Labour Allocative Efficiency and Factors Influencing Farm Households Interaction with the Labour Market

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Abstract

Farm households in western Kenya show preference for different labour market participation strategies. This paper evaluates efficiency in labour allocation between farm and off-farm activities and determines the factors influencing labour supply. Unlike previous studies where the household decisions are determined by a single wage, this study allowed household decisions to be influenced by both the shadow wage and the off-farm wage. Returns to labour vary within the farm and between household members working off-farm. This heterogeneity was exploited to generate a household specific shadow wage and off-farm wage rate. The results reveal that on average, farm households are not efficient and that participation in labour markets increases labour use efficiency on-farm. Labour supply to the farm decreases with income and increases with the education level. The lack of opportunities or rationing in off-farm employment is a constraint for households headed by persons with more than the basic level of education.

1 Introduction

Poverty is one of the major challenges facing Kenya today. Rural poverty is particularly significant because rural Kenya houses approximately 70% of the population and hosts 80% of the poor[1] (GOK 2003). Labour being one of the most important resources owned by smallholder rural households is a key factor in strategies aimed at fighting rural poverty. Because of its versatility, divisibility and mobility, it the main input in agricultural production and non-farm activities. The view that labour is abundant makes it a key input in many technologies and the main target in policy interventions for poor households in sub-saharan Africa. Labour as an entry point for change may be an ineffective strategy for increasing household incomes if its mobility within the farm or between farm and non-farm activities is constrained. This study determines whether mobility of labour in farm households is constrained.

Labour markets in western Kenya, like other parts of Kenya, can be described as active with farm households showing preference for different participation strategies. However, little is known about farm household behaviour in labour allocation between farm and off-farm activities or the effect of exogenous factors on labour supply. Previous studies show that allocative inefficiency is an important source of inefficiency in smallholder

[1] 57% of the Kenyan population lives below the poverty line.

households (Gavian and Fafchamps 1996; Bravo-Ureta and Pinheiro 1997; Sheggen 1999). According to Schultz's hypothesis (1964), there are comparatively few significant inefficiencies in traditional agriculture. Deviations from the expected behaviour therefore arise not from inefficiencies but from the different notions of the incentives/prices facing such households (Shultz 1980). Allocative inefficiency therefore points to failures of markets rather than failures of households themselves. In this paper we evaluate allocative efficiency of farm households and provide insights on the factors influencing labour supply on and off the farm.

In studying farm household behaviour in labour use, we are often constrained by non-observability of wages for households not participating in labour markets. To go around the problem one could model the problem as one of censoring or selectivity but pay the price of loosing information for non-participating households. Alternatively, wage rates imputed from households which participate in labour markets could be assigned to non-participating households. The problem with this approach is that it assumes separability in production and consumption decisions. Household decisions can only be modeled as separable under the assumption of perfect input and output markets, perfect substitutability between family and hired labour in farm production (Jacoby 1993; Skoufias 1994); where no dis-utility is associated with working off the farm (Jacoby 1993; Woldehanna 2000) or household members have no preference for farm work (Lopez 1984); and constraints in securing off-farm work are not binding (Singh, Squire et al. 1986; Benjamin 1992). The presence of these imperfections link households production decisions to its consumption decisions (De Janvry, Fafchamps et al. 1991)

Rural conditions in developing countries suggest that the assumption of separability is restrictive because although active, the labour markets are not without imperfections. This study follows Jacoby (1993) who solved the problem of non-observability without assuming separability.

2 Methodology

Evaluation of farm household efficiency in labour allocation is based on the notion that farm households are rational. This means that where there are off-farm opportunities the household will allocate its labour such that marginal payment to labour on and off-farm is equalised. In the case where labour is hired-in, the condition for efficiency is that the marginal product of

labour on the farm must equal the market wage rate for hired labour. The factors influencing farm household labour supply were determined using econometric methods.

2.1 Theoretical Framework

The farm household model provides the background for the expected household behaviour in terms of choices made. We define the farm household's problem as that of maximizing utility from consumption and leisure:

$$\text{Max } U(X_m, L_l; z_u) \tag{1}$$

Where: X_m is a sum of all goods consumed by the household, L_l is pure leisure which is the total time minus time spent on economic activities $T - L_s$ and z_u is a vector of household characteristics (size of the household and its composition) that determine the household's preferences. The utility function is continuous and non-decreasing in its arguments. The maximum utility that households can attain is restricted by a budget constraint, time constraint, home production technology and the constraint in off-farm employment.

Equation 2 shows the households budget constraint. The farm profit, earnings from off-farm employment and non-labour income must be equal or greater than the value of purchased goods.

$$\Gamma(L_F, A; z_q) - w_{hm}L_h - w_{hk}L_h + w_o L_o - w_{om}L_o + R - X_m \geq 0 \tag{2}$$

Where L_F comprises family (L_f) and hired labour (L_h) i.e. $L_F = L_f + L_h$ (3)

Γ is a function that specifies the production function for the agricultural commodity produced by the household, w_{hm} is the monetary component of the wage rate for hired labour whilst w_{hk} is any in-kind payment to hired labour including food and other favours. Payment to off-farm labour is denoted w_o while the travelling and search costs associated with off-farm labour are denoted as w_{om}. R is non-labour income including remittances. The production technology is a closed and bounded possibility set defined as:

$$\Gamma(l_F, A; z_q) \geq 0 \tag{4}$$

The farm household produces an agricultural good using labour (L_F) and land (A). z_q are farm characteristics like soil quality that influence productivity of factors of production. The inequality means that households may or may not be using the variable and fixed inputs to produce the maximum output possible (i.e. at the boundary of the set).

The time constraint is defined as:

$$T = L_f + L_O + L_l + L_h \sup + L_O tc \tag{5}$$

T is the households time endowment which is spent on the work at the farm doing actual farm work (L_f) or supervising hired labour ($L_h \sup$), off the farm working (L_O), or searching and travelling ($L_O tc$). Time spent not working is leisure time (L_l) which includes social activities and resting time.

The household may also be rationed for off-farm work due to few employment opportunities and barriers to entry in the form of skills, education or experience so that it supplies less labour off-farm (L_O) than it would be willing to supply (M_O). This constraint is expressed as:

$$L_O \leq M_O \tag{6}$$

The Lagrange function G for this maximization problem is defined as follows:

$$\begin{aligned} &U(X_m, L_l; z_u) + \lambda(T - (L_l + L_f + L_O + L_h * \sup + L_O * tc)) + \eta[M_O - L_O] \\ &+ \tau[\Gamma(L_F, A; z_u) - w_{hm} L_h - w_{hk} L_h + w_o L_O - w_{om} L_O + R - X_m] \end{aligned} \tag{7}$$

The Lagrange multipliers namely lambda (λ), tau (τ) and eta (η) are the time, cash and off-farm labour market constraints facing the household. They represent the marginal utility derived by the household when the constraint is relaxed. Specifically, lambda (λ) is the marginal utility derived when the household time is relaxed by one unit, tau (τ) is the marginal utility derived when the budget constraint is relaxed and represents the marginal value of cash in the household and eta (η) is the marginal utility derived when off-farm employment increases by one hour, it is therefore the marginal value of off-farm employment.

Maximising the Lagrange equation (G) with respect to L_F, L_f, L_h, L_O, L_l, and X_m yields the first order conditions which spell out the necessary conditions for maximising household utility.

The solution to the households labour allocation problem (optimal demand and supply functions) is obtained by simultaneously solving the first order conditions. The solution in a non-separable model may not be tractable, however the implications derived from it are testable (Sadoulet and De Janvry 1995).

The optimal solution to a households labour allocation problem is conditioned by its labour market participation strategy. Given the prevailing wage rate and household preferences, some households may prefer not to work off-farm in which case labour is allocated to the farm and leisure only. By definition, the optimal point for such households is where the shadow wage is equal to the marginal value of labour on the farm (Skoufias 1994). For households that sell labour off-farm, time is allocated to leisure, farm and off-farm activities. The optimal labour allocation in this case is at the point where the marginal value of an extra unit of time on the farm is equal to the market wage rate and we have seen how frictions in the labour market or a liquidity constraint will affect this rule.

The budget constraint for households which do not participate in labour markets is nonlinear due to strict concavity of the production technology. This means that we cannot use the traditional demand theory (Woldehanna 2000). This problem is circumvented by linearising the budget constraint (Jacoby 1993; Skoufias 1994; Woldehanna 2000) at the point of tangency with the households indifference curve so that households arrive at the same optimal choices. The slope of the linearised budget line is the shadow wage rate W^* and the shadow income of the household (V*) is a function of shadow profit:

$$\pi_F^*(W^*, W_h, A) \tag{8}$$

Shadow income is therefore defined as:

$$V^* = \pi_F^*(W^*, W_h, A) + V \tag{9}$$

where:

$$\pi_F^* = \Gamma(L_F; A) - W_h L_h - W^* L_f \tag{10}$$

V is the income earned off-farm plus non-labour income which is mainly remittances.

So we now maximize the household problem:

$$\text{Max } U(C, L_l; z_u) \tag{11}$$

Subject to the constraints:

$$C = X_m \tag{12}$$

$$X_m + W^* L_l = V^* + W^* T \tag{13}$$

$$L_l^* = T - L_s^* \tag{14}$$

$$L_S^* = T - L_l^* = L_f^* + L_o^* \tag{15}$$

Substituting the non-linear budget constraint with the linear one gives the following Lagrange function:

$$\begin{aligned} &U(X_m, (T - L_f - L_O); z_u) \\ &+ \tau\left[X_m + W^* L_l - V^* - W^* T\right] \end{aligned} \tag{16}$$

The solution to this problem provides the structural equations for labour supply and demand as shown below:

$$L_S^* = l_s(W^*, V^*; Z) \text{ for labour supply} \tag{17}$$

$$L_f^* = l_f(W^*, V^*; Z) \text{ for farm labour supply} \tag{18}$$

$$L_F^* = l_F(W^*, V^*; Z) \text{ for farm labour demand} \tag{19}$$

$$L_o^* = l_o(W^*, V^*; Z) \text{ for off-farm labour supply} \tag{20}$$

In the optimal labour supply and demand functions for non-participating households, the shadow wage replaces the market wage. For these households, labour allocation is a function of shadow wage, shadow income and household characteristics. The supply and demand functions derived in this framework differ from those derived using the market wage because W^* and V^* are endogenous i.e. they are jointly determined with labour supply. They depend on the constraints facing a household for example time and rationing in off-farm employment. Changes in exogenous factors which relax or tighten such constraints result in different levels of W^* and V^*. Moreover, the estimated marginal productivity of labour

depends on the levels of labour applied which means that W^* and V^* are correlated with the error term which summarises the effects of unobserved variables.

2.2 Econometric estimation

A two-stage estimation procedure was adopted in identifying the factors which influence farm household labour supply and demand. In the first stage, plot level production functions were estimated and the shadow wages calculated using the estimated labour elasticities. In the second stage, labour supply functions were estimated. Because the shadow wage (W*) and shadow income (V*) are determined together with labour supply, household labour supply was estimated as a function of instrumented shadow income (V*) and shadow wages (W*).

Estimation of the supply functions was performed in two steps. In the first step, the shadow wage was regressed against a set of instrumental variables. Variables that describe the household size and composition, characteristics of individuals in the household (age, age squared, education, married), household assets (value of buildings, consumer durables, land, farm implements, financial assets, livestock owned), location specific variables such as remoteness or average rainfall are potential instrumental variables. The shadow wage and shadow income were regressed against all exogenous variables in the system. These include; individual characteristics (education level, age, gender of household head), household characteristics (family size, composition of household, farm size, type of housing and value of assets), and location characteristics (division, distance to major market, tarmac and motorable road). Since individual, household characteristics and location characteristics are in the Z vector in the labour supply and demand functions, the identifying instruments were the value of type of building materials, initial cost of building, value of capital assets and sub-location dummies. In the second step, the predicted shadow wage and predicted shadow income were included as regressors in the supply and demand functions. The t-ratios are based on White's standard errors which account for the heteroskedasticity that is induced by this two-step procedure (Skoufias 1994).

From the theoretical model we know that the shadow income is the full income augmented with restricted farm profits plus non-labour income. Restricted farm profit was calculated as crop value less expenditures on hired labour, fertilizers and value of family labour. Full income is the value of the household's labour endowment where labour endowment is the total time available for work. Total time was calculated as the time for all

adults between the age of 14 - 65 years minus the time spent away from home plus free time (school holidays) for household members attending school.

The value of time depends on employment options available to the household. For households not selling labour, household time is valued at the marginal productivity of labour employed on the farm. In our assumption of utility maximizing behaviour, the wages earned off-farm should be equalized to the marginal productivity of labour employed on the farm. In this case, the shadow wage approach would be applicable to all cases irrespective of their market participation strategy (Skoufias 1994). Sometimes, cases of multiple payment to a households time may arise with implications on household behaviour. This occurs when households: are not efficient in labour use on the farm, have more than one wage for labour employed off the farm or when payment to labour on and off the farm differs markedly.

It is a common practice farms to be sub-divided into plots and for the plots to be managed independently. Kamau, (2007) showed that farm households in Kakamega and Vihiga districts do not equalise the marginal product of labour between the plots[2]. When there is more than one marginal product of labour for a single household, the first impulse is to take the mean MVP_L as the indicator for the household's shadow wage. However, in an environment with several market imperfections, it is also possible that the better indicator of the constraints facing each farm household would be the maximum marginal product. In absence of a theoretical rationale on which to base our choice of MVPL in estimation of labour supply, we used the household mean, weighted by the number of hours spent in each crop/plot.

The wage earned off-farm may vary[3] amongst household members if they engage in different off-farm activities. In this case, theory does not provide us with suggestions on which wage could be the households decision wage i.e. is it the mean or maximum? In this paper we use the households mean off-farm wage weighted by the time spent in each activity as the decision wage.

A single wage rate e.g. the shadow wage or the market wage may not explain labour allocation behaviour of a farm household where there is imperfect substitutability between farm and off-farm work and/or between family and hired labour. In this regard estimating the households total labour supply function would only reflect the average household response to

[2] Firstly, the crop specific estimates of the marginal value product were weighted with total labour.

[3] This variation occurs where skills cannot be freely acquired due to differentiation between households in terms of wealth or external linkages or where there is differentiation in the relative position of members within households on the basis of age, gender or disability. If household wealth is determined by its position in its life cycle, then it is possible that persons of different age groups within a household have different skills.

an average wage rate. More insight into farm household behaviour would be gained by exploiting the heterogeneity observed in labour employment within households.

We estimated a farm labour supply function and an off-farm labour supply function. It is expected that behaviour depends on the labour market participation strategy so two farm labour supply functions were estimated. In one function, all households in the sample were included whilst in the other only the households supplying labour off-farm were included. Only the shadow wage was included in the supply function for all households while both the shadow wage and the off-farm wage rate were included in the farm labour supply function for households selling labour off-farm. In estimation of the off-farm labour supply function, the shadow wage and the off-farm market wage were both included in the estimated function.

A Cobb-Douglas functional form was adopted to explain farm household labour supply. The functions were estimated in their log-linear form which is specified as follows.

$$\log L_{j_{it}} = \alpha + \beta_1 w^*_1 + \beta_2 w^*_2 + \gamma V^* + \varphi Z_i + \varepsilon_i \,, j = 1, 2 \;\&\; i = 1, 2, \ldots, \mathrm{N} \qquad (21)$$

where:

The dependent variable L represents the number of hours supplied per day[4] differentiated by season t, j represents the activity (1 = farm work and 2 = off-farm work) and i represents the household. The regressands are the instrumented shadow wage (w_1*), shadow income (V*), off-farm wage (w^*_2) and a vector of individual, household and farm characteristics which influence labour supply (Z). α is the constant, β, γ and φ are the parameters to be estimated. ε_i is the error term summarising the influence of unobservable variables on labour supply. A selectivity correction term is included in the supply function for households selling labour.

The data set used comprises of household data collected between 2003 and 2004 from a random sample of 327 farm households. The survey was carried out in Kakamega and Vihiga districts of western Kenya. Table 1 provides descriptive statistics of the variables included in estimation. The average farm size is 1.7 acres supporting a family of 6.3 persons. The low value of farm equipment owned is illustrative of the low level of capital investment

[4] The total number of hours supplied per day was obtained by dividing the total hours supplied by the total number of working days in a season. Total hours supplied was calculated as the sum of total hours in salaried employment, total hours in self employment, total hours in wage employment in agriculture, total hours in wage employment outside agriculture, and total hors in crop production. The total number of working days in a season was obtained by assuming there are 24 working days in a month and one season has six months. Hours supplied to the farm are given by hours in crop production whilst hours supplied off-farm is the total labour supplied less labour on the farm.

in small-holder agricultural production. The average distance to a motor-able road is about 400 meters whilst the average distance from a major market is 3.5 km.

On average, the demand for labour is equivalent to just two months in a season. On average, the family spends an equivalent of only 1.5 months in crop production in a season which is about 24% of the time it spends on off-farm work. The demand for hired labour is the equivalent of just one month for households hiring-in labour. The time spent off-farm is quite substantial for households selling labour. On average farm households spend an equivalent of 3, 4, 5 and 6 months in a season in casual employment in agriculture, casual employment outside agriculture, self-employment and salaried employment respectively. The large standard deviation suggests a large variation between households in the time spent on and off the farm.

Table 1: Description, means and standard deviation of variables included in estimation

Variable	Mean	Std. Dev.
Total labour on crop production (hr)	369	306
Family time on crop production (hr)	276	245
Family time in crop production during short rain season (hr per day)	1.8	1.6
Family time in crop production during long rain season (hr per day)	2.0	1.8
Hired labour on crop production (hr)	205	225
Total time in off-farm (hr)	1163	1028
Family time in off-farm during short rain season (hr per day)	8.7	7.7
Family time in off-farm during long rain season (hr per day)	7.5	6.4
Time in casual employment in agriculture (hr)	512	546
Time in casual employment outside agriculture (hr)	742	611
Time in self employment (hr)	887	895
Time in salaried employment (hr)	972	634
Mean MVP_L (KSh)	6.34	2.79
Maximum MVP_L (KSh)	22.34	5.67
Shadow Income (KSh)	22,491	13,792
Farm Size (acre)	1.74	1.36
Total Livestock Units	0.79	0.59
Value of capital assets (KSh)	60,776	184,549
Value of farm equipment (KSh)	1,111	1,455
Distance to a motorable road (km)	0.35	0.45
Distance to the nearest major market (km)	3.48	2.37
Dummy for gender of household head: 0 = female, 1= male	0.86	0.35
Dummy for head with no education	0.16	0.37
Dummy for head with primary level not finished	0.33	0.47
Dummy for head with primary level finished	0.27	0.44
Dummy for head with secondary level and above		
Family size	6.30	2.76
Number of household members under 6 yrs	0.96	1.01
Number of household members between 6 and 14 yrs	1.55	1.40
Number of household members between 15 and 20 yrs	1.03	1.12
Number of household members between 21 and 54 yrs	2.16	1.35
Number of household members between 55 and 65 yrs	0.35	0.57
Number of household members over 65 yrs	0.24	0.50
Initial cost of house (KSh)	32,096	122,908
Materials for wall[a]	1.15	0.53
Materials for floor[a]	1.92	0.51
Materials for roof[a]	2.72	0.60
Dummy for location: 0 = Vihiga, 1 = Kakamega	0.52	0.50
Categorical variable for season: 1= short rain, 2 = long rain	1.50	0.50

[a] Building Material Code for walls: 1=mud wall; 2=mud wall plastered with cement; 3=brick wall; 4=stone wall;
[b] Building Material Code for floor: 1=earth floor; 2=earth floor plastered with cow dung; 3 = floor plastered with cement
[c] Building Material Code for roof: 1=grass thatched; 2=used iron sheets; 3=new iron sheets
1USD = 75 KSh

An increase in the shadow wage has two effects, the income and substitution effects. The shadow income will decrease as increased costs of family labour erode the shadow profits. The income effect is therefore positive as households with lower income supply more labour to the farm. As the family labour becomes more expensive, the household substitutes hired labour for family labour. The substitution effect on farm labour supply is therefore negative. The overall effect of a higher shadow wage on farm labour supply is ambiguous

because it depends on the relative strength of the two effects. The income and substitution effect of an increase in shadow wage on off-farm labour supply is unambiguously positive.

The expected effect of a higher off-farm wage on labour supply off-farm is ambiguous due to the opposing forces; i.e. a positive substitution effect and a negative income effect. Households supply more labour as payment increases but the effect of an increased income from higher wages is negative i.e. households will consume more leisure. The effect of a higher off-farm wage on farm labour supply is negative firstly because the higher income means more leisure is consumed and also because increased labour supply off-farm means that less labour is available for farm work. The effect of a higher income is expected to be negative i.e. less labour supplied on and off the farm as households consume more leisure[5].

Copped area and labour capacity are important determinants of labour supply both on and off-farm. The effect of farm size on farm labour supply is positive whilst its effect on labour supply off-farm is negative (Kanwar 1998). Labour capacity is captured by the family size and the household composition. Labour supply both on and off the farm is expected to increase as the family needs (family size) increase. The positive effect of family size on supply off-farm is further reinforced by small farm sizes i.e. when the family farm is small and cannot employ all the family labour we expect more labour to be sold off-farm.

The households labour has been decomposed into six age groups. The first group captures the infants who provide no labour, the second group captures children aged between 6 – 14 years who are normally in school, the third group are young adults aged between 15 – 20 who may be in school or have dropped out, the fourth group are adults aged between 21 – 54, the fifth group captures retired adults aged between 55 - 65 years and the sixth group captures senior citizens (over 65 years). Households with a larger number of prime age adults are expected to supply more labour both on and off the farm compared with households with more dependants (infants or senior citizens). The young adults may supply more labour off-farm whilst seniors may only work on the farm.

Individual characteristics like education level and age of the household head also determinants household labour supply. Education level of the household head captures a household's endowment with skills for increasing farm productivity or skills for off-farm employment. It also shapes a household's attitude towards casual wage employment (Kanwar

[5] Leisure is considered to be a normal good. While many studies show that leisure is a normal good this may not always be the case for example where there are market imperfections. In environments where credit and insurance markets are absent or have failed, households can purchase desired market goods only at higher income levels. Moreover, where there is rationing, households with low incomes may be observed to supply less labour only because off-farm opportunities are lacking.

1998). The effect of education level is ambiguous. It may increase supply off-farm if off-farm jobs available require skills or if farm employment is considered to be inferior to off-farm. However, it may increase labour supply on the farm where it results in increased productivity. Education level was captured by categorising households into four groups (no education, primary unfinished, primary level finished and secondary level finished) depending on the highest education level attained by the head. A household's life cycle influences labour supply decisions and this was captured by age of head of household.

The remoteness of the farm may determine the employment opportunities available and the frictions in the labour market. Location is therefore an important determinant of off-farm labour supply. The variables included to capture this effect are sub-location[6] dummies and the distance from major markets. The district dummy captures differences in agricultural productivity between Kakamega and Vihiga districts.

3 Results

3.1 Description of labour market

Employment opportunities available for farm households in the area of study have been categorised into: self-employment on own farm, self-employment or casual employment (for wages) off the farm or salaried employment. Table 2 shows household and individual participation in each category. The most important employer outside ones own farm is casual employment. Opportunities in casual employment are available in both the agricultural and non-agricultural sectors with the agricultural sector providing the bulk of these opportunities (70% in Kakamega and 80% in Vihiga). It is also the single largest employer providing 33% of the total off-farm opportunities.

Masonry, jua kali (fabrication) and transportation are the most frequently mentioned employers of casual labour outside agriculture. These opportunities are available in local trading centres, major markets and towns. Businesses (self employment) offering a wide range of services are to be found in the study area. The most common businesses is trade in agricultural goods and non-agricultural goods. Others include shop keeping, brewing, milling and pottery.

[6] The sub-location is the second to last administration level. The lowest is the village. It comprises of several villages.

Table 2: Participation in off-farm employment (percentage of total)

Percentage of households with members working off-farm				
	Casual wages	Salaried employment	Self-employed	Total off-farm
Kakamega	44	34	37	82
Vihiga	42	29	32	75
Total	43	31	35	79
Number (percentage)of persons engaged in off-farm employment				
	Casual wages	Salaried employment	Self-employed	Total off-farm
Kakamega	200 (45)	106 (24)	138 (31)	464 (100)
Vihiga	144 (44)	76 (23)	107 (33)	227 (100)
Total	344 (45)	182 (24)	245 (32)	771 (100)

Table 3 compares the mean wage rates in various employment categories. The wage rate in casual employment was calculated as the mean of the wage received divided by the number of hours worked. Payment to labour in self employment is taken to be the marginal product of labour in self-employment. This was estimated from a revenue function. The wage rate equivalent for salaried employment was calculated as the total salary earned divided by the total number of hours in salaried employment. Hours in salaried employment are calculated from the number of months in salaried employment. The hours are calculated from twenty working days in a month and eight working hours in a day.

Table 3: Wage rate earned (KSh per hour) in various off-farm labour markets

Wage rate	Short rain season			Long rain season		
	N[a]	Mean	S.D.	N[a]	Mean	S.D.
1. Casual employment in agriculture	114	5.4	3.6	113	7.0	2.0
2. Casual employment outside agriculture	43	18.4	16.0	46	17.0	9.5
3. Self employment	94	19.0	36.0	119	23.0	23.0
4. Salaried employment	96	30.0	29.0	97	28.0	26.0

[a] the sample size representing the number of households with members working in a particular labour market.
1USD = 75 KSh

There is wide variation in payment to labour employed off-farm. In both seasons, returns to casual labour in agriculture are much lower than the returns in other employment while payment to labour in salaried employment is the highest. The standard deviation suggests a wide spread in returns to labour within each employment except casual

employment in agriculture. Since the level of education[7] determines the kind of employment secured off-farm, the high standard deviation suggests that skilled and unskilled workers attract markedly different wages off-farm.

3.2 Farm household efficiency in labour allocation

Quartile plots of the margin between returns to labour employed on and off-farm (not shown here) show that: Returns on-farm are lower than returns off-farm for the first, second and part of the third quartiles and higher than returns off-farm for the fourth quartile. Returns on-farm are lower than the market wage rate for the first three quartiles and greater than the market wage rate for the fourth quartile. Table 4 compares the return to labour employed on-farm and off the farm for households with different labour market participation strategies. The village wage rate for hired labour is also included for comparison.

The Table shows that returns to labour employed off-farm are higher than returns to labour employed on the farm. This deviation from expected behaviour maybe attributed to: One, households may be unable to sell as much labour as they wish due to lack of employment opportunities which leads to bottling up of labour on-farm (Salasya 2005); Two, the selection effect where only skilled labour gets employment off-farm while unskilled labour remains on-farm. The Table also shows that the off-farm wage rate for farm households which both hire-in and hire-out labour is higher compared with that for households which only hire-out labour. This may be because hired labour with a wage rate w_h substitutes for family labour working off-farm for a higher wage rate w_o.

Households participating in labour markets have a shadow wage higher than that for households which do not participate in labour markets. Moreover, these households are efficient in labour use on the farm because the shadow wage is not significantly different from the village wage rate for hired labour. However, households which both hire-in and hire-out labour are less efficient in labour use on the farm because the wage rate for hired labour is higher than the shadow wage. This suggests that these households have difficulty balancing hired-in and hired-out labour may be due to frictions in the labour market. On the contrary, self sufficient households (do not participate in labour markets) are inefficient in labour use

[7] A test of the difference of means of the education level by employment showed that the education level of persons working for wages in the agriculture sector is lower than that of persons working for wages outside the agriculture sector.

on the farm because the margin between the prevailing wage rate for hired labour and the shadow wage is highly significant.

Table 4: Test of equality of the shadow wage to off-farm wage and wage for hired labour by households labour market participation strategy

		Payment to labour (KSh. Per hour)		Ttest: Difference: Wmeanwageoff [c] – meanWMVPL[a] Difference: vwagea[e] – meanWMVPL[a] Ho: mean(diff) = 0		
				Pr(|T| > |t|)		
	N[b]	Mean	SD	Ha: mean(diff)<0	Ha: mean(diff)!=0	Ha: mean(diff)>0
Households hiring-in & hiring-out						
Off-farm wage rate	200	25.00	31.0	1.00	0.000	0.000
Shadow wage[a]	202	8.30	8.50			
Village wage for hired labour	202	9.50	1.80	0.97	0.04	0.02
Households hiring-out only						
Off-farm wage rate	274	16.40	16.60	1.00	0.000	0.000
Shadow wage[a]	281	10.10	11.00			
Village wage rate for hired labour	281	9.60	1.80	0.20	0.41	0.79
Households hiring-in only						
Shadow wage[a]	64	9.70	20.10			
Village wage rate for hired labour	64	9.50	1.70	0.47	0.94	0.53
Self sufficient households						
Shadow wage[a]	67	6.70	6.00			
Village wage rate for hired labour	67	9.70	1.70	0.99	0.000	0.000

[a] MVP of labour employed on-farm. It was calculated in as the weighted mean of the marginal product of labour employed in the different plots within a farm.
[b] represents the number of households adopting a particular labour market participation strategy
[c] weighted mean wage rate received off-farm
[e] village average wage rate for hired labour
1USD = 75 KSh

Characteristics of farm households in the study area differ (Salasya 2005; Tittonell, Vanlauwe et al. 2005a; Ojiem 2006). We therefore expect labour allocation behaviour to vary, even between households with a similar labour market participation strategy. Figure 1 shows that for most households selling labour off-farm, the deviation of household shadow wage from the wage rate earned off-farm is close to zero. However, there are households with a

shadow wage greater than off-farm wage rate and others with shadow wage less than the off-farm wage rate. For farm households with a shadow wage lower than off-farm wage rate, it means that there is bottling up of labour in the farm may be due to lack of off-farm opportunities (Salasya 2005) or a selection effect. For farm households with a shadow wage higher than off-farm wage rate, one or more of the following conditions are true: farm households are faced with liquidity constraints, hired labour is not a perfect substitute for family labour, frictions in hiring-in labour.

For most farm households hiring-in labour, the shadow wage is lower than the wage rate for hired labour with a margin of between KSh. 5.00 – KSh. 10.00. There are however, some households with a shadow wage greater than the wage rate for hired labour (Figure 2). A shadow wage higher than wage rate for hired labour it means there are frictions in hiring-in labour. The only possible explanation for a shadow wage lower than the wage rate paid to hired labour is that in some households labour is fixed to the farm but not a good substitute for hired labour.

In summary, farm households may fail to attain allocative efficiency when one or more of the following conditions prevail: market wages are different from effective wages due to transaction costs; hired labour is not a perfect substitute for family labour due to shirking, moral hazard and other frictions which inflate payment to hired labour; when there is rationing in the off-farm market such that households cannot supply as much labour as they would wish to; when there is lack of market information. The rest of this paper is devoted to identifying the factors which influence farm household labour supply and hence allocative efficiency of farm households in western Kenya.

Figure 1: K-density plots showing the distribution of deviations (margin) of shadow wage from the wage rate received off-farm

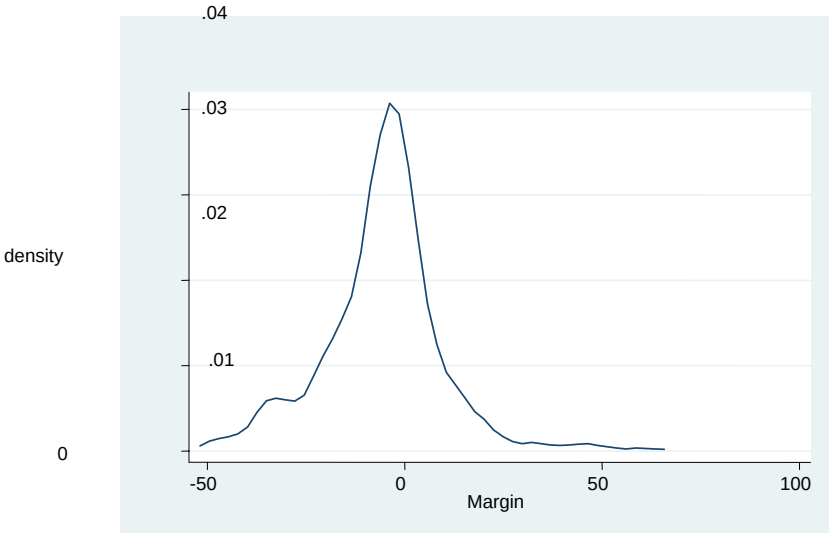
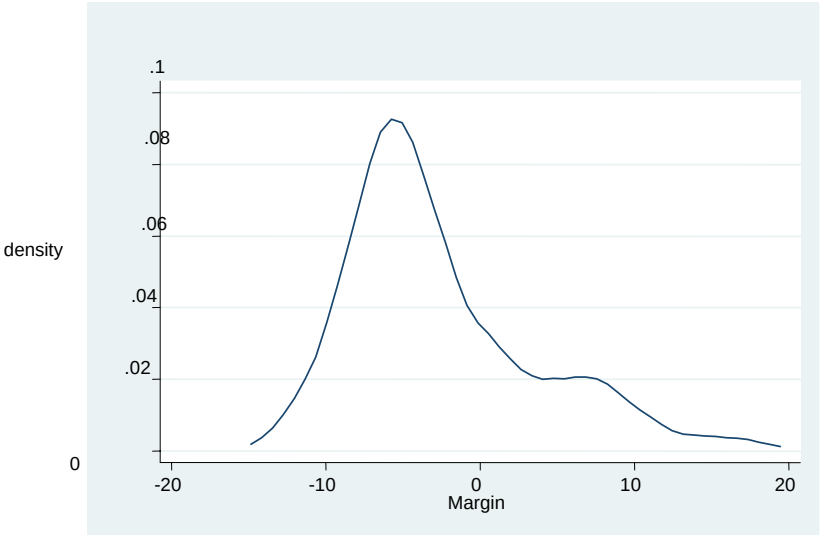


Figure 2: K-density plots showing the distribution of deviations (margin) of shadow wage from the market wage rate for hired labour



3.3 Factors influencing labour supply

3.3.1 Factors influencing farm labour supply

Table 5 summarises the estimates of the farm labour supply function. It differentiates the results for all households in the sample from those of households which sold labour.

Table 5: Factors influencing farm labour supply

	Farm Labour All Households	*Farm Labour Hholds that sold labour*
Dependent Variable in hours per day		
Log of Shadow wage	-0.20	-0.48
Log of wage rate off-farm (hhold mean)		-0.08
Log of Shadow income	-0.74***	-0.80**
Dummy for head with no education	-0.26	-0.51*
Dummy for primary level not finished	-0.20	-0.33
Dummy for primary level finished	-0.23	-0.41**
Log of age of household head	4.52	-5.02
Log of age of household head squared	-0.61	0.75
Dummy for gender of head: 0 = female, 1 = male	-0.02	0.08
Log of family size	0.38***	0.30
Number of households members over 65 yrs	0.08	-0.08
Number of households members between (55- 65)	0.28**	0.26*
Number of households members between 21-54 yrs	0.15***	0.11
Number of households members between 15-20 yrs	0.09*	0.09
Dummy for sub-location 1		-0.06
Dummy for sub-location 2	-0.19	-0.14
Dummy for sub-location 3	-0.10	-0.07
Dummy for sub-location 4	0.14	
Dummy for sub-location 5	-0.25*	-0.21
Dummy for sub-location 6	0.41***	0.46**
Dummy for location: 0 = Vihiga, 1 = Kakamega	-0.30	-0.18
Log of farm size	0.38***	0.30**
Log of distance to major market	-0.05	0.08
Categorical variable for season: 1 = SR, 2= LR	0.50***	0.62***
IMR		-3.20
Constant	-2.35	16.51
N	488	375
F	6.78	6.36
Adj. R^2	0.25	0.30

legend: * P<.1, ** P<.05, *** P<.01

The results show that farm labour supply is mainly influenced by the shadow income, the family size and composition, the location, farm size and season. The shadow income elasticity is -0.74 which means that increasing the shadow income by 1% induces a 0.74% reduction in labour supply. Leisure is therefore a normal good. An increase in the family size by 1% induces an increase in labour supply by 0.38%. Increasing the number of prime age adults induces an increase in labour supply. An increase in adults aged between 55-65 years induces the highest increase (0.28%) whilst an increase in adults aged between 15-54 years induces 0.15% increase. An increase in adults of between 15-20 years leads to a small increase of 0.09%. The differences in supply response between the age groups is a reflection of the relative availability of different age groups for farm work. Persons of the age 55-65 are more available having retired from off-farm activities while persons of the age 15-20 are in school.

Differences in the sign and significance of dummy coefficients for sub-location indicate variation in labour supply based on location. Increasing the farm size and changing the season from the short rain to the long rain induces increased supply indicating that households can respond to changes in labour demand. Labour supply is upto 50% more labour during the long rains compared to the short rains. Although not significant, households headed by persons with less than secondary level education supply less labour.

These coefficients are compared with coefficients for households selling labour. The most notable difference is that family size does not influence labour supply for households selling labour. Moreover, increasing the number of adults does not induce a significant increase in supply except when the increase is in the number of adults aged between 55-65 years which is understandable given that these are senior adults who may not have other employment options. A 1% increase in the shadow income induces a larger (0.80%) reduction in labour supply. This suggests that households which sell labour off-farm consume more leisure. The reduction in labour supply due to a higher shadow wage is higher by 0.28% suggesting that the response of households which do not sell labour off-farm is constrained. The poor response to off-farm wage rate may be because households respond to either the maximum wage or the wage paid in the most reliable off-farm job and not an average wage. Factors like season, farm size influence farm labour supply in the same direction but a different magnitude. The larger season coefficient (0.62) suggests that households that sell labour off-farm are in a better position to respond to changes in labour demand. The smaller coefficient (0.30) for farm size suggests that households selling labour off-farm are able to achieve higher farm to worker ratios. The effect of education level is greater and significant which means that households that sell labour off the farm supply less labour on the farm.

3.3.2 Factors influencing off-farm labour supply

In this section we estimate the labour supply function for off-farm labour. This includes labour engaged in casual wage employment, self employment[8] and salaried employment. Because of the zero observation[9] for hours of labour supplied off-labour, we cannot assume a linear budget constraint (Jacoby 1993; Skoufias 1994; Woldehanna 2000). Moreover the problem of truncation renders ordinary least squares (OLS) estimates inconsistent due to the problem of selectivity. We solve for these two problems by following Heckman's two stage approach where a correction term (inverse mills ratio (IMR)) is

[8] Includes petty trade which household members engage in after working on the farm
[9] Not all households sell labour off-farm

included in OLS estimates for labour supply while restricting the sample to households selling labour. The IMR is calculated from the first-stage probit equation in which the decision to participate as a seller in the labour market is made.

Participation in off-farm employment

Table 6: Factors influencing off-farm labour supply

	Decision to Supply Labour	*Off-farm Labour Supply*
Dependent Variable in hours per day		
Non-labour income	0.03	
Categorical variable for wealth group	-0.05	
Log predicted shadow wage		0.62
Log of wage rate off-farm (hhold mean)		0.58
Log predicted augmented full income		-0.03
Dummy for head with no education	0.39	0.87***
Dummy for primary level not finished	-0.03	0.43*
Dummy for primary level finished	0.24	0.51***
Log of age of household head	9.9*	0.54
Log of age of household head squared	-1.41*	-0.22
Dummy for gender of head: 0 = female, 1 = male	0.21	-0.32
Log of family size	0.40**	0.59**
Number of households members over 65 yrs	0.27	-0.34
Number of households members between (55- 65)	0.07	-0.05
Number of households members between 21-54 yrs	0.02	0.25***
Number of households members between 15-20 yrs	0.03	0.15**
Number of household members between 6-14 yrs	-0.00	
Dummy for sub-location 2		0.30*
Dummy for sub-location 3		0.42
Dummy for sub-location 4		0.07
Dummy for sub-location 5		0.15
Dummy for sub-location 6		-0.06
Dummy for location: 0 = Vihiga, 1 = Kakamega	0.28*	-0.43
Log of farm size	-0.04	0.11
Log of distance to major market	-0.39***	-0.14
Categorical variable for season: 1 = SR, 2= LR	0.13	-0.24
IMR		10.51***
Constant	-15.99	-4.40
N	586	369
F	90	3.43
Adj. R^2	0.15	0.19

legend: * P<.1, ** P<.05, *** P<.01

The factors influencing farm household participation in the labour market are not expected to differ from those influencing labour supply. We have however included the wealth status which is expected to influence a household's labour supply and non-labour income which influences households liquidity status and hence the decision to participate.

The sub-location dummies were left out in the decision to participate, however, the distance from a major market was included as the indicator of location.

The results (Table 6) show that the decision to participate in off-farm employment is mainly determined by the stage in the life cycle of a household, the family size and the location of the farm. The probability that a household will sell labour increases with the age of the household head and family size. It declines in the latter stages of a family life cycle and with greater distance from a major market. Households in Kakamega are more likely to sell labour compared with households in Vihiga.

Off-farm labour supply

Labour supply is mainly determined by the education level of the household head, the family size and composition and the location (Table 6). The coefficients for the shadow wage, the wage rate off-farm and the shadow income have the expected sign i.e. a positive response to an increase in both the shadow wage and the off-farm wage rate and a negative response to increased income (but not significant). Labour supply is higher for households headed by persons with lower than secondary level of education and is highest (87% more than households headed by persons with tertiary level education) when the household head has no formal education.

A 1% increase in family size induces an increase of 0.6% in labour supply. Moreover, households with more adults supply more labour than households with more dependants. An increase in the number of prime age adults i.e. between 15 to 54 years induces an increase in labour supply. The older the adults the larger the response i.e. supply increases by 0.25% when the increase is of adults between 21-54 years and 0.15% when the increase is in the number of adults of the age 15-20 years . This finding reinforces the argument that farms in the area of study maybe too small to fully employ a large labour capacity.

Although households in Kakamega district are more likely to participate in off-farm employment, they supply less labour (0.43%) compared with households in Vihiga District. The positive and negative coefficients for the sub-location dummies suggest differences in off-farm opportunities and/or frictions in the labour market. They also emphasise the differences in off-farm opportunities and farm sizes between the districts and the sub-locations. An increase in the distance from a major market induces a decline in labour supply (not significant). Remoteness has a stronger influence on the decision to participate compared with labour supply. Although households are more likely to sell labour during the long rain season, the amount of labour supplied is less than that supplied during the short rain season.

4 Conclusions

Significant differences were found between returns to labour employed on-farm and labour employed off-farm. Returns on-farm are lower than returns off-farm for the first, second and part of the third quartiles and higher than returns off-farm for the fourth quartile. Significant differences were also found between returns on-farm and the wage rate for hired labour. Returns on-farm are lower for the first three quartiles and greater for the third quartile. Households which participate in labour markets as sellers or buyers of labour are more productive and efficient in use of family labour on the farm. The results confirm findings in previous studies (Sadoulet and De Janvry 1995) that markets fail for individual households.

When on-farm returns are lower than returns off-farm it suggests that there is bottling up of labour in the farm. This maybe due to either lack of off-farm employment opportunities (Salasya 2005) or a selection effect. When returns on-farm are higher than returns off-farm, one or more of the following conditions may apply: farm households use labour to alleviate liquidity constraints, households cannot hire-in labour because it is not a good substitute for family labour or there are frictions in hiring-in. When returns on-farm are higher than wage rate for hired labour it suggests that frictions in hiring-in labour are prohibitive. When returns on-farm are lower than the wage rate for hired labour it confirms that some family labour cannot leave the farm.

Farm labour supply is influenced by the shadow income, the family size and composition, remoteness of farm, farm size and season. For households selling labour, farm labour supply is influenced by the education level but not household characteristics. Off-farm labour supply is influenced by the education level, remoteness, family size and composition. Off-farm opportunities are particularly limited for persons with a higher level of education. Persons with secondary level education are mainly in salaried employment or are self employed. However, such opportunities are limited because out of the 176 adults who were not in school, only 40 (23%) secured salaried employment and only 22 (12.5%) were self-employed. Casual work is the most readily available source of employment. However, opportunities for this category are also limited since only 21 (12%) of them worked in this market.

The policy implications of this study are that efforts should be made to increase off-farm job opportunities, reduce costs of participation in labour markets and making financial and credit markets work in rural areas.

Policies for increasing employment opportunities should mainly target persons with skills or more than the basic level of education. The economy in western Kenya is agriculture based which makes value addition of agricultural produce e the obvious non-farm activities to be promoted. A vibrant agricultural sector would stimulate growth in the non-farm sector in terms of activities related to storage, processing and packaging, input supply and provision of services (financial, information, transportation, maintenance and repairs). Policies that increase productivity and commercialization of smallholder agriculture are therefore important prerequisites to a vibrant non-farm sector in the study area. Direct injection of cash into the rural areas should also be encouraged.

Households located in remote areas are not likely to to supply labour off-farm because remoteness increases time and costs of transportation making non-farm jobs unattractive. Policies that improve rural infrastructure are an important step towards increasing household participation in labour markets.

One quartile of the households supply labour off-farm even though returns to labour are higher on-farm. Such households would be discouraged from selling their labour for a wage lower than returns on-farm by addressing failures in the financial and credit markets.

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