Impact of Credit on Labor Allocation and Consumption Patterns in Malawi

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Introduction

In recent years, the focus in the study of household behavior has shifted from the household as a homogeneous unit (the unitary model) to the different individuals comprising the household (collective models). The unitary model invokes the idea of 'altruism' or 'benevolent dictator' to aggregate preferences whereas the collective models of household decision-making explicitly recognize and model the individualistic elements in the household within a collective framework (Strauss and Beegle 1996). Collective models make the assumption of Pareto efficiency in intrahousehold distribution (Chiappori 1988, 1992) but do not impose a particular solution concept. The collective models include the cooperative Nash-bargaining model (Manser and Brown 1980, McElroy and Horney 1981) and a subset of noncooperative models. The unitary model is shown to be a special case of the collective model.

The concept of bargaining power plays a crucial role in the collective model, which predicts that the household allocation process and resultant outcomes will reflect the bargaining power of the individual (Quisumbing and de la Briere 2000). Individuals derive bargaining power from multiple sources, many of which correspond to the alternative options available to them in the event of withdrawing from the agreement.

Empirical studies that have tested for the validity of the collective model against the unitary model have used varying economic measures as proxies for bargaining power. These include income shares (Hoddinott and Haddad 1995), ownership of current assets (Doss 1996), inherited assets (Quisumbing 1994), assets at marriage (Thomas *et al*. 1997), unearned or nonlabor income (Thomas 1990, 1993, Schultz 1990), credit (Pitt and Khandker 1996) and exogenous policy shifts (Lundberg and Pollak 1997). The results of the tests indicate that differential control over resources has *different* impacts on the welfare of household members. The evidence suggests that resources controlled by women have a greater impact on the health and welfare of children (Strauss and Beegle 1996). Most of the proxies for bargaining power used in the empirical studies suffer from a problem of endogeneity. Spouse-specific labor income is not appropriate because it reflects their participation and labor supply decisions. Nonearned income is typically assumed as exogenous, but should actually be viewed as an endogenous choice if it represents returns on an individual's life-cycle savings.

Research Statement

The research undertaken in this paper focuses on two aspects of household decision making, labor allocation and consumption expenditures in agricultural households, using the framework of the Nash-bargaining model and the agricultural household model. Access to credit is used to operationalize the concept of 'resource control' affecting a woman's bargaining power. Recognizing that women are a

diverse population who are faced with differing constraints and opportunities this study also attempts to understand if the choices made by women living in male-headed households are different from the choices made by women living in female-headed households.

Studies of labor supply in the intrahousehold framework are relatively rare, with the exceptions being Schultz (2001), Mendoza (1997), and Pitt and Khandker (1996). Men and women in rural Malawi allocate their labor between the following activities: (i) self-employment on own farm; (ii) off-farm self-employment; (iii) off-farm wage employment; and (iv) household activities. In this study, the focus is on off-farm self-employment work and own farm work for men and women.[1] In Malawi, formal agricultural credit programs lend in-kind and the programs that target women typically lend for self-employment activities. However, there is some concern that credit is often not used for the purpose for which it is given, but is diverted for other uses, mainly for consumption purposes (Rahman 1999, Muhumuza 1997). The findings of this study will help understand if indeed access to credit influences work choices within the household. In addition, the study will also illustrate the effect of informal credit on participation decisions, if any. Furthermore, little is known about the effect of an individual's access to credit on the labor allocation patterns of other members in the household, specifically the effect of an individual's access on the spouse's labor allocation decisions.

Beyond affecting labor supply, there may be spillover effects of access to credit on household consumption and household welfare in general. Does the increase in bargaining power for women due to their having access to credit translate into differential expenditure patterns by the household? Within the context of a household model, it is reasonable to assume that apart from bargaining over labor supply, household members may also bargain over commodity consumption (Thomas and Chen 1993). Studies have shown that a greater share of nonlabor income controlled by women has positive implications for household welfare (Strauss and Beegle 1996). This study explores the impact of access to credit (differentiated by sector) on household expenditure patterns for male-headed and female-headed households.

Sampling Procedure and Data Characteristics

The data set from Malawi, 'Financial Markets and Household Food Security, 1995', used in this research is available from the International Food Policy Research Institute (IFPRI), based in Washington D.C. The data are from a household rural finance survey of 404 households in 45 villages in Malawi

[1] Participation in off-farm wage employment was not modeled because very few women in the sample participate in the activity. Furthermore, the data do not provide information on hours worked on household tasks, which makes it impossible to estimate labor allocation to household activities. The concept of participation as a dichotomous variable is not a useful measure of involvement in household activities. Understandably, it is very high and is close to 100 percent for the women in our sample.

spread over five districts (see Figure 1 for the location of the survey sites in Malawi). The survey was conducted by IFPRI in collaboration with the Bunda College of Agriculture, University of Malawi. The sample of 404 households is from five districts of Malawi: Dowa, Mangochi, Nkhotakota, Rumphi and Dedza. Fifty percent of the sample is comprised of households who are members of the credit programs, with the remaining sample comprised of non-participating households. The non-participants are further equally divided between those who never received credit from an organization and defaulters and, hence, are no longer eligible for loans. The non-participants are drawn from the same villages as the participants. The four programs considered in the study are the Malawi Rural Finance Company (MRFC), Malawi Mudzi Fund (MMF), Malawi Union of Savings and Credit Cooperatives (MUSCCO), and the Promotion of Micro-Enterprises for Rural Women (PMERW).

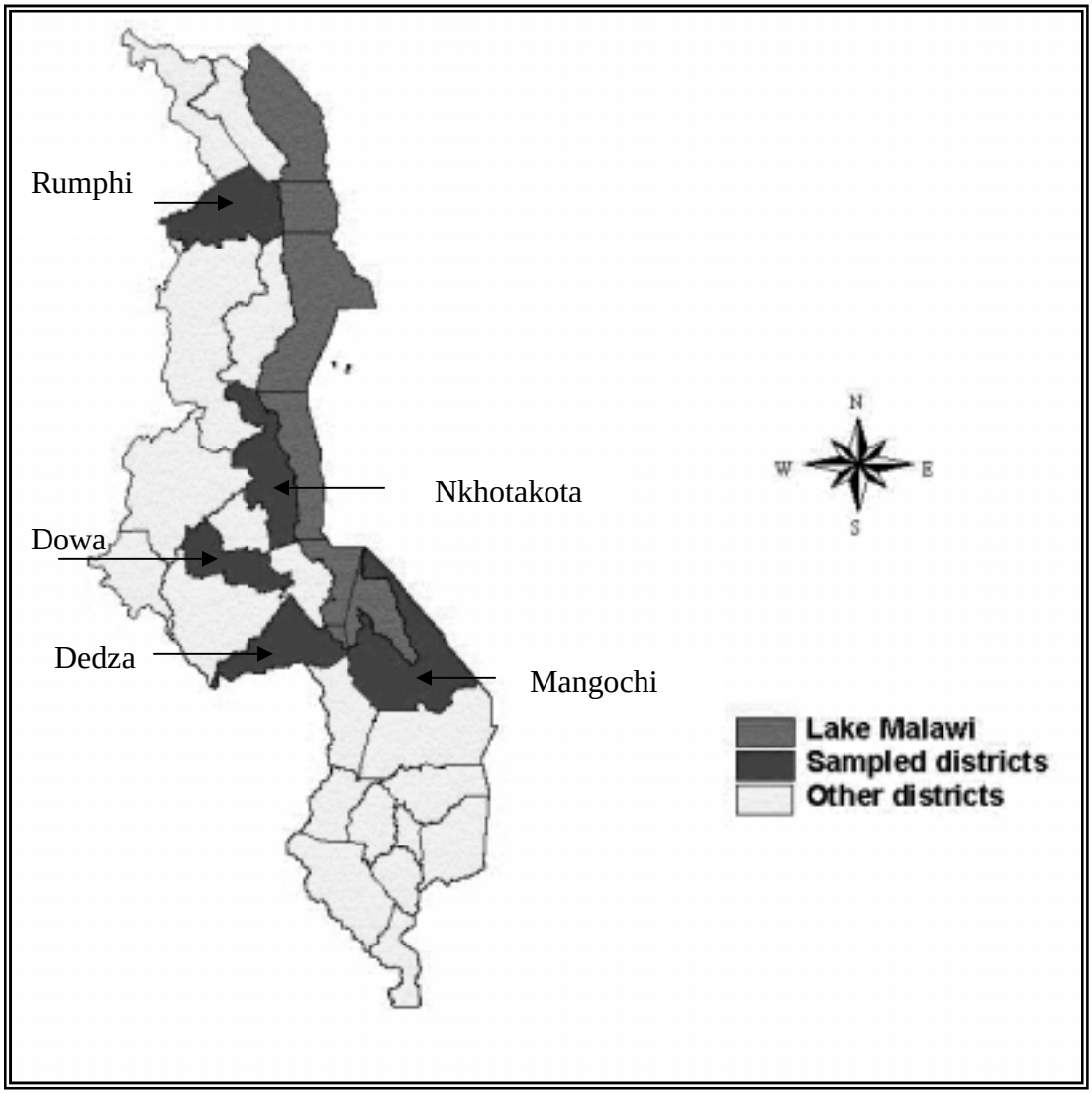
Households were interviewed in a three-round household survey with a recall period of up to two years for some data. The first round was conducted in February – April 1995, the second round in July – August 1995, and the last round in November – December 1995. The survey was conducted at three levels: the household level, community level and credit group level. The household-level survey, comprised of seven modules, was administered in all three rounds. The seven modules are (i) demographics, (ii) crop and livestock incomes, (iii) asset ownership and transactions, (iv) food and non-food expenditure, (v) credit and savings, (vi) non-farm income and time allocation, and (vii) anthropometric measures.

Access to Credit

In this paper we make a distinction between *access to credit* and *participation* in the credit market. The access to credit variable is defined following the methodology outlined in Diagne and Zeller (2001). A household has *access to credit* from a particular source if it is *able to borrow* from that source. A household *participates* if it *actually borrows* from that source of credit. Thus, a household can have access but choose not to borrow, i.e., does not participate in the credit market. A non-participating household that has access will still benefit if the knowledge of access increases the household's ability to bear risk. This in turn will encourage the household to experiment with riskier, but potentially high-yielding technology (Eswaran and Kotwal 1990). The ability to borrow will also alleviate the need for accumulation of assets that mainly serve as precautionary savings, yielding poor or negative returns (Deaton 1991).

Most previous studies estimate the marginal effects of either the amount of credit borrowed or membership in a program as measures of impact of access to credit. The main shortcomings of this approach are related to the substitutability of credit and the endogeneity of program placement and membership. Using the amount of credit borrowed or received as a measure of impact of credit

Figure 1 Map of Malawi showing the location of the DRD/IFPRI Rural Finance Survey Districts, 1995



Map made by Flora Nankhuni, GIA Core, Population Research Institute, Penn State University

relies on rather strong assumptions: first, all households in the program were credit constrained when they received credit; second, the program was the only source of credit; and finally, they had no resources to self finance even a part of their investment (Feder *et al.* 1990, as noted in Diagne and Zeller 2001). In addition, Diagne and Zeller (2001) note two other reasons where the use of the amount borrowed is not appropriate: (i) households may have access to credit, but decide not to borrow because it was not an optimal strategy for them; (ii) households may receive large amounts of credit with negligible marginal impact. In both situations outlined above, using the amount borrowed does not fully capture the positive effects that access alone can provide in terms of shields and flexible borrowing choices.

The problem of endogeneity of program placement and membership in the program can be adequately dealt with by ensuring appropriate survey design, sample selection and econometric techniques (Murdoch 1997, Pitt and Khandker 1996, Heckman and Smith 1995). Then the estimated partial effect of the membership status variable correctly measures the average impact of the program on welfare outcomes. However, Diagne and Zeller (2001) argue that the membership status variable does not measure the impact of access to formal credit for the following reasons: first, most credit programs are not focused on credit alone. They provide educational services like literacy training, family planning, training for income generating activities and so on. Hence, in the use of program impacts, we will not be able to separate out the effects due to credit received and the effects due to the educational services provided (Pitt and Khandker 1996). Second, access to credit is not necessarily automatic for members of a credit program. Many group-based credit programs lend only to a certain percent of the group at any time (Diagne and Zeller 2001).

The extent of access is determined by the maximum amount the person can borrow from that source. This is referred to as the person's credit limit or credit line from that source. In the IFPRI data set, access to credit is measured separately for all adult household members, i.e., for those over 17 years of age. In each round, information was collected from each adult household member on the maximum amount they could borrow during the recall period by the sector of the credit market (formal or informal source of credit). This question was asked of all respondents: those who were involved in a loan transaction as a borrower, those who were not involved in any loan transaction, and those whose loan request had been rejected. Thus, the data set provides information on the formal and informal credit limit of each adult member for all three rounds. In this paper we define access to credit for both formal and informal credit separately. An individual is said to have access to formal credit or to informal credit if he/she enjoys a strictly positive credit limit for formal credit or for informal credit, respectively.

Empirical Framework

Sampling Framework: Choice-Based Sampling

As discussed previously, due to low participation in credit programs in Malawi, a stratified sample selection procedure was followed. The stratification was along the program membership status variable with random selection within each stratum. Since the stratifying variable is endogenous, this is a choice-based sampling procedure. In a situation like Malawi, choice-based sampling is more cost efficient than random sampling and with the use of appropriate estimators yields estimates with better statistical properties (Diagne and Zeller 2001). However, we need to correct for the corresponding bias in the estimation process caused by the choice-based sampling procedure. The estimation procedure follows a two-step approach based on the methodology in Diagne and Zeller (2001) to correct for the bias in

estimation that arises due to the choice-based sampling. The probability choices of the household with regard to membership status, corrected for choice-based sampling, are estimated in the first step. The outcome equations are then estimated in the second step, using the corrected probability choices from the first step as weights. The models estimated in the second step estimate the impact of access to credit on work choices and on consumption decisions within the household.

First-Step Estimation: Multinomial Logit Model

In the first step, a three-alternative multinomial logit model is used for estimation of the corrected probability choices of the household. The three alternatives are specified as: (i) never participated in a credit program (j = 0), (ii) current member of any credit program (j = 1), and (iii) joined a credit program and then dropped out of the program, i.e., past member (j = 2).[2] Due to the restriction of mutual exclusivity, each household can belong to only one of the three alternatives. The probability choices for household *i* are specified as:

$$Probability\,(y_i = j) = \frac{e^{\beta_j' x_i}}{\sum_{k=0}^{2} e^{\beta_k' x_i}}, \qquad [1]$$

where *j = 0, 1 ,2*. For the purpose of identification, we impose the normalization $\beta_0 = 0$, and rewrite the probabilities as:

$$Probability\ (y_i = 0) = \frac{1}{1 + \sum_{k=1}^{2} e^{\beta_k' x_i}}, \qquad [2]$$

$$Probability\ (y_i = j) = \frac{e^{\beta_j' x_i}}{1 + \sum_{k=1}^{2} e^{\beta_k' x_i}}$$

where *j = 1, 2.*

The model is estimated as full information maximum likelihood (FIML) using the Manski and Lerman (1977) weighted-exogenous-sample maximum likelihood (WESML) estimator to correct for choice-based sampling (Greene 2000). The WESML estimator requires that the true population proportions be known. If p_0, p_1, and p_2 are the sample proportions and ω_0, ω_1, and ω_2 are the true

[2] Diagne and Zeller (2001) estimate a four-alternative nested multinomial logit model with two levels: choice is between participation vs. non-participation at the first level and at the second level (reached only if participation is chosen at the first level), the choice is between being a (i) member of MRFC, (ii) member of a second program, or (iii) past member.

population proportions corresponding to the three alternatives, then the estimator is obtained by maximizing the weighted log-likelihood

$$\log L = \sum_{i=1}^{n} w_i \log F(q_i \beta' x_i) \qquad [3]$$

where

$$w_i = y_{io}(\omega_0 / p_0) + y_{i1}(\omega_1 / p_1) + y_{i2}(\omega_2 / p_2) \qquad [4]$$

The results of the multinomial logit model are presented in the Appendix, *Table A1*.

Second-step Estimation: Credit and Labor Allocation

The IFPRI data, collected in three waves (rounds one, two and three) in 1995 enables the use of panel data techniques. Panel data sets possess several advantages over cross-section data sets. Most importantly, the use of panel data enables the researcher to control for unobserved heterogeneity at the level of the individual, household, community or specific time period. In this study the use of panel data helps to control for unobserved household and individual heterogeneity that influence participation decisions, particularly in the off-farm self-employment sector (see Skoufias 1993 for an application of a time allocation study using panel data). The basic model for panel data is:

$$y_{it} = \alpha_i + \beta' x_{it} + \varepsilon_{it} \qquad [5]$$

with $E[\varepsilon_{it}] = 0,\ Var[\varepsilon_{it}] = \sigma_\varepsilon^2$

where $i = 1,\ldots,n$ and $t = 1,\ldots,T$, x_{it} is a vector of explanatory variables and α_i is a time-invariant effect specific to each cross-sectional unit *i*. The treatment of α_i leads to two different approaches: the fixed-effects approach and the random effects approach. Following Simler (1994) and Ilahi (2001) the random-effects specification is used in the analysis. The alternative specification of fixed-effects is not appropriate for this study because of the small number of observations over time. In the fixed-effects approach, a dummy variable has to be introduced as a regressor for each individual in the sample, which would severely limit the degrees of freedom in the sample. In addition, time invariant regressors are eliminated in the differencing inherent in the fixed-effects estimator.[3] However, it may also be possible that there are no random effects in this particular data set in which case, the estimate of ρ will not be statistically different from zero. This implies that there is no additional information to be gained from the knowledge that observations are repeated over time, and that a pooled model is the appropriate

[3] In addition, Greene (2000) notes that the fixed effects approach, while appropriate for the logit model, cannot be used for the probit model.

specification. Lagrange multiplier tests are used to test the significance of ρ in the models (Greene 2000, Greene 1998, Simler 1994).

An estimation issue that must be considered is the potential for endogeneity in the model. There are several reasons why access to credit may be potentially endogenous to the participation decisions of individuals within the household. The first explanation is related to the idea that credit program participation may be endogenous, which makes it likely that access to formal credit is also endogenous. Pitt and Khandker (1996) argue that program participation is endogenous due to the non-random placement of credit programs, and common village-specific, household-specific and individual-specific unobservable characteristics. In addition, the unobserved attributes are likely to affect both credit demand and the outcomes of interest. Examples of such attributes at the village level are prices, availability of infrastructure, agro-climatic conditions; at the household level these include household environment, specific traditions and customs; and at the individual level are health endowments and entrepreneurial ability. Apart from influencing the demand for credit and the outcome of interest, the unobserved attributes also influence the supply of credit (Khandker and Faruqee 2001). This point is particularly relevant for access to informal credit. Informal lenders are comprised mainly of relatives, friends, neighbors, traders or landlords. They are likely to be well acquainted with the characteristics of the borrower or the borrowing household that can affect repayment of the loan, thus influencing their lending decision.

The potential endogeneity of access to credit to the outcome of interest implies that the random-effects probit cannot be implemented as such without correcting for endogeneity.[4] In the panel model, the endogeneity correction follows the two-step approach (pseudo-likelihood estimator) that yields bias-corrected estimates as detailed in Orme (1997). Correction for endogenous variables in a probit model in a panel data setting is a technique that is still evolving (see Arendt 2001 for a discussion of endogeneity in limited dependent variable panel data models). The two-step estimator proposed by Orme (1997) is implemented in the spirit of a conditional maximum likelihood approach and its asymptotic validity requires fairly strict distributional assumptions (see also Audas *et al.,* 2000 for another application). If the original equation is written as:

[4] We tested for exogeneity of the access variables (overall, formal and informal) using the two-step approach suggested by Rivers and Vuong (1988), and outlined in Wooldridge (2002). The test results indicated that exogeneity is rejected in a number of specific model tests, but not in others and, hence, all models are corrected for potential endogeneity of the access to credit variable.

$$
\begin{aligned}
y_{it}^{*} &= \delta + \beta' x_{it} + \beta_1 y_{it}^{1} + \alpha_i + \varepsilon_{it}, \\
y_{it} &= \begin{cases} 1 & if \;\; y_{it}^{*} \geq 0 \\ 0 & otherwise \end{cases} \\
y_{it}^{1} &= \lambda z_i + \eta_i
\end{aligned}
\qquad [6]
$$

where $i = 1,\ldots,n$ and $t = 1,\ldots,T$, x_{it} is a vector of explanatory (exogenous) regressors and y_{it}^{1} is the binary endogenous regressor, z_i is a vector of strictly exogenous instruments, and α_i and ε_{it} as described above. It is assumed that η_i is uncorrelated with z_i and x_{it}.

The two-step estimation procedure is:

(i) Obtain the residual from a probit specification for y_{it}^{1} on the exogenous instruments (z_i) including a constant

(ii) Add the residual to the original regressor set (x_{it}, y_{it}^{1}) and estimate the random-effects probit model.

Using simulations Orme (1997) finds that the corrected model yields *t-ratios* that are reliable, while inferences based on the uncorrected model are fairly misleading. The instruments used are a combination of membership status of the household (past, present or current member) in a credit program, area average value of all assets, area average share of livestock in total value of assets, area percent of male-headed households, distance in kilometers to the home of the individual's parents, percent of heads migrating from another village, percent of adults with a second occupation, area average of years of schooling of adults, Friends, relatives, neighbors and shopkeepers are all potential lenders for an individual and we expect that having a second occupation will increase their lending capacity. Living in a poorer village is likely to decrease access to informal credit. Having a marketplace in the village gives scope for greater interaction with shopkeepers and traders, and hence, a better opportunity to exploit informal networks as a source of credit. A similar argument is relevant for the number of wholesale traders visiting the village.

Second-step Estimation: Credit and Consumption Expenditures

Following Quisumbing and de la Briere (2000), Doss (1996), Handa (1996) and Hoddinott and Haddad (1995), the expenditure shares are estimated using the standard Engle curve formulation extended to include household demographic composition and have the following functional form,

$$w_i = \beta_0 + \beta_1 \cdot log(total\ household\ expenditure) + \beta_2 \cdot log(total\ household\ size) + \beta_3 \cdot (total\ household\ agricultural\ land) + \beta_4 \cdot (his\ access\ to\ credit) + \beta_5 \cdot (her\ access\ to\ credit) + \sum_{k=1}^{K} \delta_k \cdot demographic_k + \varepsilon_i \quad [7]$$

where w_i is the budget share of the i^{th} good. Including the logarithm of household size permits the effects of household scale to be flexible (Thomas and Chen 1993). Total household expenditure is a proxy for household income. Following Deaton 1997, household composition is incorporated into the model by including nine demographic groups based on a disaggregation of the household by age and gender. Since the model controls for total household size, the estimated coefficients on the demographic composition variables are to be interpreted as the effect of an increase in the number of individuals in that group relative to an equal reduction in the number of individuals in the reference group (men between 15 and 65 years of age in this model). Agricultural land (in acres) owned by the household is included in the model to control for farm size in the estimations.

With the exception of the food category, households report zero expenditure in all of the other seven categories ranging from 5 percent (energy shares) to 92 percent (social activities). To account for the censoring of the dependent variable, the Tobit model is used to estimate the budget shares in these seven categories, while the OLS model is used to estimate the budget share equation for food. The general formulation of the Tobit model is given in terms of an index function (Greene 2000):

$$y_i^* = \beta' x_i + \varepsilon_i$$
$$y_i = \begin{cases} 0 & if\ y_i^* \le 0 \\ y^* & if\ y_i^* > 0 \end{cases} \quad [8]$$

The log-likelihood function for the model is:

$$Log\ L = \sum_{y_i>0} -\frac{1}{2}\left[\log(2\pi) + \log\sigma^2 + \frac{(y_i - \beta' x_i)^2}{\sigma^2}\right] + \sum_{y_i=0} \log\left[1 - \Phi\left(\frac{\beta' x_i}{\sigma}\right)\right] \quad [9]$$

where the two parts correspond to the classical regression for the nonlimit observations and the relevant probabilities for the limit observations, respectively.

The potential endogeneity of total household expenditure to the budget shares was tested in all of the expenditure equations. If total household expenditure is endogenous to the outcome of interest then two-stage least squares (2SLS) and simultaneous-Tobit models (Amemiya 1974) are estimated instead of the OLS and the simple Tobit model, respectively. The test of endogeneity for food shares in the OLS model was implemented using a regression-based variant of the Hausman test for endogeneity. The regression-based test was suggested by Hausman and is asymptotically equivalent to the original form of the Hausman test (Wooldridge 2002). The test for endogeneity in the Tobit framework is performed by

estimating the simultaneous-Tobit model (Greene 1998, Blundell and Smith 1986): The test results indicated that for male-headed households, total household expenditure was endogenous in the same set of budget equations in all models for both the access to credit–expenditure models and the land ownership–expenditure models. Total household expenditure was endogenous in the food, energy, health and nondurables equations and is instrumented only in those equations in the presented results. This result is similar to the study by Handa (1996), who finds that total expenditure is endogenous in only the food and the adult wear equations. For female-headed households, total household expenditure was not endogenous in any of the budget share equations. The exclusion restrictions were a combination of household and village characteristics: availability of clean water to the household, availability of sanitation facilities (latrine), if the household used iodized salt, number of wells and low-lift pumps in the village, distance to the post office and distance to a commercial bank.

Results

Credit and Labor Allocation

Descriptive Statistics

Participation in off-farm self-employment activity (dichotomous variable) is defined from the self-employment module of the data set. Participation in farm work (dichotomous variable) is defined from the time allocation module of the data set. Climate plays an important role in determining farm work and consequently off-farm work patterns in Malawi. There are two main seasons: the dry season and the wet season. The dry season is from May to October and the wet season from November to April. Most smallholder agriculture is rain-fed agriculture and is grown in the wet season (Simler 1994). Land preparation, a predominantly male activity, takes place mainly in October. With early rainfall in October and November it is also the time of planting, a peak labor demand period for all farmers. During the months of November to December, women are primarily engaged in weeding and planting the household *dimba* lands (garden plots, mainly used for growing vegetables). They also spend time caring for sick individuals in the household, as it is the time for diseases and high morbidity due to the onset of the rainy season and lack of food. It is likely that the incidence of off-farm self-employment will be low in the wet season due to the conflict with farming activities and the labor constraints faced by most small farmers.

The labor participation rates for our sample are consistent with the seasonality patterns in Malawi (*Table 1*). As anticipated, it is seen that off-farm work is highest in the male-headed households in round two (dry season) and lowest in round one (first half of the wet season). In fact, more than 50 percent of those reporting some off-farm activity in our sample reported that off-farm work conflicts with farm work

during the months of October to March and in the event of a conflict, they would reduce their time allocation to the self-employment activity. It is interesting that wife's participation in farm work in round one (second half of the wet season)[5] is lower than their husband's participation in the same period, while in round three we find that they show similar work patterns. In the months of February to April (round one), some crops are ready for harvesting – men are usually more involved than women in the harvesting and marketing of crops, helping them to retain control over the farm income.

Table 1 Participation in off-farm self-employment and farm work, by round of survey

	Overall	Round 1	Round 2	Round 3
Male-headed households	%	%	%	%
Men				
Farm work (own farm)	63.8	70.6	49.6	73.1
Off-farm self-employment	22.0	13.0	28.3	25.6
Women				
Farm work (own farm)	48.8	42.2	31.6	79.1
Off-farm self-employment	15.4	12.4	19.5	13.9
Number of observations	698	244	241	213
Female-headed households				
Women				
Farm work (own farm)	46.5	44.1	21.2	74.3
Off-farm self-employment	24.8	13.6	29.0	31.8
Number of observations	255	87	86	82

Source: Based on own calculations from DRD/IFPRI Rural Finance Survey.

Examining the type of off-farm self-employment activities shows a limited range of activities, with two activities (three for men) accounting for more than 60 percent of enterprises operated (*Table 2*). Buckley (1996), in an analysis of the Malawi Mudzi Fund, points out that a limited range of activities suggests a limited resource base and a lack of income-generating activities in Malawi and argues for the need to diversify this base. In fact, agricultural-related activities are predominant forms of self-employment accounting for 50 percent of the enterprises operated by men, 78 percent of the enterprises

[5] This is categorized as the second half of the wet season, because of the structure of the survey – the recall period for farm work is the past 2 days, essentially during the time of round one.

operated by women and 92 percent of those operated by female heads.[6] These enterprises depend on agricultural spin-offs, have low entry barriers and low start-up costs (Reardon 1997). Beer brewing is by far the most prevalent activity and is exclusively undertaken by women. Tellegen (1997) notes several reasons why this activity is predominant among women. Beer brewing is a low-skilled and low-investment activity for which inputs are easily acquired. The process involves collection of water and firewood, the grinding of maize and cooking – all of which are perceived as 'female activities'. An additional advantage for women is that beer brewing can be combined with other domestic activities, since beer can be processed and sold within the compound. Other studies in Sub-Saharan Africa find that female-operated enterprises require less investment, have low returns and are operated for only part of the year (Tellegen 1997, Simler 1994). About 28 percent of the male heads participate in weaving, a traditional male activity. Produce selling accounts for more than 20 percent of off-farm self-employment among all individuals and accounts for 49 percent in female-headed households.

Table 2 also summarizes the extent of involvement of individuals (heads and spouses) in the off-farm enterprise, differentiated by the ownership of the enterprise. Women in male-headed households who own an off-farm enterprise are highly involved in the operation of the enterprise, either by themselves or jointly with their husbands. The head shows a greater involvement, as compared to the spouse, in the operation of the enterprises irrespective of ownership status. In the data set, those individuals who worked on an off-farm self-employment activity were also asked, "*Has the business changed your status in the family?*" and *"Has the business changed your status in the village?"* Individuals who felt their status had improved were asked to explain the reason for this increase.[7] Among those who responded, 97 percent of the men and 78 percent of the women felt their status within the household had improved as a result of their self-employment activity. A smaller proportion (47 percent of the men and 32 percent of the women) also perceived an increase in their status in the community.

[6] The enterprises in this category are grocery, poultry, produce selling and fishing.

[7] It would have been interesting to know the reasons why the respondent felt their status had not improved as a result of owning the enterprise. Unfortunately, this information was not collected in the data set.

Table 2 Characteristics of off-farm self-employment enterprises

Characteristics of self-employment businesses	Household type				
	Male-headed			Female-headed	
	Men	Women	N	Women	N
Type of business	%	%		%	
Grocery	5.3	2.6	119[a]	2.2	43
Bakery	0	8.5	77[b]	2.4	
Carpentry	8.3	--		--	
Beer brewing	--	30.2		26.7	
Poultry	--	2.6		--	
Produce selling	21.1	32.0		48.8	
Weaving	27.7	--		--	
Pottery	--	5.1		--	
Fishing	23.9	10.2		14.4	
Services (tailoring, repairs)	0.0	--		--	
Other	0.0	0.0		0.0	
Member who runs the business					
Self	72.94	70.47		97.1	
Spouse	21.76	23.31			
Husband and wife together	2.20	5.72			
Wife and dependants	--	0.32			
Non-members of the household	3.1	0.2			
Member who does most of the work					
Self	79.37	74.71		96.0	42
Spouse	9.23	24.28			
Husband and wife together	8.1	0.52			
Head and dependents	0.08	--			
Wife and dependents	--	0.31			
Non-members of the household	3.25	0.2			
Has the business changed your status in the family?					
% Yes	96.66	78.14	90[a] 48[b]	97.03	31
Has the business changed your status in the village?					
% Yes	46.67	32.37	90[a] 48[b]	45.88	31

All statistics are weighted using the household sampling weights.
A small percent operated more than one enterprise. It is included in the calculation of type of business.
a: men; b: women

Econometric Analysis

Participation in off-farm self-employment: *Table 3* presents the results of the random-effects probit model for women (spouses) corrected for endogeneity of access to formal credit and informal credit. The estimate of rho (ρ) in both the models suggests that unobserved individual heterogeneity is important in determining off-farm self-employment decisions. The hypothesis that all coefficients are equal to zero is rejected, indicating that the models have significant explanatory power. It is seen that access to formal credit as well as informal credit increases the probability of participation in off-farm self-employed activities for women in male-headed households. The positive impact of access to formal credit is consistent with expectations, as most formal institutions that target women are supposed to lend only for off-farm self-employment activities. The positive and significant effect of informal credit on off-farm activities is somewhat surprising as informal credit is usually considered as flowing towards consumption smoothing or short-term emergency expenditures within the household. However, it is possible that some women may not have access to formal credit and, hence, turn to kinship ties to finance their off-farm work. In addition, even those with access to formal credit may rely on informal networks to supplement their capital requirements for their enterprises because formal credit is sometimes inadequate.[8]

An increase in age increases the probability of women's participation in off-farm work, while some primary education seems to have no effect on their off-farm participation. Reardon (1997), in a review of off-farm employment in several African countries, notes that women are usually restricted to low-skill activities. It is quite possible that the level of education does not really matter for participation in low-skill activities. The number of children under 5 years of age in the household does not seem to affect women's participation in off-farm work. It is usually the case that young children have a negative effect on women's off-farm wage work unless older children or other female adults help out with caring for children. But self-employment is typically more flexible and may take place close to the home and, hence, may not interfere with women's child care duties.

The location dummy variables in the models for Rumphi and Dedza are significant and negative, implying that the probability of off-farm participation is higher for women in the Mangochi (reference) district in southern Malawi. This is consistent with the USAID (1999) report that finds that off-farm activity has a greater contribution to total income in the south than in the north or central regions of Malawi. The southern region is more densely populated, which is likely to put pressure on the limited agricultural land available and force people to seek employment opportunities outside the farm sector.

[8] When focus groups were conducted in Malawi, several not-so-poor households complained that the credit provided was not sufficient, particularly for off-farm income-generating activities.

The off-farm participation and access to credit models for female heads has fewer significant variables than the models for women in male-headed households (*Table 4*). According to the likelihood-ratio statistic, the estimate of rho (ρ) is significant at the 2.5 percent level and the hypothesis that all explanatory variables except the constant are jointly equal to zero is rejected. It is seen that while access to credit does not influence female head's participation in off-farm work, female heads from wealthier households are more likely to participate in self-employment. This possibly reflects the fact that poorer households concentrate on their farm work to maintain food security, but once having achieved a minimum level, they now turn to diversifying their income sources. The district dummies show a similar effect to that of the women in male-headed households' models.

Turning to the men's models it is seen that once again the use of a panel approach is justified – the estimated coefficient of rho (ρ) is significant at the 10 percent level and the models have significant explanatory power (*Table 5*). Access to informal credit increases men's likelihood of participation in off-farm activities, but access to formal credit has no impact on their off-farm participation. Formal credit given to men is mainly in the form of agricultural inputs (seeds and fertilizers) and hence, is not likely to encourage self-employment activities. On the other hand, informal credit enhances off-farm work participation, possibly due to the necessity of supplementing and diversifying household income sources.

For men, age has a negative and significant effect on participation in off-farm work. This is likely to reflect a greater likelihood of own-farm work, with less self-employment off farm, with increasing age. Education has the expected positive effect, implying there are greater returns for educated men than uneducated men in rural areas. An increase in household wealth as indicated by the total value of household assets increases the likelihood of men's participation in off-farm self-employment. An increase in the number of adults in the household reduces men's probability of participation in self-employed off-farm work. Similar results were obtained by Simler (1994) for both men's and women's participation in off-farm employment in northern Malawi. Since Malawi is land constrained, it was expected that increases in household size will push more household members to participate in off-farm self-employment. In fact, the number of older children in the household (between 10 and 17 years of age) seems to free men from other work to participate in off-farm work. This is likely due to older children substituting for adult labor in household work.

The location variables show the same effect as in the women's models: the district dummy variables for Rumphi and Dedza are negative and significant, implying that the probability of off-farm participation is higher for men in the Mangochi (reference) district in southern Malawi. The round dummy variables show a reasonable pattern suggesting that men are less likely to work off-farm in round one as compared to round two and round three. The period of off-farm activity considered in round one is

in the first half of the wet season (October / November to April). This is the time of land preparation, a predominantly male activity and a time of planting, which is a busy time for all farmers.

Participation in own-farm work: In the women's (spouses and female heads) access to credit and participation in own-farm work models, the estimate of rho (ρ) was not significant, i.e., the random-effects specification was rejected for the data. Hence, the models were estimated as probit models, corrected for endogeneity of access to credit. For women in male-headed households, participation in farm work is negatively influenced by access to formal or informal credit (*Table 6*). This complements the earlier result (*Table 3*) that showed an increase in participation in self-employment with access to formal or informal credit. Although the overall model for female heads shows significant explanatory power (*Table 7*), only the Dedza district dummy variable and the survey round dummy variables are statistically different from zero.

The district dummies are mostly positive and significant, implying decreased participation in farm work in the Mangochi district. The location results tie in with the explanation of the off-farm self employment models and reflect the higher population density in Mangochi and the consequent limited availability of arable land. In comparison to round one (February to April), women (spouses and female heads) are less likely to participate in farm work in round two (July to August), but more likely to participate in farm work during round three (November and December). The results are plausible, as during the months of November to December, women are primarily engaged in weeding and planting the household *dimba* lands, while farming activity is typically slow during the dry season (May to October).

Access to either formal or informal credit does not influence men's participation in farm work (*Table 8*). The lack of significance of formal access seems rather counter intuitive, as men primarily receive agricultural inputs as formal credit. While formal credit may increase men's labor intensity in farm work, it is less likely to push them over the 'participate or not participate' threshold. An increase in intensity or hours worked on the farm is not captured in the labor participation model. It is interesting to note that their wives' access to formal credit actually reduces the men's participation in farm work. This suggests that as women get access to formal credit and are involved in self-employment activities, men are also contributing their labor to their wives' enterprises. This is an interesting result and suggests the importance of off-farm income to the rural household economy.[9] Recall from the models discussed previously that men's access to informal credit also had the effect of increasing their off-farm participation.

Age and education variables complement the results of the off-farm participation models for men (see *Table 5*), with an increase in age increasing their own-farm participation and an

[9] It can also suggest that men are taking control of their wives' enterprise or appropriating their wives' credit.

increase in education decreasing the likelihood of participating in farm work. Once again, the location variables complement the results of the off-farm work models. Men are also more likely to participate in farm work in round one (wet season) as compared to round two (dry season). Unlike women, men do not show an increased participation in farm work during round three (November and December). This seems to suggest the existence of gender division in farming tasks, with weeding and working in the *dimba* lands considered primarily women's responsibilities (Green and Baden 1994).

Table 3 Women's participation in off-farm work and access to credit: two-step random-effects probit estimates corrected for endogeneity

Independent variables	Women in male-headed households			
	Participate in off-farm work			
	Coefficient	t-statistic	Coefficient	t-statistic
Constant	-3.662***	-3.200	-3.074***	-2.640
Age	0.021*	1.833	0.025**	1.959
Able to at least read and write Chichewa	0.223	0.960	0.279	1.066
Log (total value of household assets)	0.205*	1.706	0.132	1.058
Wife has access to formal credit	0.633***	3.223	--	--
Husband has access to formal credit	0.052	0.247	--	--
Wife has access to informal credit	--	--	0.327*	1.702
Husband has access to informal credit	--	--	0.148	0.816
Number of children between				
0 and 5 years of age	-0.086	-0.722	-0.111	-0.843
5 and 10 years of age	0.093	0.716	0.150	1.031
10 and 17 years of age	0.087	0.801	0.118	0.982
Total adult population in household	0.041	0.391	0.033	0.294
Location (district) dummy variables[a]				
Dowa	-0.144	-0.378	-0.776*	-1.902
Rumphi	-0.931***	-2.897	-1.202***	-3.349
Nkhotakota	0.123	0.391	-0.097	-0.282
Dedza	-1.240***	-3.499	-1.721***	-4.256
Round 2	0.395**	1.987	0.229	1.294
Round 3	0.071	0.355	-0.062	-0.364
Rho	0.496***	5.829	0.574***	7.581
Likelihood ratio statistic (χ^2, 1)	39.594		60.993	
P value	0.000		0.000	
Log likelihood function	-326.009		-334.026	
Restricted log likelihood function	-371.042		-371.042	
χ^2, 16	90.066		74.031	
P value	0.000		0.000	
Number of observations: 698 (244 individuals)				

a: Mangochi is omitted district.

*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 4 Female head's participation in off-farm self-employed work, and access to credit: two-step random-effects probit estimates corrected for endogeneity

Independent variables	Female-headed households Participate in off-farm work Coefficient	t-statistic
Constant	-1.323	-0.803
Age	-0.020	-1.503
Able to at least read and write Chichewa (dummy variable)	-0.653	-1.365
Log (total value of household assets)	0.293*	1.724
Has access to credit	0.360	0.907
Number of children between		
0 and 5 years of age	-0.024	-0.144
5 and 10 years of age	0.131	0.769
10 and 17 years of age	0.241	1.413
Total adult population in household	-0.054	-0.358
Location (district) dummy variables[a]		
Dowa	-1.023	-1.590
Rumphi	-0.885**	-2.471
Nkhotakota	-1.119**	-2.223
Dedza	-1.757***	-2.823
Round 2	0.156	0.577
Round 3	0.198	0.530
Rho	0.285*	1.676
Likelihood ratio statistic (χ^2, 1)	5.548	
P value	0.019	
Log likelihood function	-123.640	
Restricted log likelihood function	-151.761	
χ^2, 15	56.243	
P value	0.000	
Number of observations: 255 (87 individuals)		

a: Mangochi is omitted district.

*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 5 Men's participation in off-farm work and access to credit: two-step random-effects probit estimates corrected for endogeneity

Independent variables	Men			
	Participate in off-farm work			
	Coefficient	t-statistic	Coefficient	t-statistic
Constant	-1.220	-1.620	-1.892***	-2.586
Age	-0.030***	-3.691	-0.028***	-3.629
Able to at least read and write Chichewa	0.422**	2.121	0.454**	2.290
Log (total value of household assets)	0.163*	1.732	0.204**	2.324
Wife has access to formal credit	-0.140	-0.735	--	--
Husband has access to formal credit	0.275	1.375	--	--
Wife has access to informal credit	--	--	0.116	0.818
Husband has access to informal credit	--	--	0.299*	1.751
Number of children between				
0 and 5 years of age	-0.061	-0.696	-0.054	-0.655
5 and 10 years of age	0.059	0.699	0.035	0.429
10 and 17 years of age	0.163**	2.475	0.158**	2.326
Total adult population in household	-0.237***	-2.600	-0.236***	-2.780
Location (district) dummy variables[a]				
Dowa	0.135	0.569	0.081	0.335
Rumphi	-1.0401***	-3.262	-1.105***	-3.397
Nkhotakota	0.019	0.081	-0.113	-0.508
Dedza	-0.632**	-2.476	-0.654***	-2.725
Round 2	0.643***	3.770	0.611***	3.968
Round 3	0.649***	3.646	0.705***	3.965
Rho	0.180	1.610	0.171	1.516
Likelihood ratio statistic (χ^2, 1)	4.817		4.451	
P value	0.028		0.035	
Log likelihood function	-297.879		-298.046	
Restricted log likelihood function	-346.473		-346.473	
χ^2, 16	97.186		96.853	
P value	0.000		0.000	
Number of observations: 698 (244 individuals)				

a: Mangochi is omitted district.

*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 6 Women's participation in own-farm work and access to credit: probit estimates corrected for endogeneity

Independent variables	Women in male-headed households Participate in own-farm work			
	Marginal effect	t-statistic	Marginal effect	t-statistic
Constant	0.062	0.333	0.069	0.359
Age	0.001	0.646	0.001	0.360
Able to at least read and write Chichewa	-0.013	-0.367	-0.019	-0.551
Log (total value of household assets)	0.003	0.169	-0.003	-0.187
Wife has access to formal credit	-0.319***	-6.417	--	--
Husband has access to formal credit	0.056	1.368	--	--
Wife has access to informal credit	--	--	-0.490***	-6.770
Husband has access to informal credit	--	--	-0.040	-1.155
Number of children between				
0 and 5 years of age	0.003	0.165	-0.002	-0.102
5 and 10 years of age	0.010	0.511	0.007	0.372
10 and 17 years of age	-0.001	-0.085	-0.003	-0.218
Total adult population in household	0.031*	1.734	0.019	1.087
Location (district) dummy variables[a]				
Dowa	-0.017	-0.255	0.266***	4.000
Rumphi	0.079	1.238	0.230***	3.624
Nkhotakota	0.142**	2.065	0.162***	2.162
Dedza	0.207**	2.291	0.377***	4.188
Round 2	-0.204***	-3.089	-0.202***	-2.794
Round 3	0.199***	3.148	0.166***	2.719
Log likelihood function	-748.241		-857.503	
Restricted log likelihood function	-889.021		-956.331	
χ^2, 20	281.56		197.656	
P value	0.000		0.000	
Number of observations: 693				

a: Mangochi is omitted district.

*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 7 Female head's participation in farm work and access to credit: probit estimates corrected for endogeneity

Independent variables	Female-headed households	
	Participate in own-farm work	
	Marginal effect	t-statistic
Constant	-0.456	-1.144
Age	0.001	0.308
Able to at least read and write Chichewa (dummy variable)	-0.012	-0.130
Log (total value of household assets)	0.019	0.411
Has access to credit	-0.147	-0.365
Number of children between		
0 and 5 years of age	0.014	0.317
5 and 10 years of age	0.020	0.444
10 and 17 years of age	0.044	1.059
Total adult population in household	0.033	0.736
Location (district) dummy variables[a]		
Dowa	0.142	0.975
Rumphi	0.052	0.524
Nkhotakota	0.180	1.413
Dedza	0.384***	3.205
Round 2	-0.241**	-2.425
Round 3	0.244**	2.557
Log likelihood function	-311.369	
Restricted log likelihood function	-343.545	
χ^2, 18	64.352	
P value	0.000	
Number of observations: 254		

a: Mangochi is omitted district.

*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 8 Men's participation in own-farm work and access to credit: two-step random-effects probit estimates corrected for endogeneity

Independent variables	Men			
	Participate in own-farm work			
	Coefficient	t-statistic	Coefficient	t-statistic
Constant	0.558	0.762	0.644	0.913
Age	0.016**	2.317	0.014**	2.105
Able to at least read and write Chichewa	-0.395*	-1.938	-0.398**	-1.983
Log (total value of household assets)	-0.113	-1.355	-0.123	-1.560
Wife has access to formal credit	-0.379**	-2.063	--	--
Husband has access to formal credit	-0.262	-1.511	--	--
Wife has access to informal credit	--	--	-0.139	-0.952
Husband has access to informal credit	--	--	-0.047	-0.302
Number of children between				
0 and 5 years of age	0.034	0.414	0.045	0.560
5 and 10 years of age	0.065	0.707	0.031	0.354
10 and 17 years of age	-0.100	-1.381	-0.107	-1.517
Total adult population in household	0.027	0.314	0.013	0.159
Location (district) dummy variables[a]				
Dowa	0.623**	2.094	0.684**	2.469
Rumphi	1.220***	5.076	1.203***	5.156
Nkhotakota	0.696***	3.169	0.740***	3.537
Dedza	1.325***	5.316	1.370***	5.768
Round 2	-0.919***	-5.793	-0.756***	-5.114
Round 3	0.056	0.329	0.180	1.076
Rho	0.286***	3.521	0.264***	3.183
Likelihood ratio statistic (χ^2, 1)	16.447		14.237	
P value	0.000		0.000	
Log likelihood function	-384.577		-388.730	
Restricted log likelihood function	-455.329		-455.329	
χ^2, 16	141.504		133.197	
P value	0.000		0.000	
Number of observations: 698 (244 individuals)				

a: Mangochi is omitted district.

*, **, *** represent significance at 10%, 5% and 1%, respectively.

Credit and Consumption Expenditures

The expenditure module was administered in all three rounds of the IFPRI survey and is broadly categorized as food and non-food expenditures. The food expenditure module provides information on quantities and source of food consumed, prices of food and money paid for food purchase, imputed value of food out of domestic production, and value of in-kind salary received as food. The non-food expenditure categories include clothing, personal care products, energy, health and education and infrequent expenditures like religious events and social ceremonies. The recall period for food expenditures is three days and for non-food expenditures, depending upon the type of product, the recall period varies from one to three months. In the empirical work, the expenditure shares are standardized to one month. After some experimentation, the expenditures were classified into eight categories: food, energy, health (medicines and doctors' fees), education, adult goods (expenditures on men's clothing and accessories, expenditures on women's clothing and accessories, and expenditures on cigarettes and alcohol), children's clothing and accessories, nondurables (mainly essential consumption items and household utensils) and social activities (social ceremonies, religious events and recreation). The expenditure models estimated utilize the data from all three rounds. The main advantage of this approach is that seasonal effects (likely to be important for food expenditure in an agrarian setting) can be controlled for.

Table 9 presents the summary statistics of the expenditure shares for male-headed and female-headed households that form the sample for the credit–expenditure models. It is seen that expenditure on food dominates the total expenditure of the households in the sample, with approximately 41 percent of the cash value of food consumed produced in their own fields. This is slightly lower than the figure reported by the National Economic Council (2000), which estimates subsistence production at more than 50 percent of the value of food consumed by rural households. Female-headed households spend significantly higher amounts on food as compared to male-headed households (90 percent versus 85 percent). This likely reflects the higher poverty status of the female-headed households. Investments in education, at 0.2 percent for male-headed households and 0.1 percent for female-headed households, are at the lower end of monthly expenditures. On average, expenditures on health, education and children together account for less than 2 percent of the monthly expenditures. It is also in these categories that a majority of households reports zero expenditure.

Table 9 Summary statistics of expenditure shares, rounds one to three by household type, credit-expenditure model

Expenditure category	Household type					
	Male-headed			Female-headed		
	Mean	Median	%[a]	Mean	Median	%[a]
Food	0.85	0.87	(0)	0.90*	0.92	(0)
Produced at home	0.35	0.33	(22)	0.37	0.28	(28)
Purchased	0.50	0.54	(2)	0.53	0.62	(9)
Energy	0.05	0.03	(5)	0.03*	0.02	(16)
Health	0.003	0	(67)	0.002*	0	(80)
Education	0.002	0	(87)	0.001	0	(76)
Adult goods	0.03	0.01	(35)	0.01*	0	(47)
Children's clothing and accessories	0.01	0	(71)	0.01	0	(72)
Nondurables	0.04	0.03	(8)	0.04	0.03	(4)
Social activities	0.001	0	(92)	0.002*	0	(83)
Total monthly expenditure (MK)	449			445		
Number of observations	753			275		

Source: Based on own calculations from DRD/IFPRI Rural Finance Survey.
a: Percent of households with zero expenditure are given in parentheses.
Shares do not add up to one because expenditure on miscelleanous items is not included.
*: Tested for difference in means. Significant at 10% or higher.
Malawi Kwacha (MK): 15 MK = 1 US $ at the time of survey.

Expenditure Shares and Access to Formal Credit: The results for the formal credit model for male-headed households (*Table 10*) indicate that the household should not be treated as a single entity and that men's and women's access to credit have different effects on household expenditure patterns. Men's access to formal credit has a positive impact on food shares and a negative impact on the share of adult goods. Given that formal credit to men is mainly in-kind agricultural credit, it is to be expected that men's access will have a positive impact on food production and, hence, on the budget share of food since it includes the value of food consumed from home production.

Women's access to formal credit has a positive and significant effect on the share of health expenditures (*Table 10*). Expenditures on health can be interpreted as increasing the overall welfare of the household, and this finding is consistent with results from previous studies (Doss 1996, Thomas and Chen 1993).

In the education budget share equation for male-headed households (*Table 10*) the demographic composition variables suggest that controlling for household size, an increase in the number of infants and children under 10 relative to the reference category (men between the ages 15 to 65) reduces the expenditures on education. A study by Nankhuni and Findeis (2002) finds that individuals in Malawi are attending school into their early twenties. Thus, it is likely that expenditure on schooling is greater for secondary and higher level of schooling than it is for primary school. In order to check if the same result was valid in this sample, the household composition variables were re-categorized with no significantly different results. In the adult goods budget share equation, the household composition variables suggest that the presence of older males (greater than 65 years of age) increases expenditure share on adult goods while the presence of older women decreases the expenditure share.

Table 10.1 shows the effect of access to formal credit when expenditures on food are disaggregated into value of food purchased and value of food produced within the household. Consistent with expectations, men's access to formal credit increases home production, while reducing the share of food purchased by the household. The location variables (district dummies) in *Table 10.1* indicate that households in the Mangochi district (reference category) are more likely to purchase food and less likely to produce food at home than households in the other districts. As discussed previously in the labor allocation models, Mangochi in Southern Malawi has a higher population density and limited agricultural land available as compared to the other districts in Malawi. Thus, it is likely that the location variables reflect the higher food production within the household in the other four districts in the Northern and Central regions of the country. The round dummy variables in the food equations show that households are less likely to purchase food in round one (or more likely to consume food out of their own production) as compared to round two and round three. As discussed previously, certain crops are ready for harvesting in the months of February to April (round 1), which is likely to boost household food stocks in that period. Consistent with the small farm size and subsistence nature of production in the sample, an increase in agricultural area (in acres) owned by the household reduces the share of food purchased by the household, implying that households are focused on production of subsistence crops, not cash crops.

For female heads, rather surprisingly, access to formal credit reduces the budget share on food (*Table 11*). Since female-headed households are on average poorer than male-headed households, it is implausible to consider the reduction in food expenditures as a sign of prosperity. Access to formal credit increases the budget share allocated to adult goods. Similar results were reported by Handa (1996) in a study of female-headed households in Jamaica. The study concluded that it was likely that women too had their 'vices', *viz.*, expenditures on clothing and accessories. Similar to the results for women in male-headed households, female head's access to formal credit has a positive and significant effect on the share of health expenditures.

The effect of access to formal credit on the value of food purchased and value of food produced within the household is examined in *Table11.1*. The district dummies and the round dummies show results that are similar to the models for male-headed households and are not discussed again (see *Table 10.1*).

Expenditure Shares and Access to Informal Credit: In male-headed households, informal credit seems to be playing a more supplementary role, with men's and women's access increasing the share of total household expenditure allocated to health and education, respectively, and women's access reducing the share allocated to social activities (*Table 12*). It is seen that the household expenditure and composition, and location variables in the formal and informal access models show similar results to the access to formal credit models in terms of direction and significance of their effects. Not surprisingly, the disaggregated food expenditure equations (*Table 12.1*) do not show any effect of either men's access to informal credit or women's access to informal credit on the value of food purchased or produced at home. Once again, the district dummies suggest that relative to households in other districts, households in the Mangochi district are more likely to spend money purchasing food.

Access to informal credit increases the household allocation to the food budget for female-headed households, suggesting that informal credit is helping to maintain food security in the household (*Table 13*). If indeed informal credit is mainly used for consumption-smoothing purposes at times of dire need, then it provides an insight as to why access to informal credit reduces outlays towards those items that are not crucial like education and children's clothing. The location and the district dummies in the disaggregated food expenditure equations (*Table 13.1*) show similar results to the other models discussed previously.

Table 10 Household expenditure shares and access to formal credit in male-headed households: 2SLS and Tobit estimates

Independent variables	Food[a]		Energy[b]		Health[b]		Education[c]	
	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic
Constant	0.937***	5.213	-0.030	-0.421	-0.135***	-2.927	-0.032	-0.926
Ln total monthly expenditure	-0.026	-0.769	0.010	0.907	0.020***	2.748	-0.002	-0.415
Ln total household size	0.033	1.354	0.008	1.228	0.002	0.606	0.032***	3.373
Household agricultural area (acres)	-0.001	-0.545	0.001	1.024	0.0001	0.126	0.001	1.116
Wife has access to formal credit	0.005	0.466	-0.006	-1.080	0.005*	1.730	0.006	0.870
Husband has access to formal credit	0.019*	1.741	0.007	1.419	0.002	0.587	-0.005	-0.687
Demographic composition[d]								
Males, 0-5	-0.029	-0.616	0.019	0.949	0.011	0.872	-0.081**	-2.527
Females, 0-5	-0.047	-0.982	0.019	0.895	0.016	1.169	-0.118***	-3.240
Males, 5-10	0.033	0.646	-0.010	-0.394	0.012	1.063	-0.087**	-2.519
Females, 5-10	0.006	0.111	0.007	0.310	0.006	0.417	-0.082**	-2.310
Males, 10-15	0.034	0.700	-0.009	-0.361	0.019	0.871	-0.024	-0.786
Females, 10-15	0.016	0.296	0.008	0.426	-0.004	-0.297	0.018	0.532
Females, 15-65	0.022	0.397	0.029	1.350	0.009	0.554	-0.051	-1.426
Males, 65+	0.022	0.308	-0.089***	-2.883	-0.025	-1.264	-0.135*	-1.930
Females, 65+	0.146	1.382	0.105**	2.238	0.078***	3.044	-0.077	-0.776
Location (district) dummy variables[e]								
Dowa	0.017	0.765	-0.021**	-2.176	0.006	1.064	-0.008	-0.726
Rumphi	0.033**	1.975	-0.021***	-2.633	-0.003	-0.629	-0.001	-0.097
Nkhotakota	0.021	1.618	-0.029***	-3.384	-0.011**	-2.557	0.003	0.338
Dedza	0.016	0.846	-0.016**	-2.496	-0.0001	-0.022	-0.015*	-1.645
Round variables								
Round 2	-0.003	-0.348	-0.003	-0.550	-0.011***	-3.420	-0.045***	-5.615
Round 3	0.013	1.220	-0.0002	-0.037	-0.019***	-5.558	-0.019***	-2.765
$\sigma_{21} / \sigma_{22}^2$			-0.031	-2.636	-0.0260	-3.522		
σ							0.050	16.661
Overidentification test statistic	7.021							
Likelihood ratio statistic							123.455	
P value	0.219						0.000	
Number of observations: 753								

(Continued on next page)

a: 2SLS estimates; b: Simultaneous-Tobit estimates; c: Tobit estimates; d: Males 15-65 is reference category; e: Mangochi is omitted district.

*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 10 Household expenditure shares and access to formal credit in male-headed households: 2SLS and Tobit estimates (continued)

Independent variables	Adult goods[c]		Children[c]		Nondurables[b]		Social activities[c]	
	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic
Constant	0.090***	2.689	-0.134***	-3.148	0.029	0.604	-0.044**	-2.203
Ln total monthly expenditure	-0.004	-0.834	0.010*	1.831	0.0003	0.041	0.002	0.931
Ln total household size	-0.028***	-3.068	0.023**	2.046	0.002	0.418	0.006*	1.173
Household agricultural area (acres)	0.001*	1.814	-0.002	-1.607	0.001*	1.708	0.0001	0.225
Wife has access to formal credit	-0.004	-0.668	-0.004	-0.533	-0.0002	-0.059	0.004	0.973
Husband has access to formal credit	-0.017**	-2.540	-0.009	-1.070	0.003	0.744	-0.007	-1.542
Demographic composition[d]								
Males, 0-5	0.003	0.094	0.072*	1.915	0.014	0.831	-0.016	-0.885
Females, 0-5	0.066**	2.147	0.115***	2.950	0.002	0.150	-0.005	-0.294
Males, 5-10	0.001	0.026	-0.045	-1.104	-0.010	-0.537	0.005	0.251
Females, 5-10	0.035	1.066	-0.007	-0.180	0.026	1.509	-0.028	-1.394
Males, 10-15	-0.002	-0.075	0.026	0.631	-0.001	-0.044	0.001	0.040
Females, 10-15	-0.020	-0.571	0.022	0.510	-0.004	-0.235	-0.028	-1.320
Females, 15-65	-0.030	-0.800	-0.011	-0.239	0.008	0.430	-0.006	-0.300
Males, 65+	0.079*	1.815	-0.030	-0.449	0.032**	-2.137	0.026	1.095
Females, 65+	-0.185***	-2.603	-0.066	-0.540	-0.053	-1.443	-0.005	-0.131
Location (district) dummy variables[e]								
Dowa	0.008	0.893	0.016	1.353	-0.005	-0.733	0.014**	2.538
Rumphi	-0.025***	-2.797	-0.031***	-2.621	-0.009*	-1.675	-0.014**	-2.246
Nkhotakota	-0.012	-1.488	0.025***	2.642	-0.012**	-2.180	-0.010*	-1.871
Dedza	-0.012	-1.488	-0.001	-0.102	-0.006	-1.383	0.001	0.164
Round variables								
Round 2	0.005	0.834	-0.010	-1.296	0.002	0.570	-0.008**	-2.072
Round 3	-0.020***	-2.849	-0.044***	-4.550	0.006*	1.865	-0.021***	-3.828
$\sigma_{21} / \sigma_{22}^2$					-0.019	-2.326		
σ	0.066	29.284	0.066	18.725			0.024	10.589
Likelihood ratio statistic	86.487		107.039				56.433	
P value	0.000		0.000				0.000	
Number of observations: 753								

a: 2SLS estimates; b: Simultaneous-Tobit estimates; c: Tobit estimates; d: Males 15-65 is reference category; e: Mangochi is omitted district.
*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 10.1 Household expenditure shares on food (produced at home and purchased) and access to formal credit in male-headed households: 2SLS estimates

Independent variables	Purchased		Home production	
	Coefficient	t statistic	Coefficient	t statistic
Constant	-1.155***	-2.588	2.092***	4.305
Ln total monthly expenditure	0.325***	3.940	-0.351***	-3.902
Ln total household size	-0.134**	-2.242	0.166**	2.560
Household agricultural area (acres)	-0.019***	-2.989	0.010**	2.543
Wife has access to formal credit	-0.032	-1.270	0.036	1.339
Husband has access to formal credit	-0.050*	-1.857	0.068**	2.349
Demographic composition[a]				
Males, 0-5	0.092	0.774	-0.121	-0.938
Females, 0-5	-0.028	-0.237	-0.019	-0.146
Males, 5-10	0.059	0.459	-0.026	-0.182
Females, 5-10	-0.156	-1.255	0.162	1.194
Males, 10-15	0.086	0.719	-0.052	-0.401
Females, 10-15	-0.033	-0.251	0.049	0.340
Females, 15-65	0.181	1.310	-0.159	-1.056
Males, 65+	0.396**	2.251	-0.374*	-1.953
Females, 65+	0.425	1.621	-0.279	-0.977
Location (district) dummy variables[b]				
Dowa	-0.197***	-3.577	0.214***	3.567
Rumphi	-0.095**	-2.315	0.127***	2.857
Nkhotakota	-0.233***	-7.331	0.254***	7.330
Dedza	-0.184***	-3.906	0.200***	3.900
Round 2	0.078***	3.160	-0.082***	-3.030
Round 3	0.063**	2.336	-0.050*	-1.693
Overidentification test	8.934		7.782	
P value	0.111		0.169	
Number of observations: 753				

a: Males 15-65 is reference category; b: Mangochi is omitted district.
*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 11 Household expenditure shares and access to formal credit in female-headed households: OLS and Tobit estimates

Independent variables	Food[a]		Energy		Health		Education	
	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic
Constant	0.716***	10.540	0.077**	2.055	-0.036*	-1.810	-0.028	-0.962
Ln total monthly expenditure	0.038***	3.736	-0.011*	-1.863	-0.0001	-0.025	0.001	0.263
Ln total household size	-0.012	-0.697	0.014	1.578	0.006	1.480	0.018**	2.513
Household agricultural area (acres)	-0.004*	-1.685	0.001	0.972	-0.0002	-0.363	0.0003	0.398
Has access to formal credit	-0.026*	-1.861	0.012	1.594	0.009**	2.503	-0.001	-0.169
Demographic composition[b]								
Males, 0-5	-0.175***	-2.934	0.060*	1.860	0.014	0.852	-0.035	-1.191
Females, 0-5	-0.027	-0.490	-0.024	-0.784	0.019	1.182	0.008	0.370
Males, 5-10	-0.038	-0.640	-0.025	-0.765	0.016	0.911	0.002	0.099
Females, 5-10	-0.073	-1.338	0.011	0.361	0.000	-0.001	-0.044*	-1.746
Males, 10-15	0.028	0.517	-0.031	-1.037	0.019	1.312	-0.033	-1.359
Females, 10-15	0.043	0.735	-0.027	-0.855	0.011	0.661	-0.008	-0.339
Females, 15-65	-0.054	-1.255	0.019	0.805	0.025**	2.036	-0.002	-0.111
Males, 65+	-0.024	-0.077	-0.124	-0.742	-0.768	-0.043	0.025	0.189
Females, 65+	-0.015	-0.261	-0.009	-0.286	0.033**	1.983	-0.006	-0.207
Location (district) dummy variables[c]								
Dowa	0.044*	1.752	-0.037***	-2.670	-0.005	-0.704	-0.023*	-1.836
Rumphi	0.042**	2.491	-0.012	-1.335	-0.003	-0.654	-0.019***	-2.589
Nkhotakota	0.032	1.559	-0.023**	-2.085	-0.0004	-0.075	-0.022**	-2.496
Dedza	0.031*	1.770	-0.015	-1.531	0.007	1.393	-0.019**	-2.297
Round variables								
Round 2	-0.010	-0.723	0.005	0.620	-0.010***	-2.739	-0.013**	-2.111
Round 3	0.001	0.072	0.0004	0.044	-0.016***	-3.389	-0.014**	-2.015
σ			0.050	21.979	0.018	10.564	0.026	9.566
F statistic	2.280							
Likelihood ratio statistic			32.020		47.505		44.187	
P value	0.002		0.031		0.000		0.001	
Number of observations: 275								

(Continued on next page)

a: OLS estimates; b: Males, 15-65 is reference category; c: Mangochi is omitted district.
*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 11 Household expenditure shares and access to formal credit in female-headed households: OLS and Tobit estimates (continued)

Independent variables	Adult goods		Children		Nondurables		Social activities	
	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic
Constant	-0.048*	-1.654	-0.147**	-2.068	0.170***	5.088	-0.049	-1.142
Ln total monthly expenditure	0.006	1.337	0.016*	1.651	-0.026***	-5.207	0.004	0.721
Ln total household size	-0.003	-0.471	-0.011	-0.708	0.003	0.336	-0.013	-1.409
Household agricultural area (acres)	-0.0001	-0.059	0.0001	0.073	0.002**	2.102	0.0001	0.112
Has access to formal credit	0.014**	2.263	0.002	0.146	0.006	0.880	0.002	0.274
Demographic composition[b]								
Males, 0-5	0.046*	1.837	0.187***	3.382	0.058**	1.971	-0.088	-1.522
Females, 0-5	0.028	1.212	0.045	0.834	0.010	0.382	0.068**	2.174
Males, 5-10	-0.007	-0.298	0.031	0.590	0.058**	2.022	-0.009	-0.239
Females, 5-10	0.032	1.418	0.103**	1.995	0.028	1.049	0.052*	1.755
Males, 10-15	-0.011	-0.486	0.047	0.954	0.008	0.314	0.031	0.968
Females, 10-15	-0.001	-0.027	-0.054	-0.850	-0.009	-0.308	0.021	0.647
Females, 15-65	0.008	0.453	0.018	0.397	0.016	0.762	0.014	0.492
Males, 65+	0.241**	2.059	-0.014	-0.042	0.024	0.158	-0.956	-0.035
Females, 65+	0.005	0.211	-0.046	-0.631	0.0001	0.003	0.019	0.526
Location (district) dummy variables[c]								
Dowa	0.010	1.017	-0.003	-0.116	-0.003	-0.221	-0.009	-0.740
Rumphi	-0.007	-0.950	-0.013	-0.879	-0.021**	-2.509	-0.026*	-1.840
Nkhotakota	-0.023**	-2.347	0.020	1.143	-0.011	-1.092	0.020**	2.088
Dedza	0.009	1.305	-0.004	-0.259	-0.007	-0.850	-0.001	-0.092
Round variables								
Round 2	0.015**	2.479	-0.011	-0.915	0.0004	0.064	-0.005	-0.664
Round 3	-0.004	-0.609	-0.052***	-3.232	0.010	1.226	0.035***	-2.884
σ	0.035	16.381	0.057	9.247	0.045	22.588	0.027	7.328
Likelihood ratio statistic	40.396		48.728		54.235		50.306	
P value	0.003		0.000		0.000		0.000	
Number of observations: 275								

a: OLS estimates; b: Males, 15-65 is reference category; c: Mangochi is omitted district.

*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 11.1 Household expenditure shares on food (produced at home and purchased) and access to formal credit in female-headed households: OLS estimates

Independent variables	Purchased		Home production	
	Coefficient	t statistic	Coefficient	t statistic
Constant	0.388**	2.158	0.328*	1.707
Ln total monthly expenditure	0.066**	2.436	-0.028	-0.956
Ln total household size	-0.071	-1.615	0.059	1.262
Household agricultural area (acres)	-0.00004	-0.007	-0.004	-0.589
Has access to formal credit	-0.053	-1.415	0.027	0.664
Demographic composition[a]				
Males, 0-5	-0.007	-0.042	-0.168	-0.997
Females, 0-5	0.219	1.518	-0.245	-1.591
Males, 5-10	-0.070	-0.449	0.032	0.193
Females, 5-10	0.064	0.444	-0.138	-0.888
Males, 10-15	0.071	0.493	-0.043	-0.278
Females, 10-15	0.042	0.273	0.001	0.005
Females, 15-65	0.033	0.294	-0.087	-0.718
Males, 65+	0.972	1.198	-0.996	-1.146
Females, 65+	-0.202	-1.298	0.187	1.120
Location (district) dummy variables[b]				
Dowa	-0.346***	-5.240	0.390***	5.514
Rumphi	-0.169***	-3.781	0.210***	4.412
Nkhotakota	-0.287***	-5.261	0.319***	5.464
Dedza	-0.337***	-7.259	0.368***	7.405
Round 2	0.054	1.439	-0.065	-1.599
Round 3	0.118***	2.887	-0.117***	-2.671
F statistic	7.950		6.960	
P value	0.000		0.000	
Number of observations: 275				

a: Males 15-65 is reference category; b: Mangochi is omitted district.
*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 12 Household expenditure shares and access to informal credit in male-headed households: 2SLS and Tobit estimates

Independent variables	Food[a]		Energy[b]		Health[b]		Education[c]	
	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic
Constant	0.920***	4.956	-0.032	-0.450	-0.139***	-3.008	-0.043	-1.262
Ln total monthly expenditure	-0.023	-0.669	0.011	0.932	0.020***	2.841	-0.001	-0.287
Ln total household size	0.033	1.330	0.007	1.116	0.003	0.870	0.033***	3.557
Household agricultural area (acres)	-0.001	-0.526	0.001	1.284	0.00004	0.084	0.0004	0.620
Wife has access to informal credit	-0.003	-0.367	-0.005	-1.041	-0.001	-0.366	0.015**	2.518
Husband has access to informal credit	0.012	1.322	-0.002	-0.539	0.004*	1.871	0.008	1.241
Demographic composition[d]								
Males, 0-5	-0.027	-0.559	0.022	1.046	0.010	0.778	-0.080**	-2.521
Females, 0-5	-0.044	-0.942	0.022	0.981	0.015	1.118	-0.119***	-3.274
Males, 5-10	0.043	0.836	-0.004	-0.140	0.012	1.054	-0.093***	-2.721
Females, 5-10	0.008	0.168	0.011	0.508	0.006	0.465	-0.090**	-2.571
Males, 10-15	0.040	0.832	-0.007	-0.287	0.011	0.941	-0.025	-0.813
Females, 10-15	0.016	0.312	0.009	0.467	-0.005	-0.329	0.017	0.496
Females, 15-65	0.028	0.502	0.030	1.436	0.009	0.558	-0.049	-1.377
Males, 65+	0.038	0.551	-0.081***	-2.620	-0.026	-1.337	-0.117*	-1.753
Females, 65+	0.156	1.479	0.093**	2.046	0.084***	3.201	-0.063	-0.643
Location (district) dummy variables[e]								
Dowa	0.020	0.902	-0.014	-1.389	0.004	0.719	-0.019*	-1.831
Rumphi	0.034**	2.022	-0.017**	-2.091	-0.004	-0.786	-0.007	-0.814
Nkhotakota	0.020	1.532	-0.026***	-3.278	-0.013***	-2.805	-0.001	-0.164
Dedza	0.019	1.021	-0.011*	-1.820	-0.002	-0.404	-0.022**	-2.447
Round variables								
Round 2	-0.009	-0.908	-0.003	-0.645	-0.012***	-4.200	-0.043***	-5.741
Round 3	0.010	0.968	-0.002	-0.339	-0.020***	-6.057	-0.015**	-2.278
$\sigma_{21} / \sigma_{22}^2$			-0.031	-2.594	-0.027	-3.668		
σ							0.050	16.721
Overidentification test statistic	5.628							
Likelihood ratio statistic							132.807	
P value	0.229						0.000	
Number of observations: 753								

(Continued on next page)

a: 2SLS estimates; b: Simultaneous-Tobit estimates; c: Tobit estimates; d: Males 15-65 is reference category; e: Mangochi is omitted district.

*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 12 Household expenditure shares and access to informal credit in male-headed households: 2SLS and Tobit estimates (continued)

Independent variables	Adult goods[c]		Children[c]		Nondurables[b]		Social activities[c]	
	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic
Constant	0.095***	2.853	-0.133***	-3.131	0.027	0.537	-0.038**	-1.993
Ln total monthly expenditure	-0.005	-1.096	0.010*	1.795	0.001	0.080	0.002	0.774
Ln total household size	-0.030***	-3.187	0.022*	1.956	0.002	0.456	0.006	1.141
Household agricultural area (acres)	0.001	1.427	-0.002	-1.640	0.001*	1.732	0.00001	0.027
Wife has access to formal credit	0.001	0.240	0.001	0.099	0.0005	0.148	-0.009***	-2.583
Husband has access to formal credit	0.003	0.530	-0.005	-0.657	0.001	0.173	0.002	0.593
Demographic composition[d]								
Males, 0-5	0.001	0.047	0.072*	1.919	0.015	0.870	-0.015	-0.843
Females, 0-5	0.067**	2.163	0.115***	2.950	0.003	0.162	-0.005	-0.249
Males, 5-10	-0.011	-0.322	-0.049	-1.193	-0.009	-0.465	0.007	0.344
Females, 5-10	0.027	0.819	-0.008	-0.208	0.026	1.543	-0.021	-1.046
Males, 10-15	-0.008	-0.258	0.024	0.584	-0.0002	-0.012	0.003	0.189
Females, 10-15	-0.020	-0.565	0.022	0.496	-0.004	-0.252	-0.023	-1.137
Females, 15-65	-0.032	-0.844	-0.012	-0.252	0.009	0.457	-0.001	-0.067
Males, 65+	0.065	1.491	-0.039	-0.584	-0.030*	-1.990	0.020	0.886
Females, 65+	-0.177**	-2.470	-0.071	-0.573	-0.054	-1.420	0.002	0.060
Location (district) dummy variables[e]								
Dowa	0.002	0.174	0.015	1.358	-0.004	-0.602	-0.012**	2.448
Rumphi	-0.031***	-3.327	-0.031***	-2.605	-0.009	-1.619	-0.013**	-2.178
Nkhotakota	-0.014*	-1.656	0.025***	2.723	-0.012**	-2.209	-0.009*	-1.657
Dedza	-0.017**	-2.192	-0.001	-0.128	-0.005	-1.206	-0.001	-0.260
Round variables								
Round 2	0.010	1.609	-0.007	-0.994	0.002	0.469	-0.009**	-2.490
Round 3	-0.015**	-2.108	-0.042***	-4.479	0.006*	1.759	-0.022***	-4.195
$\sigma_{21} / \sigma_{22}^2$					-0.019	-2.290		
σ	0.066	29.283	0.067	18.718			0.024	10.616
Likelihood ratio statistic	80.175		106.125				59.885	
P value	0.000		0.000				0.000	
Number of observations: 753								

a: 2SLS estimates; b: Simultaneous-Tobit estimates; c: Tobit estimates; d: Males 15-65 is reference category; e: Mangochi is omitted district.
*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 12.1 Household expenditure shares on food (produced at home and purchased) and access to informal credit in male-headed households: 2SLS estimates

Independent variables	Purchased		Home production	
	Coefficient	t statistic	Coefficient	t statistic
Constant	-0.976**	-2.179	1.897***	3.915
Ln total monthly expenditure	0.291***	3.488	-0.314***	-3.482
Ln total household size	-0.121**	-2.010	0.154**	2.369
Household agricultural area (acres)	-0.010***	-2.895	0.010**	2.475
Wife has access to informal credit	0.004	0.201	-0.007	-0.326
Husband has access to informal credit	-0.012	-0.538	0.024	1.004
Demographic composition[a]				
Males, 0-5	0.079	0.689	-0.106	-0.852
Females, 0-5	-0.029	-0.253	-0.016	-0.127
Males, 5-10	0.024	0.198	0.018	0.137
Females, 5-10	-0.174	-1.436	0.182	1.393
Males, 10-15	0.063	0.545	-0.023	-0.185
Females, 10-15	-0.043	-0.338	0.060	0.432
Females, 15-65	0.168	1.259	-0.140	-0.972
Males, 65+	0.341**	2.045	-0.303*	-1.680
Females, 65+	0.403	1.583	-0.247	-0.898
Location (district) dummy variables[b]				
Dowa	-0.217***	-4.077	0.237***	4.116
Rumphi	-0.110***	-2.730	0.144***	3.300
Nkhotakota	-0.227***	-7.296	0.247***	7.335
Dedza	-0.200***	-4.464	0.218***	4.520
Round 2	0.096***	4.160	-0.104***	-4.194
Round 3	0.082***	3.253	-0.072***	-2.638
Overidentification test	9.807		7.514	
P value	0.081		0.111	
Number of observations: 753				

a: Males 15-65 is reference category; b: Mangochi is omitted district.
*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 13 Household expenditure shares and access to informal credit in female-headed households: OLS and Tobit estimates

Independent variables	Food[a]		Energy		Health		Education	
	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic
Constant	0.726***	10.766	0.072*	1.920	-0.045**	-2.238	-0.022	-0.794
Ln total monthly expenditure	0.033***	3.320	-0.008	-1.482	0.002	0.550	0.002	0.382
Ln total household size	-0.011	-0.637	0.014	1.512	0.009*	1.924	0.016**	2.303
Household agricultural area (acres)	-0.004*	-1.676	0.001	0.953	0.000	-0.635	0.001	0.606
Has access to informal credit	0.021*	1.655	-0.008	-1.205	0.004	1.054	-0.010*	-1.933
Demographic composition[b]								
Males, 0-5	-0.183***	-3.063	0.064**	1.960	0.012	0.691	-0.031	-1.078
Females, 0-5	-0.035	-0.633	-0.021	-0.674	0.016	1.039	0.009	0.383
Males, 5-10	-0.054	-0.918	-0.017	-0.510	0.015	0.856	0.002	0.101
Females, 5-10	-0.071	-1.284	0.010	0.312	-0.001	-0.048	-0.044*	-1.792
Males, 10-15	0.002	0.046	-0.020	-0.662	0.020	1.354	-0.028	-1.178
Females, 10-15	0.024	0.405	-0.019	-0.580	0.012	0.745	-0.007	-0.289
Females, 15-65	-0.064	-1.501	0.024	1.007	0.028**	2.229	-0.004	-0.245
Males, 65+	-0.109	-0.353	-0.088	-0.520	-0.773	-0.043	0.060	0.476
Females, 65+	-0.022	-0.377	-0.006	-0.194	0.032*	1.913	-0.004	-0.164
Location (district) dummy variables[c]								
Dowa	0.038	1.501	-0.035**	-2.486	-0.006	-0.791	-0.019	-1.577
Rumphi	0.035**	2.073	-0.009	-1.012	-0.004	-0.929	-0.017**	-2.316
Nkhotakota	0.038*	1.824	-0.026**	-2.308	-0.002	-0.388	-0.023***	-2.649
Dedza	0.033*	1.861	-0.016	-1.615	0.005	1.052	-0.018**	-2.222
Round variables								
Round 2	0.002	0.158	-0.001	-0.091	-0.012***	-3.094	-0.016***	-2.632
Round 3	0.020	1.252	-0.008	-0.912	-0.018***	-3.765	-0.018***	-2.633
σ			0.050	21.981	0.018	10.534	0.025	9.586
F statistic	2.240							
Likelihood ratio statistic			30.940		42.101		47.926	
P value	0.003		0.041		0.002		0.000	
Number of observations: 275								

(Continued on next page)

a: OLS estimates; b: Males, 15-65 is reference category; c: Mangochi is omitted district.
*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 13 Household expenditure shares and access to informal credit in female-headed households: OLS and Tobit estimates (continued)

Independent variables	Adult goods		Children		Nondurables		Social activities	
	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic	Coefficient	t statistic
Constant	-0.057*	-1.954	-0.138**	-1.995	0.168***	5.053	-0.058	-1.312
Ln total monthly expenditure	0.008*	1.864	0.017*	1.837	-0.025***	-5.079	0.005	0.836
Ln total household size	-0.002	-0.340	-0.015	-0.990	0.003	0.312	-0.011	-1.236
Household agricultural area (acres)	-0.0002	-0.214	0.0004	0.244	0.002**	2.094	0.00004	0.047
Has access to informal credit	-0.002	-0.377	-0.030**	-2.463	-0.005	-0.741	0.004	0.587
Demographic composition[b]								
Males, 0-5	0.048*	1.886	0.204***	3.610	0.060**	2.028	-0.089	-1.513
Females, 0-5	0.030	1.254	0.050	0.920	0.012	0.442	0.071**	2.223
Males, 5-10	-0.003	-0.137	0.039	0.743	0.062**	2.148	-0.005	-0.145
Females, 5-10	0.031	1.360	0.111**	2.132	0.028	1.022	0.054*	1.783
Males, 10-15	-0.004	-0.167	0.072	1.415	0.014	0.531	0.032	0.994
Females, 10-15	0.009	0.339	-0.039	-0.616	-0.004	-0.149	0.024	0.739
Females, 15-65	0.013	0.718	0.023	0.499	0.018	0.874	0.018	0.613
Males, 65+	0.258**	2.167	0.125	0.380	0.043	0.283	-0.966	-0.036
Females, 65+	0.007	0.286	-0.044	-0.612	0.002	0.054	0.024	0.658
Location (district) dummy variables[c]								
Dowa	0.011	1.102	0.005	0.213	-0.001	-0.109	-0.011	-0.850
Rumphi	-0.005	-0.643	-0.004	-0.287	-0.019**	-2.303	-0.026*	-1.873
Nkhotakota	-0.025***	-2.590	0.018	1.019	-0.012	-1.213	0.020**	2.083
Dedza	0.008	1.142	-0.003	-0.215	-0.008	-0.893	-0.001	-0.084
Round variables								
Round 2	0.010*	1.742	-0.019	-1.586	-0.002	-0.350	-0.004	-0.573
Round 3	-0.010	-1.477	-0.067***	-4.014	0.005	0.664	-0.035***	-2.821
σ	0.035	16.351	0.056	9.273	0.045	22.591	0.027	7.321
Likelihood ratio statistic	35.406		55.279		54.010		50.580	
P value	0.012		0.000		0.000		0.000	
Number of observations: 275								

a: OLS estimates; b: Males, 15-65 is reference category; c: Mangochi is omitted district.

*, **, *** represent significance at 10%, 5% and 1%, respectively.

Table 13.1 Household expenditure shares on food (produced at home and purchased) and access to informal credit in female-headed households: OLS estimates

Independent variables	Purchased		Home production	
	Coefficient	t statistic	Coefficient	t statistic
Constant	0.435**	2.436	0.291	1.526
Ln total monthly expenditure	0.059**	2.212	-0.026	-0.900
Ln total household size	-0.079*	-1.801	0.069	1.465
Household agricultural area (acres)	0.001	0.134	-0.004	-0.719
Has access to informal credit	-0.015	-0.464	0.036	1.022
Demographic composition[a]				
Males, 0-5	-0.001	-0.003	-0.183	-1.081
Females, 0-5	0.215	1.484	-0.249	-1.617
Males, 5-10	-0.083	-0.536	0.029	0.178
Females, 5-10	0.064	0.436	-0.134	-0.864
Males, 10-15	0.054	0.373	-0.051	-0.334
Females, 10-15	0.015	0.097	0.009	0.052
Females, 15-65	0.010	0.090	-0.074	-0.616
Males, 65+	0.987	1.202	-1.096	-1.253
Females, 65+	-0.215	-1.377	0.193	1.159
Location (district) dummy variables[b]				
Dowa	-0.344***	-5.150	0.382***	5.365
Rumphi	-0.170***	-3.779	0.206***	4.281
Nkhotakota	-0.281***	-5.155	0.319***	5.483
Dedza	-0.333***	-7.157	0.366***	7.376
Round 2	0.064*	1.686	-0.062	-1.526
Round 3	0.129***	3.124	-0.110***	-2.489
F statistic	7.800		7.010	
P value	0.000		0.000	
Number of observations: 275				

a: Males 15-65 is reference category; b: Mangochi is omitted district.
*, **, *** represent significance at 10%, 5% and 1%, respectively.

Discussion

The credit–labor allocation models indicate that access to formal as well as informal credit *increases* participation in off-farm self-employment activities, and *reduces* participation in own farm work for women in male-headed households. Access to informal credit *increases* men's participation in off-farm self-employment activities. Women's access to formal credit also *reduces* men's participation in own farm work.

For women in male-headed households, access to credit enables them to transition into self-employment while reducing their involvement on the farm. The higher returns to women's labor attract women into off-farm self-employment from their work on the farm and serve to diversify the household's income sources. Although food security is an important goal for farm households in Malawi, it is also the case that landholdings are, on average, very small and the need exists for diversification into other enterprises. Diversification of income sources helps the goal of achieving food security by increasing the purchasing power of households, so that they can also buy some of their food requirements in the market instead of relying solely on their farm output. In many developing countries, diversification into off-farm wage employment is possible. Unfortunately, in rural Malawi, few opportunities exist for off-farm formal wage employment and, hence, off-farm self-employment must be relied upon to provide the additional income. Opportunities do exist to work as off-farm casual laborers (*ganyu* workers) during the peak agricultural season, to work at very low wages for cash or for food. This, however, clashes with the household's own farming activities, leading to low yields on-farm.

An increase in women's participation in income-generating self-employment activities is of interest because not only does it give them independent access to resources, but it also enables them to make a greater contribution to household income and welfare, thus possibly enhancing their status within the household. This nexus between access to credit and women's status and bargaining power likely has implications for other policy measures that aim to improve welfare measures such as the increased adoption of new technologies, lower fertility, and improved human capital investments.

In female-headed households, access to credit does not seem to have a relationship with their self-employment activity. In part this result may reflect the small sample size of the data on female-headed households in the data set. On the other hand, female-headed households are poorer on average than male-headed households and there may be a weaker link, if any, between their access to credit and their actual involvement in self-employment activity. That is, they may have access to credit but be constrained by other barriers to being self-employed – these households may have less adult labor, for example.

Men's access to formal credit does not affect their participation in farm work or off-farm work, while their access to informal credit increases their participation in off-farm work. Many men in rural

Malawi work on their own farms and, therefore, access to formal credit that is *directed toward providing agriculture inputs* does not influence participation but likely affects work intensity and agricultural output. The participation models do not reflect changes in the intensity of own-farm work as a result of access to formal credit targeted to the agricultural sector. What is interesting is that since men do not have access to formal credit allowing them to move into off-farm self-employment, they use other ways of accessing funds. Men appear to be moving into off-farm jobs only through their own informal credit access and perhaps through the formal credit access of their wives. The latter has the effect of reducing their participation in own-farm work. This suggests that men may also be looking for self-employment opportunities in an effort to reduce dependence on agricultural production as the principal income source. Malawi suffered two major droughts during the 1990s, in 1991-92 and in 1993-94, followed by a below-average maize crop in 1994-95, thus making it very likely that men are also turning to the off-farm sector to help diversify household income sources and maintain basic food security. Since formal credit to men is mainly in-kind agricultural credit, it cannot be used for off-farm economic activity, with the result that when they have access to credit through informal networks, they attempt to diversify. Formal credit programs, at times of natural calamities that make agriculture non-profitable, may want to diversify their loan options to better serve poor households. In fact, a more flexible approach by the credit programs that allows them to lend for off-farm activities during poor agricultural periods may also work to their own benefit by preventing a total loss on their loans to the farm households.

The results suggest that formal credit programs that intended to target women for self-employment are indeed engaging women in such activities. The interesting effect of targeting women for self-employment is that men's access into self-employment is now mainly through their wives. This could be potentially problematic if men later 'take over' the enterprise from women, who will still have to bear the repayment burden of the loan. In fact, this very issue has generated a fair amount of debate among researchers, with some studies reporting that women are worse off because they have lost 'control' of the loan and the enterprise, but have to repay the loan. On the other hand, other studies contend that due to cultural values and traditions women may willingly not want to be at the forefront of the self-employment activity, but still enjoy 'control' of the enterprise or an improvement in status within the household due to their access to formal credit (see Kabeer 2001 for an interesting discussion on this topic). A more careful understanding of the behavior of rural households in Malawi is required before the results from this study can be extended to include issues of control over loans and the self-employment activity.

As shown in other studies of off-farm employment in Africa, education in rural Malawi appears to be a differentiating characteristic between those working off-farm and those allocating time to farm work. More education among men in Malawi encourages their participation in off-farm self-employment,

whereas those men with less education are concentrated on farms. However, this relation does not appear to be true where women are concerned: education does not influence their labor allocation. This suggests that women are engaging in low-skill self-employment activities where the level of education does not really make a difference. While access to credit gives women the capital necessary for self-employment, it is likely that the self-employment options available to them are not varied. This observation is also borne out from the descriptive analyses. This is cause for concern because if returns to education for women in rural areas are very low, then investment in human capital is also likely to be affected, proving detrimental to long-term household welfare.

Locational characteristics were found to be important in explaining participation in self-employment activity. In particular, a high population density and the consequent pressure on limited agricultural land encourage participation in off-farm self-employment activities. It is also likely that the matrilineal system that is predominant in the southern region of Malawi (and to a lesser extent in the central region) helps women take better advantage of their opportunities.

The results of the credit–expenditure models suggest that *individual access to credit* is important in determining household allocation patterns. Furthermore, the impact of credit on household expenditures is also dependent on the sector of credit. The results from the expenditure models do not unequivocally support the hypothesis that men spend more on items of personal consumption while women are more oriented towards children and household welfare. While women in Malawi (spouses and heads) do seem to spend more on general household items (nondurables), health and education, men in Malawi are also spending less on adult goods when they have access to formal credit. Female heads, on the other hand, increase the share of household expenditure on adult goods with access to formal credit.

Men's access to formal credit is predictably enhancing agricultural output, while for women formal credit is being directed towards health expenditures. Interestingly, expenditures on health increase in all the models, except for female heads' access to informal credit. This suggests that health care is of primary concern and that additional income will be invested in that direction. This result is of interest because of the long-term benefits that households can enjoy due to better health and in turn, increased productivity. An interesting result is that child-related investments (education, clothing and accessories) are negatively affected by female head's access to informal credit. Combined with the results from the other equations in the models, it suggests that child-related investments are not yet a 'priority' area for the household. As long as basic concerns like food security and minimum levels of welfare in the household are not addressed it is unlikely that investments in education and children will increase.

It is reasonable to expect that women may make different consumption choices with nonlabor income (as in other studies that have shown a greater effect) than with credit. Women in poor households

may be faced with a choice of whether to invest in the enterprise or utilize it towards household consumption. If used towards household consumption, it is beneficial in the short term, but not necessarily in the long term. If used for the self-employment activity, then credit will not make as much of an impact on household consumption patterns as might be expected.[1] This can potentially explain why credit is not affecting household consumption compared to previous studies that have estimated the impact of nonlabor income on consumption in the household.

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[1] Women in wealthy households may not be faced with this choice as they may have other income sources that can help 'smooth consumption.'

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Table A1 Results of the multinomial logit model for predicting probability choices for the household, corrected for choice-based sampling (weighted-exogenous-sample maximum likelihood estimates)

Independent variables	Marginal effects for membership status of the household		
	Never	**Current**	**Past**
Constant	3.300***	-2.526***	-0.774***
	(10.146)	(-8.172)	(-4.630)
Age of household head	-0.050***	0.044***	0.0050
	(-5.156)	(4.479)	(1.028)
(Age of household head)^2	0.001***	-0.0004***	-0.0001
	(4.962)	(-4.201)	(-1.133)
Male-headed household (dummy variable)	-0.037	-0.018	0.055*
	(-0.812)	(-0.407)	(1.823)
Head attended primary school (dummy variable)	-0.010	0.036	-0.025
	(-0.207)	(0.731)	(-0.971)
Total adult population in the household (15 to 64 years of age)	-0.085***	0.070***	0.014
	(-4.352)	(3.927)	(1.332)
Dependency ratio (household members aged less than 15 and over 64 divided by total household size)	-0.552***	0.418***	0.134**
	(-5.641)	(4.291)	(2.444)
Share of agricultural land of total land owned	-0.264**	0.280***	-0.017
	(-2.285)	(2.608)	(-0.236)
Log (total value of assets owned by household)	-0.160***	0.140***	0.020
	(-6.318)	(5.919)	(1.451)
Share of value of livestock of total value of assets owned	0.678***	-0.767***	0.089
	(4.277)	(-5.254)	(1.175)
Share of value of land of total value of assets owned	-0.060	-0.095	0.155***
	(-0.602)	(-1.027)	(2.988)

Continued on next page

t statistics are presented in parentheses. *, **, *** represent significance at 10%, 5% and 1%, respectively.

Table A1 Results of the multinomial logit model for predicting probability choices for the household, corrected for choice-based sampling (weighted-exogenous-sample maximum likelihood estimates) continued

Independent variables	Marginal effects for membership status of the household		
	Never	**Current**	**Past**
Location (district) dummy variables[a]			
Dedza	0.121*	-0.088	0.209***
	(-1.823)	(-1.394)	(5.195)
Dowa	-0.057	-0.108	0.166***
	(-0.767)	(-1.549)	(3.742)
Nkhotakota	-0.188**	0.036	0.153***
	(-2.537)	(0.523)	(3.447)
Rumphi	0.029	-0.125*	0.096**
	(0.406)	(-1.923)	(2.014)
Log likelihood function		-652.947	
Restricted log likelihood		-796.262	
Likelihood ratio statistic ($?^2$)		286.631	
P value		0.0000	
Likelihood ratio index (McFadden's pseudo R^2)		0.18	
Number of observations		403	

a: Mangochi is omitted district; t statistics are presented in parentheses.

*, **, *** represent significance at 10%, 5% and 1%, respectively.