Labor markets and labor allocative efficiency among farm households in western Kenya

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Abstract

This paper evaluates how efficiently farm households allocate labor between farm and off-farm activities. It estimates farm and off-farm labor supply functions to determine the factors that influence labor allocation. Both the shadow wage and the off-farm wage rate are included as regressors in the supply functions. The study reveals that, on average, farm households are inefficient, but when linked to labor markets their productivity and internal efficiency increase. The decision to sell labor is influenced by location, and off-farm employment is difficult to find, particularly for the better educated. Interventions should aim to increase opportunities for off-farm employment for persons with skills or with higher than the basic level of education, and to reduce the cost of participating in labor markets, for example by improving rural infrastructure. Addressing failures in rural financial markets would save poor households from having to sell their labor for less than they get from their farms.

Keywords: labor market; allocative efficiency; labor supply; Kenya

Cet article évalue l'efficacité de la répartition du travail des fermiers, entre les activités agricoles et non agricoles. Il jauge les fonctions relatives aux offres de travail agricole et non agricole afin de déterminer les facteurs qui influencent la répartition du travail. Le salaire de référence et le taux de salaire non agricole sont compris en tant que variables indépendantes dans les fonctions relatives aux offres. L'étude révèle qu'en moyenne les fermiers ne sont pas efficaces, mais lorsque ces derniers sont reliés aux marchés du travail, leur productivité et leur efficacité interne augmentent. La décision de vendre un travail est influencée par le lieu, et il est difficile de trouver un emploi non agricole, en particulier pour les plus instruits. Le but des interventions devrait être d'augmenter les chances de trouver un emploi non agricole pour les personnes ayant acquis des compétences ou possédant un niveau d'instruction supérieur au niveau basique, et de réduire les coûts de participation aux marchés du travail ;

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à titre d'exemple, en améliorant l'infrastructure rurale. S'attaquer aux faiblesses des marchés financiers ruraux éviterait aux fermiers pauvres de devoir vendre leurs services pour un tarif inférieur à celui qu'ils obtiennent dans leur propre ferme.

Mots-clés : *marché du travail ; efficacité allocative ; offre de travail ; Kenya*

1. Introduction

Alleviating poverty is one of the major challenges facing Kenya today: 57% of its population lives below the poverty line. Rural poverty is particularly significant because 70% of the total population and 80% of the poor are in the rural areas (GoK, 2003). Labor is one of the most important resources owned by smallholder farm households and is therefore key in strategies aimed at fighting poverty. Because of its versatility, divisibility and mobility, it is an important input in agricultural production as well as in non-farm activities. The popularly held view that labor is abundant in poor households in sub-Saharan Africa has encouraged the development of labor intensive technologies and other policy interventions that target the labor resource. However, labor as an entry point for increasing or stabilizing household incomes is ineffective where labor mobility within the farm or between farm and non-farm activities is constrained.

As in other parts of the country, labor markets in western Kenya can be described as active, with each farm household showing a preference for a different participation strategy. Little is known, however, about the outcomes of household behavior in labor allocation between farm and off-farm activities or the effect of exogenous factors on labor supply. In this paper, labor allocative efficiency is evaluated and insights into the factors behind labor supply on and off the farm are provided.

Our evaluation of household allocative efficiency is based on the notion that farm households maximize their utility. This means that a household will allocate its labor such that the marginal return to labor on- and off-farm equalizes, and the marginal product of labor on the farm equalizes with the wage rate for hired labor (Kamau, 2007). Subsequent re-allocation can only make the household worse off. According to Schultz (1964), there are few significant inefficiencies in the allocation of the factors of production in traditional agriculture given the prices faced by households. Deviations from expected behavior therefore do not reflect inefficiencies but rather the different incentives or prices facing the household (Schultz, 1980).

Econometric analysis of farm household labor supply is constrained by the non-observability of wages for households which do not participate in labor markets. Modeling the problem as one of censoring or selectivity leads to loss of information from non-participating households. While wage rates from households that participate in labor markets could be imputed to non-participating households, doing so assumes separability[1] in production and consumption decisions. The imperfections in rural markets link a household's production decisions to its consumption decisions (De Janvry et al., 1991), which invalidates this assumption of

[1] Household decisions can be modeled as separable only where: input and output markets are perfect, substitutability between family and hired labor in farm production is perfect (Jacoby, 1993; Skoufias, 1994); 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 et al., 1986; Benjamin, 1992).

separability. This study follows Jacoby's approach (1993), which solved the problem of non-observability without assuming separability.

2. Methodology

Households' deviations from expected behavior in labor allocation were evaluated using descriptive analysis and T-tests, and factors influencing household behavior in labor supply were determined using econometric analysis. The dataset used comprises household level data collected between 2003 and 2004 from a random sample of 327 farm households in Kakamega and Vihiga Districts in western Kenya. Table 1 summarizes the variables included in estimation and is later discussed in Section 3.1.

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

Variable	Mean	Std. dev.
Total labor in crop production (hr)	369	306
Family time in crop production (hr)	276	245
Family time in crop production in SR (hr per day)	1.8	1.6
Family time in crop production in LR (hr per day)	2.0	1.8
Hired labor in crop production (hr)	205	225
Total time in off-farm (hr)	1163	1028
Family time in off-farm in SR (hr per day)	8.7	7.7
Family time in off-farm in LR (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 completed	0.33	0.47
Dummy for head with primary level completed	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 used for building wall[a]	1.15	0.53
Materials used for building floor[a]	1.92	0.51
Materials used for building roof[a]	2.72	0.60
Dummy for location: 0 = Vihiga, 1 = Kakamega	0.52	0.50
Categorical variable for season: 1 = SR, 2 = LR	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
1US$ = 74.7 KSh as at 21 September 2009

2.1 Econometric estimation of labor supply

Factors influencing farm household labor supply were identified in a two-stage procedure. First, plot level production functions were estimated. The marginal value products of labor, as derived from these functions for the observed value of production and quantity of labor, were used as shadow wages.[2] The shadow wage was used to calculate the household's shadow income. Thereafter, labor supply functions were estimated, with shadow wage and shadow income among the explanatory variables. Because the shadow wage and shadow income are determined concurrently with household labor supply (Kamau, 2007), the supply functions were estimated as functions of instrumented shadow income and shadow wage by following the procedure described next.

The shadow wage and shadow income were regressed against a set of instrumental variables. 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). The identifying instruments were the type of building materials, initial cost of building, value of capital assets and sub-location dummies. The predicted shadow wage and predicted shadow income were then included as regressors in the supply functions. Skoufias (1994) defines shadow income as the full income augmented by restricted farm profits plus non-labor income. The restricted farm profit was calculated as crop value less expenditure on hired labor, fertilizers and value of family labor and full income as the value of household's labor endowment, i.e. total time available for work.[3]

In standard utility maximizing behavior the value of time is uniform. This means that the wage earned off-farm is not different from the marginal productivity of labor employed on the farm. In this case, the shadow wage is applicable to all households, irrespective of their market participation strategy (Skoufias, 1994). However, it has been shown that market imperfections can result in multiple wage rates, with implications for household behavior. For example, Kamau (2007) found that farm households in Kakamega and Vihiga Districts do not allocate labor so as to equalize the marginal product of labor between plots.[4] Furthermore, the wage earned off-farm varies[5] between members of a household depending on the off-farm activity they engage in. The value of time therefore depends on the options available to a household (and its members). For households that do not sell labor, time can be valued at the marginal productivity of labor on-farm.

[2] A shadow wage is the value of household's labour and at the optimal point it is equal to the value of the marginal product of labour.
[3] Total time was calculated as the time for all adults between the ages of 14 and 65 minus the time spent away from home plus free time (school holidays) for household members attending school.
[4] The crop specific estimates of the marginal value product were first weighted with total labor.
[5] 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.

2.2 Estimated model

Useful insights into farm household behavior can be gained from the heterogeneity observed within households in the value of time.[6] For example, where there is imperfect substitutability between farm and off-farm or between family and hired labor, neither the shadow wage nor the market wage alone can adequately explain labor supply. And the off-farm wages often apply to jobs available for only limited periods of time. Furthermore, all that the total labor supply function reflects is a household's average response to an average wage rate. Therefore, in the two functions that are estimated (farm labor supply and off-farm labor supply), both the shadow wage and the wage rate are included as explanatory variables. The functions are estimated in their log-linear form and specified as follows:

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

where the dependent variable L represents the number of hours supplied in a day[7] differentiated by season t, the activity j (1 = farm work and 2 = off-farm work) and household i. The regressands are instrumented shadow wage (w^*_1), shadow income (V^*), off-farm wage (w^*_2) and a vector of individual, household and farm characteristics that influence labor supply (Z). α is a constant, β, γ and φ are the parameters to be estimated. ε_i is the error term summarizing the influence of unobservable variables on labor supply. A selectivity correction term was included in the supply function for households selling labor.

An increase in the shadow wage is expected to affect the farm household in three ways, namely through family labor supply, with the usual income and substitution effects of a wage change, and through the possibility of substituting hired labor for family labor. The shadow income will be affected to the extent that the decrease in shadow profits as a result of the increased costs of family labor is compensated by higher shadow wage income of the household. The higher shadow price of family labor will mean that households will substitute labor for leisure on the consumer side of the household, and hired labor for family labor on the farm side. The substitution effects on family farm labor supply add up to being negative. The income effect will in most cases not be able to compensate for the combined substitution effects, but the possibility remains. The effect of an increase in shadow wage on off-farm labor supply is zero for the rationed, but well-paid jobs, and possibly positive if the household adjusts its allocation to farm work easily in favor of off-farm work, for example by resorting to hired farm workers.

The expected effect of a higher off-farm wage on off-farm labor supply is ambiguous due to the opposing forces of substitution and income effects. Households supply more labor as payment increases but the effect of increased income from higher wages is negative as

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[6] In the absence of a theoretical rationale on which to base our choice of shadow wage and off-farm wage in estimating labor supply, we used the household mean weighted by the number of hours spent on each crop/plot and the household mean off-farm wage weighted by the time spent on each activity, respectively.

[7] 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 hours 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, while hours supplied off-farm is the total labor supplied less labor on the farm.

households consume more leisure.[8] The effect of a higher off-farm wage on farm labor supply is negative firstly because the higher income means more leisure is consumed and secondly because increased labor supply off-farm means that less labor is available for farm work. The effect of a higher income is expected to be negative.

Cropped area and labor capacity are important determinants of labor supply both on- and off-farm. The effect of farm size on farm labor supply is expected to be positive but negative on labor supply off-farm (Kanwar, 1998). Labor capacity is captured by the family size and the household composition. Labor supply both on and off the farm is expected to increase as the family needs (family size) increase. The positive effect on supply off-farm is further reinforced by a small farm size because as farm size decreases more labor will be sold off-farm. Household composition was captured by breaking down family labor into the following age groups: infants who provide no labor, children of school-going age aged 6–14 years, young adults aged 15–20 years who may be in school or not, adults aged 21–54 years, retired adults aged 55–65 years, and senior citizens (over 65 years). Households with a higher number of adults are expected to supply more labor both on and off the farm than households with more dependants (infants or senior citizens). The young adults may supply more labor off the farm, while seniors may only work on the farm.

Individual characteristics such as the education level and age of the household head are also important determinants of household labor supply. The education level of the household head is an important determinant of labor supply as it captures a household's endowment with skills that are important for increasing labor productivity on the farm and securing off-farm employment. Education level also shapes a household's attitude towards casual wage employment (Kanwar, 1998). The effect of education level is therefore ambiguous because it may increase supply off-farm if the available off-farm jobs require skills or if farm employment is considered to be inferior to off-farm. It may also increase labor supply on the farm if education leads to increased farm productivity on-farm. Education level was captured by categorizing households according to the highest education level attained by the head, namely no education, primary level not completed, primary level completed and secondary level completed. The age of head of household was included to capture a household's life cycle.

Location is an important determinant of off-farm labor supply because it determines the opportunities available and the transaction costs in the labor markets.[9] This effect is captured by the sub-location[10] dummies and by the distance from major markets. The dummy for district captures the variation in agricultural productivity between Kakamega and Vihiga, which is mainly due to differences in rainfall and soil fertility.

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[8] 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 labor only because off-farm opportunities are lacking.

[9] Location was indicated by the distance travelled. Transaction costs in this case are costs incurred when travelling to secure off-farm employment. Such costs are mainly transport and time costs. Location in terms of distance travelled increases fixed travelling costs (time and monetary).

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

3. Results

3.1 Description of study area and labor markets

Western Kenya is one of Kenya's most densely populated areas. Vihiga District has a particularly high density, with an estimated 978 persons per square km. Kakamega District is less dense, with an estimated 461 persons per square km. Consequently, farms in this area are generally small with an average farm size of 1.7 acres supporting a family of 6.3 persons (Table 1). The low value of farm equipment owned is an indication of the low level of capital investment in smallholder agriculture in the area. The average distance to a motorable road is about 400 meters and the average distance to a major market is 3.5 km. On average, the total demand for labor in a cropping season[11] is equivalent to two man-months. The households spend the equivalent of 1.5 man-months per season in crop production, which is only 24% of the time spent in off-farm activities. Households that hire-in labor demand an equivalent of only one month of hired labor per season. On the other hand, households that hire-out labor devote a substantial amount of time to off-farm employment. The employment opportunities available to farm households were categorized as follows: self-employment on own farm, self-employment and casual employment (for wages) off the farm, and salaried employment.

On average the farm households spend per season the equivalent of three months in casual employment in agriculture, four months in casual employment outside agriculture, five months in self-employment and six months in salaried employment. Agriculture is the single largest source of employment, providing 33% of total off-farm opportunities (Kamau, 2007). Casual employment in the agriculture sector provides the bulk of these opportunities (70% in Kakamega and 80% in Vihiga) in terms of the numbers engaged. Outside agriculture, opportunities for casual work are available in local trading centers, major markets and towns in masonry, *jua kali* (fabrication) and transport. Small owner-managed businesses offering a wide range of services are to be found in the area of study. The most common is petty trade in agricultural goods and non-agricultural goods. Others are shopkeeping, brewing, milling and pottery.

Table 2 compares the mean wage rate across the various employments. The wage rate for casual employment is calculated as the mean of the wage received divided by the number of hours worked. The payment for self-employed labor is the marginal product of labor in self-employment, which is estimated from a revenue function (Kamau, 2007). The wage rate equivalent for salaried employment is estimated from the total salary earned divided by the total number of hours in employment, where hours[12] in salaried employment are based on the number of months thus employed.

[11] A cropping season is the reference period for labour supplied or demanded.
[12] Hours in a month are calculated on the basis of 20 working days in a month and eight hours in a day.

Table 2: Wage rate earned (KSh per hour) in various off-farm labor markets

Wage rate	Short rainy season			Long rainy 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] Sample size representing the number of households with members working in a particular labor market.
1US$ = 74.7 KSh as at 21 September 2009

Table 2 shows a wide variation in returns to off-farm labor. During both the short and the long rainy season, returns are lowest in casual employment in agriculture and highest in salaried employment. There is also a wide spread in returns within each category, with the exception of casual employment in agriculture. Since the level of education[13] determines the kind of employment secured off-farm, the high standard deviation suggests that skilled and unskilled workers are paid markedly different wages.

3.2 Labor allocative efficiency

When the returns to labor on-farm and off-farm were set against income, it was found firstly that returns on-farm are lower than returns off-farm for the first, second and part of the third quartiles and higher for the fourth income quartile only, and secondly that returns on-farm are lower than the wage rate for hired labor for the first three quartiles and greater than the wage rate for the fourth quartile only.

Table 3 compares returns to labor on-farm and off-farm for households with different labor market participation strategies. The village wage rate for hired labor was included for comparison. The tests show large and significant differences between returns to on-farm and off-farm labor. These deviations from expected behavior can be attributed to lack of employment opportunities (Salasya, 2005), such that households cannot sell as much labor as they would wish, and the selection effect, where only skilled labor gets employment off-farm, while unskilled labor remains on-farm. The off-farm wage rate for farm households that both hire-in and hire-out labor is higher than that for households that only hire-out labor, which may be because hired labor substitutes for family labor with a higher off-farm wage rate.

Households that participate in labor markets have a higher shadow wage than non-participating households, which suggests they are more productive. Moreover, they are more efficient in labor use on the farm since the shadow wage is not significantly different from the village wage rate for hired labor. Surprisingly, households that both hire-in and hire-out labor are less efficient in labor use on the farm. This may be attributed to the transaction costs in the labor market, which make it difficult for such households to balance the hiring-in and hiring-out of labor. The significant difference between the prevailing wage rate for hired labor and

[13] 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 agricultural sector is lower than that of persons working for wages outside this sector.

the shadow wage for households not participating in labor markets suggests that these households are less efficient.

Table 3: Test of equality of the shadow wage to off-farm wage and wage for hired labor by household's labor market participation strategy

	Payment to labor (KSh per hour)			T-test: 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	31.00	1.00	0.00	0.00
Shadow wage [a]	202	8.30	8.50			
Village wage for hired labor	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	0.00	0.00
Shadow wage [a]	281	10.10	11.00			
Village wage rate for hired labor	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 labor	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 labor	67	9.70	1.70	0.99	0.000	0.000

[a] MVP of labor employed on-farm – calculated as the weighted mean of the marginal product of labor employed in the different plots within a farm.
[b] represents the number of households adopting a particular labor market participation strategy
[c] weighted mean wage rate received off-farm
[e] village average wage rate for hired labor
1US$ = 74.7 KSh as at 21 September 2009

Since the socioeconomic characteristics of farm households in the study area differ (Salasya, 2005; Tittonell et al., 2005a; Ojiem, 2006), the outcomes of household behavior are likely to vary even between households with a similar labor market participation strategy. On average, households selling labor off-farm are shown to be more efficient. However, a close look at individual households reveals that some have a shadow wage greater than the off-farm wage rate, while others do not. A shadow wage lower than the off-farm wage rate is an indication of bottling-up of labor in the farm, which may be due to lack of off-farm opportunities (Salasya, 2005) or a selection effect. Where the shadow wage is higher than off-farm wage rate, one or more of the following conditions prevail: farm households are faced with liquidity constraints, hired labor is not a perfect substitute for family labor, or there are transaction costs in hiring-in labor. For most farm households hiring-in labor, the shadow wage is lower than the wage rate for hired labor (by a margin of between 5 and 10 KSh). This suggests that probably some family labor is fixed on the farm and is not a good substitute for hired labor. A shadow wage that is greater than the wage rate for hired labor is suggestive of frictions in hiring-in labor.

In summary, farm households may fail to attain allocative efficiency when one or more of the following conditions prevail: market prices are different from effective prices because of transaction costs; hired labor is not a perfect substitute for family labor because of the various frictions (transaction costs, shirking, moral hazard)[14] that inflate the payment to hired labor; there is rationing in the off-farm market such that households cannot supply as much labor as they would wish to; there is lack of market information. The rest of this paper is devoted to identifying the factors that influence farm household labor supply and demand and hence the allocative efficiency of farm households in western Kenya.

3.3 Factors influencing labor supply

3.3.1 Farm labor supply

In this section, two farm labor supply functions are estimated and the results compared. Two samples are analyzed, one including all the households in the sample and one including only the households that supplied labor off-farm (Table 4).

Table 4: Factors influencing farm labor supply

	Farm labor – all households	*Farm labor – h.holds that sold labor*
Dependent variable in hours per day		
Log of shadow wage	-0.20	-0.48
Log of wage rate off-farm (h.hold 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 completed	-0.20	-0.33
Dummy for primary level completed	-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 household members over 65 yrs	0.08	-0.08
Number of household members from 55 to 65 yrs	0.28**	0.26*
Number of household members from 21 to 54 yrs	0.15***	0.11
Number of household members from 15 to 20 yrs	0.09*	0.09
Dummy for sub-location 1		-0.06
Dummy for sub-location 2	-0.19	-0.14

[14] Moral hazard arises when individuals or institutions do not take full responsibility for the consequences of their actions, and therefore tend to act less carefully, thereby leaving another party to take some responsibility for the consequences of those actions.

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***
IMRworkoff		-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

Farm labor supply is mainly influenced by shadow income, family size and its composition, location, farm size and cropping season. An increase in the shadow income by 1% induces a 0.74% reduction in labor supply, which implies that leisure is a normal good. An increase in the family size by 1% induces a 0.38% increase in labor supply. Increasing the number of prime age adults in a household induces an increase in labor supply, with an increase in adults aged between 55 and 65 years inducing the highest increase (0.28%). Differences in supply response between the age groups reflect the relative availability or preference of the different age groups for farm work. Persons aged 55–65 are readily available, having retired from off-farm activities, while persons aged 15–20 are often still in school and hence unavailable for farm work.

Differences in sign and significance of coefficients for sub-location dummies are an indication of variations in labor supply between locations. An increase in the farm size and change from the short rainy season to the long one induces a greater supply, an indication that households do respond to changes in demand for farm labor. Labor supply is up to 50% more during the long rains, confirming that the short rainy season is indeed a slack season. Although not significant, households headed by persons with less than secondary level education supply less labor on the farm.

Notable differences are observed for households that sell labor off-farm. First, family size does not influence farm labor supply. Second, an increase in the number of adults does not induce a significant increase in supply except when the increase is in persons aged between 55–65 years, which may be because they lack other employment options. Third, an increase in the shadow income induces a larger (0.80%) reduction in labor supply, suggesting that households that sell labor off-farm consume more leisure. Fourth, the higher response to the shadow wage suggests that households that sell labor are less constrained in their response.

The poor response to the off-farm wage rate suggests that households respond not to the average wage but rather to the maximum wage or perhaps the wage paid for the most reliable off-farm job available to them. Although seasonality and farm size influence farm labor supply in the same direction, the magnitude differs. A larger coefficient (0.62) for the season among households that sell labor suggests that they are in a better position to respond to changes in on-farm demand. A smaller coefficient (0.30) for farm size suggests that, given the small farm sizes in the study area, households selling labor off-farm are able to attain a higher farm-to-worker ratio. The effect of education level is greater and significant for households that sell labor off the farm, which means that they supply significantly less labor on the farm.

3.3.2 Off-farm labor supply

In this section an off-farm labor supply function is estimated. Off-farm labor includes labor in casual wage employment, self-employment[15] and salaried employment. Due to zero-observation[16] for labor supplied off-farm, a linear budget constraint cannot be assumed (Jacoby, 1993; Skoufias, 1994; Woldehanna, 2000). Furthermore, the problem of truncation renders ordinary least squares (OLS) estimates inconsistent due to the potential problem of selectivity. These two problems are tackled by following Heckman's two-stage approach where a correction term, the inverse Mills ratio (IMR), is included in OLS estimation for labor supply while restricting the sample to households that sell labor. The IMR was calculated from the first-stage Probit equation in which the decision is made to participate as a seller in the labor market.

Participation in off-farm employment

The factors influencing farm household participation in labor markets are not expected to differ from those influencing labor supply. We have, however, included the wealth status, which is expected to influence a household's labor supply and non-labor income, which in turn influences a household's liquidity status and hence the decision to participate. The location is important and is included as distance from a major market.

Participation 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 (Table 5). The probability that a household will sell labor increases with the age of the household head and the family size, and declines in the latter stages of a family life cycle and with distance from a major market. Households in Kakamega are more likely to sell labor than their counterparts in Vihiga.

Table 5: Factors influencing off-farm labor supply

	Decision to supply labor	*Off-farm labor supply*
Dependent Variable in hours per day		
Non-labor income	0.03	
Categorical variable for wealth group	-0.05	
Log predicted shadow wage		0.62
Log of wage rate off-farm (h.hold 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

[15] Includes petty trade which household members engage in after working on the farm.
[16] Not all households sell labor off-farm.

Log of family size	0.40**	0.59**
Number of households members over 65 yrs	0.27	-0.34
Number of households members from 55 to 65 yrs	0.07	-0.05
Number of households members from 21 to 54 yrs	0.02	0.25***
Number of households members from 15 to 20 yrs	0.03	0.15**
Number of household members from 6 to 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

Labor supply off-farm

Supply of labor off-farm is mainly determined by the education level of the household head, family size and the household's composition and location (Table 5). Although not significant, coefficients for the shadow wage, off-farm wage rate and the shadow income have the plausible signs, 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. Households headed by persons with less than secondary level of education supply more labor off-farm. In fact, supply is highest (87% more than households whose head has tertiary level education) in households headed by persons with no formal education.

A 1% increase in family size induces an increase of 0.6% in labor supply off-farm. The family structure is important because households with more adults supply more labor than households that have more dependants (children or senior adults). The older the adult added, the larger the response, i.e. the supply increases by 0.25% when the number of adults between 21 and 54 years increases and by only 0.15% when the number of adults between 15 and 20 years increases. These findings reinforce the argument that farms in the study area may be too small to fully employ a large labor capacity.

Although households in Kakamega District were shown to be more likely to participate in off-farm employment, they supply 43% less labor than households in Vihiga District. The positive and negative coefficients of sub-location dummy variables emphasizes the differences in terms of off-farm opportunities and transaction costs in the labor market. Distance from a major market has a stronger influence on the decision to participate than it does on labor supply. And although households are more likely to sell labor during the long rainy season, the amount of labor supplied is less than that supplied during the short one.

4. Conclusions

Significant differences were found between returns to labor employed on-farm and labor employed off-farm, a strong indication of inefficiencies in labor use in smallholder households. Returns on-farm were lower than returns off-farm for the first, second and part of the third quartiles and higher for the fourth quartile. Significant differences were also found between returns to labor employed on-farm and the wage rate for hired labor. Returns on-farm were lower for the first three quartiles and higher for the fourth quartile. The presence of on-farm returns to labor that are lower than returns off-farm suggests that there is bottling-up of labor on the farm. This may be due to lack of off-farm employment opportunities (Salasya, 2005) or to a selection effect. Where returns on-farm are larger than returns off-farm, one or more of the following conditions may apply: the household uses its labor to mitigate liquidity constraint; hired labor is not a good substitute for family labor; there are high costs associated with hiring-in labor. Where returns on-farm are higher than the wage rate for hired-in labor, this suggests that the costs of hiring-in labor may be prohibitive. Where returns on-farm are lower than the wage rate for hired labor this confirms that family labor is indeed bottled-up on the farm.

Not surprisingly, households participating in labor markets were found to be more productive and efficient in their use of labor on the farm. Unfortunately, opportunities for off-farm employment seem inadequate or rationed, particularly in remote areas and for the better educated. Casual work in the agriculture sector is the most readily available source of off-farm employment and mainly offers employment for persons with no education or some basic education. Persons with secondary level education are mainly in salaried or self-employment. Such opportunities are, however, limited. For example, of the 176 adults who were not in school, only 40 (23%) secured salaried employment and only 22 (12.5%) were self-employed. Opportunities in the casual labor market for skilled labor are also limited, with only 21 (12%) securing employment in this market. Interventions that are aimed at increasing off-farm job opportunities and reducing the costs of participation in labor markets should mainly target persons with skills or persons with more than a basic education. The economy of western Kenya is mainly based on agriculture, hence value-addition would be a viable non-farm source of employment. A vibrant agricultural sector is a prerequisite for stimulating growth in value-addition related activities such as storage, processing and packaging, input supply and provision of services (financial, information, transport, maintenance and repairs). Policies aimed at increasing productivity and commercializing smallholder agriculture are therefore necessary to catalyze growth in the non-farm sector in the study area.

Households that are located in remote areas are less likely to supply labor off-farm because of higher time and transport costs. Interventions that improve rural infrastructure would therefore increase household participation in labor markets.

One quartile of the households continues to sell its labor off-farm in spite of returns being higher on-farm. Interventions that address failures in the financial markets, particularly for the poor households, are likely to discourage households from selling their labor for a wage below what they would earn on their farms.

Acknowledgements

The authors would like to thank the Rockefeller Foundation for funding and the Director of KARI (The Kenya Agricultural Research Institute) for institutional support. We are grateful to an anonymous reviewer and the participants in the 106th EAAE (European Association of Agricultural Economists) seminar held in Montpellier, France, for helpful comments.

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