Constraints to Tanzanian Agricultural Development: Input Use in Households Under Non-Separability

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Abstract

This paper builds on the literature testing for labor market inefficiencies in developing countries. Empirical tests using a panel data survey from Tanzania first reject the homogeneity of family and hired labor, and then reject labor market separation or completeness. Further tests for the efficient allocation of manure among plots reject, revealing that agricultural households face considerable constraints in factor markets. All rejections, except hired harvest labor, are robust to the inclusion of household-specific effects, and control for heterogenous household preferences, and village-specific shocks. I incorporate high-resolution annual population estimates from the LandScan database, which uses satellite imagery to construct population estimates, and find that in areas with higher population density, less family labor is used and more hired labor is used. JEL Codes J1, J43, O12, Q10, Q12, Q13, Q16

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1 Introduction

Smallholder farms still account for a large share of labor in developing countries, and in many countries a substantial portion of this labor is provided by family members. Starting with the work by Chayanov (1986), analysis of agricultural households' behavior dates back decades in the empirical microeconomics literature. In this paper, utilizing the framework of the separability hypothesis as advanced by Benjamin (1992), I analyze three major aspects of smallholder farms in Tanzania. First, I analyze the substitution of family and hired labor in different periods of the agricultural season. Supported by the results of those tests, I analyze, using reduced form expressions for labor demand, whether household consumption and production are interlinked through their choice of labor allocations, 'separable.' As part of the reduced-form labor demand estimates, I utilize a remote-sensing dataset to estimate the effects of population density as a determinant of labor use. Last, I assess whether smallholder farms in Tanzania are constrained in their use of organic fertilizer, a valuable and accessible input to many smallholders.

The main inspiration for this paper is the seminal *Econometrica* paper by Dwayne Benjamin, which explored family and hired labor use on rice-growing farms in Central Java (Indonesia) in the 1980s (Benjamin, 1992). Following the basic framework in Benjamin (1992), this paper examines Tanzanian household's participation in functioning labor markets. As is argued by Benjamin (1992) and Card et al. (1987), market prices and wages should function as indicators if markets are complete and efficient. If this type of mechanism is in operation it should lead to a detectable 'separation' between household productive and consumption activities. There is a growing body of literature now analyzing market access or market completeness issues across many countries (LaFave and Thomas, 2016). For example, if we say that labor markets are incomplete, it is implied that households must rely on family members to provide agricultural and other enterprise labor, which reflects that their demand for quality hired labor is going unmet. In contrast, if markets were complete and farmers are profit maximizing, farm decisions about hired labor and other input use would be determined exclusively by farm characteristics and input prices including wages. If, on the other hand, household production decisions rely on household parameters, such as the number of residents in the household, the wealth of the household, the number of livestock in the household's herd, the level of fitness of the residents of that household, or their consumption levels, then we must estimate both consumption and production jointly in order to yield consistent results. An F-test or a likelihood ratio test of the exclusion restriction of all household parameters, or simply a T-test of any coefficient on household characteristics, may be interpreted as tests for the presence of complete labor markets; if household production still relies principally on family labor, tests for the effects of household demographics on household production should yield a significant result. Benjamin notes that there can be several potential sources of separation in labor markets, this paper is principally molded around addressing those broad areas. Following the analysis of the separation of labor decisions from household characteristics and building on analysis in Gavian and Fafchamps (1996), I analyze whether household characteristics affect manure use, and explore whether factor markets for manure could exist.

The contributions of this paper are several: first this work builds on the analysis of labor market inefficiencies, and extends this analysis for the first time to sub-Saharan Africa using a rich set of panel data. I also test for and estimate explicitly the elasticity of substitution between family and hired labor, which is considered an important potential source of separation. Lastly, I incorporate high quality population density data using the LandScan dataset provided by the OakRidge National Laboratory (ORNL) to analyze the effects of population density on labor use. To the best of my knowledge, this type of data has not yet been used to analyze labor market outcomes in developing countries.

The following section discusses the idea of separation and market completeness. I outline potential sources of separation, including differences in the marginal products of family and hired labor. I outline the meaning of separation in this context, and I discuss tests to examine explicitly the breakdown of differences in family and hired labor. In section 3 I give background on the datasets and data collection process. In section 4, I report results of tests for labor heterogeneity, and then I go on to report the results of tests for separation between household characteristics and labor supplied to the farm, and tests for the optimal allocation of fertilizer across all plots, and verify the existence of a relationship between household characteristics and fertilizer allocation (non-separability in manure markets). Section 5 discusses potential implications for agricultural policies and concludes.

2 Theoretical Background

Separation of Production and Consumption Activities

Benjamin (1992) theorizes that there may be three principal sources of breakdowns in the labor market that lead to nonseparation: (1) a binding constraint on off-farm employment, (2) labor rationing, (3) and differences in the returns to on-farm and off-farm employment. I will now explore each of these potential breakdowns in more detail, and discuss how this applies to Tanzania.

Based on the above outline the following hypotheses will be considered in this paper:

- H1: Family and hired labor in Tanzania are imperfect substitutes. The elasticity of substitution between family and hired labor is (not) constant.
- H2: There exists a (no) separation between labor committed to household farming activities and household consumption, assets, wealth, and household demographics
- H3: Organic fertilizer is allocated efficiently within households and within villages. There exists a (no) separation between organic fertilizer use and household consumption, assets, wealth, and household demographics

Labor Heterogeneity

Whether labor hired from the marketplace is comparable to family labor is an important question. If there exists a differential between hired and family labor, this could contribute to the observation of separation. The literature on the homogeneity of labor can be divided largely into two types of tests, what I have termed a Bardhan-Frisvold type test, and the Deolalikar-Vijverberg test. The first test estimates a Cobb-Douglas production function, but assumes that the marginal products may differ between family and hired labor. This method avoids an explicit estimation of the elasticity of substitution *between* hired and family labor, whereas the Deolalikar-Vijverberg test, which uses a simultaneous estimation procedure to estimate a labor services function, seems, *a priori*, less restrictive in the way it allows for substitution of family and hired labor, zero-labor inputs, and higher-order terms.

Bardhan-Frisvold Type Tests

Bardhan (1973) Journal of Political Economy paper on farm size estimates a Cobb-Douglas production function. In this paper, using Indian agricultural data from the Farm Management Surveys, the author finds that family and hired labor are *not* substitutable in West Godavari and Thanjavur, but for the remaining districts in the sample the author cannot reject homogeneity of labor. Frisvold (1994) explores labor heterogeneity, again using Indian household survey data.

The author's primary motivations are to explore supervisory costs and how they affect farm activity, but he also examines the question of labor heterogeneity. Using a similar specification to Bardhan (1973), Frisvold (1994) rejects labor homogeneity and finds that family supervision labor augments hired labor.
Bardhan (1973) and Frisvold (1994) both estimate a production function similar to:

$$\ln q = \ln \alpha_0 + \alpha_1 \ln A + \alpha_2 \ln V + \alpha_3 \ln L + \theta \ln RATIO + \delta_1 SOIL_1 + \delta_2 HYV + \sum_{k=3}^{n} \delta_k Z_k + u \quad (1)$$

where L is total labor (F+H) labor services functions of the following form:

$$E = (F+H)\left[\frac{F}{F+H}\right]^{\gamma} \quad (2)$$

in log form:

$$\log(E) = \log(F+H) + \gamma \cdot \log\left(\frac{F}{F+H}\right) \quad (3)$$

E represents effective total labor, F is family labor, and H is hired labor; γ can then be estimated by OLS. If family and hired labor are perfect substitutes, I can test $\gamma = 0$. Unfortunately the data available to me do not include the same type of detailed information about supervisory labor that are available for Frisvold (1994), so further analysis of supervision of hired labor is left to future research.

Deolalikar and Vijverberg tests

Deolalikar et al. (1987) use a generalized quadratic labor services function to test for the effects of labor heterogeneity using Indian and Malaysian data. Importantly they separate two aspects: (a) perfect substitutability, and (b) a quality differential between family and hired labor. They outline in their article the implications for labor heterogeneity between hired and family labor; if the two are substitutes, the authors argue, and family members migrate away from the village farms, this will raise the wages of hired labor. They add that in the case that the two are not at all substitutable, an outmigration of family labor could actually decrease demand for hired labor. This makes sense particularly when hired labor markets are illiquid or incomplete. In contrast to Tanzania, India and Malaysia have or had active agricultural labor markets, with most farms hiring in some labor. In Tanzania, on the other hand, a smaller percentage of farms, 43% in my sample, hire-in labor. Deolalikar et al. (1987) reject perfect substitutability between family and hired labor in both India and Malaysia. They also find that hired labor is more efficient in terms of output than family labor using the ratio of marginal productivities.

Following the specification of their paper, a Cobb-Douglas form is estimated, and a generalized quadratic form is used to characterize the labor services function. The reason for using the quadratic form nested in a Cobb-Douglas is that, by contrast, in Cobb-Douglas the marginal product of all inputs goes to infinity as as the input goes to zero. Using the quadratic form will allow for slightly more flexibility than Benjamin (1992), as I would like to consider explicitly the nature of the substitution of hired and family labor.

$$lnY = lnC + \beta_1 lnL + \beta_2 lnA + \Sigma_i \beta_i lnX_i + \varepsilon \quad (4)$$

in the above equation, Y is output, and labor services L , A represents services from land, and X_i= quantity of input i. Continuing in the format of Deolalikar et al. (1987), I assume that labor services are produced using family labor and hired labor by the generalized quadratic function:

$$L = \alpha_1 L_f + (1 - \alpha_1)L_h + \delta_{11}L_f^2 + \delta_{22}L_h^2 + \delta_{12}L_h \cdot L_f \tag{5}$$

This form is flexible enough to allow various elasticities of substitution between family and hired labor (Deolalikar et al., 1987). In order for equation (4) to be concave, equation (5) must also be concave, a necessary condition is that δ_{11} and δ_{22} are not positive. Furthermore, α_1 and $(1 - \alpha_1)$ must be positive. Following Deolalikar et al. (1987), the appropriate test is then an likelihood ratio (LR) test that $\delta_{11} = \delta_{22} = \delta_{12} = 0$, which is a direct test of the hypothesis of perfect substitutability between labor types. If the two types of labor are equivalent, $\alpha_1 = 0.5$, then equations (4) and (5) simplify to a standard Cobb-Douglas form:

$$L = \alpha_1 L_f + (1 - \alpha_1)L_h \tag{6}$$

Note that, in the case where $\delta_{11} = \delta_{22} = \delta_{12} = 0$, and we are in a Cobb-Douglass unviverse, the marginal product of labor is given in full by $\beta_1 \cdot \alpha_1 L_f$ and $\beta_1 \cdot (1 - \alpha_1)L_h$ and we have:

$$lnY = lnC + \beta_1\alpha_1 lnL_f + \beta_1(1 - \alpha_1)lnL_h + \beta_2 lnA + \Sigma_i\beta_i lnX_i + \varepsilon \tag{7}$$

Fertilizer Factor Allocation

A final strategy I employ in understanding Tanzanian agricultural households is to analyze intensity of input use in the form of organic fertilizer. Organic fertilizer is much more abundant and accessible in Tanzania than chemical fertilizers, as organic fertilizer is simply an output from livestock kept by many farms. Similar to Gavian and Fafchamps (1996), I regress organic fertilizer use per acre on household and plot characteristics. Organic fertilizer is considered a short term investment since it's benefits may last longer than one cropping season (Gavian and Fafchamps, 1996). If markets for organic fertilizer inputs are functioning and complete, returns to fertilizer should be equalized across all plots conditional on plot characteristics, crop choice, and weather. Although organic fertilizer is too bulky to transport, at least in the West African context overnight paddocking contracts have been documented. Gavian and Fafchamps (1996) find that land holdings per household member negatively influenced organic fertilizer use per hectare, and that organic fertilizer use was largely determined by the size of the livestock holdings of the household.

3 Data

The data used are from the World Bank's Living Standards Measurement Survey (LSMS) instrument from Tanzania, which includes a substantial agricultural component captured over four waves from 2008-2015. All waves of data are freely available from several sources including the World Bank website and the website of the Tanzanian National Bureau of Statistics. Data were collected on basic household demographic characteristics, and the questionnaire included modules on labor, consumption, assets, and anthropometric data for household members. Agricultural data were recorded separately, but at the same sitting for the two agricultural seasons experienced in some parts of Tanzania. For the two separate seasons, locally referred to as the 'short rainy' season and the 'long rainy' season, plot inputs and are recorded as one observation per year, though outputs are recorded separately and summed across seasons for our analysis.

An important feature of this dataset is that records kept at the plot level are highly detailed. Included are information on plot ownership, seed type and purchases, fertilizer use, which household member manages the plot, as well as which family members provide labor on the plot and whether or not any hired labor was used. Descriptive statistics for household demographic characteristics as well as farm assets and other characteristics can be found in Table 3.

Wave 1 of the survey was collected from September 2008 and the bulk of interviews were completed by September of the following year. The sample contains 3,265 households, including 16,709 individuals, with a median of 5 members per household. There were 5,126 plots held by 2,284 households, 4,934 (96%)of which were planted, and 81 percent of households in the sample held agricultural land. The median number of plots in the 2008-09 survey wave is 2.5 plots per (planted) agricultural household with an median overall land area of 2.5 (s.d.=11)) acres. The household head has an median age of 43, whereas the median household age is only 22.3, quite a large gap. The average adult (12-65) in a household has 5 years of schooling, and is 34 years of age. Households have a median of 2 children, 2 adult members, and a median of 0 senior members.

Wave 2 was collected from October 2010 with the majority of interviews completed by September 2011. The second wave sample contains 3,924 households, including 20,559 individuals with a median of 5 members per household. Included are 3,168 round one households, a re-interview rate of 97 percent. Households with agricultural land represent 2,630 households (67 percent) in the survey, and there are a total of 3,829 planted plots, with a median of 2 plots per agricultural household and an average farm size of 2.8 (s.d.=10) acres.

Collection for wave 3 began in October of 2012 with interviews nearly complete by the end of October 2013. The 3rd wave of the sample is expanded, and includes 5,010 households and 25,412 individuals with a median of 6 members per household. The households who held agricultural land were 3,300 (65 percent) with a total of 4,934 usable plots, a median of 2 plots per farm household with an average farm size of 3 (s.d.=15.7) acres.

The fourth wave of the survey sampled the same villages, but replaced the households in the sample. The interviews began in October 2014 and were completed by August 2015. It includes 3,352 households and 16,285 individuals. The median number of household members remains 6. The agricultural modules contains data on 4,291 plots with the average farm size being 3.4 (s.d.=16) acres. The median number of plots planted per agricultural household is 2.

Descriptive table 1 shows both family and hired labor use at the plot level. Labor is split into harvest and preparatory periods. Family labor use is much higher than hired labor use on average. Average hired labor use in both the preparatory and harvest periods appears to be very stable across all waves.

LandScan Data

LandScan gridded population data is a set of gridded population estimates, available on an annual basis, with a fine resolution allowing analysis at a more dissaggregated level. These data originate from the OakRidge National Laboratory (ORNL), which is a research institution funded by the US Department of Energy, and managed in partnership with the University of Tennessee. The estimates which are generated by an algorithm that takes as its primary inputs high resolution, proprietary daytime imagery. The following brief description comes from the ORNL-LandScan documentation, "the modeling process uses sub-national level census counts for each country and primary geospatial input or ancillary datasets, including land cover, roads, slope, urban areas, village locations, and high resolution imagery analysis; all of which are key indicators of population distribution."[1]

[1]https://landscan.ornl.gov/documentation/#inputData

Table 1: Deolalikar-Vijverberg Test - NLLS Estimates

VARIABLES	b0	α_1	δ_{11}	δ_{22}	δ_{12}
	13.22***	0.424***	0.00326***	0.000859***	0.0141***
	(0.172)	(0.00131)	(0.000107)	(1.24e-05)	(0.000136)
Observations	25,467	25,467	25,467	25,467	25,467
R-squared	0.870	0.870	0.870	0.870	0.870

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	b0	α_1	δ_{11}	δ_{22}	δ_{12}
	3.013***	0.461***	-0.00153***	0.000781***	0.0236***
	(0.0582)	(0.00150)	(0.000174)	(2.27e-05)	(0.000281)
Observations	25,467	25,467	25,467	25,467	25,467
R-squared	0.809	0.809	0.809	0.809	0.809

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4 Results

Tests for Labor Heterogeneity

Deolalikar and Vijverberg Generalized Quadratic NLLS Estimates

In the case of this dataset I chose to estimate preparatory labor (any labor that occurs pre-harvest including planting, weeding, and fertilizing activity) and harvest labor separately. This is in contrast with the original authors who estimate all farm labor together, with the only distinction being between family and hired labor. The first test is a likelihood ratio test of the model ($\delta_{11} = \delta_{22} = \delta_{12} = 0$). The test for the preparatory labor period rejects with $\lambda_3 = 28672.14$, and $\lambda_3 = 12929.81$ which are both significant at the .1% level. This means that in both the harvest period and the preparatory labor period I can reject perfect substitutability between hired labor and family labor. I perform the likelihood ratio tests then for the perfect substitutability of labor ($\delta_{11} = \delta_{22} = \delta_{12} = 0; \alpha_1 = 0.5$) and in both cases, homogeneity of labor is rejected: $\lambda_4 = 52043.73$ for the preparatory period, and $\lambda_4 = 42101.23$.

Next I present the full results from the nonlinear least squares estimates of the parameters in expression (4). The estimates for α_1 are 0.424 for the preparatory season, and $\alpha_1 = 0.461$ in the harvest labor season. This indicates that family labor increases to be more productive during the harvest labor period, and that the ratio of the marginal productivities ($\alpha_1/1 - \alpha_1$) is larger in the harvest season, 0.74 (prep) compared to 0.86 (harv). This ratio being closer to unity indicates higher/greater substitutability. This is slightly lower than but comparable to 0.78 for Malaysia, and quite far off from the estimated 0.32 for Matar Taluka (India) in Deolalikar et al. (1987).

As we can see, the preceding exercise has indicated that hired and family are not perfect substitutes, neither in the preparatory period, nor in the harvest period. The harvest period estimates indicate that the marginal product of family labor is positive but decreasing, significant at the 0.1% level. The coefficient on the interaction term is also positive, which could be interpreted as signifying that increased supervision costs improve the performance of hired labor.

Bardhan-Frisvold Test for Labor Homogeneity

The next test I run to examine the relationship between hired and family labor is based on those used in papers by authors Pranab Bardhan (1973) and George Frisvold (1994), but adapted to include indicator variables for irrigation status and land tenancy. Unlike in previous works, I choose to preparatory period and harvest period labor into separate categories for analysis. The following expression can then estimated by ordinary least squares (OLS):

$$\begin{aligned}\ln q = \ln \alpha_0 + \alpha_1 \ln A + \alpha_2 \ln V + \alpha_3 \ln L_{prep} + \alpha_4 \ln L_{harv} + \\ \theta_1 \ln RATIO_{prep} + \theta_2 \ln RATIO_{harv} + \delta_k \Sigma_{k=1}^{K} SOIL_k + \\ \psi_1 HYV + + \psi_2 FERT + \psi_3 IRR + \psi_4 RENT + u \quad (8)\end{aligned}$$

This is a production function estimation. In this case I estimate non-tree crops and tree crops separately. The results can be found in table 2. The terms $RATIO_{prep}$ and $RATIO_{harv}$ are the main variables of interest. These ratios represent the expression defined earlier in (2) and (3), and the coefficient of these ratios corresponds to the expression $\theta = \alpha_3 \gamma$, where $L_j = (F+1)/L$. Therefore a test of $\theta = 0$ is a test for the substitutability of labor. Columns 1 and 2 of Table 2 are the pooled OLS estimates using the full sample of data, and including wave dummies to capture variation common to the entire sample in each of the 4 waves. Column 1 represents the plots planted to perennial (ground-cover) crops, and column 2 represents tree crops. Columns 3 and 4 are the same pair of regressions, this time using a within-village transformation to remove village-specific effects. All coefficients therefore represent the deviations from village-specific means. The final columns (5) and (6) are the same regression this time using within-household transformations.

We can see the pattern of rejections looking across the column of ratio_1. For perennial crops, the coefficient is not rejected in any specification. For the tree crops, however, the coefficient on the preparatory labor ratio of family to total labor, an increase in the amount of family labor relative to hired labor results in an increase in output. We can interpret this as meaning that in the case of tree prep labor, family labor is more productive than hired, while I cannot reject differences between family and hired labor in the preparatory period for perennial crops. With respect to the harvest period the ratio_2 variable is the variable of interest. In all cases the variable is significant and negative, meaning a higher ratio of family to total labor decreases overall productivity. This is consistent with the results in the Deolalikar-Vijverberg tests of the previos section.

Plot-level Labor Demand Estimates

I now turn my attention to focus on the tests of the separation hypothesis. Based on the results of the earlier analysis, family labor and hired labor are estimated separately here. A household fixed effect is included, as well as a village-wave dummy to capture price or rainfall variation at the village level. The dependent variables are the log number of total family labor days, and the log of total hired labor days. The regressions take the form:

$$L_{ih}^{FAM} = \beta N_{ih} + \delta X_{ih} + \epsilon_i \quad (9)$$

and similarly, hired labor:

$$L_{ih}^{HIRED} = \beta N_{ih} + \delta X_{ih} + \epsilon_i \quad (10)$$

Table 2: Bardhan-Frisvold Tests for Labor Homogeneity

VARIABLES	(1) ln q	(2) ln q	(3) ln q	(4) ln q	(5) ln q	(6) ln q
log_area_planted	0.692***		0.684***		0.630***	
	(0.0165)		(0.0219)		(0.0295)	
log_num_trees		0.225***		0.235***		0.330***
		(0.0104)		(0.0152)		(0.0225)
log_total_prep_labor	-0.0770***	0.146***	-0.0779***	0.142***	-0.0369	0.107***
	(0.0196)	(0.0263)	(0.0234)	(0.0396)	(0.0289)	(0.0395)
log_total_harv_labor	0.436***	0.349***	0.443***	0.348***	0.339***	0.176***
	(0.0188)	(0.0284)	(0.0282)	(0.0364)	(0.0271)	(0.0389)
log_plot_expense	0.0274***	0.0596***	0.0271***	0.0598***	0.0206***	0.0404***
	(0.00255)	(0.00397)	(0.00303)	(0.00532)	(0.00405)	(0.00605)
log_ratio_1	-0.0175	0.0541**	-0.0170	0.0534*	-0.00127	0.0582**
	(0.0127)	(0.0213)	(0.0134)	(0.0281)	(0.0196)	(0.0293)
log_ratio_2	-0.0341***	-0.133***	-0.0340***	-0.133***	-0.0200	-0.0342
	(0.0126)	(0.0252)	(0.0124)	(0.0284)	(0.0188)	(0.0348)
improved_seeds	0.0330		0.0389		0.0202	
	(0.0268)		(0.0353)		(0.0422)	
log_organic_fert	0.0728***	0.0582***	0.0750***	0.0562***	0.0626***	0.0104
	(0.00502)	(0.00705)	(0.00667)	(0.00784)	(0.00989)	(0.0139)
irrigated	-0.433***	-0.282**	-0.377***	-0.283*	-0.339**	-0.110
	(0.0698)	(0.123)	(0.0978)	(0.145)	(0.132)	(0.205)
rented_in	-0.0778	-0.343	-0.0871	-0.358	-0.0752	-0.157
	(0.0522)	(0.265)	(0.0671)	(0.345)	(0.0773)	(0.469)
2.soil_type	0.146***	0.0939*	0.132***	0.101*	0.0403	0.103
	(0.0287)	(0.0502)	(0.0396)	(0.0576)	(0.0383)	(0.0773)
3.soil_type	0.162***	-0.0275	0.153***	-0.0306	0.0263	0.0173
	(0.0350)	(0.0645)	(0.0409)	(0.0737)	(0.0494)	(0.102)
4.soil_type	0.214***	-0.332**	0.207**	-0.318**	0.189*	-0.0343
	(0.0701)	(0.145)	(0.0796)	(0.143)	(0.0971)	(0.167)
Constant	5.104***	4.510***	4.873***	4.299***	5.128***	4.249***
	(0.149)	(0.257)	(0.211)	(0.326)	(0.275)	(0.428)
Observations	15,275	7,806	15,275	7,806	11,246	5,603
R-squared	0.314	0.251	0.311	0.250	0.191	0.163
Number of y2_hhid					2,659	1,965
Number of ea			177	160		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

where the error term is given the following structure:

$$\epsilon_i = \eta_h + \eta_v + \eta_t + \eta_{vt} + \zeta_{hvt} \tag{11}$$

Where N is vector of household characteristics on plot i, in household h and village v, and X is a vector of other plot characteristics. In some equations the subscripts for time and village are omitted for legibility. The structure of the error term for the fixed effects estimates is illustrated by equation 3. The error term includes one household-specific component, one time-specific component, one village-specific component, and a set of village-wave dummies. Table 6 displays the results of the OLS and FE-within transform estimations of family preparatory and harvest labor demand at the plot level. Table 7 shows the results of regressing the log number of hired labor days on the same set of control variables. The columns in table 7 also correspond to pooled OLS and within-household fixed effects estimates.

The first two columns represent the regression of family preparatory labor on the set of plot, household, and environmental control variables described above and the second two columns represent family harvest labor. For each column-pair the first column represents the pooled OLS (POLS) estimates, and the second column the household-fixed-effects regressions. All columns contain village-wave fixed effect dummy variables, which control for things like village-specific weather and price shocks. Note that all regressions also contain controls for soil type and for the slope or gradient of the plot.

Starting with the family labor in Table 7. The first half of the table shows mostly the plot-level control variables. We can see that labor days in all categories are increasing with the size of the plot, which is an indication that households are able to vary their labor supply to meet plot-level demands. Except in the case of the first column, plot labor is increasing with plot expenditure. Expenditure includes items like seeds and total wages expended on hired labor.

Irrigated plots receive more labor, though a plot becoming irrigated leads to a decline in family harvest labor. Organic fertilizer increases labor use in all columns but column 3. Intercropped plots demand higher levels of preparatory labor, though they require less harvest labor.

The log of area planted on all other plots is significant and negative for family preparatory labor, implying some constraints there, but significant and positive in the case of harvest labor. An increase in the farmer-estimated value of the plot also increases labor.

Turning to the managerial human capital variables, we see that the plot having exclusively female managers results in a large reduction in the amount of labor, the same is true as well for mixed gender plots. Those also receive less labor, with the estimates significant at the .01% significance level. Average age of the managers increases the family labor demanded in both preparatory and harvest periods. If we consider average age of the manager is likely to proxy very well for experience, this makes a lot of sense.

The indicator variable for the manager being also the head of the household has a negative effect on labor demand in both prep and harvest periods, most likely because the head of the household has many demands on his time.

Next are the main variables of interest, the variables indicating total family size in different categories. As we see, one additional member in the adults category leads to an increase in labor days, with the effects statistically significant at the highest levels. Harvest and prep labor days are also increasing in the number of children, and decreasing in the number of senior household members.

Family labor use is decreasing in the log of population density as measured by LandScan data, and family labor is also decreasing in the log of total household assets.

Next are several control variables for the demographics of the household head. The age of the household head has a negative effect on the amount of labor demanded at the plot level, as does education, with both effects identified in POLS model but only the age of the head being identified by the within-FE model.

Turning to the hired labor demand estimates in Table 7, we see that, although hired labor use is pretty low in terms of the intensity, it is increasing with area planted, and increasing with area planted to other plots, though that effect is only identified in the POLS regressions and not by the within-FE model. Collective plots receive less hired labor than individually-managed plots, and rented plots receive less hired labor as well, possibly because farmers who rent are poorer, though household assets have been controlled for.

Organic fertilizer has a decreasing effect on hired labor, possibly indicating the two are rough substitutes. Interestingly increases in the value of the plot, possibly caused by increases in the soil quality, increase the amount of hired labor indicating hired labor and soil quality are compliments rather than substitutes. This stands in contrast with the above findings about organic fertilizer. Interestingly, improved seeds also decrease hired labor, possibly because the two are being substituted by farmers facing capital constraints.

Most importantly, the number of adult members *decreases* the amount of hired labor. This means I can unequivocally reject separation, except in the case of hired harvest labor. This is interesting, and logical. Harvest season labor is the most critical. In the peak season, labor markets *plus* family labor are rising to 'meet' demand.

Hired labor is increasing in the log of population density as well, both for preparatory and harvest hired labor, though the effect is only identified at the 10% level in the harvest season. Hired labor is also increasing in household assets, which is another rejection of the separation hypothesis, though there does not appear to be enough variation in household asset values to identify the effects beyond the 10% level for the fixed-effects within model in columns two and four.

Robustness Checks

Due to evidence of recall bias in data collection, some of which came from Tanzania itself (Beegle et al., 2012), I have included a robustness check that adds dummies for the month in which the survey interview was conducted. These dummies are also included in all subsequent robustness checks unless otherwise noted. These results are excluded for brevity, but the results remain largely unchanged, though the interview-month dummies are statistically significant in some cases.

Check 1 - Endogenous HH Size

According to a paper by Grimard (2000), endogeneity of household demographics and composition to agricultural decisions is a significant concern in the context of Cote d'Ivoire, where large kinship networks facilitate the movement of family members to and from regions in need of agricultural labor. In Tanzania, by contrast, the large distances make this type of movement, I argue, much less of a concern, nevertheless, this question can be analyzed using a robustness check.

For this robustness check I exclude all labor which was carried out on the plot by household members who have recently joined the household as a measure to control against endogeneity of household composition to agricultural labor decisions. Based on the survey questionnaire it is possible to identify which household members have joined the household in the past year and for what reason they have moved. In this robustness check, all labor contributions by survey participants who reported moving in the last year due to acquiring agricultural land or for work purposes are excluded. The test in this case still strongly rejects labor market completeness and the results can be found in Table 10.

Check 2 - Farm Size Check

The third robustness check, Table 11, evaluates whether farms of different sizes have different demands for labor. Farms are broken into quantiles based on the area under control by each farm. The smallest quantile of farms are approximately less than a football field, the largest quantile farms are over ten football fields in size. All tests still reject labor market completeness, although households in the largest quantile of farms appear to be the most constrained in their labor use.

Check 3 - Individual Crop Regressions

In order to better understand Tanzanian agricultural labor markets, and owing to the large sample size of this survey, I run regressions for several crops individually including maize, paddy (rice), sweet potatoes, legumes, cotton, and tobacco. These results are reported in the appendix in regression tables 11-16.

Maize and rice are both staple and cash crop, legumes and sweet potatoes are considered staple crops. It therefore seems consistent that an increase in the acreage planted to maize, legumes, or sweet potatoes increases family prep and harvest labor the most. Similarly, a higher number of adult household members of working age (12-65) corresponds to higher plot labor demand *for all crops*. This implies that there are no localized areas where the tests fail to reject separability between household composition and farm labor use.

With respect to hired labor, an increase in acres planted to tobacco or cotton increases hired labor the most, with each additional acre of land planted to cotton increasing hired harvest labor by 65%. This indicates that hired labor markets are not totally dysfunctional, although the *level* of reported hired labor use remains fairly low relative to other, more densely populated countries. Lastly, household assets appear to be an important determinant of hired labor use in many cases, or at least of access to hired labor. This indicates that some households are potentially constrained in the amount of working capital they have access to, and implies credit markets are also dysfunctional.

Fertilizer Factor Allocation Regressions

Fertilizer regressions represent the following estimated model:

$$M_{ih} = \beta N_{ih} + \delta X_h + \epsilon_i \tag{12}$$

where the error term is again given the following structure:

$$\epsilon_i = \eta_h + \eta_j + \eta_t + \eta_{jt} + \zeta_{hjt} \tag{13}$$

where M_{ih} the dependent variable is the log of fertilizer per acre applied to plot i in household h. N_{ih} & X_h are vectors of plot characteristics at the plot and household level. The error term is again given the same structure with dummy variables for household and village-wave included.

Results from the regression of the log of fertilizer per acre on plot and household control variables are shown in Table 6 . Columns 1-2 are pooled OLS and FE-within respectively. Columns 3 and 4 are the same regression, this time including the value of animal portfolio holdings in the place of animal units. As the animal units variable is more likely to be correlated with fertilizer use (often livestock is left overnight on the field for the purposes of fertilizing), this offers the advantage of representing the value of the stock while hopefully being less endogenous. Columns 5-6 mirror 3 and 4, but with fixed effects now included at the village level for the purposes of leveraging the full dataset.

The number of children is negative and strongly significant in columns one, two and four, indicating children and organic fertilizer are, potentially, rough substitutes. A higher number of children corresponds to a lower use of organic fertilizer per acre, and in the case of the model in columns two and four, an increase in the number of children also results in a decrease in the amount of organic fertilizer used.

Organic fertilizer use is decreasing in area planted, as well as decreasing in area planted to all other plots indicating severe constraints to its use. Organic fertilizer use is also increasing in plot expenditure, though the effect is very small.

Rented plots receive less fertilizer, and irrigated plots receive much less fertilizer as well. The fact that the coefficient of rented plots is statistically significant confirms also the results of Gavian and Fafchamps (1996) who find that tenure status affects manuring in Niger. Also similar to their findings, in my estimates area planted to other plots as well as plot distance to household are significant and negative, indicating the "stretching" of limited manure resources across all plots. Further, animal assets and portfolio assets are strongly significant. This again reflects the findings in Gavian and Fafchamps (1996), application of manure is determined by the amount of livestock in a household's herd.

Organic fertilizer use per acre is increasing in the log of population density, possibly because of the higher availability of labor to apply this fertilizer. Intercropped plots receive more fertilizer per acre.

All of the asset variables are strongly significant, though the magnitude varies, with HH assets having the largest effect on fertilizer per acre. Interestingly, gender is not a statistically significant determinant of organic fertilizer use per acre, although the age of the plot manager as well as the log years of education of the manager and plot workers do have a significant and positive effect on the intensity of fertilizer use. Most importantly for rejection, we see that the head of the household being listed as a manager *increases* organic fertilizer use, statistically significant at the .01 % level in all but column two where it is not significant at standard levels.

5 Conclusion

This paper uses high-quality panel data from Tanzania to examine labor market inefficiencies. I first check for differences in the efficiencies of family and hired labor. Using two tests I find that hired labor is more efficient than family labor, though in the harvest season the differential in productivities between hired and family labor decreases according to the Deolalikar-Vijverberg test. This result is important because differentials between family and hired labor are considered to be an important potential source of labor market inefficiency.

In all specifications my test rejects the completeness of labor markets, and confirms the non-separable nature of household production and consumption decisions. In all cases, increases in the number of working adults in the household results in increases in labor applied to the household farm, measured at the plot level. Crop-disaggregated analysis indicates that most hired labor is applied to plots where cash crops, such as tobacco and cotton, rather than staple crops are cultivated.

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Table 3: Labor Use Per Plot

	Labor Days per Plot	Labor Days per Acre	Labor Days per Hectare
child prep days	0.7	0.7	0.3
adult prep days	37.8	37.7	15.3
old prep days	3.4	3.5	1.4
hired prep days	3.8	3.5	1.4
child harv days	0.5	0.5	0.2
adult harv days	18.2	19.0	7.7
old harv days	1.3	1.3	0.5
hired harv days	1.5	1.4	0.6

Table 4: Summary Statistics of Regression Variables

VARIABLES	N	mean	s.d.	min	max
mgr_is_head	18184	1.00	0	1	1
organic_fert	2168	926.40	1891	2	32000
dist_to_hh	14747	4.42	4.34	0.01	18.00
seed_type	8593	1.44	0.59	1	3
soil_type	21282	2.05	0.67	1	4
soil_quality	21282	1.62	0.59	1	3
plot_slope	21239	1.74	0.99	1	4
irrigated	21281	1.98	0.14	1	2
plot_value (in 10,000 2015 TSH)	21242	353	6604	0	827300
rented_in	809	1	0	1	1
value_all_other_plots (in 10,000 2015 TSH)	20162	523	4979	0	345100
area_planted_op	13100	7	12.27	0	339
all_female	4257	1	0	1	1
mixed_gend_mgr	9236	1	0	1	1
collective_plot	9773	1	0	1	1
educ_mgr	21284	11.75	7.94	1	46
age_mgr	21284	41.64	19.41	1	100
bmi_mgr	21284	76.81	834.10	1	20001
intercropped	21228	1.48	0.50	1	2
area_planted	21234	3.27	9.55	0	400
plot_expense	10763	87872	261249	2	7600000
age_hh_head	21315	48.63	15.42	16	108
educ_hh_head	21315	4.94	3.93	0	22
gender_hh_head	21315	0.78	0.42	0	1
num_children	21315	2.15	1.89	0	26
num_adult_members	21315	2.38	1.39	0	20
num_old_members	21315	0.27	0.55	0	3
hh_death	21315	0.10	0.30	0	1
animal_units	16456	5.12	26.93	0	527
farm_assets (in 10,000 2015 TSH)	21315	501	6408	0	333800
hh_assets (in 10,000 2015 TSH)	21315	892	11050	0	590900
density	16428	306	2392	0	77028

Table 5: Household Summary Statistics

VARIABLES	N	mean	sd	min	max
num_hh_members	15544	5.08	3.03	1	55
num_married_members	15544	3.27	1.95	1	31
num_children	15544	1.77	1.7	0	26
num_adult_members	15544	2.237	1.319	0	20
num_adult_men	12156	1.352	0.752	1	10
num_adult_women	13622	1.346	0.704	1	10
num_old_members	15544	0.212	0.491	0	3
hh_avg_age	15544	25.58	12.82	7.33	93
avg_adult_age	15063	34.69	9.063	18	64
avg_adult_educ	15063	5.729	3.676	0	22
hh_head_married	15544	0.715	0.452	0	1
age_hh_head	15543	45.37	15.68	0	108
educ_hh_head	15544	5.88	4.67	0	22
gender_hh_head	15544	1.26	0.44	0	2
hh_death	15543	0.09	0.28	0	1
family_death	15543	0.32	0.47	0	1
density	11324	1816	7684	0	77066
hh_assets (in 10,000 2015 TSH)	15542	15870	1845000	0	230100000
dur_goods_exp (in 10,000 2015 TSH)	15544	735	5178	0	215100
total_exp (in 10,000 2015 TSH)	15544	2201	8995	0	361800
dur_exp_ratio	15364	0.165	0.24	0	1
business_income (in 10,000 2015 TSH)	15544	220	5205	0	614700
nfarm_wages_1 (in 10,000 2015 TSH)	15544	449	6986	0	715300
total_bus_physical_k (in 10,000 2015 TSH)	15544	79.39	715	0	29130
animal_portfolio (in 10,000 2015 TSH)	9240	148.2	888	0	26390
bovine_holdings (in 10,000 2015 TSH)	9240	120.6	824.8	0	21650
animal_units	9240	4.147	26.09	0	527
live_sales (in 10,000 2015 TSH)	9240	13.50	94.07	0	6156
dead_sales (in 10,000 2015 TSH)	9240	0.53	10.88	0	805.2
area	13294	3.761	9.34	0	337.5
area_planted	13294	3.1	7.746	0	337.5
farm_assets (in 10,000 2015 TSH)	15542	348.3	6039	0	333800
Marketed surplus "LRS" (in 10,000 2015 TSH)	10534	13.55	74.07	0	3653
Marketed surplus "SRS" (in 10,000 2015 TSH)	10534	3.08	36.03	0	1955
Total marketed perennial (in 10,000 2015 TSH)	10534	16.63	85.84	0	3653
Marketed tree surplus "LRS" (in 10,000 2015 TSH)	10534	2.01	28.80	0	2263
Marketed tree surplus "SRS" (in 10,000 2015 TSH)	10534	6.99	111.40	0	8728
Total marketed tree surplus (in 10,000 2015 TSH)	10534	9.00	116.00	0	8728
Total marketed surplus (T + P) (in 10,000 2015 TSH)	10534	25.63	147.30	0	8728

Table 6: Plot-level Family Labor Demand

VARIABLES	(1) lab_5_ols_1 prep_labor	(2) lab_5_fe_1 prep_labor	(3) lab_5_ols_2 harv_labor	(4) lab_5_fe_2 harv_labor
area_planted	0.546***	0.450***	0.469***	0.347***
	(0.0123)	(0.0231)	(0.0138)	(0.0245)
plot_expense	-0.00744***	0.00763***	0.00522***	0.0160***
	(0.00168)	(0.00238)	(0.00182)	(0.00274)
collective_plot	0.451***	0.393***	0.340***	0.330***
	(0.0486)	(0.0774)	(0.0524)	(0.0940)
rented_in	0.0748**	0.142***	0.0172	0.0300
	(0.0348)	(0.0452)	(0.0389)	(0.0526)
irrigated	0.193***	0.00912	0.141***	-0.237***
	(0.0467)	(0.0728)	(0.0497)	(0.0874)
organic_fert	0.0116***	0.0302***	0.00366	0.0138**
	(0.00383)	(0.00521)	(0.00447)	(0.00621)
intercropped	0.0329**	-0.0146	-0.0966***	-0.122***
	(0.0167)	(0.0216)	(0.0185)	(0.0256)
improved_seeds	-0.0101	-0.00962	-0.0780***	-0.0844***
	(0.0184)	(0.0260)	(0.0206)	(0.0300)
dist_to_hh	0.00669***	0.0173***	-0.000344	0.0103***
	(0.00183)	(0.00285)	(0.00189)	(0.00295)
area_planted_op	-0.0719***	-0.0906***	0.0217**	-0.0107
	(0.00915)	(0.0204)	(0.00985)	(0.0218)
plot_value	0.00956***	0.0342***	0.00790***	0.0426***
	(0.00256)	(0.00596)	(0.00258)	(0.00660)
value_all_other_plots	-0.000652	-0.00537*	-0.00271	-0.00339
	(0.00162)	(0.00318)	(0.00173)	(0.00372)
Observations	24,038	17,087	24,038	17,087
R-squared	0.694	0.647	0.501	0.400
Number of y2_hhid		3,916		3,916
Soil & Slope controls	yes	yes	yes	yes
HH FE	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Plot-level Family Labor Demand

VARIABLES	(1) lab_5_ols_1 prep_labor	(2) lab_5_fe_1 prep_labor	(3) lab_5_ols_2 harv_labor	(4) lab_5_fe_2 harv_labor
all_female	-0.159***	-0.194***	-0.163***	-0.234***
	(0.0320)	(0.0609)	(0.0337)	(0.0668)
mixed_gend_mgr	-0.212***	-0.208***	-0.207***	-0.271***
	(0.0504)	(0.0803)	(0.0547)	(0.0981)
educ_mgr	-0.00623	0.0154	0.0263**	0.0467*
	(0.0119)	(0.0223)	(0.0124)	(0.0252)
age_mgr	0.921***	0.854***	0.611***	0.576***
	(0.0183)	(0.0360)	(0.0181)	(0.0359)
bmi_mgr	0.00713	0.0419	-0.00212	0.0117
	(0.00849)	(0.0255)	(0.00946)	(0.0272)
mgr_is_head	-0.137***	-0.190***	-0.0919**	-0.106
	(0.0445)	(0.0734)	(0.0446)	(0.0763)
num_children	0.0373***	0.0141	0.0417***	0.00746
	(0.00403)	(0.0133)	(0.00448)	(0.0154)
num_adult_members	0.0702***	0.0873***	0.0619***	0.0984***
	(0.00576)	(0.0170)	(0.00616)	(0.0206)
num_old_members	-0.0582***	0.0780	-0.0615***	0.0370
	(0.0160)	(0.0485)	(0.0172)	(0.0555)
density	-0.0322***	-0.00277	-0.0260***	0.0203*
	(0.00446)	(0.00993)	(0.00498)	(0.0114)
hh_assets	-0.0604***	-0.0271***	-0.0376***	-0.0259**
	(0.00531)	(0.00997)	(0.00535)	(0.0112)
farm_assets	0.00109	0.000185	0.00390**	0.00278
	(0.00161)	(0.00319)	(0.00169)	(0.00372)
animal_units	-0.0295***	0.0744***	0.00158	0.0839***
	(0.00845)	(0.0264)	(0.00916)	(0.0290)
age_hh_head	-0.358***	-0.469***	-0.212***	-0.276**
	(0.0297)	(0.116)	(0.0306)	(0.125)
educ_hh_head	-0.0427***	0.0204	-0.0361***	-0.0565*
	(0.00983)	(0.0298)	(0.00998)	(0.0295)
gender_hh_head	-0.0930***	-0.197**	-0.0354	-0.0925
	(0.0228)	(0.0842)	(0.0237)	(0.0996)
hh_death	-0.0237	-0.0325	0.0337	0.00159
	(0.0227)	(0.0430)	(0.0239)	(0.0461)
ag_wage	-0.000716	0.00770	-0.0223***	-0.0178
	(0.00619)	(0.0108)	(0.00697)	(0.0136)
Constant	1.418***	0.930	0.783***	0.653
	(0.179)	(0.581)	(0.184)	(0.608)
Observations	24,038	17,087	24,038	17,087
R-squared	0.694	0.647	0.501	0.400
Number of y2_hhid		3,916		3,916
Soil & Slope controls	yes	yes	yes	yes
HH FE	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Plot-level Hired Labor Demand

VARIABLES	(1) lab_5_ols_5 hired_prep_labor	(2) lab_5_fe_5 hired_prep_labor	(3) lab_5_ols_6 hired_harv_labor	(4) lab_5_fe_6 hired_harv_labor
area_planted	0.226***	0.180***	0.192***	0.158***
	(0.0127)	(0.0201)	(0.0105)	(0.0167)
plot_expense	0.115***	0.115***	0.0525***	0.0462***
	(0.00158)	(0.00291)	(0.00125)	(0.00210)
collective_plot	-0.110***	-0.0876	-0.0649**	-0.00580
	(0.0423)	(0.0604)	(0.0320)	(0.0503)
rented_in	-0.457***	-0.521***	-0.154***	-0.168***
	(0.0416)	(0.0572)	(0.0330)	(0.0469)
irrigated	-0.00399	-0.00986	-0.122***	-0.0795
	(0.0490)	(0.0876)	(0.0409)	(0.0694)
organic_fert	-0.0180***	-0.0249***	-0.0105***	-0.00687
	(0.00441)	(0.00569)	(0.00352)	(0.00549)
intercropped	-0.131***	-0.0637***	-0.139***	-0.0794***
	(0.0169)	(0.0214)	(0.0133)	(0.0175)
improved_seeds	-0.265***	-0.234***	-0.100***	-0.0728***
	(0.0186)	(0.0245)	(0.0144)	(0.0197)
soil_t_1	0.0845	0.200	0.0536	0.143
	(0.0780)	(0.197)	(0.0463)	(0.190)
soil_t_2	0.0932	0.233	0.0974**	0.172
	(0.0769)	(0.195)	(0.0454)	(0.188)
soil_t_3	0.0510	0.188	0.132***	0.187
	(0.0783)	(0.196)	(0.0470)	(0.190)
soil_t_4	0.0692	0.225	0.145**	0.273
	(0.0876)	(0.208)	(0.0570)	(0.196)
pl_slope1	0.250***	0.267***	0.0682***	0.0733**
	(0.0248)	(0.0425)	(0.0178)	(0.0319)
pl_slope2	0.214***	0.259***	0.0140	0.0677*
	(0.0335)	(0.0521)	(0.0241)	(0.0395)
pl_slope3	0.229***	0.289***	0.0352*	0.0660**
	(0.0257)	(0.0432)	(0.0186)	(0.0320)
pl_slope4	0.195***	0.307***	0.0404	0.141***
	(0.0382)	(0.0563)	(0.0286)	(0.0429)
dist_to_hh	0.0208***	0.0171***	0.0125***	0.00843***
	(0.00173)	(0.00267)	(0.00139)	(0.00197)
area_planted_op	0.0260***	0.0187	0.0292***	0.0161
	(0.00830)	(0.0184)	(0.00669)	(0.0147)
plot_value	0.00205	0.0101**	0.00224	0.0125***
	(0.00208)	(0.00497)	(0.00153)	(0.00382)
value_all_other_plots	-0.00138	0.000279	-0.000624	-0.00202
	(0.00150)	(0.00310)	(0.00113)	(0.00242)
Observations	24,038	17,087	24,038	17,087
R-squared	0.386	0.352	0.230	0.171
Number of y2_hhid		3,916		3,916
Soil & Slope controls	yes	yes	yes	yes
HH FE	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Plot-level Hired Labor Demand

	(1)	(2)	(3)	(4)
	lab_5_ols_5	lab_5_fe_5	lab_5_ols_6	lab_5_fe_6
VARIABLES	hired_prep_labor	hired_prep_labor	hired_harv_labor	hired_harv_labor
all_female	0.0599**	0.0244	0.0370*	-0.00465
	(0.0273)	(0.0457)	(0.0208)	(0.0328)
mixed_gend_mgr	0.0494	0.0857	0.0354	-0.0145
	(0.0444)	(0.0630)	(0.0335)	(0.0515)
educ_mgr	0.0356***	0.0472**	0.0254***	0.00928
	(0.0104)	(0.0186)	(0.00835)	(0.0153)
age_mgr	0.00420	-0.0261	0.0214*	0.0282
	(0.0146)	(0.0271)	(0.0115)	(0.0215)
bmi_mgr	-0.00615	-0.00723	-0.00866	-0.00984
	(0.00838)	(0.0212)	(0.00636)	(0.0198)
mgr_is_head	0.0337	0.0689	-0.0543*	-0.0225
	(0.0367)	(0.0588)	(0.0291)	(0.0470)
num_children	-0.0236***	-0.00422	-0.0218***	-0.0143
	(0.00375)	(0.0129)	(0.00299)	(0.0103)
num_adult_members	-0.0445***	-0.0399**	-0.0315***	-0.0189
	(0.00519)	(0.0168)	(0.00419)	(0.0134)
num_old_members	0.00792	-0.0405	-0.00772	-0.0149
	(0.0139)	(0.0438)	(0.0108)	(0.0374)
density	0.0127***	0.00652	0.00460*	-0.000984
	(0.00350)	(0.00885)	(0.00261)	(0.00656)
hh_assets	0.0617***	0.0176*	0.0338***	0.00949
	(0.00454)	(0.00912)	(0.00349)	(0.00689)
farm_assets	-0.00190	0.00547*	-0.00278**	-0.00202
	(0.00143)	(0.00299)	(0.00111)	(0.00226)
animal_units	0.0516***	-0.0397*	0.0388***	-0.0114
	(0.00862)	(0.0235)	(0.00706)	(0.0185)
age_hh_head	0.0143	0.103	-0.0473**	-0.00599
	(0.0245)	(0.112)	(0.0193)	(0.0850)
educ_hh_head	-0.00955	-0.00398	-0.0206***	0.0112
	(0.00862)	(0.0284)	(0.00723)	(0.0260)
gender_hh_head	0.0255	-0.0258	0.0140	-0.00238
	(0.0182)	(0.0747)	(0.0139)	(0.0606)
hh_death	0.0238	0.00874	0.0121	0.0116
	(0.0196)	(0.0386)	(0.0155)	(0.0301)
ag_wage	-0.00474	-0.0191*	0.0102**	0.00656
	(0.00540)	(0.0107)	(0.00399)	(0.0103)
Constant	-1.019***	-0.630	-0.297**	-0.292
	(0.167)	(0.512)	(0.125)	(0.423)
Observations	24,038	17,087	24,038	17,087
R-squared	0.386	0.352	0.230	0.171
Number of y2_hhid		3,916		3,916
Soil & Slope controls	yes	yes	yes	yes
HH FE	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8: Fertilizer Factor Allocation Regressions

VARIABLES	(1) org_fert_acre	(2) org_fert_acre	(3) org_fert_acre	(4) org_fert_acre	(5) org_fert_acre	(6) org_fert_acre
num_children	-0.0115***	-0.0162***	-0.00333	-0.0152***	-0.00333	-0.00333
	(0.00313)	(0.00447)	(0.00363)	(0.00547)	(0.00363)	(0.00482)
num_adult_members	0.000571	0.00548	0.00460	0.00247	0.00460	0.00460
	(0.00436)	(0.00646)	(0.00487)	(0.00744)	(0.00487)	(0.00564)
num_old_members	-0.00400	-0.00486	-0.00488	-0.00651	-0.00488	-0.00488
	(0.0111)	(0.0178)	(0.0133)	(0.0213)	(0.0133)	(0.0164)
area_planted	-0.0751***	-0.0784***	-0.0656***	-0.0851***	-0.0656***	-0.0656***
	(0.00767)	(0.00993)	(0.00887)	(0.0123)	(0.00887)	(0.0110)
plot_expense	0.00629***	0.00727***	0.00547***	0.00660***	0.00547***	0.00547***
	(0.00103)	(0.00136)	(0.00124)	(0.00170)	(0.00124)	(0.00172)
collective_plot	-0.0146	-0.00618	-0.0387	-0.0320	-0.0387	-0.0387
	(0.0281)	(0.0295)	(0.0386)	(0.0437)	(0.0386)	(0.0428)
rented_in	-0.0955***	-0.141***	-0.108***	-0.155***	-0.108***	-0.108***
	(0.0208)	(0.0307)	(0.0267)	(0.0381)	(0.0267)	(0.0310)
irrigated	-0.294***	-0.305***	-0.350***	-0.342***	-0.350***	-0.350***
	(0.0471)	(0.0708)	(0.0535)	(0.0834)	(0.0535)	(0.0936)
density	0.0230***	0.0167***	0.0336***	0.0266***	0.0336***	0.0336***
	(0.00405)	(0.00467)	(0.00510)	(0.00583)	(0.00510)	(0.00789)
intercropped	0.0742***	0.0759***	0.0772***	0.0950***	0.0772***	0.0772***
	(0.0103)	(0.0124)	(0.0125)	(0.0156)	(0.0125)	(0.0164)
improved_seeds	0.0256**	-0.0228	0.0127	-0.0535***	0.0127	0.0127
	(0.0124)	(0.0152)	(0.0146)	(0.0185)	(0.0146)	(0.0191)
dist_to_hh	-0.0200***	-0.0213***	-0.0264***	-0.0295***	-0.0264***	-0.0264***
	(0.00102)	(0.00149)	(0.00127)	(0.00194)	(0.00127)	(0.00131)
area_planted_op	-0.0499***	-0.0319***	-0.0397***	-0.0303***	-0.0397***	-0.0397***
	(0.00577)	(0.00771)	(0.00652)	(0.00923)	(0.00652)	(0.00716)
plot_value	0.0294***	0.0274***	0.0388***	0.0364***	0.0388***	0.0388***
	(0.00365)	(0.00473)	(0.00461)	(0.00608)	(0.00461)	(0.00515)
hh_assets	0.0163***	0.0110**	0.0268***	0.0263***	0.0268***	0.0268***
	(0.00355)	(0.00507)	(0.00458)	(0.00767)	(0.00458)	(0.00619)
farm_assets	0.00785***	0.00717***	0.0213***	0.0291***	0.0213***	0.0213***
	(0.00110)	(0.00151)	(0.00154)	(0.00362)	(0.00154)	(0.00181)
animal_units	0.119***	0.114***				
	(0.00722)	(0.0115)				
Constant	-0.190	-0.0682	-0.644***	-0.688**	-0.644***	-0.644***
	(0.149)	(0.210)	(0.180)	(0.270)	(0.180)	(0.247)
Observations	15,284	11,247	11,956	8,211	11,956	11,956
R-squared	0.159		0.149		0.149	
Number of y2_hhid		2,658		2,147		
Number of ea						147
Soil & Slope controls	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Plot-level Fertilizer Factor Allocation

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	org_fert_acre	org_fert_acre	org_fert_acre	org_fert_acre	org_fert_acre	org_fert_acre
age_hh_head	0.00807	-0.00465	0.0432	0.00736	0.0432	0.0432
	(0.0292)	(0.0416)	(0.0374)	(0.0567)	(0.0374)	(0.0460)
educ_hh_head	0.0147	0.0135	0.0126	0.0111	0.0126	0.0126
	(0.00920)	(0.0126)	(0.0113)	(0.0157)	(0.0113)	(0.0140)
gender_hh_head	0.0261	0.0372	0.00588	0.0274	0.00588	0.00588
	(0.0201)	(0.0270)	(0.0251)	(0.0342)	(0.0251)	(0.0425)
hh_death	-0.00484	0.0124	-0.00373	0.0151	-0.00373	-0.00373
	(0.0157)	(0.0178)	(0.0194)	(0.0231)	(0.0194)	(0.0231)
mgr_is_head	0.0749***	0.0524	0.114***	0.0927**	0.114***	0.114***
	(0.0257)	(0.0338)	(0.0318)	(0.0449)	(0.0318)	(0.0362)
all_female	0.0508**	0.0410	0.0478*	0.0448	0.0478*	0.0478
	(0.0226)	(0.0289)	(0.0281)	(0.0374)	(0.0281)	(0.0461)
mixed_gend_mgr	0.0303	0.0212	0.0492	0.0420	0.0492	0.0492
	(0.0296)	(0.0306)	(0.0401)	(0.0451)	(0.0401)	(0.0469)
educ_mgr	0.00211	0.0105	0.00280	0.0191	0.00280	0.00280
	(0.0114)	(0.0139)	(0.0140)	(0.0180)	(0.0140)	(0.0151)
age_mgr	0.0195	0.0333	0.00185	0.0293	0.00185	0.00185
	(0.0243)	(0.0320)	(0.0316)	(0.0430)	(0.0316)	(0.0318)
bmi_mgr	-0.00187	-0.00663	-0.00436	-0.0127	-0.00436	-0.00436
	(0.00631)	(0.0127)	(0.00696)	(0.0165)	(0.00696)	(0.00523)
plot_prep_avg_age	-0.00194	-0.00123	0.0110	0.00758	0.0110	0.0110
	(0.0103)	(0.0143)	(0.0124)	(0.0197)	(0.0124)	(0.0150)
plot_prep_avg_bmi	0.00201	0.0209	0.000965	0.0224	0.000965	0.000965
	(0.00347)	(0.0130)	(0.00360)	(0.0194)	(0.00360)	(0.00255)
plot_prep_avg_educ	0.0216***	0.0180**	0.0193**	0.0125	0.0193**	0.0193**
	(0.00702)	(0.00898)	(0.00863)	(0.0116)	(0.00863)	(0.00876)
animal_portfolio			3.11e-09***	1.26e-08**	3.11e-09***	3.11e-09***
			(7.88e-10)	(4.94e-09)	(7.88e-10)	(8.57e-10)
Constant	-0.190	-0.0682	-0.644***	-0.688**	-0.644***	-0.644***
	(0.149)	(0.210)	(0.180)	(0.270)	(0.180)	(0.247)
Observations	15,284	11,247	11,956	8,211	11,956	11,956
R-squared	0.159		0.149		0.149	
Number of y2_hhid		2,658		2,147		
Number of ea						147
Soil & Slope controls	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Robustness 2 - Endogenous HH Size Check

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	prep_days_r2	prep_days_r2	hired_prep_labor	hired_prep_labor	harv_days_r2	harv_days_r2	hired_harv_labor	hired_harv_labor
area_planted	0.157***	0.259***	0.175***	0.131***	0.241***	0.213***	0.120***	0.0810***
	(0.0171)	(0.0293)	(0.0133)	(0.0226)	(0.0143)	(0.0263)	(0.0108)	(0.0181)
plot_expense	0.00921***	0.0209***	0.117***	0.115***	0.0146***	0.0258***	0.0580***	0.0513***
	(0.00212)	(0.00390)	(0.00179)	(0.00366)	(0.00185)	(0.00353)	(0.00146)	(0.00278)
collective_plot	0.332***	0.528***	-0.107**	-0.198**	0.321***	0.431***	-0.0351	0.0118
	(0.0642)	(0.157)	(0.0482)	(0.0871)	(0.0526)	(0.102)	(0.0374)	(0.0713)
rented_in	0.0671	0.136	-0.453***	-0.418***	0.0842*	0.0717	-0.164***	-0.109
	(0.0506)	(0.0844)	(0.0505)	(0.0784)	(0.0466)	(0.0728)	(0.0413)	(0.0705)
irrigated	0.184***	0.122	0.0840	-0.105	0.115**	-0.210**	-0.0818	-0.0697
	(0.0697)	(0.113)	(0.0655)	(0.123)	(0.0586)	(0.107)	(0.0541)	(0.0864)
soil_type	0.0424***	0.112***	-0.0120	-0.0331*	0.0132	0.0610***	0.0498***	0.0361**
	(0.0136)	(0.0240)	(0.0112)	(0.0192)	(0.0122)	(0.0224)	(0.00921)	(0.0157)
soil_quality	-0.0162	-0.00515	0.00288	-0.0104	-0.00931	0.00139	-0.0377***	-0.0141
	(0.0157)	(0.0300)	(0.0127)	(0.0213)	(0.0139)	(0.0273)	(0.0101)	(0.0162)
organic_fert	0.0257***	0.0407***	-0.0257***	-0.0322***	0.00855*	0.0221***	-0.0166***	-0.0167***
	(0.00493)	(0.00793)	(0.00488)	(0.00707)	(0.00447)	(0.00765)	(0.00391)	(0.00647)
plot_slope	-0.0147	0.0137	-0.00694	0.0130	-0.0346***	-0.0196	-0.0121**	0.00503
	(0.00963)	(0.0174)	(0.00758)	(0.0136)	(0.00864)	(0.0164)	(0.00608)	(0.0111)
intercropped	-0.0121	-0.0202	0.0751***	0.0631***	0.0198	-0.00862	0.0881***	0.0453**
	(0.0189)	(0.0298)	(0.0147)	(0.0236)	(0.0165)	(0.0283)	(0.0120)	(0.0195)
seed_type	-0.191***	0.0424	-0.104***	-0.303***	-0.190***	-0.0268	-0.0272**	-0.143***
	(0.0132)	(0.0358)	(0.0137)	(0.0327)	(0.0113)	(0.0326)	(0.0109)	(0.0279)
dist_to_hh	0.00642***	0.0226***	0.0207***	0.0173***	0.00177	0.0113***	0.0123***	0.00646**
	(0.00246)	(0.00413)	(0.00207)	(0.00348)	(0.00209)	(0.00376)	(0.00168)	(0.00273)
area_planted_op	-0.0607***	0.00107	0.0227*	-0.0336	-0.0668***	-0.0938***	0.00259	-0.0691***
	(0.0158)	(0.0420)	(0.0130)	(0.0246)	(0.0132)	(0.0300)	(0.0109)	(0.0204)
plot_value	0.00958	0.0578***	0.0328***	0.0253**	0.0190***	0.0948***	0.0202***	0.0343***
	(0.00689)	(0.0132)	(0.00519)	(0.0105)	(0.00580)	(0.0132)	(0.00391)	(0.00787)
value_all_other_plots	-0.00443**	-0.00597	0.00277	0.00300	0.000603	0.00413	0.00251*	0.000773
	(0.00209)	(0.00594)	(0.00176)	(0.00481)	(0.00180)	(0.00536)	(0.00137)	(0.00379)
hh_death	0.0253	-0.0110	0.0345	0.0573	0.0245	-0.0601	0.0303	0.0288
	(0.0333)	(0.0948)	(0.0265)	(0.0655)	(0.0307)	(0.0709)	(0.0217)	(0.0519)
ag_wage	0.0192	-0.0150	-0.0302***	-0.0142	-0.0231**	-0.0278	0.00191	0.00120
	(0.0131)	(0.0317)	(0.0101)	(0.0213)	(0.0117)	(0.0244)	(0.00786)	(0.0161)
Observations	16,999	10,417	16,999	10,417	16,999	10,417	16,999	10,417
R-squared	0.654	0.390	0.387	0.323	0.574	0.284	0.234	0.164
Number of y2_hhid		2,727		2,727		2,727		2,727
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Robustness 2 - Endogenous HH Size Check

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	prep_days_r2	prep_days_r2	hired_prep_labor	hired_prep_labor	harv_days_r2	harv_days_r2	hired_harv_labor	hired_harv_labor
all_female	-0.100**	0.0117	0.0775**	0.0576	-0.129***	-0.174*	0.0487*	0.00427
	(0.0448)	(0.109)	(0.0349)	(0.0728)	(0.0401)	(0.0972)	(0.0272)	(0.0514)
mixed_gend_mgr	-0.0791	-0.237	0.0193	0.186**	-0.227***	-0.345***	-0.00774	-0.0487
	(0.0678)	(0.164)	(0.0508)	(0.0925)	(0.0552)	(0.109)	(0.0394)	(0.0745)
educ_mgr	0.0136	0.0714	0.0434***	0.0784***	0.0217	0.0576	0.0298***	0.0159
	(0.0169)	(0.0456)	(0.0130)	(0.0282)	(0.0142)	(0.0392)	(0.0110)	(0.0220)
age_mgr	0.824***	0.945***	0.0362**	-0.0517	0.572***	0.646***	0.0442***	0.0685**
	(0.0246)	(0.0607)	(0.0175)	(0.0376)	(0.0210)	(0.0533)	(0.0143)	(0.0293)
bmi_mgr	0.101***	-0.00151	-0.00826	0.00518	0.0721***	0.0132	-0.0115*	-0.0296
	(0.0105)	(0.0394)	(0.00861)	(0.0262)	(0.00834)	(0.0352)	(0.00696)	(0.0235)
mgr_is_head	-0.310***	-0.354***	0.0404	0.0991	-0.0996**	-0.124	-0.0489	-0.0431
	(0.0539)	(0.117)	(0.0440)	(0.0821)	(0.0487)	(0.104)	(0.0347)	(0.0669)
num_children_r2	0.0234***	0.0342	-0.0170***	0.0443**	0.0404***	0.00788	-0.0170***	-0.000474
	(0.00571)	(0.0324)	(0.00454)	(0.0200)	(0.00501)	(0.0218)	(0.00370)	(0.0175)
num_adult_members_r2	0.0513***	-0.0192	-0.0493***	-0.0497**	0.0662***	0.0647***	-0.0386***	-0.0183
	(0.00804)	(0.0320)	(0.00646)	(0.0207)	(0.00714)	(0.0245)	(0.00535)	(0.0172)
num_old_members_r2	-0.0464**	-0.258***	0.00464	-0.0117	-0.0763***	-0.156**	-0.0117	-0.0439
	(0.0218)	(0.0785)	(0.0172)	(0.0535)	(0.0196)	(0.0684)	(0.0137)	(0.0469)
density	-0.0235**	0.0354*	0.0114	-0.00919	-0.0342***	0.0372**	0.00162	0.00115
	(0.0106)	(0.0184)	(0.00707)	(0.0121)	(0.00935)	(0.0151)	(0.00553)	(0.00932)
hh_assets	-0.0455***	-0.0379**	0.0533***	0.000351	-0.0408***	-0.0271*	0.0286***	0.0105
	(0.00629)	(0.0188)	(0.00518)	(0.0120)	(0.00558)	(0.0152)	(0.00408)	(0.00914)
farm_assets	-0.000403	-0.00621	0.000552	0.00584	0.00474***	0.00729	-0.00134	-0.00415
	(0.00198)	(0.00531)	(0.00167)	(0.00374)	(0.00174)	(0.00450)	(0.00132)	(0.00292)
animal_units	-0.0516***	0.144***	0.0431***	-0.0683**	-0.0214**	0.0848**	0.0465***	-0.0285
	(0.0120)	(0.0508)	(0.0104)	(0.0339)	(0.0102)	(0.0363)	(0.00885)	(0.0290)
age_hh_head	-0.482***	-0.517***	-0.0101	0.182	-0.272***	-0.0631	-0.0434*	0.0365
	(0.0426)	(0.166)	(0.0322)	(0.146)	(0.0369)	(0.153)	(0.0262)	(0.109)
educ_hh_head	-0.0244	0.0137	-0.0198*	-0.0591	-0.0305**	-0.0651	-0.0319***	0.0235
	(0.0153)	(0.0549)	(0.0116)	(0.0389)	(0.0127)	(0.0448)	(0.0102)	(0.0338)
gender_hh_head	-0.172***	-0.182	0.0154	0.0203	-0.0487	-0.0720	0.0281	0.0603
	(0.0375)	(0.167)	(0.0260)	(0.121)	(0.0336)	(0.127)	(0.0201)	(0.0878)
Observations	16,999	10,417	16,999	10,417	16,999	10,417	16,999	10,417
R-squared	0.654	0.390	0.387	0.323	0.574	0.284	0.234	0.164
Number of y2_hhid		2,727		2,727		2,727		2,727
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Robustness 2 - Endogenous HH Size Check

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	prep_days_r2	prep_days_r2	hired_prep_labor	hired_prep_labor	harv_days_r2	harv_days_r2	hired_harv_labor	hired_harv_labor
2.interview_month	0.0102	-0.0550	0.0630*	0.0588	0.0695*	0.182*	0.0630**	0.0797
	(0.0417)	(0.122)	(0.0345)	(0.0931)	(0.0375)	(0.0994)	(0.0276)	(0.0672)
3.interview_month	0.116**	-0.0810	0.0526	0.162	0.110***	0.128	0.0655**	0.0951
	(0.0470)	(0.144)	(0.0373)	(0.105)	(0.0415)	(0.114)	(0.0300)	(0.0769)
4.interview_month	0.0253	-0.0600	0.0147	0.0242	0.0819**	0.0253	0.0444	0.0385
	(0.0433)	(0.175)	(0.0363)	(0.128)	(0.0381)	(0.139)	(0.0293)	(0.0943)
5.interview_month	0.0372	-0.0653	-0.0306	-0.167	0.116***	-0.0689	0.0399	-0.0816
	(0.0418)	(0.179)	(0.0333)	(0.133)	(0.0362)	(0.149)	(0.0259)	(0.106)
6.interview_month	0.110**	0.257	0.0344	-0.136	0.115***	0.0423	0.0160	-0.0574
	(0.0446)	(0.189)	(0.0347)	(0.138)	(0.0384)	(0.155)	(0.0273)	(0.110)
7.interview_month	0.0265	-0.109	-0.0443	-0.167	0.112***	-0.0273	0.0224	-0.0585
	(0.0401)	(0.197)	(0.0341)	(0.143)	(0.0360)	(0.159)	(0.0269)	(0.123)
8.interview_month	0.117***	0.227	-0.0133	-0.0481	0.164***	0.425**	0.0532*	-0.114
	(0.0427)	(0.218)	(0.0348)	(0.154)	(0.0368)	(0.168)	(0.0290)	(0.140)
9.interview_month	0.224***	0.142	-0.0405	-0.0400	0.122**	0.253	0.0580	-0.0840
	(0.0655)	(0.256)	(0.0496)	(0.193)	(0.0570)	(0.184)	(0.0402)	(0.170)
10.interview_month	0.0556	0.0637	-0.000420	0.0205	0.128***	0.193	0.00399	-0.0101
	(0.0432)	(0.191)	(0.0331)	(0.123)	(0.0367)	(0.148)	(0.0258)	(0.0891)
11.interview_month	0.114***	0.0832	0.0621*	0.00420	0.138***	0.121	0.0794***	0.0472
	(0.0416)	(0.154)	(0.0319)	(0.105)	(0.0367)	(0.127)	(0.0261)	(0.0852)
12.interview_month	0.0552	0.240*	0.0124	0.0867	0.0579	-0.0387	0.0342	0.0133
	(0.0392)	(0.126)	(0.0316)	(0.0810)	(0.0354)	(0.107)	(0.0247)	(0.0682)
Constant	1.679***	-1.243	-0.795	-0.284	0.784	-0.0411	-0.800***	-0.647
	(0.361)	(1.577)	(0.485)	(0.803)	(0.789)	(0.827)	(0.245)	(0.601)
Observations	16,999	10,417	16,999	10,417	16,999	10,417	16,999	10,417
R-squared	0.654	0.390	0.387	0.323	0.574	0.284	0.234	0.164
Number of y2_hhid		2,727		2,727		2,727		2,727
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Robustness 3 - Farm Size Check

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	prep_labor	prep_labor	hired_prep_labor	hired_prep_labor	harv_labor	harv_labor	hired_harv_labor	hired_harv_labor
area_planted	0.353***	0.292***	0.152***	0.127***	0.272***	0.200***	0.107***	0.0836***
	(0.0158)	(0.0256)	(0.0147)	(0.0227)	(0.0175)	(0.0270)	(0.0120)	(0.0184)
plot_expense	0.00302	0.0221***	0.117***	0.115***	0.00961***	0.0268***	0.0580***	0.0513***
	(0.00200)	(0.00337)	(0.00178)	(0.00365)	(0.00210)	(0.00349)	(0.00146)	(0.00279)
collective_plot	0.471***	0.499***	-0.0955**	-0.192**	0.398***	0.395***	-0.0321	0.00364
	(0.0572)	(0.103)	(0.0483)	(0.0877)	(0.0576)	(0.103)	(0.0375)	(0.0715)
rented_in	0.0942**	0.151**	-0.436***	-0.416***	0.0589	0.0688	-0.153***	-0.108
	(0.0419)	(0.0615)	(0.0504)	(0.0781)	(0.0488)	(0.0716)	(0.0413)	(0.0705)
irrigated	0.205***	-0.00417	0.0806	-0.106	0.129*	-0.209*	-0.0860	-0.0718
	(0.0649)	(0.0974)	(0.0656)	(0.122)	(0.0668)	(0.107)	(0.0542)	(0.0861)
soil_type	0.0625***	0.108***	-0.0100	-0.0346*	0.0414***	0.0570**	0.0504***	0.0360**
	(0.0131)	(0.0205)	(0.0112)	(0.0192)	(0.0136)	(0.0224)	(0.00921)	(0.0157)
soil_quality	-0.00706	0.00752	0.00244	-0.00975	-0.0245	0.00296	-0.0379***	-0.0138
	(0.0149)	(0.0241)	(0.0127)	(0.0212)	(0.0157)	(0.0271)	(0.0101)	(0.0162)
organic_fert	0.0235***	0.0473***	-0.0244***	-0.0324***	0.00805	0.0222***	-0.0160***	-0.0168***
	(0.00422)	(0.00635)	(0.00487)	(0.00707)	(0.00501)	(0.00760)	(0.00391)	(0.00650)
plot_slope	-0.00863	-0.00164	-0.00675	0.0135	-0.0345***	-0.0161	-0.0123**	0.00508
	(0.00893)	(0.0144)	(0.00758)	(0.0136)	(0.00941)	(0.0162)	(0.00609)	(0.0111)
intercropped	0.0177	-0.00996	0.0671***	0.0594**	-0.00572	-0.0144	0.0838***	0.0449**
	(0.0175)	(0.0256)	(0.0148)	(0.0236)	(0.0182)	(0.0283)	(0.0120)	(0.0196)
seed_type	0.203***	0.0616**	-0.102***	-0.301***	0.115***	-0.0323	-0.0260**	-0.143***
	(0.0152)	(0.0273)	(0.0137)	(0.0328)	(0.0162)	(0.0323)	(0.0109)	(0.0280)
dist_to_hh	0.00867***	0.0213***	0.0207***	0.0173***	-0.000540	0.0109***	0.0124***	0.00639**
	(0.00222)	(0.00373)	(0.00207)	(0.00347)	(0.00225)	(0.00377)	(0.00168)	(0.00272)
area_planted_op	-0.0111	-0.0286	-0.000393	-0.0391	-0.0120	-0.109***	-0.00915	-0.0682***
	(0.0157)	(0.0295)	(0.0146)	(0.0251)	(0.0164)	(0.0305)	(0.0121)	(0.0208)
plot_value	0.0137**	0.0725***	0.0337***	0.0254**	0.0269***	0.0931***	0.0210***	0.0344***
	(0.00641)	(0.0121)	(0.00521)	(0.0105)	(0.00640)	(0.0131)	(0.00392)	(0.00789)
2.pctile_tla	0.0563**	-0.0124	-0.00248	-0.0433	0.0837***	0.0841	0.00119	-0.0251
	(0.0268)	(0.0594)	(0.0229)	(0.0541)	(0.0291)	(0.0679)	(0.0173)	(0.0443)
3.pctile_tla	0.0565*	-0.0982	0.0275	0.0820	0.138***	0.101	0.0311	0.00432
	(0.0302)	(0.0780)	(0.0263)	(0.0696)	(0.0320)	(0.0865)	(0.0207)	(0.0532)
4.pctile_tla	0.0537	-0.0906	0.0311	0.116	0.195***	0.235**	0.0214	-0.00769
	(0.0328)	(0.0939)	(0.0295)	(0.0845)	(0.0351)	(0.105)	(0.0230)	(0.0668)
5.pctile_tla	-0.0840**	-0.171	0.145***	0.0480	0.204***	0.246*	0.0745***	-0.0731
	(0.0395)	(0.119)	(0.0365)	(0.116)	(0.0420)	(0.129)	(0.0284)	(0.0894)
Observations	16,999	10,417	16,999	10,417	16,999	10,417	16,999	10,417
R-squared	0.575	0.493	0.389	0.324	0.400	0.289	0.235	0.164
Number of y2_hhid		2,727		2,727		2,727		2,727
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Robustness 3 ctd - Farm Size Check

VARIABLES	(1) prep_labor	(2) prep_labor	(3) hired_prep_labor	(4) hired_prep_labor	(5) harv_labor	(6) harv_labor	(7) hired_harv_labor	(8) hired_harv_labor
value_all_other_plots	-0.0130***	-0.00469	0.00110	0.00252	-0.0105***	6.17e-05	0.00135	0.00175
	(0.00193)	(0.00486)	(0.00187)	(0.00511)	(0.00207)	(0.00575)	(0.00147)	(0.00403)
all_female	-0.208***	-0.189**	0.0740**	0.0619	-0.141***	-0.179*	0.0498*	0.00718
	(0.0428)	(0.0943)	(0.0347)	(0.0726)	(0.0434)	(0.0969)	(0.0272)	(0.0516)
mixed_gend_mgr	-0.182***	-0.275***	0.0118	0.184**	-0.235***	-0.318***	-0.00837	-0.0411
	(0.0595)	(0.107)	(0.0508)	(0.0926)	(0.0604)	(0.110)	(0.0395)	(0.0745)
educ_mgr	-0.0168	0.0150	0.0428***	0.0767***	0.0225	0.0498	0.0292***	0.0154
	(0.0156)	(0.0354)	(0.0130)	(0.0281)	(0.0155)	(0.0392)	(0.0110)	(0.0220)
age_mgr	1.080***	1.071***	0.0404**	-0.0517	0.722***	0.655***	0.0455***	0.0650**
	(0.0240)	(0.0524)	(0.0175)	(0.0374)	(0.0225)	(0.0526)	(0.0143)	(0.0294)
bmi_mgr	0.0102	-0.0103	-0.00801	0.00272	0.00360	0.0159	-0.0113	-0.0278
	(0.00913)	(0.0316)	(0.00862)	(0.0262)	(0.0102)	(0.0353)	(0.00693)	(0.0234)
mgr_is_head	-0.260***	-0.389***	0.0254	0.105	-0.135**	-0.130	-0.0552	-0.0339
	(0.0566)	(0.109)	(0.0439)	(0.0820)	(0.0541)	(0.103)	(0.0350)	(0.0679)
num_children	0.0505***	-0.00543	-0.0161***	0.0480**	0.0518***	0.000223	-0.0166***	-0.00456
	(0.00504)	(0.0191)	(0.00461)	(0.0208)	(0.00538)	(0.0223)	(0.00376)	(0.0182)
num_adult_members	0.0728***	0.0892***	-0.0579***	-0.0585**	0.0675***	0.0885***	-0.0405***	-0.00219
	(0.00797)	(0.0237)	(0.00680)	(0.0238)	(0.00818)	(0.0295)	(0.00559)	(0.0191)
num_old_members	-0.0668***	0.0287	-0.0129	0.0308	-0.0781***	-0.0140	-0.0191	0.00601
	(0.0200)	(0.0730)	(0.0170)	(0.0659)	(0.0210)	(0.0788)	(0.0136)	(0.0553)
density	-0.0301***	0.0206	0.0131*	-0.00819	-0.0265***	0.0367**	0.00254	0.00109
	(0.00954)	(0.0140)	(0.00709)	(0.0120)	(0.00932)	(0.0150)	(0.00555)	(0.00936)
hh_assets	-0.0739***	-0.0289**	0.0540***	-0.000683	-0.0504***	-0.0282*	0.0289***	0.00906
	(0.00629)	(0.0136)	(0.00520)	(0.0119)	(0.00646)	(0.0149)	(0.00410)	(0.00909)
farm_assets	0.00114	0.00121	0.000161	0.00525	0.00608***	0.00626	-0.00160	-0.00422
	(0.00193)	(0.00400)	(0.00169)	(0.00372)	(0.00200)	(0.00452)	(0.00134)	(0.00294)
animal_units	-0.00923	0.0859***	0.0417***	-0.0651*	0.00553	0.0730**	0.0461***	-0.0270
	(0.0103)	(0.0317)	(0.0104)	(0.0334)	(0.0112)	(0.0351)	(0.00889)	(0.0288)
hh_death	-0.0325	-0.0595	0.0302	0.0620	0.0302	-0.0503	0.0285	0.0355
	(0.0307)	(0.0722)	(0.0265)	(0.0651)	(0.0322)	(0.0705)	(0.0217)	(0.0515)
ag_wage	0.0197*	-0.0252	-0.0294***	-0.0148	-0.00743	-0.0263	0.00247	0.00108
	(0.0117)	(0.0216)	(0.0101)	(0.0214)	(0.0126)	(0.0241)	(0.00785)	(0.0161)
Observations	16,999	10,417	16,999	10,417	16,999	10,417	16,999	10,417
R-squared	0.575	0.493	0.389	0.324	0.400	0.289	0.235	0.164
Number of y2_hhid		2,727		2,727		2,727		2,727
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10: Robustness 3 ctd - Farm Size Check

VARIABLES	(1) prep_labor	(2) prep_labor	(3) hired_prep_labor	(4) hired_prep_labor	(5) harv_labor	(6) harv_labor	(7) hired_harv_labor	(8) hired_harv_labor
age_hh_head	-0.483***	-0.607***	-0.00784	0.119	-0.290***	-0.228	-0.0422	0.00366
	(0.0415)	(0.140)	(0.0328)	(0.151)	(0.0412)	(0.160)	(0.0268)	(0.114)
educ_hh_head	-0.0509***	0.0223	-0.0209*	-0.0634	-0.0557***	-0.0676	-0.0324***	0.0249
	(0.0140)	(0.0468)	(0.0115)	(0.0390)	(0.0137)	(0.0448)	(0.0103)	(0.0339)
gender_hh_head	-0.157***	-0.275**	0.0141	0.0230	-0.0523	-0.104	0.0292	0.0559
	(0.0340)	(0.120)	(0.0260)	(0.120)	(0.0349)	(0.127)	(0.0202)	(0.0884)
2.interview_month	-0.0247	0.0700	0.0647*	0.0608	0.0887**	0.207**	0.0638**	0.0760
	(0.0401)	(0.0857)	(0.0344)	(0.0928)	(0.0420)	(0.0968)	(0.0277)	(0.0671)
3.interview_month	0.111***	0.0717	0.0561	0.167	0.0937**	0.169	0.0667**	0.0975
	(0.0421)	(0.0990)	(0.0373)	(0.104)	(0.0445)	(0.113)	(0.0300)	(0.0769)
4.interview_month	0.00976	0.0108	0.0155	0.0270	0.0828*	0.0663	0.0452	0.0350
	(0.0403)	(0.133)	(0.0363)	(0.128)	(0.0428)	(0.139)	(0.0293)	(0.0941)
5.interview_month	0.0836**	0.0226	-0.0320	-0.166	0.100**	-0.0372	0.0391	-0.0851
	(0.0383)	(0.136)	(0.0333)	(0.134)	(0.0405)	(0.147)	(0.0259)	(0.106)
6.interview_month	0.139***	0.132	0.0314	-0.124	0.177***	0.0606	0.0135	-0.0566
	(0.0412)	(0.142)	(0.0346)	(0.138)	(0.0429)	(0.152)	(0.0273)	(0.110)
7.interview_month	0.0301	-0.148	-0.0470	-0.170	0.133***	-0.0215	0.0204	-0.0572
	(0.0379)	(0.152)	(0.0340)	(0.143)	(0.0401)	(0.157)	(0.0269)	(0.122)
8.interview_month	0.185***	-0.0242	-0.0119	-0.0390	0.170***	0.430***	0.0534*	-0.107
	(0.0383)	(0.158)	(0.0348)	(0.153)	(0.0411)	(0.165)	(0.0291)	(0.138)
9.interview_month	0.157***	-0.246	-0.0406	-0.0280	0.111*	0.259	0.0569	-0.0743
	(0.0581)	(0.180)	(0.0499)	(0.192)	(0.0580)	(0.182)	(0.0403)	(0.167)
10.interview_month	0.0604	0.0485	-0.00298	0.0246	0.0631	0.224	0.00251	-0.00970
	(0.0389)	(0.133)	(0.0332)	(0.124)	(0.0407)	(0.146)	(0.0259)	(0.0889)
11.interview_month	0.0889**	0.179	0.0632**	0.00694	0.139***	0.131	0.0791***	0.0519
	(0.0384)	(0.128)	(0.0319)	(0.104)	(0.0400)	(0.127)	(0.0261)	(0.0842)
12.interview_month	0.120***	0.258**	0.0180	0.0857	0.131***	-0.0299	0.0373	0.0136
	(0.0380)	(0.101)	(0.0315)	(0.0804)	(0.0399)	(0.107)	(0.0247)	(0.0680)
Constant	0.839**	1.169	-0.743	-0.105	0.186	0.433	-0.773***	-0.601
	(0.408)	(0.875)	(0.490)	(0.802)	(0.871)	(0.836)	(0.243)	(0.608)
Observations	16,999	10,417	16,999	10,417	16,999	10,417	16,999	10,417
R-squared	0.575	0.493	0.389	0.324	0.400	0.289	0.235	0.164
Number of y2_hhid		2,727		2,727		2,727		2,727
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Robustness 4 - Maize Regressions

VARIABLES	(1) prep_labor	(2) prep_labor	(3) harv_labor	(4) harv_labor	(5) hired_prep_labor	(6) hired_prep_labor	(7) hired_harv_labor	(8) hired_harv_labor
area_planted	0.489***	0.410***	0.489***	0.369***	0.257***	0.0928***	0.168***	0.0833***
	(0.0154)	(0.0276)	(0.0176)	(0.0315)	(0.0185)	(0.0338)	(0.0143)	(0.0242)
plot_expense	-0.0185***	0.00125	-0.00541**	0.00938***	0.111***	0.112***	0.0498***	0.0392***
	(0.00208)	(0.00330)	(0.00234)	(0.00346)	(0.00240)	(0.00483)	(0.00181)	(0.00326)
collective_plot	0.247***	0.325***	0.167**	0.210*	-0.139**	-0.128	-0.0884*	-0.151*
	(0.0626)	(0.0982)	(0.0649)	(0.118)	(0.0708)	(0.114)	(0.0482)	(0.0821)
rented_in	0.0209	0.0847	0.0952*	0.0178	-0.415***	-0.436***	-0.177***	-0.0834
	(0.0476)	(0.0701)	(0.0525)	(0.0761)	(0.0644)	(0.0978)	(0.0478)	(0.0645)
irrigated	0.337***	0.283**	0.333***	0.0441	-0.00201	-0.243	-0.124	-0.177
	(0.0827)	(0.125)	(0.0894)	(0.171)	(0.0983)	(0.150)	(0.0830)	(0.123)
organic_fert	0.0110**	0.0285***	0.00898*	0.0108	-0.0155***	-0.0194**	-0.0148***	-0.00453
	(0.00437)	(0.00659)	(0.00511)	(0.00812)	(0.00601)	(0.00878)	(0.00449)	(0.00752)
intercropped	0.0244	-0.00124	-0.00640	0.0351	-0.0702***	-0.0520*	-0.0530***	-0.0101
	(0.0211)	(0.0257)	(0.0229)	(0.0313)	(0.0236)	(0.0306)	(0.0180)	(0.0249)
improved_seeds	0.0107	-0.0118	-0.0344	-0.0823**	-0.224***	-0.258***	-0.0645***	-0.0919***
	(0.0231)	(0.0351)	(0.0255)	(0.0406)	(0.0277)	(0.0398)	(0.0213)	(0.0329)
dist_to_hh	0.00868***	0.0211***	0.00512*	0.0154***	0.0310***	0.0195***	0.0172***	0.00970***
	(0.00277)	(0.00427)	(0.00285)	(0.00454)	(0.00322)	(0.00474)	(0.00250)	(0.00332)
area_planted_op	-0.116***	-0.112***	-0.0269*	-0.0698**	0.0594***	-0.0779***	0.0544***	-0.0407*
	(0.0143)	(0.0238)	(0.0154)	(0.0294)	(0.0165)	(0.0292)	(0.0130)	(0.0238)
plot_value	0.0252***	0.0791***	0.0152*	0.0781***	0.0421***	0.0435**	0.0332***	0.0369***
	(0.00735)	(0.0137)	(0.00822)	(0.0163)	(0.00890)	(0.0170)	(0.00618)	(0.0104)
value_all_other_plots	-0.00155	-0.00422	-0.00599**	-0.00466	-0.00235	0.00861	-0.00341*	-0.00238
	(0.00221)	(0.00474)	(0.00244)	(0.00523)	(0.00264)	(0.00568)	(0.00200)	(0.00459)
all_female	-0.146***	0.110	-0.135**	-0.0760	0.118**	-0.105	0.0196	-0.0409
	(0.0533)	(0.0886)	(0.0605)	(0.0905)	(0.0583)	(0.0820)	(0.0444)	(0.0589)
mixed_gend_mgr	-0.125**	-0.238**	-0.121*	-0.226*	0.0372	0.101	0.0517	0.162*
	(0.0626)	(0.100)	(0.0655)	(0.122)	(0.0733)	(0.118)	(0.0498)	(0.0849)
Observations	9,410	6,827	9,410	6,827	9,410	6,827	9,410	6,827
R-squared	0.338	0.273	0.287	0.200	0.369	0.320	0.227	0.159
Number of y2_hhid		2,109		2,109		2,109		2,109
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Robustness 4 - Maize Regressions

VARIABLES	(1) prep_labor	(2) prep_labor	(3) harv_labor	(4) harv_labor	(5) hired_prep_labor	(6) hired_prep_labor	(7) hired_harv_labor	(8) hired_harv_labor
educ_mgr	-0.0678***	0.0358	-0.0236	0.0565	0.0596***	0.0564	0.0319*	0.0342
	(0.0204)	(0.0391)	(0.0212)	(0.0412)	(0.0224)	(0.0405)	(0.0179)	(0.0300)
age_mgr	0.108	0.144	0.109	0.122	0.0143	0.0417	0.0775*	0.00252
	(0.0861)	(0.115)	(0.0852)	(0.107)	(0.0660)	(0.0878)	(0.0447)	(0.0642)
bmi_mgr	-0.00408	-0.0523	-0.0111	-0.000345	0.0105	-0.0111	0.00285	-0.00638
	(0.0106)	(0.0328)	(0.0129)	(0.0356)	(0.0131)	(0.0322)	(0.0100)	(0.0323)
mgr_is_head	0.0432	0.0430	0.0192	-0.0357	0.109	0.0853	-0.0634	0.00567
	(0.0716)	(0.104)	(0.0766)	(0.107)	(0.0722)	(0.102)	(0.0545)	(0.0778)
num_children	0.0461***	0.0273	0.0542***	0.0376*	-0.0272***	-0.00139	-0.0208***	-0.0175
	(0.00594)	(0.0176)	(0.00692)	(0.0210)	(0.00714)	(0.0199)	(0.00559)	(0.0143)
num_adult_members	0.100***	0.0949***	0.0878***	0.0991***	-0.0786***	-0.0159	-0.0581***	-0.0198
	(0.0106)	(0.0201)	(0.0115)	(0.0252)	(0.0114)	(0.0258)	(0.00829)	(0.0228)
num_old_members	-0.0238	0.0471	-0.0427	-0.00817	0.0375	-0.0669	0.00165	0.0482
	(0.0239)	(0.0683)	(0.0262)	(0.0679)	(0.0259)	(0.0708)	(0.0187)	(0.0565)
density	-0.0612***	-0.00872	-0.0667***	0.0170	0.0266***	-0.00908	0.000806	-0.00188
	(0.00980)	(0.0146)	(0.0110)	(0.0180)	(0.00979)	(0.0166)	(0.00685)	(0.0132)
hh_assets	-0.0667***	-0.0127	-0.0376***	-0.0184	0.0574***	-0.00232	0.0359***	0.0146
	(0.00765)	(0.0134)	(0.00850)	(0.0153)	(0.00825)	(0.0142)	(0.00605)	(0.0116)
farm_assets	0.00242	-0.00138	0.00911***	-0.000705	0.00238	0.00698	-0.00226	-0.00169
	(0.00237)	(0.00431)	(0.00262)	(0.00480)	(0.00276)	(0.00470)	(0.00209)	(0.00362)
animal_units	-0.0397***	0.0626*	0.00777	0.0831**	0.0876***	-0.0713*	0.0465***	-0.00376
	(0.0122)	(0.0331)	(0.0135)	(0.0374)	(0.0156)	(0.0379)	(0.0123)	(0.0308)
age_hh_head	0.290***	0.202	0.154*	0.263	-0.111	0.0582	-0.160***	0.0353
	(0.0859)	(0.175)	(0.0877)	(0.183)	(0.0730)	(0.183)	(0.0511)	(0.135)
educ_hh_head	0.0269	0.0128	0.00187	-0.0915**	-0.0528**	0.00239	-0.0285	0.0404
	(0.0193)	(0.0455)	(0.0195)	(0.0433)	(0.0212)	(0.0488)	(0.0176)	(0.0372)
gender_hh_head	-0.0361	0.0770	-0.00203	0.122	0.0603	-0.0891	-0.00749	0.0457
	(0.0462)	(0.112)	(0.0549)	(0.129)	(0.0493)	(0.122)	(0.0379)	(0.0935)
hh_death	0.0374	-0.0327	0.0734**	0.0375	0.0437	0.0344	0.0366	0.0763*
	(0.0322)	(0.0544)	(0.0355)	(0.0572)	(0.0367)	(0.0598)	(0.0284)	(0.0403)
ag_wage	0.00664	0.0254	-0.00140	0.00158	-0.0282**	-0.0497***	-0.00683	0.00206
	(0.0112)	(0.0159)	(0.0130)	(0.0196)	(0.0131)	(0.0181)	(0.00984)	(0.0165)
Constant	-0.862	-2.736***	-1.014*	-2.339**	0.117	1.056	0.475	0.399
	(0.661)	(1.050)	(0.518)	(1.019)	(0.499)	(0.877)	(0.341)	(0.657)
Observations	9,410	6,827	9,410	6,827	9,410	6,827	9,410	6,827
R-squared	0.338	0.273	0.287	0.200	0.369	0.320	0.227	0.159
Number of y2_hhid		2,109		2,109		2,109		2,109
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12: Robustness 4 - Paddy/Rice Regressions

VARIABLES	(1) prep_labor	(2) prep_labor	(3) harv_labor	(4) harv_labor	(5) hired_prep_labor	(6) hired_prep_labor	(7) hired_harv_labor	(8) hired_harv_labor
area_planted	0.313***	0.104	0.418***	0.170**	0.145***	0.199*	0.160***	0.0639
	(0.0384)	(0.0695)	(0.0503)	(0.0850)	(0.0479)	(0.106)	(0.0431)	(0.0899)
plot_expense	-0.0269***	-0.0173**	-0.00938**	0.00675	0.139***	0.136***	0.0926***	0.0860***
	(0.00439)	(0.00689)	(0.00478)	(0.00814)	(0.00470)	(0.00930)	(0.00429)	(0.00858)
collective_plot	0.170	0.177	0.352**	0.0175	0.130	-0.0428	0.0754	0.304*
	(0.152)	(0.175)	(0.138)	(0.209)	(0.147)	(0.231)	(0.139)	(0.162)
rented_in	-0.0102	-0.0347	0.188**	0.392**	-0.514***	-0.541*	-0.446***	-0.594*
	(0.0860)	(0.163)	(0.0916)	(0.186)	(0.126)	(0.312)	(0.106)	(0.318)
irrigated	0.239**	0.0380	0.392***	0.0278	0.0974	0.239	-0.0389	0.282
	(0.115)	(0.150)	(0.123)	(0.182)	(0.137)	(0.298)	(0.124)	(0.213)
organic_fert	-0.0436**	0.00607	-0.0557**	-0.0101	-0.0283	-0.0639**	-0.00313	-0.0277
	(0.0221)	(0.0262)	(0.0217)	(0.0260)	(0.0214)	(0.0300)	(0.0203)	(0.0290)
intercropped	0.146**	-0.209**	-0.00398	-0.0458	-0.173**	-0.142	-0.162**	-0.0569
	(0.0579)	(0.102)	(0.0717)	(0.136)	(0.0716)	(0.140)	(0.0663)	(0.121)
improved_seeds	0.0283	0.00909	-0.0931	-0.182*	-0.299***	-0.396***	-0.178***	-0.171*
	(0.0574)	(0.0785)	(0.0624)	(0.102)	(0.0711)	(0.111)	(0.0605)	(0.0968)
dist_to_hh	0.00538	0.00648	0.00513	0.000533	0.00697	-0.0100	0.00932	-0.00347
	(0.00480)	(0.00887)	(0.00548)	(0.0121)	(0.00663)	(0.0136)	(0.00605)	(0.0122)
area_planted_op	-0.0921***	-0.207***	-0.00394	-0.0314	-0.0253	-0.0164	-0.0376	0.00792
	(0.0256)	(0.0529)	(0.0296)	(0.0732)	(0.0326)	(0.0766)	(0.0292)	(0.0659)
plot_value	0.0218	0.0632*	0.0442**	0.116***	0.0886***	0.0513*	0.0548***	0.0855***
	(0.0220)	(0.0375)	(0.0189)	(0.0352)	(0.0171)	(0.0292)	(0.0169)	(0.0300)
value_all_other_plots	0.0105**	0.0166	0.0137**	0.0153	-0.00271	0.0105	0.00285	0.0153
	(0.00523)	(0.0120)	(0.00577)	(0.0125)	(0.00647)	(0.0162)	(0.00545)	(0.0126)
all_female	-0.220**	-0.250	-0.143	-0.504***	0.210*	0.217	0.158	-0.0432
	(0.0971)	(0.178)	(0.113)	(0.193)	(0.120)	(0.209)	(0.108)	(0.205)
mixed_gend_mgr	0.0554	-0.147	-0.112	0.158	-0.0763	0.144	-0.0513	-0.367**
	(0.158)	(0.187)	(0.143)	(0.220)	(0.150)	(0.247)	(0.139)	(0.177)
Observations	2,459	1,810	2,459	1,810	2,459	1,810	2,459	1,810
R-squared	0.299	0.282	0.306	0.312	0.450	0.417	0.362	0.372
Number of y2_hhid		785		785		785		785
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12: Robustness 4 - Paddy/Rice Regressions

VARIABLES	(1) prep_labor	(2) prep_labor	(3) harv_labor	(4) harv_labor	(5) hired_prep_labor	(6) hired_prep_labor	(7) hired_harv_labor	(8) hired_harv_labor
educ_mgr	-0.0398	-0.0321	0.0206	0.0212	0.0950**	0.101	0.0431	-0.0412
	(0.0340)	(0.0673)	(0.0390)	(0.0874)	(0.0445)	(0.0886)	(0.0416)	(0.0806)
age_mgr	0.303***	0.147	0.280**	0.468**	-0.00573	0.0924	-0.0238	0.158
	(0.0989)	(0.195)	(0.132)	(0.214)	(0.110)	(0.228)	(0.134)	(0.263)
bmi_mgr	0.0359*	0.144*	0.00814	0.0263	-0.0708***	-0.0192	-0.0353	-0.119*
	(0.0217)	(0.0774)	(0.0229)	(0.0655)	(0.0266)	(0.0881)	(0.0235)	(0.0651)
mgr_is_head	-0.272**	-0.212	-0.181	-0.331	0.0526	-0.122	-0.0106	-0.246
	(0.107)	(0.213)	(0.121)	(0.244)	(0.134)	(0.254)	(0.135)	(0.305)
num_children	0.0441***	0.00879	0.0522***	0.0430	-0.0520***	-0.00919	-0.0282**	-0.00744
	(0.0107)	(0.0376)	(0.0120)	(0.0395)	(0.0143)	(0.0489)	(0.0125)	(0.0388)
num_adult_members	0.0980***	0.108**	0.123***	0.120**	-0.0562**	-0.0439	-0.0523***	0.0623
	(0.0192)	(0.0461)	(0.0200)	(0.0547)	(0.0229)	(0.0649)	(0.0196)	(0.0530)
num_old_members	-0.0687	0.0194	-0.0389	-0.185	-0.0125	0.00553	0.00847	-0.200
	(0.0456)	(0.142)	(0.0552)	(0.145)	(0.0559)	(0.157)	(0.0508)	(0.133)
density	-0.0563***	-0.0327	-0.0133	0.0728**	0.0625***	0.0946**	0.0192	0.00282
	(0.0168)	(0.0266)	(0.0187)	(0.0301)	(0.0203)	(0.0400)	(0.0177)	(0.0332)
hh_assets	-0.0476***	-0.0397*	-0.0398***	0.0229	0.0705***	-0.00552	0.0278*	-0.0285
	(0.0141)	(0.0241)	(0.0151)	(0.0300)	(0.0163)	(0.0335)	(0.0142)	(0.0263)
farm_assets	-0.000574	-0.00800	0.00571	0.00413	0.00868	0.0252**	0.00359	0.00125
	(0.00473)	(0.00764)	(0.00508)	(0.00909)	(0.00587)	(0.0115)	(0.00515)	(0.00929)
animal_units	0.00838	0.0906	0.0427	-0.0558	0.0234	-0.0798	0.0620**	-0.0566
	(0.0225)	(0.0597)	(0.0263)	(0.0678)	(0.0292)	(0.0853)	(0.0263)	(0.0694)
age_hh_head	-0.0740	0.341	-0.199	-0.422	0.124	-0.253	-0.145	-0.314
	(0.129)	(0.337)	(0.152)	(0.404)	(0.146)	(0.539)	(0.156)	(0.561)
educ_hh_head	-0.0323	0.0263	0.0152	-0.0425	-0.0570	-0.0269	-0.0525	0.0980
	(0.0337)	(0.0803)	(0.0382)	(0.102)	(0.0449)	(0.115)	(0.0409)	(0.0870)
gender_hh_head	-0.127	-0.137	-0.0782	-0.270	0.112	-0.102	0.0509	-0.102
	(0.0803)	(0.190)	(0.0983)	(0.240)	(0.105)	(0.269)	(0.0939)	(0.277)
hh_death	0.101	0.310***	0.0433	-0.236**	0.0649	-0.262*	-0.114	-0.104
	(0.0668)	(0.117)	(0.0734)	(0.119)	(0.0833)	(0.147)	(0.0763)	(0.114)
ag_wage	-0.00381	0.0582*	-0.00996	0.0565	0.0585**	0.0577	0.0472**	0.0278
	(0.0191)	(0.0334)	(0.0244)	(0.0358)	(0.0238)	(0.0413)	(0.0212)	(0.0363)
Constant	-0.0404	0.606	-1.349*	-0.892	-3.729***	-1.898	-1.142	0.0550
	(0.663)	(1.593)	(0.757)	(1.899)	(0.786)	(2.194)	(0.782)	(2.263)
Observations	2,459	1,810	2,459	1,810	2,459	1,810	2,459	1,810
R-squared	0.299	0.282	0.306	0.312	0.450	0.417	0.362	0.372
Number of y2_hhid		785		785		785		785
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13: Robustness 4 - Legumes

VARIABLES	(1) prep_labor	(2) prep_labor	(3) harv_labor	(4) harv_labor	(5) hired_prep_labor	(6) hired_prep_labor	(7) hired_harv_labor	(8) hired_harv_labor
area_planted	0.458***	0.317***	0.451***	0.282***	0.257***	0.163***	0.145***	0.161***
	(0.0197)	(0.0472)	(0.0231)	(0.0494)	(0.0255)	(0.0502)	(0.0192)	(0.0431)
plot_expense	-0.0172***	0.00769	-0.00345	0.00689	0.112***	0.112***	0.0484***	0.0305***
	(0.00317)	(0.00506)	(0.00351)	(0.00558)	(0.00372)	(0.00718)	(0.00279)	(0.00481)
collective_plot	0.248***	0.258	0.135	-0.0785	-0.115	0.0484	-0.112	-0.0971
	(0.0852)	(0.174)	(0.0961)	(0.143)	(0.0996)	(0.192)	(0.0707)	(0.119)
rented_in	-0.128	0.0113	-0.0839	-0.155	-0.293***	-0.559***	-0.0591	-0.189
	(0.0792)	(0.155)	(0.0789)	(0.131)	(0.101)	(0.171)	(0.0803)	(0.146)
irrigated	0.402***	-0.0214	-0.0202	-0.273	0.152	0.246	0.0997	-0.0118
	(0.148)	(0.273)	(0.146)	(0.241)	(0.168)	(0.358)	(0.134)	(0.276)
organic_fert	0.0216***	0.0433***	0.0106	0.0213	-0.0235**	-0.0124	-0.0219***	-0.0184
	(0.00642)	(0.0109)	(0.00766)	(0.0143)	(0.00919)	(0.0158)	(0.00681)	(0.0136)
intercropped	-0.0169	-0.0693	-0.0814*	-0.186**	0.00652	-0.00134	-0.102**	-0.0709
	(0.0430)	(0.0684)	(0.0476)	(0.0811)	(0.0526)	(0.0860)	(0.0413)	(0.0695)
improved_seeds	0.0505	-0.0728	0.00516	-0.00470	-0.248***	-0.316***	-0.0714**	-0.135**
	(0.0343)	(0.0605)	(0.0380)	(0.0674)	(0.0435)	(0.0697)	(0.0331)	(0.0613)
dist_to_hh	0.00443	0.0157***	0.00156	-0.000454	0.0267***	0.0247***	0.0176***	0.0106*
	(0.00399)	(0.00581)	(0.00427)	(0.00683)	(0.00486)	(0.00752)	(0.00372)	(0.00575)
area_planted_op	-0.0942***	-0.168***	-0.0403*	-0.147***	0.0801***	0.00569	0.0915***	0.00118
	(0.0213)	(0.0397)	(0.0222)	(0.0473)	(0.0250)	(0.0483)	(0.0196)	(0.0410)
plot_value	0.0224**	0.0312	0.0235**	0.0546**	0.0296**	0.0431*	0.0237***	0.0213
	(0.00983)	(0.0211)	(0.0114)	(0.0263)	(0.0119)	(0.0237)	(0.00787)	(0.0171)
value_all_other_plots	0.000551	-0.00569	-0.000407	0.0139*	-0.00394	0.0132	-0.00454*	-0.0102
	(0.00314)	(0.00682)	(0.00344)	(0.00821)	(0.00369)	(0.00918)	(0.00276)	(0.00717)
all_female	-0.283***	-0.0649	-0.294***	-0.0764	0.156*	-0.235	0.0496	-0.0696
	(0.0763)	(0.146)	(0.0865)	(0.147)	(0.0893)	(0.176)	(0.0607)	(0.102)
mixed_gend_mgr	-0.181**	-0.191	-0.139	-0.0637	0.0717	-0.0228	0.0459	0.0874
	(0.0864)	(0.169)	(0.0970)	(0.146)	(0.105)	(0.195)	(0.0731)	(0.117)
Observations	4,455	3,164	4,455	3,164	4,455	3,164	4,455	3,164
R-squared	0.341	0.286	0.295	0.228	0.349	0.361	0.226	0.187
Number of y2_hhid		1,482		1,482		1,482		1,482
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13: Robustness 4 - Legumes

VARIABLES	(1) prep_labor	(2) prep_labor	(3) harv_labor	(4) harv_labor	(5) hired_prep_labor	(6) hired_prep_labor	(7) hired_harv_labor	(8) hired_harv_labor
educ_mgr	-0.0414	0.00749	-0.0450	0.0635	0.0574*	0.0379	0.0707***	0.00305
	(0.0286)	(0.0624)	(0.0320)	(0.0613)	(0.0340)	(0.0673)	(0.0272)	(0.0582)
age_mgr	0.224**	0.293	0.249**	-0.0699	-0.00780	0.0459	0.0462	0.00569
	(0.103)	(0.201)	(0.109)	(0.199)	(0.0873)	(0.155)	(0.0544)	(0.114)
bmi_mgr	0.00404	0.0174	0.00482	0.0306	0.00731	0.0699	-0.00765	0.0464
	(0.0159)	(0.0556)	(0.0186)	(0.0637)	(0.0223)	(0.0577)	(0.0160)	(0.0717)
mgr_is_head	-0.113	0.0574	-0.0689	0.349**	0.191*	-0.0138	0.0481	-0.0924
	(0.0940)	(0.149)	(0.105)	(0.173)	(0.104)	(0.201)	(0.0670)	(0.126)
num_children	0.0444***	-0.0184	0.0626***	0.0143	-0.0125	0.0420	-0.00653	-0.0138
	(0.00898)	(0.0290)	(0.0104)	(0.0385)	(0.0114)	(0.0349)	(0.00864)	(0.0287)
num_adult_members	0.0927***	0.151***	0.0829***	0.108**	-0.104***	-0.110**	-0.0650***	-0.0288
	(0.0155)	(0.0400)	(0.0166)	(0.0538)	(0.0176)	(0.0452)	(0.0130)	(0.0360)
num_old_members	-0.0272	0.0121	-0.0319	0.00639	-0.00337	-0.353***	-0.0151	-0.0451
	(0.0353)	(0.0983)	(0.0392)	(0.121)	(0.0400)	(0.114)	(0.0293)	(0.105)
density	-0.0630***	-0.0462**	-0.0738***	0.00926	-0.00650	0.00436	0.00893	-0.00477
	(0.0148)	(0.0223)	(0.0171)	(0.0277)	(0.0152)	(0.0292)	(0.0102)	(0.0236)
hh_assets	-0.0680***	-0.00407	-0.0320**	-0.0357	0.0760***	0.00462	0.0467***	-0.00564
	(0.0110)	(0.0218)	(0.0125)	(0.0270)	(0.0132)	(0.0280)	(0.00950)	(0.0183)
farm_assets	0.00580*	0.00183	0.0108***	-0.00468	-0.00347	-0.00244	-0.00543*	-0.00587
	(0.00351)	(0.00754)	(0.00389)	(0.00875)	(0.00419)	(0.00855)	(0.00306)	(0.00595)
animal_units	-0.0745***	0.0498	-0.0282	0.134**	0.0633**	-0.176**	0.0659***	0.0203
	(0.0191)	(0.0548)	(0.0209)	(0.0665)	(0.0259)	(0.0700)	(0.0201)	(0.0472)
age_hh_head	0.146	0.405	0.0719	0.458*	-0.0128	0.158	-0.0998	0.114
	(0.107)	(0.272)	(0.115)	(0.270)	(0.101)	(0.309)	(0.0690)	(0.211)
educ_hh_head	0.0137	0.0229	0.0324	-0.0635	-0.0759**	-0.00162	-0.0842***	0.00439
	(0.0266)	(0.0652)	(0.0293)	(0.0761)	(0.0321)	(0.0861)	(0.0268)	(0.0709)
gender_hh_head	-0.112*	0.0345	-0.124	0.150	0.154**	-0.436*	0.0206	-0.0429
	(0.0643)	(0.167)	(0.0765)	(0.204)	(0.0746)	(0.254)	(0.0500)	(0.133)
hh_death	-0.00226	-0.116	0.0980*	0.111	0.0797	0.182*	0.0660	0.101
	(0.0478)	(0.0844)	(0.0543)	(0.104)	(0.0552)	(0.0954)	(0.0436)	(0.0827)
ag_wage	0.000623	0.0393	-0.00503	-0.0108	-0.00804	-0.00822	0.0186	0.0501*
	(0.0162)	(0.0240)	(0.0199)	(0.0289)	(0.0172)	(0.0261)	(0.0119)	(0.0259)
Constant	-0.795	-2.570**	-0.174	-1.870	-1.280**	0.718	-0.791*	-0.0702
	(0.599)	(1.268)	(0.641)	(1.266)	(0.635)	(1.437)	(0.465)	(1.060)
Observations	4,455	3,164	4,455	3,164	4,455	3,164	4,455	3,164
R-squared	0.341	0.286	0.295	0.228	0.349	0.361	0.226	0.187
Number of y2_hhid		1,482		1,482		1,482		1,482
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 14: Robustness 4 - Sweet Potatoes

VARIABLES	(1) prep_labor	(2) prep_labor	(3) harv_labor	(4) harv_labor	(5) hired_prep_labor	(6) hired_prep_labor	(7) hired_harv_labor	(8) hired_harv_labor
area_planted	0.336***	0.369***	0.244***	0.171	0.208***	0.105	0.0942***	0.216**
	(0.0381)	(0.134)	(0.0492)	(0.222)	(0.0480)	(0.142)	(0.0351)	(0.0893)
plot_expense	-0.00591	-0.0153	0.00181	0.0104	0.120***	0.130***	0.0429***	0.0379**
	(0.00598)	(0.0172)	(0.00802)	(0.0267)	(0.00825)	(0.0282)	(0.00565)	(0.0192)
collective_plot	-0.0583	0.262	0.143	0.387	-0.0624	-0.354	-0.0203	-0.550**
	(0.204)	(0.356)	(0.226)	(0.500)	(0.181)	(0.355)	(0.151)	(0.263)
rented_in	0.186	-0.0958	0.197	-0.968**	-0.630***	-0.616	-0.366***	-0.387
	(0.135)	(0.233)	(0.215)	(0.426)	(0.214)	(0.521)	(0.0957)	(0.245)
irrigated	0.0934	-0.934**	-0.0355	2.403***	0.553**	0.227	0.275**	-0.841**
	(0.239)	(0.462)	(0.400)	(0.669)	(0.277)	(0.791)	(0.118)	(0.393)
organic_fert	0.00779	0.0322*	0.00312	0.0168	-0.0244	-0.0372	-0.0132	-0.0307
	(0.0116)	(0.0173)	(0.0162)	(0.0402)	(0.0175)	(0.0454)	(0.0130)	(0.0287)
intercropped	0.165***	0.336**	-0.104	0.375	-0.0174	-0.0631	0.0267	-0.00892
	(0.0577)	(0.134)	(0.0820)	(0.249)	(0.0736)	(0.230)	(0.0504)	(0.157)
improved_seeds	-0.0107	0.0744	-0.0483	0.354	-0.437***	-0.476*	-0.115*	-0.167
	(0.0704)	(0.148)	(0.0912)	(0.226)	(0.100)	(0.268)	(0.0695)	(0.223)
dist_to_hh	0.00137	0.0350*	0.00513	0.00920	0.0479***	0.0565**	0.0267**	0.00209
	(0.0114)	(0.0186)	(0.0137)	(0.0279)	(0.0124)	(0.0282)	(0.0104)	(0.0208)
area_planted_op	-0.0314	-0.187*	-0.00984	-0.0495	0.0323	0.00240	0.0175	0.274***
	(0.0360)	(0.102)	(0.0491)	(0.179)	(0.0442)	(0.112)	(0.0347)	(0.0869)
plot_value	0.0975***	-0.0581	0.0610**	-0.0265	0.0703***	0.0307	0.0335*	0.0176
	(0.0218)	(0.0558)	(0.0281)	(0.0605)	(0.0243)	(0.0516)	(0.0175)	(0.0265)
value_all_other_plots	-0.0153***	0.0119	-0.00380	-0.00700	0.00978	-0.00195	0.00144	-0.0331*
	(0.00532)	(0.0193)	(0.00780)	(0.0271)	(0.00707)	(0.0233)	(0.00504)	(0.0181)
all_female	-0.0843	-0.625*	0.00612	-1.801***	0.308*	0.536	-0.00126	1.207***
	(0.137)	(0.368)	(0.204)	(0.495)	(0.173)	(0.379)	(0.138)	(0.274)
mixed_gend_mgr	0.145	-0.164	-0.0389	-0.378	0.195	0.477	-0.0432	0.478*
	(0.199)	(0.338)	(0.235)	(0.584)	(0.185)	(0.375)	(0.147)	(0.262)
Observations	1,134	700	1,134	700	1,134	700	1,134	700
R-squared	0.536	0.709	0.353	0.574	0.449	0.623	0.318	0.576
Number of y2_hhid		482		482		482		482
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 14: Robustness 4 - Sweet Potatoes

VARIABLES	(1) prep_labor	(2) prep_labor	(3) harv_labor	(4) harv_labor	(5) hired_prep_labor	(6) hired_prep_labor	(7) hired_harv_labor	(8) hired_harv_labor
educ_mgr	-0.0553	0.0804	-0.0443	-0.617***	0.0782	0.0579	0.0233	0.311**
	(0.0549)	(0.132)	(0.0789)	(0.219)	(0.0619)	(0.205)	(0.0487)	(0.123)
age_mgr	0.501*	0.159	0.755***	-0.392	0.205	0.219	0.229*	-0.664
	(0.268)	(0.886)	(0.259)	(1.144)	(0.189)	(1.079)	(0.134)	(0.567)
bmi_mgr	-0.0483**	-0.00906	-0.0913**	-0.0680	-0.0168	-0.144	0.0141	0.0158
	(0.0226)	(0.142)	(0.0379)	(0.205)	(0.0451)	(0.230)	(0.0368)	(0.104)
mgr_is_head	-0.0890	-0.245	-0.237	-2.310***	0.326*	-0.313	-0.00335	1.020***
	(0.150)	(0.400)	(0.233)	(0.548)	(0.197)	(0.400)	(0.181)	(0.266)
num_children	0.0175	0.0136	0.0292	0.0366	-0.0384**	0.00105	-0.00605	0.0126
	(0.0153)	(0.0483)	(0.0199)	(0.0727)	(0.0174)	(0.0805)	(0.0140)	(0.0368)
num_adult_members	0.0826***	0.143***	0.0924***	0.102	-0.0378	-0.0949	-0.0398**	0.0936**
	(0.0237)	(0.0464)	(0.0266)	(0.0671)	(0.0282)	(0.0705)	(0.0191)	(0.0429)
num_old_members	-0.0577	-0.157	-0.102	-0.0757	0.0351	0.0477	0.0544	0.0577
	(0.0637)	(0.230)	(0.0798)	(0.288)	(0.0741)	(0.331)	(0.0560)	(0.212)
density	-0.0629***	-0.159***	-0.0378	0.0238	-0.0232	-0.0699	-0.0150	-0.0427
	(0.0218)	(0.0445)	(0.0325)	(0.0854)	(0.0214)	(0.0683)	(0.0129)	(0.0398)
hh_assets	-0.0671***	0.0244	0.0165	0.286***	0.0384	0.218**	0.0320	0.0534
	(0.0260)	(0.0620)	(0.0314)	(0.0899)	(0.0291)	(0.102)	(0.0210)	(0.0504)
farm_assets	0.0233***	0.00885	0.00785	-0.0413	-0.00230	-0.0186	-0.00148	-0.00390
	(0.00771)	(0.0175)	(0.00909)	(0.0271)	(0.00814)	(0.0274)	(0.00564)	(0.0182)
animal_units	0.0238	0.176**	0.0413	-0.159	0.0351	-0.0247	0.0583**	0.131*
	(0.0259)	(0.0686)	(0.0352)	(0.114)	(0.0348)	(0.146)	(0.0286)	(0.0718)
age_hh_head	-0.213	-0.720	-0.543**	-0.353	-0.222	0.902	-0.386***	1.331*
	(0.257)	(0.856)	(0.264)	(1.161)	(0.220)	(1.034)	(0.149)	(0.711)
educ_hh_head	-0.00813	-0.127	0.00146	0.500**	-0.0494	-0.0346	-0.0150	0.0548
	(0.0517)	(0.144)	(0.0787)	(0.212)	(0.0601)	(0.180)	(0.0445)	(0.108)
gender_hh_head	0.0586	-0.769**	0.0900	-0.717	-0.0181	0.426	-0.111	0.420
	(0.118)	(0.357)	(0.186)	(0.563)	(0.151)	(0.390)	(0.121)	(0.310)
hh_death	-0.0954	0.469**	0.146	0.114	-0.00715	0.473**	0.0169	0.446***
	(0.0789)	(0.202)	(0.101)	(0.240)	(0.0943)	(0.220)	(0.0715)	(0.148)
ag_wage	-0.00366	-0.134**	-0.00155	-0.0378	0.0679**	0.0440	0.00924	-0.0156
	(0.0293)	(0.0519)	(0.0429)	(0.0812)	(0.0324)	(0.0831)	(0.0211)	(0.0498)
Constant	-0.107	2.594	0.0768	-8.683*	-2.216**	-5.318	0.100	-4.298
	(1.040)	(3.378)	(1.377)	(4.689)	(1.091)	(4.409)	(0.635)	(2.723)
Observations	1,134	700	1,134	700	1,134	700	1,134	700
R-squared	0.536	0.709	0.353	0.574	0.449	0.623	0.318	0.576
Number of y2_hhid		482		482		482		482
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15: Robustness 4 - Cotton

VARIABLES	(1) prep_labor	(2) prep_labor	(3) harv_labor	(4) harv_labor	(5) hired_prep_labor	(6) hired_prep_labor	(7) hired_harv_labor	(8) hired_harv_labor
area_planted	0.209***	0.433***	0.218**	0.234	0.243**	0.237	0.334***	0.647***
	(0.0639)	(0.0987)	(0.0880)	(0.158)	(0.116)	(0.243)	(0.0914)	(0.233)
plot_expense	-0.00408	-0.0303	-0.000353	0.00376	0.204***	0.161***	0.164***	0.0790*
	(0.0185)	(0.0247)	(0.0240)	(0.0287)	(0.0283)	(0.0501)	(0.0217)	(0.0401)
collective_plot	0.666***	-0.0749	0.531*	-0.139	-0.336	-0.113	-0.166	-0.431
	(0.237)	(0.261)	(0.309)	(0.311)	(0.342)	(0.606)	(0.272)	(0.405)
rented_in	-0.000907	0.301	0.331	0.445*	-0.303	0.214	-0.359*	-0.224
	(0.166)	(0.212)	(0.201)	(0.260)	(0.231)	(0.369)	(0.210)	(0.383)
irrigated	-0.216		-1.158***		1.962***		1.555***	
	(0.254)		(0.375)		(0.428)		(0.364)	
organic_fert	0.0331	0.0337	0.0202	0.0329	0.0124	-0.0181	0.0536*	-0.0467
	(0.0208)	(0.0419)	(0.0264)	(0.0601)	(0.0327)	(0.0614)	(0.0305)	(0.0641)
intercropped	-0.0830	-0.150	-0.124	0.192	0.245	-0.470**	0.0123	-0.261
	(0.0997)	(0.131)	(0.130)	(0.174)	(0.159)	(0.236)	(0.133)	(0.262)
improved_seeds	-0.0439	0.00884	-0.120	-0.417**	0.0493	0.0799	-0.0511	0.114
	(0.0965)	(0.146)	(0.146)	(0.182)	(0.161)	(0.293)	(0.139)	(0.367)
dist_to_hh	-0.0104	0.0152	-0.0469**	-0.0736*	0.0512**	0.0399	0.0467**	0.0215
	(0.0174)	(0.0264)	(0.0230)	(0.0383)	(0.0227)	(0.0487)	(0.0222)	(0.0403)
area_planted_op	-0.104	-0.0143	-0.0689	0.0594	0.0620	-0.298	0.0728	0.152
	(0.0640)	(0.0935)	(0.0770)	(0.120)	(0.0933)	(0.203)	(0.0799)	(0.201)
plot_value	0.138**	0.136**	0.142**	0.0784	0.126	0.0118	0.00656	-0.144
	(0.0534)	(0.0580)	(0.0682)	(0.135)	(0.0775)	(0.133)	(0.0601)	(0.119)
value_all_other_plots	-0.0149	0.00542	-0.00478	-0.0129	0.0230	0.0239	0.00806	-0.0243
	(0.0115)	(0.0246)	(0.0143)	(0.0260)	(0.0177)	(0.0355)	(0.0147)	(0.0372)
all_female	-0.462**	-0.195	-0.271	-0.545	0.118	0.740	-0.119	0.771*
	(0.225)	(0.250)	(0.281)	(0.363)	(0.306)	(0.519)	(0.253)	(0.417)
mixed_gend_mgr	-0.647***	-0.105	-0.432	-0.0513	0.107	0.0947	-0.251	0.575
	(0.233)	(0.243)	(0.327)	(0.321)	(0.351)	(0.607)	(0.279)	(0.489)
Observations	497	306	497	306	497	306	497	306
R-squared	0.505	0.735	0.404	0.648	0.446	0.595	0.481	0.515
Number of y2_hhid		134		134		134		134
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15: Robustness 4 - Cotton

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	prep_labor	prep_labor	harv_labor	harv_labor	hired_prep_labor	hired_prep_labor	hired_harv_labor	hired_harv_labor
educ_mgr	-0.0990	0.266*	-0.208*	-0.0384	0.00714	0.0999	-0.0376	-0.0569
	(0.0820)	(0.152)	(0.113)	(0.228)	(0.123)	(0.201)	(0.122)	(0.218)
age_mgr	1.006**	0.644	1.606***	1.482*	-0.100	-0.394	-0.0385	-1.295*
	(0.439)	(0.478)	(0.454)	(0.863)	(0.561)	(0.969)	(0.523)	(0.739)
bmi_mgr	0.00964	0.194*	-0.00626	0.0921	-0.157**	-0.237	-0.0692	-0.310*
	(0.0514)	(0.111)	(0.0517)	(0.137)	(0.0606)	(0.145)	(0.0502)	(0.184)
mgr_is_head	-0.259	-0.266	-0.575*	-0.910*	0.470	0.803	-0.113	0.968**
	(0.231)	(0.349)	(0.312)	(0.484)	(0.362)	(0.633)	(0.300)	(0.458)
num_children	0.0269	0.0475	0.0270	-0.00565	-0.0271	-0.469***	-0.0225	-0.116
	(0.0180)	(0.0703)	(0.0259)	(0.0699)	(0.0322)	(0.147)	(0.0263)	(0.107)
num_adult_members	0.0931***	-0.0108	0.142***	0.0737	-0.115**	0.159	-0.0998**	-0.0986
	(0.0287)	(0.0662)	(0.0446)	(0.0657)	(0.0535)	(0.137)	(0.0405)	(0.112)
num_old_members	0.0124	0.334	-0.0884	0.00438	0.0725	0.853	-0.0997	0.959*
	(0.0777)	(0.369)	(0.111)	(0.473)	(0.138)	(0.570)	(0.109)	(0.525)
density	0.0618	0.0189	0.0746	0.290*	0.0527	0.446**	0.0886	0.247
	(0.0859)	(0.139)	(0.114)	(0.161)	(0.0939)	(0.201)	(0.0843)	(0.187)
hh_assets	-0.0534	-0.0801	-0.0717	0.0825	0.0432	-0.0326	0.0407	0.0125
	(0.0468)	(0.0997)	(0.0625)	(0.112)	(0.0668)	(0.122)	(0.0600)	(0.140)
farm_assets	0.0119	0.00746	0.0293	-0.0363	-0.0251	-0.00985	-0.0202	-0.0150
	(0.0130)	(0.0323)	(0.0222)	(0.0382)	(0.0241)	(0.0349)	(0.0215)	(0.0355)
animal_units	0.0143	0.00844	-0.0400	0.0255	0.0816	0.0860	0.104*	-0.00398
	(0.0454)	(0.0966)	(0.0621)	(0.114)	(0.0692)	(0.131)	(0.0609)	(0.163)
age_hh_head	-0.559	-1.206*	-1.246**	-1.451	-0.308	0.955	-0.430	1.200
	(0.452)	(0.662)	(0.490)	(0.976)	(0.574)	(0.981)	(0.550)	(1.117)
educ_hh_head	0.00513	-0.596**	-0.00150	-0.679**	0.148	-0.0645	0.161	0.160
	(0.0857)	(0.232)	(0.119)	(0.282)	(0.128)	(0.457)	(0.128)	(0.402)
gender_hh_head	-0.139	0.434	-0.258	0.368	-0.142	2.000*	-0.0372	1.933**
	(0.185)	(0.515)	(0.239)	(0.630)	(0.241)	(1.023)	(0.197)	(0.748)
hh_death	-0.0779	-0.0449	-0.0867	0.317	-0.0451	0.996**	0.112	0.943**
	(0.133)	(0.224)	(0.193)	(0.270)	(0.212)	(0.428)	(0.175)	(0.444)
ag_wage	-0.0136	-0.0262	-0.0914	0.117	0.0285	-0.230	0.0425	-0.122
	(0.0657)	(0.0644)	(0.0766)	(0.102)	(0.0811)	(0.162)	(0.0880)	(0.139)
Constant	1.881	4.299	5.135**	1.055	-4.936*	-2.064	-2.277	-1.228
	(1.522)	(2.642)	(2.252)	(3.028)	(2.688)	(4.545)	(2.344)	(5.405)
Observations	497	306	497	306	497	306	497	306
R-squared	0.505	0.735	0.404	0.648	0.446	0.595	0.481	0.515
Number of y2_hhid		134		134		134		134
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 16: Robustness 4 - Tobacco

VARIABLES	(1) prep_labor	(2) prep_labor	(3) harv_labor	(4) harv_labor	(5) hired_prep_labor	(6) hired_prep_labor	(7) hired_harv_labor	(8) hired_harv_labor
area_planted	0.209***	0.433***	0.218**	0.234	0.243**	0.237	0.334***	0.647***
	(0.0639)	(0.0987)	(0.0880)	(0.158)	(0.116)	(0.243)	(0.0914)	(0.233)
plot_expense	-0.00408	-0.0303	-0.000353	0.00376	0.204***	0.161***	0.164***	0.0790*
	(0.0185)	(0.0247)	(0.0240)	(0.0287)	(0.0283)	(0.0501)	(0.0217)	(0.0401)
collective_plot	0.666***	-0.0749	0.531*	-0.139	-0.336	-0.113	-0.166	-0.431
	(0.237)	(0.261)	(0.309)	(0.311)	(0.342)	(0.606)	(0.272)	(0.405)
rented_in	-0.000907	0.301	0.331	0.445*	-0.303	0.214	-0.359*	-0.224
	(0.166)	(0.212)	(0.201)	(0.260)	(0.231)	(0.369)	(0.210)	(0.383)
irrigated	-0.216		-1.158***		1.962***		1.555***	
	(0.254)		(0.375)		(0.428)		(0.364)	
organic_fert	0.0331	0.0337	0.0202	0.0329	0.0124	-0.0181	0.0536*	-0.0467
	(0.0208)	(0.0419)	(0.0264)	(0.0601)	(0.0327)	(0.0614)	(0.0305)	(0.0641)
intercropped	-0.0830	-0.150	-0.124	0.192	0.245	-0.470**	0.0123	-0.261
	(0.0997)	(0.131)	(0.130)	(0.174)	(0.159)	(0.236)	(0.133)	(0.262)
improved_seeds	-0.0439	0.00884	-0.120	-0.417**	0.0493	0.0799	-0.0511	0.114
	(0.0965)	(0.146)	(0.146)	(0.182)	(0.161)	(0.293)	(0.139)	(0.367)
dist_to_hh	-0.0104	0.0152	-0.0469**	-0.0736*	0.0512**	0.0399	0.0467**	0.0215
	(0.0174)	(0.0264)	(0.0230)	(0.0383)	(0.0227)	(0.0487)	(0.0222)	(0.0403)
area_planted_op	-0.104	-0.0143	-0.0689	0.0594	0.0620	-0.298	0.0728	0.152
	(0.0640)	(0.0935)	(0.0770)	(0.120)	(0.0933)	(0.203)	(0.0799)	(0.201)
plot_value	0.138**	0.136**	0.142**	0.0784	0.126	0.0118	0.00656	-0.144
	(0.0534)	(0.0580)	(0.0682)	(0.135)	(0.0775)	(0.133)	(0.0601)	(0.119)
value_all_other_plots	-0.0149	0.00542	-0.00478	-0.0129	0.0230	0.0239	0.00806	-0.0243
	(0.0115)	(0.0246)	(0.0143)	(0.0260)	(0.0177)	(0.0355)	(0.0147)	(0.0372)
all_female	-0.462**	-0.195	-0.271	-0.545	0.118	0.740	-0.119	0.771*
	(0.225)	(0.250)	(0.281)	(0.363)	(0.306)	(0.519)	(0.253)	(0.417)
mixed_gend_mgr	-0.647***	-0.105	-0.432	-0.0513	0.107	0.0947	-0.251	0.575
	(0.233)	(0.243)	(0.327)	(0.321)	(0.351)	(0.607)	(0.279)	(0.489)
Observations	497	306	497	306	497	306	497	306
R-squared	0.505	0.735	0.404	0.648	0.446	0.595	0.481	0.515
Number of y2_hhid		134		134		134		134
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 16: Robustness 4 - Tobacco

VARIABLES	(1) prep_labor	(2) prep_labor	(3) harv_labor	(4) harv_labor	(5) hired_prep_labor	(6) hired_prep_labor	(7) hired_harv_labor	(8) hired_harv_labor
educ_mgr	-0.0990	0.266*	-0.208*	-0.0384	0.00714	0.0999	-0.0376	-0.0569
	(0.0820)	(0.152)	(0.113)	(0.228)	(0.123)	(0.201)	(0.122)	(0.218)
age_mgr	1.006**	0.644	1.606***	1.482*	-0.100	-0.394	-0.0385	-1.295*
	(0.439)	(0.478)	(0.454)	(0.863)	(0.561)	(0.969)	(0.523)	(0.739)
bmi_mgr	0.00964	0.194*	-0.00626	0.0921	-0.157**	-0.237	-0.0692	-0.310*
	(0.0514)	(0.111)	(0.0517)	(0.137)	(0.0606)	(0.145)	(0.0502)	(0.184)
mgr_is_head	-0.259	-0.266	-0.575*	-0.910*	0.470	0.803	-0.113	0.968**
	(0.231)	(0.349)	(0.312)	(0.484)	(0.362)	(0.633)	(0.300)	(0.458)
num_children	0.0269	0.0475	0.0270	-0.00565	-0.0271	-0.469***	-0.0225	-0.116
	(0.0180)	(0.0703)	(0.0259)	(0.0699)	(0.0322)	(0.147)	(0.0263)	(0.107)
num_adult_members	0.0931***	-0.0108	0.142***	0.0737	-0.115**	0.159	-0.0998**	-0.0986
	(0.0287)	(0.0662)	(0.0446)	(0.0657)	(0.0535)	(0.137)	(0.0405)	(0.112)
num_old_members	0.0124	0.334	-0.0884	0.00438	0.0725	0.853	-0.0997	0.959*
	(0.0777)	(0.369)	(0.111)	(0.473)	(0.138)	(0.570)	(0.109)	(0.525)
density	0.0618	0.0189	0.0746	0.290*	0.0527	0.446**	0.0886	0.247
	(0.0859)	(0.139)	(0.114)	(0.161)	(0.0939)	(0.201)	(0.0843)	(0.187)
hh_assets	-0.0534	-0.0801	-0.0717	0.0825	0.0432	-0.0326	0.0407	0.0125
	(0.0468)	(0.0997)	(0.0625)	(0.112)	(0.0668)	(0.122)	(0.0600)	(0.140)
farm_assets	0.0119	0.00746	0.0293	-0.0363	-0.0251	-0.00985	-0.0202	-0.0150
	(0.0130)	(0.0323)	(0.0222)	(0.0382)	(0.0241)	(0.0349)	(0.0215)	(0.0355)
animal_units	0.0143	0.00844	-0.0400	0.0255	0.0816	0.0860	0.104*	-0.00398
	(0.0454)	(0.0966)	(0.0621)	(0.114)	(0.0692)	(0.131)	(0.0609)	(0.163)
age_hh_head	-0.559	-1.206*	-1.246**	-1.451	-0.308	0.955	-0.430	1.200
	(0.452)	(0.662)	(0.490)	(0.976)	(0.574)	(0.981)	(0.550)	(1.117)
educ_hh_head	0.00513	-0.596**	-0.00150	-0.679**	0.148	-0.0645	0.161	0.160
	(0.0857)	(0.232)	(0.119)	(0.282)	(0.128)	(0.457)	(0.128)	(0.402)
gender_hh_head	-0.139	0.434	-0.258	0.368	-0.142	2.000*	-0.0372	1.933**
	(0.185)	(0.515)	(0.239)	(0.630)	(0.241)	(1.023)	(0.197)	(0.748)
hh_death	-0.0779	-0.0449	-0.0867	0.317	-0.0451	0.996**	0.112	0.943**
	(0.133)	(0.224)	(0.193)	(0.270)	(0.212)	(0.428)	(0.175)	(0.444)
ag_wage	-0.0136	-0.0262	-0.0914	0.117	0.0285	-0.230	0.0425	-0.122
	(0.0657)	(0.0644)	(0.0766)	(0.102)	(0.0811)	(0.162)	(0.0880)	(0.139)
Constant	1.881	4.299	5.135**	1.055	-4.936*	-2.064	-2.277	-1.228
	(1.522)	(2.642)	(2.252)	(3.028)	(2.688)	(4.545)	(2.344)	(5.405)
Observations	497	306	497	306	497	306	497	306
R-squared	0.505	0.735	0.404	0.648	0.446	0.595	0.481	0.515
Number of y2_hhid		134		134		134		134
Soil & Slope controls	yes	yes	yes	yes	yes	yes	yes	yes
HH FE	yes	yes	yes	yes	yes	yes	yes	yes
Village-Wave FE	yes	yes	yes	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1