15.5)	(2.13)	(10.0)
Agricultural wage	396.5	337.3	228.3	358.8
	(15.1)	(16.2)	(3.8)	(10.2)
Non-agricultural wage	444.1	359.4	324.2	404.5
	(15.5)	(21.0)	(11.1)	(11.6)
Salary (regular wage)	507.3	339.4	1288.4	549.5
	(14.2)	(23.3)	(175.3)	(25.1)
Self-employment	554.9	419.2	344.3	489.2
	(36.8)	(25.3)	(19.7)	(23.5)

Values in parentheses are standard errors.

In contrast, farmers in the southwest pay for hired labor at wages that are slightly higher than the going casual wage rates. Farm households in the region are net hirers of labor, and transaction costs in the hired labor market make farmers pay a wage that is higher than the going casual wage.

Three other explanations could be advanced for this observed behavior: (1) most farmers are smallholders and have limited bargaining power2; (2) the majority employ labor during periods of peak labor demand, when wages are high; and (3) farmers employ outside labor for harder tasks, and are hence charged higher wage rates. These possible explanations would have minimal effects on farm wages in the central region, since the proportion of hired labor is insignificant (4.6 percent) compared to that in Masaka (10.3 percent) and the southwest (10.4 percent) (Table 2).

[1] Casual off-farm wages are wages paid to casual labourers who are contracted on a daily basis to do work in either the nonagricultural or agricultural sectors. This is in contrast to farm wages, which are wages paid to farm workers contracted on a monthly basis or for a piece of work (e.g. weeding one acre of bananas). Casual off-farm wages were obtained by interviewing key informants (e.g. local council officials) in the villages, while farm wages were computed from actual payments to farm workers.

2For the central region, the majority of the small farmers are net suppliers of labour. They rarely hire labour, and are therefore not affected by this assumption.

Table 2. Labor used in farm production (hours/year) by representative households

Type of labor	Central	Masaka	Southwest
Family labor	2540.6	1865.7	1643.1
Hired labor[3]	123.4	213.3	191.6
Total labor	2664	2079	1834.7
Proportion hired labor	0.046	0.103	0.104
Use hired labor	0.45	0.74	0.55

The above interpretation is supported by data showing important differences in the amounts and sources of nonfarm income across the study regions (Table 3).

Table 3. Composition of household income from agriculture and nonfarm employment

Variable	Central	Masaka	Southwest	Overall
Income from crops (x 1000)	498.5	541.0	849.8	555.0
	(36.2)	(38.1)	(50.1)	(25.1)
Agricultural wage (x 1000)	51.1	34.8	45.1	45.2
	(18.0)	(8.7)	(6.6)	(8.1)
Non-agricultural wage (x 1000)	71.5	34.8	73.6	63.8
	11.4	(7.8)	(17.5)	(8.0)
Regular (salary) (x 1000)	137.4	26.4	186.7	129.3
	(31.6)	(10.5)	(142.7)	(51.9)
Self-employment (x 1000)	467.4	176.6	130.1	282.2
	(45.7)	(39.7)	(27.0)	(24.9)
Not defined (x 1000)	10.0	0.1	0.3	4.3
	(3.4)	(0.1)	(0.3)	(1.5)
Total nonfarm (x 1000)	727.4	272.4	435.5	520.5
	(63.9)	(39.2)	(143.9)	(58.7)
N	340	180	140	660

Values in parentheses are standard errors.

Households in the central region obtain most of their income from nonfarm self-employment (64 percent). In the southwest, in contrast, self-employment off-farm as a share of total nonfarm cash income is 30 percent. Income from crops (including subsistence production) is highest in the southwest and lowest in the central region, where the income from nonfarm sources is greater (by approximately one and half times) than that from crops.

3 Hired labour is labour used from outside the household (use of paid labor or outside labor)

3. THEORETICAL BACKGROUND

There are two basic approaches for the analysis of time allocation in the literature: (1) strategies using perfect labor markets, which assume that household production and consumption decisions are separable (Ahn et al. 1981; Barnum and Squire 1979; Rosenzweig 1980); and (2) strategies using missing labor markets or constraints in the labor market, which assume nonseparability between production and consumption decisions (Abdulai and Regmi 2000; Benjamin 1992; Jacoby 1993; Lopez 1984; Skoufias 1994).

Under the assumption of perfect labor markets, individuals are willing to participate in off-farm work as long as their marginal value of farm labor (reservation wage) is less than the off-farm wage rate (Becker 1965; Gronau 1973). Thus, farmers with low returns to labor on-farm have a stronger incentive to diversify into off-farm activities because they earn a lower marginal value from farm labor.

However, with rationing in the labor market, farmers may not participate in the off-farm labor market even if the reservation wage rate is less than the marginal value of labor (Blundell and Meghir 1987). Moreover, substantial entry or mobility barriers within the rural nonfarm sector limit poorly endowed households from accessing high-return niches (Barrett et al. 2001). Thus, the actual participation of farmers in off-farm activities depends on the incentive and their capacity to participate (Reardon 1997). Variables that increase the reservation wage reduce the probability and level of participation in off-farm work, while variables that increase the value of the marginal product of labor in off-farm employment increase the probability and level of participation in off-farm work. Hence, the direction of the influences conferred by individual characteristics (e.g. age, gender and education), location, and household assets (farm and nonfarm equipment) on off-farm employment is indeterminate, since these parameters may affect both the reservation and the off-farm wage.

With labor rationing, the household's full income can no longer be determined by the profits from production alone; the calculation must also include the conditions in the nonfarm labor market. The farmer's utility problem is solved by concurrently maximizing the consumption of goods, *c*, and leisure, *l*, given household consumption characteristics, z^h. Limiting *c* to a staple crop (e.g. bananas), the farmer's utility maximization problem becomes:

$$\text{Max } u(c, l; z^h) \tag{1}$$

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$$c = pf(l_F, x, z^q) - w_h l_h + w_o l_o + y \text{ (budget constraint)} \tag{2}$$

$$E = l + l_f + l_0 \text{ (time constraint)} \tag{3}$$

$$l_F = l_f + l_h \tag{4}$$

$$l_o = l_o^{\max} = E - l - l_f \text{ (off-farm labor constraint)} \tag{5}$$

$$l, l_f, l_o, l_h \geq 0 \tag{6}$$

The Lagrange function for utility maximization is:

$$\Gamma = u(c,l;z) + \lambda[c - pf(l_F, x, z^q) + w_h l_h - w_o E + w_o l + w_o l_f - y] + \psi[l_o^{\max} - E + l + l_f] \tag{7}$$

where $pf(l_F, x, z^q)$ is the value of crop production, *p* is the farm-gate price of farm output, *x* is the area allocated to crops, z^q represents fixed factors and other farm characteristics (e.g. cattle, land, skills and experience), w_h is the wage rate for hired labor, w_o is the wage rate for off-farm employment, l_h is the amount of labor hired from outside, l_f is the family labor hours in crop production, l_o is the family labor hours in off-farm production, $l_o^{\max}$ is the maximum number of family labor hours available for off-farm

production, l_F is the total labor in farm production (family + hired labor), *E* is the total household time endowment, *y* is the exogenous household income (remittances + rent + interest), and *z* represents household characteristics.

From (7), first-order conditions can be derived. The labor allocation decisions will depend on the labor market regime facing the household, as described below:

For households that hire out labor and for which the off-farm employment constraint is binding, the labor allocation decisions of the household give the following first-order conditions:
Family labor use:

$$pf'(.) = w_o + \frac{\psi}{\lambda} = w^* \tag{8}$$

Household consumption:

$$\frac{\partial \Gamma}{\partial c} = u_c + \lambda = 0 \tag{9}$$

It follows that $\lambda = -u_c < 0$, where $\lambda < 0$ is the Lagrange multiplier associated with the budget constraint and $\psi \geq 0$ is the Lagrange multiplier associated with the time constraint. From (8), we see that the impact of ψ >0 (i.e. a binding off-farm labor constraint) is to reduce the opportunity cost of labor, $pf'(.) = w^*$ (since λ<0). This is because excess family labor will be applied on-farm, reducing pf'(l_f) below w_o.

Utility maximization with respect to *l* leads to the following first-order condition:

$$\frac{\partial \Gamma}{\partial l} = u_l + \lambda w_o + \psi = 0 \tag{10}$$

Combining (9) and (10), we obtain the following first-order condition for utility maximization:

$$\frac{u_l}{u_c} = w_0 + \frac{\psi}{\lambda} \tag{11}$$

Since $\lambda < 0$, the utility maximizing point is when $w^* < w_0$. With binding off-farm labor constraints, production and consumption decisions are not separable and the use of family labor is affected by the household consumption characteristics, the wage rate, the price of output, and other factors that determine *f'(.)* (i.e. z^q).

The impact of these variables on total farm labor demand depends on their effect on *w**. For example, a rise in output prices will increase the opportunity cost of labor and the employment constraint may become non-binding; beyond this point, further increases in p will cause labor to shift from off-farm to on-farm employment. Hence, households facing higher output prices and for which the off-farm employment constraint is binding are most likely to use more labor on-farm and hire out less labor to off-farm employment.

The impact of wage rates on the demand for farm labor is expected to be negative. From equations (8) and (11), we see that an increase in the wage rate increases the opportunity cost of labor; this will be associated with a lower use of labor on-farm and probably more hiring-out of labor to off-farm employment. It is clear from the figure that an increase in the wage rate, say from w_0 to w_0', results in decreased demand for farm labor and an increase in supply of labor to the off-farm labor market. A higher w_0 increases the likelihood of having $w^* < w_0$, meaning that less labor is employed on the farm. However, there is no effect on off-farm employment unless the wage rate increases to the point where the employment constraint is no longer binding; in this case, more labor will be employed off-farm.

The fixed factors included in the model are farm size, household size, age of household head, and education level of household head. Having more land increases the marginal product of labor, and hence the opportunity cost. Thus, farm size is positively related to farm labor demand. Again, there is no effect on off-farm employment, since farm size changes the opportunity cost of labor on-farm but not the off-farm employment constraint. However, if the on-farm labor demand increases enough (i.e. w^* increases enough) such that the off-farm labor constraint becomes non-binding, farm size becomes negatively related to off-farm employment. Household size influences farm productivity through the household's labor endowments. The use of family labor has inherent advantages, including decreased moral hazards and incentive problems, leading to higher productivity in households with larger family labor endowments. Moreover, family labor may be complementary if it helps overcome monitoring and incentive problems with hired labor.

Age and education of household head are used as proxies for the experience level of a given family. Households with older, better-educated heads are predicted to perform better in farm production. Thus, the demand for farm labor is positively related to the age and education of household head. The square term of the age of the household head is added to capture possible life-cycle effects. Productivity both on- and off-farm may be higher for older and more educated households, leading to higher on-farm and off-farm employment. Also age and education could help in overcoming the off-farm employment constraint, leading to a higher supply of labor to off-farm employment. Thus, the effect of age and education on labor demand and supply is indeterminate. The impact of ψ is to reduce total labor supply, but increase farm labor demand.

Another farm household characteristic that influences smallholder labor allocation decisions is the proximity to markets and urban centers, which may be proxied by distance to a paved road. Households located nearer to factor markets are expected to have higher farm productivity than those located in remote areas. Proximity to good roads increases access to training and extension programs, from which farmers can gain information on better crop management. Proximity to markets and urban centers also increases farmers' access to financial institutions and income-generating facilities (medium-size enterprises and off-farm employment) that can enable them to buy and apply inputs in a timely manner. Therefore, close proximity to markets is expected to be positively related to family and hired labor demand. If the demand for farm labor is high enough (i.e. w^* increases to a high enough level) such that the off-labor constraint is relaxed, we would see a decrease in off-farm employment. However, close proximity to nonfarm labor markets increases the probability of diversification into nonfarm activities, where farmers reallocate labor from farm to nonfarm activities and may not be able to implement management practices on schedule. Also, farmers who diversify into off-farm activities are less likely to be committed to farming and may spend less time managing the farm enterprises, which could then become less productive. This translates into a decreased demand for family labor and increased involvement in off-farm employment (proximity to markets relaxes the off-farm labor constraint by increasing access to nonfarm labor opportunities). Hence, the relationship between proximity to markets and the labor allocation decisions of smallholder farmers is ambiguous. If proximity to good roads and urban centers increases the household's access to nonfarm labor opportunities, farm productivity may be reduced. Conversely, if proximity to good roads increases access to other factor markets (specifically variable inputs, financial institutions and information), this can increase farm productivity for rural households. Both effects may occur concurrently, with the net result depending on which one is stronger.

The other sets of factors that affect household labor demand and supply decisions for smallholder farmers are household and individual member characteristics pertaining to consumption (z^h). If household production and consumption decisions are inseparable, household characteristics impact farm labor demand decisions by negatively or positively affecting the demand for leisure and consumption goods. The household characteristics capable of affecting consumption by smallholder farmers include household size and the number of dependants. Large households are expected to consume more food and put increased pressure on agricultural production if food cannot be bought from the market. This results in a higher household-level demand for farm labor and negatively impacts off-farm employment. At the

level of individual household members, work is shared among household workers; the larger the household, the lower the individual labor supply. In contrast, a larger share of dependants has a positive impact on the individual-level labor supply, as laborers within the household must work harder to be able to feed the laborers and dependants. However, when we control for household size, the household labor supply should decrease as the share of dependants gets larger.

The choice and level of participation between farm work, off-farm work and home activities will largely depend on the characteristics of the individual household members, as these determine the work preferences, capabilities and opportunities of the individuals. Thus, education and age are positively related with the productivity of the individuals, and these parameters are expected to have a positive impact on the labor supply. The positive impact on productivity translates through a higher probability for and level of participation in farm work. On the other hand, both age and education are also positively related to the off-farm wage, which increases the probability and level of participation in off-farm work. Thus, it is not possible to determine, *a priori*, the influence of age and education on off-farm employment because these parameters affect both farm productivity and the off-farm wage. However, if off-farm work is available mainly in the farm sector, labor hiring-out would be negatively related to the education level, as educated individuals may find it unpalatable to work on someone else's farm (Bardhan 1979).

For households that hire out labor and for which the off-farm employment constraint is non-binding, the labor allocation decisions of the household give the following first-order conditions: Family labor use:

$$pf'(.) = w_o \tag{12}$$

Household consumption:

$$\frac{\partial \Gamma}{\partial c} = u_c + \lambda = 0 \tag{13}$$

$$\frac{\partial \Gamma}{\partial l} = u_l + \lambda w_o = 0 \tag{14}$$

$$\frac{u_l}{u_c} = w_0 \tag{15}$$

Total labor demand is determined by the wage rate, output prices and the other factors that determine $f'(.)$ (i.e. x and z^q). The household's opportunity cost of labor is equal to w_0, and an increase in w_0 raises the opportunity cost of labor, leading to a reduced demand for farm labor. In this manner, labor shifts from farm production to off-farm employment.

A price increase initially raises the opportunity cost of labor, but this is accompanied by an increase in farm labor demand, thereby equalizing $pf'(.)$ to the appropriate market wage rate. Thus, a rise in output price increases farm labor demand and reduces the hiring out of labor. Likewise, factors that increase $f'(.)$ lead to higher demand for farm labor and lower hiring out of labor, since they raise the productivity and/or the marginal product of labor. Thus, farm size is positively related to farm labor demand and negatively related to hiring out, since the possession of more land increases the marginal productivity of labor. The impact of age and education on labor allocation decisions is therefore indeterminate, and these parameters affect the productivity of both farm and off-farm labor.

Household characteristics pertaining to consumption have no effect on labor allocation decisions, as production and consumption decisions are separable.

For autarkic households that do not participate in the labor market:

$$pf'(l_f) = w^* \tag{16}$$

$$w_0 < pf'(.) < w_h \tag{17}$$

In this case, production and consumption decisions are not determined by the exogenous wage rate, but rather by the household production and consumption characteristics that determine w*. An increase in the wage rate would have no effect on labor hiring out. However, if the increase is large enough that $w_0 \geq w^*$, then the rise in wage will cause labor to shift from farm to off-farm employment.

A rise in output price increases the opportunity cost of labor; if it rises enough that $pf'(.) > w_h$, the household starts to hire in labor. However, if the rise is not significant, the impact on labor hiring in and on total farm labor demand will be insignificant.

The impact of fixed factors is similar to that of output price, through the effect on productivity and/or marginal productivity of labor. If the impact on marginal productivity is large enough that $pf'(.) > w_h$, households will move from the autarkic situation to the hiring-in regime. Thus, farm size and the age and education of household head have a positive impact on labor hiring in and total farm labor demand in this case.

The impact of household consumption characteristics would be the same as in the case of hiring-out and employment-constrained households. Larger households consume more food, putting pressure on the family labor to increase the labor supply, which would be equal to the farm labor demand. The larger the share of dependents the higher the required supply of labor by individual household laborers (i.e. for households with many dependents, the laborers within the household have to work longer and harder).

For households that hire in labor, the labor allocation decisions give the following first-order conditions:

Family labor use:

$$pf'(.) = w_h \tag{18}$$

From (16), $w^* = w_h$ if the household is hiring in labor (i.e. if $pf'(.) > w_h$ when $l_h=0$), implying that the household consumption characteristics do not affect labor hiring decisions. In this case, economic rationing of labor hiring is related with the market wage, output prices, fixed factors, and the farm characteristics that affect farm productivity, but not household size and composition.

The effect of the wage rate on the amount of labor hired in is unambiguously negative. Its effect on the family labor supply (and hence on the family labor used on-farm) could be positive, since the family labor supply increases. If the impact on labor supply (family labor use) outstrips the impact on labor hired in, the net effect on total farm labor use would be positive (otherwise, it would be negative). Thus, in communities that rely heavily on the farm sector, the wage rate would be positively related to family labor and total farm labor demand, but negatively related to the amount of labor hired in.

An increase in output price will not change the household's opportunity cost of labor, which must equal w_h. Instead, the amount of labor hired in adjusts to equalize $pf'(.)$ to w_h. Thus, hired labor demand and total labor demand are positively related to output price. However, there is no effect on family labor use, since the opportunity cost of labor remains the same (an increase in output price shifts the demand curve outward but does not alter the supply curve).

The effect of fixed factors is the same as that of output price (i.e. they have a positive impact on hired labor and total labor demand, but no impact on family labor use or supply).

4. MODEL SPECIFICATION

From equations (8), (11), (12), (15), (16) and (18), demand functions for farm labor can be derived as follows:

$$l_d = l_d(p, w^*, y, z^q, z^h) \tag{19}$$

where l_d represents the demand for family labor (l_f), hired labor (l_h) and total farm labor (l_F); and w^* itself is a function of market prices (w_o, w_h and p), exogenous income (y), farm characteristics (z^q) and the household-specific characteristics (z^h) that affect household consumption decisions. However, z^h appears in the demand equations only if the household is hiring out labor and the off-farm employment constraint is binding, or if the household is autarkic (where two or more markets fail at the same time). Most households would fall into these two labor market regimes, as failures of the labor and food markets are common in developing countries. Moreover, some households could appear in more than one market regime (e.g. they may hire out labor during lean periods and hire in labor or become autarkic during periods of peak labor demand). Thus, with the exception of hired labor demand, the most appropriate equation for analyzing labor demand would be one that includes z^h.

The demand for leisure and home time, and the supply of labor for individual household members are respectively derived as follows:

$$l_l^i = l_l^i(p, w_o, y, z^q, z^h) \tag{20}$$

$$l_s^i = l_s^i(p, w_o, y, z^q, z^h) \tag{21}$$

where l_s^i represents the supply of individual household member labor to farm labor (l_f^i), to off-farm labor (l_o^i) and total labor supply (l_t^i), while l_l^i represents the demand for home time (l_z^i) and leisure (l_c^i).

Home time includes the entire range of activities associated with daily household maintenance (e.g. food preparation, household repair, fuel and water carrying, and child care), which are part of satisfying the consumption needs of the household. In this case, goods and services are produced within the household for direct use rather than for market exchange (Ellis 1993).

5. DATA AND ANALYSIS

Data

Village-, household-, plot- and individual-level data were collected from March 2003 to April 2004 from the random sample described in section 2. The obtained village-level data included elevation, distance to a tarmac road, wage rates, and prices. Household-level data included demographic characteristics, production, income and access to credit. Plot-level data included crop production characteristics, inputs and outputs. Individual household member characteristics included gender, age, education level and relationship with other household members (e.g. whether the individual was the household head, spouse, child or relative).

Data on individual and household characteristics (gender, age and education level for the household member, and gender, age and education level of household head) were collected at the beginning of the survey in March 2003. Data on time allocation by the individual household members among farm production, home production, off-farm work, schooling and leisure activities was obtained once every month for seven months (September 2003 to March 2004). Each individual was asked to narrate how s/he had used her/his time on the day prior to the interview, and allocate the 12 hours of that day (7.00 to 19.00 hours) among farm production, home production, off-farm work and leisure. The utilized variables are defined in Table 3.

Table 3. Definition of variables

Variable	Variable definition
Endogenous variables	
workhrs[1]	Total hours worked (farm + off-farm) by individual (hours/day)
farmt[2]	Share of individual household member's time allocated to farm production
offfarmt[2]	Share of individual household member's time allocated to off-farm production
homet[2]	Share of individual household member's time allocated to home time[3]
leisuret[2]	Share of individual household member's time allocated to leisure
fl	Family labor used in farm production by household (hours/year)
hl	Hired labor used in farm production by household (hours/year)
tl	Total labor used in farm production by household (hours/year)
Explanatory variables	
p	Price of bananas (U.Shs/kg)
w	Village wage rate for casual labor (U.Shs/day)
hhsize	Family size
depratio	Dependency share (dependants/family size) = $\frac{<14\,years + >64\,years}{hhsize}$
ageh	Age of household head (years)
ageh[2]	Ageh squared
gender	Gender of household head (1 if male and 0 otherwise)
educh	Education of household head (years in school)

Table 3. (Continued)

Variable	Variable definition
hhland	Total farm size (acres)
	Distance to tarmac road (km) proxy measure for proximity to market centers
age	Age of individual household member (years)
age^2	Age squared
educ	Education level of individual household member (years)
R1	Regional dummy 1 (1 = southwest and 0 otherwise)
R2	Regional dummy 2 (1 = Masaka and 0 otherwise)

[1] Excludes home time. [2] Each household member is assumed to have 12 hours in a day to allocate to different activities. [3] Home time refers to hours allocated to household activities (food preparation, child care, household cleaning, etc.).
Note: Exogenous income was dropped from the labor demand estimations because its effect was not significant.

Analysis

The factors influencing labor allocation decisions by individual household members and household demand for family and hired labor were determined using econometric analysis. For equations involving a continuous uncensored dependent variable (total labor supply, total labor demand, and family labor demand), least squares regression was used to estimate the equations. The dependent variable and some of the explanatory variables in the least squares regression were transformed into logarithms to reduce problems associated with nonlinearity and outliers, thus improving on the robustness of the estimates. Variables for which the observations were within close range (e.g. age and education) were not log transformed. A quadratic term for the age variable was included among the explanatory variables to account for life-cycle effects. The dependency share variable (depratio) had some zero observations, and thus could not be directly log transformed. Instead, a dummy variable (ddepratio = 0 for positive values and 1 for zero values) was included to allow the intercept to shift for households with no dependents.

The other dependent variables were limited dependent variables (censored), for which the least squares method was not an appropriate estimator. Thus, variables capturing individual labor supply to farm production and off-farm employment, as well as time allocated to home production and leisure, were computed as shares of the time available to the individual in a day (12 hours). There were thus continuous dependent variables censored below 0 and above 1, for which the appropriate estimator is a maximum likelihood Tobit estimator with left and right censoring. The hired labor demand variable was a censored continuous variable (censored below 0), thus it was estimated using a maximum likelihood Tobit estimator.

Descriptive statistics for the variables used in our econometric analysis are summarized in Tables 4 and 5. Each individual household member was assumed to be the decision-making unit with respect to labor supply. Interdependence between individuals belonging to the same household was assumed; thus, to obtain efficient estimates, we retained only one individual in the sample when analyzing the determinants of individual participation in farm, off-farm and home production. Moreover, the determinants of male and female labor supply were expected to be unequal, and were therefore estimated separately. In the first analysis, we used only the husbands. In the second analysis, we estimated the labor supply for their spouses. Single men, single women and female-headed households were excluded from the analysis to increase the ease of comparison.

Table 4. Descriptive statistics for variables included in the labor supply estimations

Variable	Husbands			Wives		
	Central	Masaka	Southwest	Central	Masaka	Southwest
workhrs	7.218	6.67	7.067	4.761	5.551	5.636
	(2.64)	(2.53)	(2.29)	(1.66)	(1.33)	(1.39)
farmt	0.324	0.402	0.32	0.334	0.443	0.441
	(0.2)	(0.18)	(0.2)	(0.12)	(0.09)	(0.128)
offfarmt	0.277	0.154	0.269	0.063	0.02	0.029
	(0.3)	(0.2)	(0.3)	(0.15)	(0.06)	(0.08)
homet	0.079	0.095	0.093	0.375	0.367	0.335
	(0.1)	(0.105)	(0.11)	(0.13)	(0.13)	(0.09)
leisuret	0.319	0.349	0.318	0.228	0.17	0.195
	(0.19)	(0.19)	(0.17)	(0.14)	(0.11)	(0.104)
p	159.1	120.4	92.96	160.2	118.1	92.58
	(46.8)	(32.09)	(20.84)	(46.3)	(33.7)	(20.67)
w	422.7	270.5	226.3	427.96	258.4	225.07
	(146.5)	(109.4)	(27.4)	(150.9)	(96.9)	(26.87)
hhsize	6.469	5.66	6.396	6.803	6.294	6.349
	(2.82)	(2.71)	(2.38)	(2.64)	(2.32)	(2.32)
depratio	0.497	0.452	0.484	0.514	0.504	0.487
	(0.22)	(0.24)	(0.18)	(0.2)	(0.209)	(0.18)
ageh	44.43	42.47	42.3	45.07	43.4	43.42
	(16.78)	(15.2)	(14.09)	(16.73)	(14.2)	(14.48)
ageh^2	2254.1	2032.2	1985.9	2309.7	2082.5	2092.7
	(1706.3)	(1391)	(1306.1)	(1712.8)	(1308)	(1372.3)
educh	6.207	5.193	5.649	6.029	5.54	5.057
	(4.51)	(3.02)	(3.85)	(4.62)	(3.12)	(3.59)
hhland	4.86	5.418	3.215	4.771	5.514	5.057
	(6.08)	(17.3)	(6.21)	(5.44)	(17.6)	(3.59)
D	13.03	24.47	10.89	13.02	24.91	11.764
	(9.5)	(33.65)	(13.7)	(9.63)	(35.82)	(14.16)
age	44.43	42.47	42.3	33.779	36.64	34.698
	(16.78)	(15.2)	(14.09)	(12.01)	(12.67)	(10.95)
age^2	2254.1	2032.2	1985.9	1284.5	1500.8	1322.6
	(1706.3)	(1391)	(1306.1)	(962.7)	(1043.5)	(839.7)
educ	6.207	5.193	5.649	4.49	4.741	3.896
	(4.51)	(3.02)	(3.85)	(3.75)	(3.19)	(3.35)
n	213	88	111	208	85	106

Values in parentheses are standard deviations. The number of observations for husbands and wives differs due to a lack of data for some of the observations.

Table 5. Descriptive statistics for the variables included in the labor demand estimations

Variable	Central	Masaka	Southwest	Overall sample
fl	2111.1	1579.8	1458.8	1823.3
	(1814)	(997.3)	(794.6)	(1474)
hl	101.2	154.14	226.5	145.3
	(221.8)	(260.6)	(416.8)	(295.9)
tl	2212.2	1733.9	1685.3	1968.6
	(1868.2)	(1046.1)	(861.1)	(1516.4)
p	159.2	120.9	93.44	133.7
	(46.97)	(31.6)	(20.72)	(47.6)
w	437.6	269.6	227.2	345.5
	(151.4)	(108.1)	(27.25)	(154.8)
hhsize	6.147	5.376	6.12	5.965
	(2.78)	(2.64)	(2.45)	(2.68)
depratio	0.5	0.467	0.483	0.488
	(0.23)	(0.25)	(0.19)	(0.23)
ageh	46.37	43.26	42.71	44.73
	(16.9)	(14.96)	(13.95)	(15.82)
ageh^2	2434.9	2093	2017.2	2250.3
	(1726.6)	(1392.5)	(1315.1)	(1566.2)
gender	0.804	0.752	0.847	0.803
	(0.398)	(0.43)	(0.36)	(0.4)
educh	5.736	4.838	5.115	5.372
	(4.53)	(3.08)	(3.99)	(4.12)
hhland	4.518	4.545	3.006	4.138
	(5.61)	(15.06)	(5.76)	(8.75)
D	12.4	19.32	10.779	13.57
	(9.2)	(30.84)	(13.45)	(17.76)
n	265	117	131	513

Values in parentheses are standard deviations.

6. RESULTS AND DISCUSSION

Labor Supply

An F-test was performed on the separate regressions for the male and female labor equations; the results are presented in Table 6. The null hypothesis (that the labor supply determinants of husbands and wives are equal) was rejected for all of the regressions (i.e. in the overall sample, central region, Masaka, and southwest). The F-value for Masaka was quite low although statistically significant; this is not surprising given the low level of off-farm employment in the region. The determinants of work hours were different for husbands and wives in the nonfarm sector but not in the farm sector (discussed further in the section on labor demand). This is likely because women were customarily segregated in the nonfarm labor market (Udry et al. 1995), and/or because they had lower marginal productivities than men in the nonfarm sector.

Table 6. Test for separate regressions for men and women

Region	F-value	F-tabulated (0.05)	Outcome
Overall sample	13.33	1.83	Nonpooling
Central	79.03	1.94	Nonpooling
Masaka	2.3	1.94	Nonpooling
Southwest	4.34	1.94	Nonpooling

The results from the Chow test for separate regions showed that labor supply should be analyzed separately for the different regions (Central, Masaka and Southwest) when considering the husband, spouse and overall sample, as shown in Table 7.

Table 7. Test for nonpooling of regions

Type of household member	F-value	F-tabulated (0.01)	Outcome
Overall	7.57	1.94	Nonpooling
Husbands	4.72	1.94	Nonpooling
Wives	5.02	1.94	Nonpooling

Total Labor Supply

The results of the total labor supply analysis (hours supplied to farm and/or off-farm employment) are presented in Table 8. Total labor supply was largely influenced by individual household member characteristics (specifically age), distance to a paved road, and education level (for the central region). The wage rate and price of bananas (a major staple crop) had no statistically significant effect on an individual's total labor supply, except in Masaka. Household characteristics (family size and dependency share) had insignificant effects on labor supply; accordingly, these variables were removed from the total labor supply equation.

In Masaka, where the effect of price on total labor supply was significant, the results were mixed; the effect was positive for husbands but negative for their spouses. Banana production is a major activity in the region. Where prices were high, it is probable that the crop was grown mainly for cash, and men took control of the production process. Hence at higher prices, husbands increased their efforts in farm production while wives reduced their work efforts. A rise in the price of a major staple food crop also increased the budget requirements of the household, with the result that husbands increased their work

efforts to meet the new demands. For wives, the negative relationship between price and labor supply was consistent with our hypothesis that higher prices for the staple causes a pure substitution effect in consumption, resulting in higher consumption of lower-priced goods (including home time) and less time available for farm or wage work (yielding a negative effect on total labor supply). The pure substitution effect in farm production and the income effect in consumption had a smaller impact on wives, who do not control the income from the staple crop (husbands take over control of the crop when prices are high). Thus, for wives, the pure substitution effect in own consumption outweighed the combined effect of the income effect plus the pure substitution effect in own production.

The effect of wage rate on total labor supply was not statistically significant for the central region or southwest, but was significant and positive for Masaka (albeit only for wives). Higher wage rates are associated with higher productivity of labor and hence a higher labor supply for high wages. The insignificant results obtained for most of the cases could be attributed to imperfections in the labor markets, given that the majority of the household members did not participate in the off-farm labor market and most labor was employed on-farm. In Masaka, it is possible that the poor households were the ones offering their labor to paid work. Women would be the most vulnerable within the poor households, especially when it comes to accessing off-farm employment. Higher wages indicated higher farm productivity, suggesting that there were more opportunities for the poor and vulnerable (i.e. the women), both on their farms and in farm-related enterprises. This resulted in a higher labor supply to both farm and off-farm employment.

Farm size had no effect on total labor supply in all cases. Distance to paved roads was negatively related to labor supply, but this was only statistically significant for the central region and southwest. As predicted from equation 13, members of households located in remote areas faced more off-farm labor constraints, and therefore supply less labor.

In terms of the age variable, age had a positive effect on labor supply among younger household members, but the supply decreased in later years, as shown by the negative coefficient of the quadratic term. Education had no effect on labor supply except in the central region, where the impact of education was positive for wives. The nonfarm sector was more developed in the central region, but women were typically segregated within nonfarm employment. Education most likely reduced the chances of being segregated in the employment sector, thereby increasing the work time for women.

The effect of the regional dummies (R1 for the southwest and R2 for Masaka, compared to the central region) on total labor supply was not significant for husbands, but it was positive and statistically significant for wives. Women tended to be more engaged in farm production, and farm productivity was higher in Masaka and the southwest compared to the central region. Thus, the supply of labor tended to be higher for wives in Masaka and the southwest.

Table 8. Estimates of total labor supply (farm + off-farm) for individual household members

Variable	Central		Masaka		Southwest		
	husbands	wives	husbands	wives	husbands	wives	husbands
Constant	2.888**	1.957**	-0.069	0.642	5.04*	2.237	1.522*
	(3.28)	(2.59)	(-0.05)	(1.32)	(2.12)	(1.24)	(2.56)
Ln(p)	-0.06	-0.089	0.378^	-0.233**	0.039	0.014	0.024
	(-0.66)	(-1.15)	(1.78)	(-2.86)	(0.24)	(0.11)	(0.33)
Ln(w)	-0.069	-0.048	0.085	0.373**	-0.551	-0.099	0.066
	(-0.75)	(-0.6)	(0.46)	(5.04)	(-1.5)	(-0.35)	(0.097)
Ln(hhland)	0.02	0.041	0.049	-0.001	0.037	0.043	0.026
	(0.72)	(1.6)	(0.89)	(-0.06)	(1.02)	(1.4)	(1.23)
Ln(D)	-0.099*	-0.005	0.075	-0.01	-0.149**	-0.062*	-0.036^
	(-2.29)	(-0.12)	(1.58)	(-0.57)	(-4.37)	(-2.42)	(-1.77)
age	0.012	0.022*	-0.023	0.021**	0.012	0.012	0.009
	(1.23)	(2.32)	(-1.06)	(2.87)	(0.84)	(0.86)	(1.22)
age^2	-0.0002*	-0.0003*	0.0003	-0.0003**	-0.0002	-0.0002	-0.0002*
	(-2.04)	(-2.53)	(1.17)	(-3.47)	(-1.47)	(-0.8)	(-1.99)
educ	-0.003	0.019**	-0.005	-0.007	-0.005	-0.01	-0.001
	(-0.57)	(2.93)	(-0.26)	(-0.97)	(-0.6)	(-1.37)	(-0.27)
R1							0.019
							(0.25)
R2							-0.06
							(-0.98)
Adj R^2	0.09	0.09	0.04	0.35	0.18	0.06	0.04
n	213	208	88	85	111	106	412

Ln = natural logarithm. Figures in parenthesis are t-values. **, *, ^ represent 1%, 5% and 10% levels of significance, respectively.

Estimates of time allocation decisions by individual household members are presented in Tables 9 through 12. The results for labor supply to farm production are presented in Table 9. Price had a positive impact on individual labor supply to farm production for husbands but a negative impact for wives. As discussed above, higher prices for a staple crop can cause husbands to take over the management and control of production and its benefits, meaning that they increase their work effort in farm production at higher prices, while wives reduce their work effort. However, these results were only statistically significant for husbands in the central region and for wives in Masaka and the southwest.

The results for wage rate were mixed (Table 9). The effect of wage rate on labor supplied to farm production was negative for the central (both husbands and wives) and southwest (only wives) regions, whereas it was positive in all other cases, but significant only for wives in Masaka. For the central and southwest regions, the nonfarm sector is more developed; therefore, the wage rate is more likely to be positively related to productivity in the off-farm sector, but negatively related to the farm labor supply. For Masaka, the nonfarm sector is less developed and most individuals are employed on-farm. In this case, it is likely that higher wages reflected higher farm productivity, thereby explaining the positive effect of wages on the farm labor supply.

In cases where estimates for family size were significant, the effect on the farm labor supply was positive. This is consistent with our hypothesis that family size is positively related to farm productivity through a positive effect on labor endowment. The converse is true for the dependency share, which was negatively related to farm productivity through lower labor endowments.

Farm size had no effect on labor supplied to farm production. Most likely, this reflects a problem of data aggregation, in that we pooled the data from households belonging to different labor market regimes. The results for distance to a paved road were mixed; the effects were positive for husbands in Masaka and the southwest, but negative for wives in the same regions. The effect was not statistically significant for husbands or wives in the central region. For Masaka, the positive relationship between distance and farm labor supply by husbands can be attributed to the effect of distance on migration. Individuals living nearer paved roads were more likely to migrate to urban areas (Beraho 2008); the less productive were left behind, thereby accounting for the lower labor supply nearer the paved roads. In the southwest, near the paved roads, husbands most likely diversified into off-farm labor activities and thus supplied less labor to farm production. The effect of distance on farm labor for spouses was negative in all cases, but was statistically significant only for the southwest. This could be attributed to the lower productivity of farm labor in remote areas.

The effect of age on farm labor supply was statistically significant only for wives in the central region and Masaka. The relationship was positive in the early years, but became negative in the later years.

Education was negatively related to the farm labor supply in all cases, but was statistically significant only in the central and southwest regions, where the nonfarm sectors were more vibrant. This result is consistent with our hypothesis that education increases the probability and level of participation in off-farm work, thus reducing work effort in farm production.

The effect of the regional dummies was positive, with the exception of husbands in the southwest, where the effect was not statistically significant. This is consistent with earlier results showing that farm productivity was higher in Masaka and the southwest compared to the central region (Bagamba 2007).

Table 9. Tobit estimates of farm labor supply by individual household members

Variable	Central		Masaka		Southwest		Overall	
	husbands	wives	husbands	wives	husbands	wives	husbands	wives
Constant	0.185	0.228*	0.38^	0.349*	0.055	1.141**	0.198^	0.232**
	(1.16)	(2.52)	(1.71)	(4.07)	(0.12)	(4.24)	(1.7)	(3.82)
W	-0.0004**	-0.00003	0.0002	0.0003**	0.0004	-0.002*	-0.002*	0.00005
	(-2.86)	(-0.38)	(0.93)	(3.18)	(0.32)	(-2.38)	(-2.34)	(0.95)
P	0.0006*	-0.00001	0.0009	-0.001**	0.0008	-0.003**	0.0005^	-0.0004*
	(1.77)	(-0.65)	(1.14)	(-3.25)	(0.59)	(-3.82)	(1.87)	(-2.44)
hhsize	0.017**	0.003	0.016	-0.003	-0.006	0.015*	0.011*	0.005^
	(2.69)	(0.75)	(1.32)	(-0.59)	(-0.54)	(2.44)	(2.39)	(1.88)
depratio	-0.145*	0.041	-0.025	-0.049*	0.129	-0.012	-0.076	0.009
	(-2)	(0.91)	(-0.23)	(-0.94)	(1.09)	(-0.18)	(-1.46)	(0.3)
hhland	0.003	0.003	-0.002	-0.0006	0.004	0.002	-0.0004	-0.0002
	(1)	(1.54)	(-1.29)	(-1.16)	(0.94)	(0.58)	(-0.33)	(-0.29)
D	-0.0008	-0.0008	0.001^	-0.0003	0.005^	-0.005**	0.001*	-0.0004
	(-0.39)	(-0.65)	(1.93)	(-0.93)	(1.96)	(-4.03)	(2.3)	(-1.22)
age	0.009	0.007^	-0.012	0.011**	0.003	-0.003	0.005	0.008**
	(1.6)	(1.86)	(-1.27)	(3.23)	(0.3)	(-0.39)	(1.2)	(3.1)
age^2	-0.0001	-0.0001^	0.0002	-0.0001**	-0.00002	0.00002	-0.00004	-0.0001**
	(-1.45)	(-1.87)	(1.55)	(-3.63)	(-0.14)	(0.19)	-0.94	(-3.19)
educ	-0.01**	-0.007**	-0.007	-0.004	-0.018**	-0.008*	-0.01**	-0.007**
	(-2.84)	(-2.86)	(-1.02)	(-1.13)	(-3.08)	(-2.18)	(-3.99)	(-4.15)
R1							-0.02	0.085**
							(-0.58)	(4.26)
R2							0.055^	0.11**
							(1.79)	(6.15)
χ^2	39.4	21.2	14.4	34.6	25.1	35.1	61.1	118
Prob > χ^2	0.000	0.012	0.109	0.000	0.003	0.000	0.000	0.000
N	213	208	88	85	111	106	412	399

Estimates for off-farm labor supply are presented in Table 10. With the exception of the case for wives in Masaka, wage rate had no significant effect on the off-farm labor supply. However, the effect of wage rate was positive for the overall sample, and it was statistically significant for husbands, consistent with our hypothesis that more labor is likely to employed off-farm at higher wages because of a higher likelihood of $w^* < w_o$.

The results for price were mixed. For the central region, the relationship between price and off-farm labor supply was negative, as we had expected. However, for husbands in Masaka and wives in the southwest, the relationship between price and off-farm labor supply was surprisingly positive. Perhaps this can be explained as follows: at high farm-gate prices, households can hire in outside labor and release family members' time to the off-farm sector, particularly if the two sectors require different skills. In Masaka, most of the labor employed in the nonfarm sector was self-employed. Higher prices enabled husbands to hire in outside labor and diversify into nonfarm self employment. In the southwest, in contrast, much of the employment in the off-farm sector was salaried employment. High farm-gate prices enabled households to hire in outside labor, thereby releasing time for wives to engage in salaried off-farm activities.

Household characteristics (family size and dependency share) had no significant effect on labor hired out. Farm size had a negative effect on time allocated to off-farm activities, but this was statistically significant only for spouses in the central region. This is consistent with the assertion that farmers undertake off-farm activities because of constraints limiting them from gaining access to productive land (Matshe and Young 2004). It could also be a result of a pull factor towards farming (e.g. households with more land are likely to have a higher marginal product of labor in farming).

The effect of age on off-farm labor supply was not statistically significant. Education had a positive effect on off-farm labor supply in all cases, although not always to a statically significant degree.

Regional dummies had a negative impact on off-farm labor supply, but this was only statistically significant for Masaka. This is consistent with our assertion that Masaka had the least developed nonfarm sector.

Table 10. Tobit estimates of off-farm labor supply by individual household members

Variable	Central		Masaka		Southwest		Overall	
	husbands	wives	husbands	wives	husbands	wives	husbands	wives
Constant	1.071**	0.021	-0.756	-0.496^	1.665^	-1.438	0.405^	-0.228
	(3.43)	(0.07)	(-1.55)	(-1.95)	(1.9)	(-1.64)	(1.70)	(-1.15)
w	-0.00003	-0.0001	0.0004	0.0007**	-0.004	0.002	0.0004*	0.0001
	(-0.14)	(-0.62)	(1.13)	(3.71)	(-1.5)	(1.02)	(2.12)	(0.71)
p	-0.002**	-0.001*	0.005**	0.0004	-0.002	0.009**	-0.0008	-0.0002
	(-2.82)	(-2.14)	(2.63)	(0.38)	(-0.9)	(2.93)	(-1.36)	(-0.35)
hhsize	-0.014	0.011	-0.016	-0.007	-0.02	-0.026	-0.017^	-0.003
	(-1.16)	(0.8)	(-0.6)	(-0.55)	(-0.9)	(-1.19)	(-1.69)	(-0.36)
depratio	0.24^	-0.256^	0.172	0.061	-0.16	-0.039	0.129	-0.166^
	(1.69)	(-1.85)	(0.74)	(0.42)	(-0.75)	(-0.22)	(1.19)	(-1.68)
hhland	-0.004	-0.021*	-0.016	0.0002	-0.004	-0.017	-0.004	-0.01^
	(-0.84)	(-2.5)	(-1.37)	(0.11)	(-0.6)	(-0.57)	(-0.93)	(-1.84)
D	-0.019**	-0.002	0.004*	0.0006	-0.039**	-0.002	-0.005**	-0.0002
	(-4.4)	(-0.56)	(2.42)	(0.66)	(-5.06)	(-0.36)	(-3.6)	(-0.18)
age	-0.01	0.007	-0.008	0.006	0.004	-0.003	-0.005	0.005
	(-0.94)	(0.47)	(-0.37)	(0.6)	(0.21)	(-0.14)	(-0.51)	(0.54)

Table 10. (Continued)

Variable	Central		Masaka		Southwest		Overall	
	husbands	wives	husbands	wives	husbands	wives	husbands	wives
age^2	0.00002	-0.0002	0.0001	-0.0001	-0.0001	0.0001	-0.00001	-0.0001
	(0.21)	(-0.73)	(0.46)	(-0.58)	(-0.66)	(0.36)	(-0.12)	(-0.66)
educ	0.006	0.044**	0.03*	0.008	0.016	0.016	0.014**	0.031**
	(0.99)	(5.5)	(2.05)	(1.07)	(1.44)	(1.44)	(2.68)	(5.45)
R1							-0.027	-0.089
							(-0.37)	(-1.39)
R2							-0.132*	-0.109^
							(-2.07)	(-1.92)
χ^2	51.8	55.2	20.09	20.8	71	37.4	73.8	55.6
Prob > χ^2	0.000	0.000	0.017	0.014	0.000	0.000	0.000	0.000
n	213	208	88	85	111	106	412	399

The results for home production decisions and leisure are presented in Tables 11 and 12. Our findings for the effect of wage rate on home time and leisure were mixed. The effect on home time for husbands was positive, but it was negative or insignificant for wives. The negative effect on home time for wives is as expected, but the positive effect for men is surprising. It could be possible that at higher wage rates, the women had a higher participation rate in productive work, thereby reducing their time in home production. Conversely, the husbands' time in home production increased with the wage rate because their spouses were less willing (or able) to participate in unpaid activities. The results given in Table 12 show that leisure time for wives increased with wage rate. The effect of wage rate on leisure time was not significant for husbands, with the exception of the southwest, where the effect was positive and significant ($p<0.01$).

The effect of price on home time was positive in all cases, with the exception of Masaka, where it was negative for husbands. At higher prices, the use of outside labor was expected to increase. As a result, household labor (specifically for wives) was freed to home production activities, particularly in the southwest and Masaka, where banana production was commercially important. The effect on leisure time was not significant, except for wives in Masaka (negative effect) and husbands in the southwest (positive effect).

Household characteristics had a significant effect on home time in a few cases. Specifically, family size had a negative effect on home time, although only to a statistically significant degree in the southwest. The dependency share had a positive effect on home time, but only in cases where the effect was significant. These results showed that home production activities were shared among the household members. The larger the family size, the less time each individual spent on home production, while the larger the dependency share, the greater the time spent in home production.

In a few cases where statistically significant results were obtained, farm size had a positive effect on home time and leisure. It seems likely that households with large farm sizes engaged in activities that use more outside labor than own labor, with the result that household members had more time for home production and leisure. Distance from paved roads had a significantly positive effect on home time in most cases, except in Masaka, where the effect was not significant. Leisure was also positively influenced by distance, with the exception of Masaka (for husbands and wives) and the central region (for wives only). With the exception of Masaka, labor productivity was expected to decrease as one moves away from the paved roads; consequently, less time would be spent in productive activities and more in home time and leisure.

Age did not have a statistically significant effect on time allocated by husbands to home production and leisure. In the central region, the effect of age on home time varied; for wives, middle-aged individuals allocated less time to home production, whereas young and old individuals allocated more time to home production. The opposite was true for Masaka. In the case of time allocated to home production, the turning point was 35 years for both the central region and Masaka. In Masaka, the time husbands allocated to leisure activities increased with age until 50, when it began to decrease. For wives, time allocated to leisure first decreased and then increased after 30 years of age.

In the central region, education had a negative effect on leisure for wives; as already discussed, this time was spent on off-farm activities. In Masaka, education had a negative effect on home production.

For the overall sample, the effect of dummies was such that wives spent reduced time in home production in both Masaka and the southwest, while more time was spent on farm production; this was likely due to the higher farm productivity seen in these regions compared to that in the central region.

Table 11. Tobit estimates of time allocation to home production by individual household members

Variable	Central		Masaka		Southwest		Overall	
	husbands	wives	husbands	wives	husbands	wives	husbands	wives
Constant	-0.299**	0.482**	0.519**	0.093	-0.605*	0.235	0.106	0.496
	(-2.83)	(5.58)	(3.34)	(0.88)	(-2.32)	(1.28)	(1.19)	(`8.37))
w	0.0003**	-0.0001*	0.00001	-0.0006**	0.002**	0.00004	-0.000	-0.0003**
	(3.39)	(-2)	(0.1)	(-5.01)	(3.28)	(0.08)	(-0.12)	(-5.89)
p	0.001**	0.0002	-0.002**	0.003**	0.0002	0.002**	0.0001	0.0005**
	(3.43)	(0.84)	(-3.62)	(6.79)	(0.25)	(3.47)	(0.68)	(3.18)
hhsize	-0.006	-0.005	-0.006	-0.0009	-0.014*	-0.002	-0.006^	-0.003
	(-1.48)	(-1.35)	(-0.71)	(-0.15)	(-2.25)	(-0.57)	(-1.69)	(-1.17)
depratio	-0.05	0.082^	-0.131	-0.06	0.122^	0.075^	-0.034	0.064*
	(-1.09)	(1.91)	(-1.66)	(-0.92)	(1.85)	(1.71)	(-0.86)	(2.1)
hhland	0.002	0.004*	-0.0007	0.0004	0.005**	-0.002	-0.0002	0.001
	(1.03)	(2.34)	(-0.37)	(0.63)	(2.8)	(-0.75)	(-0.25)	(1.64)
D	0.009**	0.003*	-0.003	0.005	0.01**	0.002^	0.001*	-0.0001
	(6.5)	(2.55)	(-5.07)	(1.37)	(7.38)	(1.9)	(2.1)	(-0.4)
age	0.0001	-0.007*	0.002	0.007^	-0.001	-0.006	-0.002	-0.004^
	(0.03)	(-2.02)	(0.24)	(1.73)	(-0.2)	(-1.02)	(-0.67)	(-1.76)
age^2	0.00001	0.0001*	-0.00004	-0.0001*	0.00003	0.0001	0.00003	0.0001
	(0.42)	(2.13)	(-0.55)	(-2.22)	(0.42)	(1)	(0.81)	(1.61)
educ	0.002	-0.003	-0.013*	-0.002	0.002	0.001	-0.0007	-0.001
	(1.11)	(-1.34)	(-2.57)	(-0.58)	(0.57)	(0.61)	(-0.35)	(-0.51)
R1							0.018	-0.061**
							(0.67)	(-3.14)
R2							0.008	-0.034^
							(0.34)	(-1.96)
χ^2	48.7	44.3	47.7	57.16	81.1	30.7	13.95	60.6
Prob > χ^2	0.000	0.000	0.000	0.000	0.000	0.000	0.24	0.000
n	213	208	88	85	111	106	412	399

Table 12. Tobit estimates of time allocation to leisure by individual household members

Variable	Central		Masaka		Southwest		Overall	
	husbands	wives	husbands	wives	husbands	wives	husbands	wives
Constant	0.203	0.0213^	0.208	0.62**	-0.703*	-0.256	0.283**	0.247**
	(1.37)	(1.95)	(0.87)	(5.84)	(-2.09)	(-1.07)	(2.68)	(3.51)
w	0.0002	0.0003**	-0.0002	0.00001	0.003**	0.002*	-2.5e-06	0.0003**
	(1.51)	(3.41)	(-1.3)	(0.13)	(2.82)	(2.38)	(-0.03)	(4.79)
p	-0.0003	0.0004	-0.001	-0.002**	0.003**	-0.0003	-0.0003	-0.0001
	(-1.15)	(0.1)	(-1.65)	(-4.49)	(3.62)	(-0.48)	(-1.09)	(-0.55)
hhsize	0.001	0.0004	-0.013	0.002	0.016^	-0.008	0.003	-0.001
	(0.21)	(0.1)	(-0.98)	(0.35)	(1.94)	(-1.52)	(0.66)	(-0.38)
depratio	0.026	-0.078	0.075	0.021	-0.022	-0.043	0.022	-0.033
	(0.39)	(-1.44)	(0.65)	(0.32)	(-0.25)	(-0.76)	(0.46)	(-0.91)
hhland	0.0002	-0.003	0.003*	0.0004	-0.003	0.0006	0.0009	-0.0001
	(0.1)	(-1.31)	(2.06)	(0.55)	(-1.28)	(0.19)	(0.83)	(-0.12)
D	0.004*	-0.001	-0.0008	-0.0004	0.005**	0.004**	0.0002	0.0005
	(2.12)	(-0.99)	(-1.07)	(-1.01)	(2.99)	(3.12)	(0.31)	(1.23)
age	-0.001	-0.001	0.02^	-0.018**	-0.003	0.009	0.0005	-0.005^
	(-0.27)	(-0.3)	(1.91)	(-4.32)	(-0.35)	(1.21)	(0.13)	(-1.81)
age^2	0.00004	8.4e-06	-0.0002^	0.0003**	0.00006	-0.0001	0.00001	0.0001^
	(0.77)	(0.15)	(-1.96)	(5.23)	(0.7)	(-1.12)	(0.38)	(1.95)
educ	-0.0007	-0.008**	0.002	0.005	-0.002	0.002	-0.002	-0.004*
	(-0.24)	(-2.87)	(0.32)	(1.28)	(-0.58)	(0.58)	(-0.68)	(-2.06)
R1							-0.012	0.019
							(-0.38)	(0.83)
R2							0.024	-0.024
							(0.85)	(-1.14)
χ^2	17.2	32.6	13.5	47.4	25.2	18.5	20.3	44.8
Prob > χ^2	0.046	0.000	0.143	0.000	0.003	0.03	0.041	0.000
n	213	208	88	85	111	106	412	399

Demand for Labor

The results from the Chow test rejected the alternative hypothesis of nonpooling in favor of pooling the equations for male-headed and female-headed households (Table 13). The calculated F-values are less than the tabulated values in all cases, implying that the parameters are the same for both male and female equations. Thus, the data support the case for pooling data from male- and female-headed households.

However, the results for separate regions show that labor demand should be analyzed separately for the different regions (central, Masaka and southwest) (Table 14). The calculated F-values were greater than the tabulated values, implying that the parameters were not the same in the three regions, and

rejecting pooling in favor of nonpooling. Thus, the labor demand equations were estimated separately for the three different regions (central, Masaka and southwest).

Table 13. Test for separate regressions for male-headed and female-headed households

Region	F-value	F-tabulated (0.05)	Outcome
Overall sample	0.86	1.75	Pooling
Central	0.96	1.83	Pooling
Masaka	1.11	1.93	Pooling
Southwest	0.69	1.83	Pooling

Table 14. Test for nonpooling of regions

Type of household members	F-value	F-tabulated (0.01)	Outcome
Overall	4.31	1.75	Nonpooling
Female-headed	4.10	1.97	Nonpooling
Male-headed	3.22	1.83	Nonpooling

The estimates of total farm labor are presented in Table 15. The effect of wage rate was such that farm labor use was lower at a higher wage rate in the central region, but the relationship between labor demand and wage rate was positive and statistically significant in the southwest. It is likely that higher wage rates for unskilled labor in the southwest were associated with higher farm productivity; thus, households retained more labor (family) in farm production. The effect of banana prices on total labor demand was insignificant.

Family size had a positive effect on total labor use, as expected (this was statistically significant for the central and southwest regions). The positive and significant results for family size were indicative of imperfections in the farm labor market: Farm labor demand and supply were determined not only by market forces, but also by household characteristics. This is a characteristic of households that do not participate in the labor market (i.e. households for which labor supply and demand are equal and those constrained in labor hiring out). The effect of farm size on total labor use was positive and statistically significant in all cases. This result was consistent with our expectation that the marginal productivity of labor is greater if the farm size is larger.

The results for proximity to paved roads were mixed. Our findings were statistically insignificant for the central region, positive for Masaka and negative for the southwest. The result for Masaka was as expected. The negative effect of road proximity in the southwest could potentially be explained as follows: Proximity to paved roads increases the probability and level of off-farm employment for household members, which reduces farm productivity, leading to reductions in farm labor use. Education and age of household head had no significant effect on total labor use.

The regional dummies showed that localization to Masaka or the southwest had a negative impact on total labor use. It possible that the technologies/activities adopted in Masaka and the southwest were less labor-intensive than those in the central region, contributing to a lower level of total farm labor in the former regions.

Table 15. Labor demand estimates (total labor used on-farm)

Variable	Central		Masaka		Southwest		Overall	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Constant	11.302**	7.19	7.555**	6.96	2.366	1.01	10.813**	12.95
Ln(w)	-0.553**	-3.45	0.105	0.62	1.0005**	2.8	-0.469**	-5.05
Ln(p)	-0.156	-0.98	-0.213	-1.17	-0.175	-1.04	-0.12	-1.21
Ln(hhsize)	0.488**	4.28	0.176	1.5	0.422**	4.68	0.398**	5.69
Ln(depratio)	-0.156	-1.25	-0.068	-0.51	-0.0297	-0.37	-0.101	-1.36
ddepratio	-0.563*	-2.45	-0.231	-1.06	-0.212	-1.11	-0.526**	3.86
Ln(hhland)	0.223**	4.43	0.2**	3.88	0.216**	5.53	0.207**	6.65
Ln(D)	-0.001	-0.01	-2.088**	-4.93	0.071*	2.09	-0.061*	-2.16
ageh	-0.026	-1.41	0.019	0.93	-0.02	-1.31	-0.018	-1.55
ageh^2	-0.0003^	1.67	-0.0002	-1.09	0.0002	1.36	0.0002^	1.69
Educh	0.004	0.34	0.006	0.35	-0.006	-0.64	0.002	0.22
R1							-0.311**	-2.98
R2							-0.222*	-2.52
Adj R^2	0.25		0.24		0.473		0.24	
n	265		117		131		513	

The results obtained for family labor use are similar to those of total labor use (Table 16). As seen in the demand for total labor, the effect of wage rate on family labor use is negative for the central region, positive for the southwest, and insignificant for Masaka. The effect of price on family labor use was not statistically significant in the tested cases, with the exception of the overall sample, where the effect was negative and significant ($p<0.01$). It is possible that farmers who received higher banana prices used less labor-intensive technologies or activities, resulting in the negative effect of price on family labor use.

Family size had a positive effect on family labor use in all cases, consistent with our expectations. The effect of farm size on family labor use was also positive. The positive relationship between farm size and family labor use can be attributed to a higher marginal product of labor for households with larger farm sizes.

The effect of the distance variable was such that households in close proximity to roads in Masaka used more family labor, while in the southwest, family labor use was lower closer to the paved roads. In the southwest, lower family use closer to the paved roads can be attributed to diversification into nonfarm employment.

Age of household head had an insignificant effect on family labor. The effect of education on family labor use was significant only in the southwest, where the effect was negative. More education in the southwest was associated with a higher probability of being employed in the nonfarm sector (particularly in the salaried sector). This reduced farm sector employment for family members.

The effect of regional dummies on family labor use was negative, implying that less family labor was used on-farm in Masaka and the southwest than in the central region.

Table 16. Family labor demand estimates

Variable	Central		Masaka		Southwest		Overall	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Constant	10.663**	6.53	7.363**	6.51	-1.053	-0.38	10.28**	11.56
Ln(w)	-0.438*	-2.62	0.074	0.42	1.53**	3.65	-0.124	-1.18
Ln(p)	-0.195	-1.18	-0.129	-0.68	-0.16	-0.81	-0.399**	-4.03
Ln(hhsize)	0.526**	4.44	0.026*	2.12	0.367**	3.49	0.415**	5.57
Ln(depratio)	-0.168	-1.29	-0.153	-1.09	0.01	0.11	-0.1	-1.26

Table 16. (Continued)

ddepratio	-0.536*	-2.25	-0.335	-1.48	-0.014	-0.06	-0.498**	-3.43
Ln(hhland)	0.201**	3.85	0.165**	3.08	0.214**	4.67	0.185**	5.58
Ln(D)	0.031	0.39	-0.209**	-4.72	0.176**	4.46	-0.02	-0.85
ageh	-0.029	-1.47	0.012	0.57	-0.008	-0.45	-0.017	-1.39
ageh^2	0.0003^	1.73	-0.002	-0.73	0.0001	0.35	0.0002	1.49
Educh	0.001	0.09	-0.004	-0.26	-0.031**	-2.82	-0.006	-0.77
R1							-0.369**	-3.33
R2							-0.232*	-2.49
Adj R^2	0.22		0.21		0.45		0.20	
n	265		117		130		512	

The results for hired labor demand are presented in Table 17. The effect of wage rate was negative in the tested cases, with the exception of Masaka, where it was not statistically significant. The price of bananas had no significant effect on the amount of labor hired from outside the family. Demographic variables (family size and dependency share) had no significant effect on hiring of labor, except in the central region, where the effect of family size was negative, indicating that larger households hired in less outside labor. These findings indicate that economic rationing of labor hiring had more to do with market wage than family size and composition.

As expected, the effect of farm size on hired labor was positive; however it was only statistically significant for the central region and Masaka. The effect of distance from paved roads was negative, but this effect was statistically significant only in the southwest. This suggests that households in remote areas of the southwest used less outside labor, as expected. The effect of education on use of outside labor was positive and statistically significant in all cases. Education seemed to reduce reliance on family labor and increased the use of outside labor by farm households. Regional dummies had no effect on hired labor.

Table 17. Tobit estimates of hired labor demand

Variable	Central		Masaka		Southwest		Overall	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Constant	41.02	0.14	-417.1	-0.95	3647**	3.07	108.8	0.4
w	-0.896**	-4.11	0.426	1.14	-9.809**	-3.09	-0.705**	-3.55
p	0.576	1	-1.581	-1.04	-6.69^	-1.92	0.063	0.1
hhsize	-25.51*	-2.19	-20.97	-0.91	29.11	1.08	2.3555	0.22
depratio	26.951	0.22	243.4	1.15	-3.82.6	-1.32	-128.1	-1.18
hhland	19.487**	4.24	5.388*	2	13.29	1.51	10.38**	4.06
D	-4.393	-1.26	-1.878	-1.13	-45.051**	-5.53	-5.745**	-3.73
ageh	5.905	0.57	14.08	0.77	-32.71	-1.27	-4.746	-0.49
ageh^2	-0.047	-0.46	-0.136	-0.7	0.411	1.56	0.078	0.81
educh	20.103**	3.23	39.15**	2.85	30.565*	2.11	25.632**	4.29
R1							86.91	1.11
R2							78.44	1.17
χ^2	44.6		15		67		72.2	
Prob > χ^2	0.000		0.092		0.000		0.000	
n	265		117		131		513	

7. CONCLUSIONS

The objective of this paper was to analyze the factors that influenced labor supply and demand among smallholder farmers in Uganda. The factors that influenced individual household members' choices among farm labor, off-farm labor, home time and leisure were also determined. Our findings have implications for policies to support improved labor allocation decisions in the rural sector.

Under the influence of imperfect labor markets and institutional constraints, the endogeneity of wages and prices was likely to affect the results from an analysis of individual supply responses and household demand for labor. For example, the work time of individual household members was found to be unaffected by changes in wages and prices, with the exception of wives in Masaka, for whom we found that wages positively influenced labor supply while output prices negatively influenced labor supply. Household decisions thus reflected production technology and individual preferences.

Our results showed that farmers in Masaka increased their labor supply most in response to a wage increase, but that this parameter had insignificant effects in the other regions. In contrast, farmers in the central and southwest regions increased their labor supply most in response to improvement in the road infrastructure. These results suggest that where labor markets were least developed, the labor supply would respond most to productivity increases. However, in order for farmers to benefit from market development, the development of the labor market should have been accompanied by development of road infrastructure and subsequent reductions in transaction costs.

Our results concerning the time allocation decisions between on- and off-farm work were consistent with the assertion that participation in off-farm activities depends on the conditions in the labor market and productivity/profits from farm production.

Farm size had a negative effect on the amount of labor supplied to off-farm work, but this was only statistically significant for the central region, where access to nonfarm self-employment was higher. This result was consistent with the assertion that farmers seek off-farm employment due to push factors (e.g. constraints in accessing land for farm production), or remain on the farm due to pull factors (e.g. the greater marginal product of labor on farms having more land). These results also confirmed that factors capable of increasing the relative marginal returns to labor in the off-farm sector (e.g. road access and education) positively affected the amount of time allocated to off-farm activities. The implication of this result was that investment in education and road infrastructure would favor the off-farm sector versus farm employment.

Demand for farm labor was negatively related to changes in wage rate in the central region, positively related in the southwest, and insignificant in Masaka. This suggests that higher wages were associated with higher productivity in the nonfarm sector in the central region, but with higher farm productivity in the southwest.

Family size was positively related to farm labor demand. The effect was statistically significant in the central and southwest regions; this may indicate that there were imperfections in the farm labor market, with farm labor decisions being dependent more on family size and composition than on the market wage. Family labor use increased with increasing family size, while the effect of family size on hired labor demand was negative. However, this effect was not significant in Masaka and the southwest. These results suggest that economic rationing of hired labor had more to do with the market wage (in the southwest) and farm resources (in Masaka) than family size and composition.

In the southwest, road access had a significantly positive impact on the use of outside labor and a negative effect on the use of family labor. This indicates that road access in the southwest improved labor productivity both on-farm and in the nonfarm sector. Hence, near paved roads, more family labor was supplied off-farm and the use of outside labor increased.

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