CHAPTER 9
RESULTS OF THE STUDY

This chapter presents and discusses the results of the empirical estimation to test the effects of social capital and other hypothesized factors on the use of mat management (corm paring, de-suckering and post-harvest pseudo-stem management) as well as soil fertility management practices (manure application and mulching). Technology use decisions are considered in terms of a discrete decision (to use or not to use) and an extent-of-use decision (the share of the crop area allocated to these practices). The extent-of-use decision is defined for banana plantations in terms of the share of banana mats managed using the recommended practices. Findings on the factors that influence the social capital of farm households, another focus of this dissertation, are also discussed.

Variables included in the analysis of the use of banana production management practices were selected based on the theoretical analysis developed in Chapter 5, guided by the existing literature. Final specification of the explanatory variables in the estimating equations was constrained by multicollinearity considerations. The problem of multicollinearity in the explanatory variables can inflate the standard errors, causing failure to reject the null hypothesis when the data actually support its rejection, and thus lead to the wrong conclusions.

Each explanatory factor was partially correlated with other explanatory variables in the model to examine those factors that are highly correlated (results are presented in Appendix B). As indicated in the correlation matrix, the intensity of weevils measured at community level was highly correlated with the distance from paved roads and with the relative price of bananas. Hence, weevil intensity was omitted from the analysis. The problem of multicollinearity is often induced by the use of the Heckman procedure, when the explanatory variables in the first and second stage regressions are identical. Although non-linearity of the inverse Mills ratio allows the identification condition to be met (Wooldridge, 2002), multicollinearity can still be a problem. A variance inflation factor (VIF) technique in Stata 8.0 was also used to test for multicollinearity in the second-stage regression. All explanatory variables included in

the estimation had a VIF of less than 5.0, which suggests that multicollinearity did not in fact affect the results.[1]

The chapter is organized into three major sections. The first section presents results regarding the determinants of the decision to use improved production management practices. This is followed by results regarding the extent of use of improved production management practices. Factors that influence household participation in local associations and private social networks, which proxy for social capital in this research, are presented last in section three.

9.1 The decision to use improved management practices

A Probit model was used to estimate the probability of a positive use decision. The summary of the results is presented in Table 34 while the full results are presented in Appendices C.1 to C.5. Marginal effects computed for the use decision in each model measure the expected change in the probability of observing a positive use of the selected technology with respect to a change in the particular explanatory variable at its mean value. In terms of the overall percentage of predictions correctly classified, the model performs well for all management practices, thus implying a good fit (Table 34).

Applying the same equation structure (set of explanatory variables) for all practices reveals that the determinants of the use of improved banana production management practices are technology-specific. There are few patterns that can be discerned across technologies. Thus, the interpretation of results is presented by practice and comparisons across technologies are made only when relevant.

Econometric findings confirm that all five groups of variables (household characteristics, farm characteristics, market factors, information diffusion parameters and social capital) shape the decision to use banana management practices.

[1] A variance inflation factor (VIF) greater than 10 indicates the existence of a collinearity problem (Kennedy, 1985).

Table 34. A summary of the Probit estimation of factors affecting the probability of using improved banana management practices

Variables	Mulching	Manure	De-suckering	Residue management	Corm paring
Household characteristics (Ω_{HH})					
Age	0.000	-0.006*	-0.004	0.001	-0.001
Gender	-0.052	-0.024	-0.157^	0.040	0.004
Education	0.009	0.008	0.013	0.011*	0.027**
Household size	0.017	0.018	0.019	0.010	0.013
Dependency ratio	-0.216^	-0.004	-0.031	-0.016	0.006
Livestock unit	0.018	0.109**	-0.048*	-0.019**	0.003
Per capita cultivable land	0.052^	0.023	-0.002	0.046*	0.013
Income from private assets I)	0.000	1.2E-06	6.7E-06	-6.4E-07	2.2E-07
Physical farm characteristics (Ω_F)					
Elevation	0.026	-0.036	0.851**	0.111*	0.215*
Poor drainage conditions	-0.023	0.148*	-0.026	-0.006	-0.082^
Moisture retention capacity	-0.138*	0.071	-0.076	0.028	0.054
Slope of the farm	0.037	-0.160^	0.137	-0.020	-0.111^
Age of the banana plants	-0.002	-0.003	-0.003	0.001	-0.002
Number of banana mats	0.0003*	0.0001	5.6E-06	9.8E-06	8.2E-05
Market factors (Ω_M)					
Distance from paved roads	-0.011*	-0.007	-0.016*	-0.009**	0.016**
Price/labour wage ratio	3.080**	2.847*	3.143*	1.299*	2.939**
Information diffusion parameters (Ω_D)					
Relative experience (τ)	0.814**	1.280**	0.172^	0.012	0.098*
Exposure	-0.017	0.099	0.326**	0.012	0.286**
Extension contact	0.015	0.020	-0.007	0.009	0.016
Social capital (Ω_{SS})					
Household membership density	0.021	0.047	-0.075	0.004	-0.036
Leadership heterogeneity	0.057	0.205**	0.240**	0.008	0.092*
Participatory decision-making norms	0.312**	0.261**	0.138	0.057	-0.256**
Net labour transfers	4.1E-06	2.4E-06	-2.4E-06	1.0E-06	8.9E-07
Net cash transfers	5.6E-07	6.6E-07	-2.4E-07	-5.3E-08	3.3E-07
Net transfers of durable consumer goods	3.4E-07	4.0E-06**	2.2E-07	-5.9E-07	5.6E-07
Observed probability	7.0E-01	0.426	0.432692	0.835	0.229
Predicted probability	7.9E-01	0.413	0.488	0.930	0.145
% Correctly specified	78.100	79.200	86.500	87.900	85.000
Number of observations	312.000	312.000	312.000	309.000	310.000
Likelihood ratio chi sq (25)	115.540	124.000	210.210	80.670	113.730
Probability > chi sq	0.000	0.000	0.000	0.000	0.000
Pseudo R2	0.3026	0.2913	0.4925	0.2914	0.341
Log likelihood	-133.159	-150.860	-108.322	-98.0792	-109.949

** Significant at 1%, * significant at 5% and ^ significant at 10%.

9.1.1. Effect of household characteristics

Most of the household characteristics included in the analysis (demographic factors, human capital and wealth) are typically significant in one or two equations. Household size is not significant in any equation. Other household demographic factors (i.e. age, dependency ratio and gender) appear to be important only in decisions regarding the use of technologies (i.e. mulching, manure and de-suckering) related to soil fertility management. Age and the dependency ratio are negatively associated with the probability of manure application and the use of mulching. Age is associated with a short time preference, which reduces the benefits of soil conservation technologies. Shiferaw and Holden (1998) also found that there was a negative relationship between age and the adoption of soil conservation structures in Ethiopia. The dependency ratio measures market failures in output markets. Imperfections in output markets encourage self-sufficiency in that output, and an increase in the consumer-worker ratio increase the household consumption demand and consequently production. However, when insurance and labour markets also fail, a higher consumer/worker ratio may increase the risk of starvation, which could limit the investment in labour-intensive activities.

Education (measured in terms of years of schooling) is a significant factor explaining the probability that a household will use corm paring and post-harvest pseudo-stem management. Education may induce a positive use of these practices through the increased ability to acquire information. Corm paring and some components of pseudo-stem management (i.e. chopping) are relatively new to farmers, hence the importance of education.

Endowments of wealth (livestock and landholdings), which are also productive assets in banana production, are more important in explaining variations in the use of banana management than household demographic factors. Livestock capital is important in the decision to apply manure, de-sucker and manage post-harvest pseudo-stems, but with contrasting signs. Livestock capital may influence the decision to use these practices through different mechanisms related to soil fertility. Ownership of livestock may reduce the cost of using manure but at the same time encourage farmers to grow more plants per mat since they may not be concerned about soil fertility. Similarly,

the accumulation of livestock may imply a shift away from crop production and consequently a reduction of pressure on the land that could suppress the use of intensification techniques of recycling banana residues.

The per capita size of cultivatable landholdings (adjusted for areas under swamps and water bodies) has a positive sign but is only significant (at ten percent) in the decision to use mulch-related practices (grass or crop residue mulch and stumping and post-harvest pseudo-stem management). This finding supports the idea that the organic materials used in mulching are non-tradable as they are made on the farm using farmer resources. Landholding size increases the availability of mulching materials, thus enabling farmers endowed with this physical asset to overcome the problem of missing markets for organic mulch. The positive effect of landholdings on the decision to use post-harvest pseudo-stem management can be interpreted based on sociological considerations. Larger farmers typically have a higher social status in their communities, which could increase their expected social rewards, such as the recognition and approval that society accords a farmer for possession of a clean and healthy banana plantation[2].

The lack of statistical significance of per capita cultivable land in the use decision for other management practices (de-suckering, corm paring and manure application) could be related to the characteristics of these technologies, as stated in Chapter 1. Given that the materials for these technologies are made on the farm, there are no factors associated with land area that would affect the probability of use after controlling for the scale of production. Similarly, access to income from private assets does not seem to be important in the decision to use improved banana production management practices. These two findings reinforce the point that the materials for these technologies are not introduced so much as they are made on-farm. Consequently, farmers with a larger landholding or income from outside sources do not have any particular advantages in gaining access to the technology.

[2] Good sanitation in banana plantations is used as a symbol of wealth in some rural areas. One of the reasons farmers give when asked why they carry out sanitation practices, of which pseiod-stem management is primary, is that the plantation looks smart.

9.1.2. Effect of farm characteristics

Estimation results indicate that farm location factors (represented by elevation and physical land characteristics) are important determinants of the decision to use improved banana management practices, although the direction of the effect differs across technologies. As already suggested in the descriptive statistics presented in Chapter 8, disparities in the rate of use of the practices related to mat management between the low and high elevation production areas are evident. Households located in high elevation areas are more likely to leave the recommended three plants per mat, manage the pseudo-stems after harvesting the bananas and do corm paring at planting time than are those located in low elevation areas. However, elevation does not seem to be relevant in the use decisions for mulching with grass or crop residues and manure application.

The effect of physical land characteristics was captured in the qualitative indicators of the slope of the farm, soil moisture retention capacity and the drainage conditions on the banana plot. The slope of the farm represents the erosion potential and hence perceptions regarding soil fertility problems, which could stimulate the use of soil fertility improvements. At steeper slopes the use of management practices could also be higher because the disease threat is lower.

The results of the study indicate that the slope of the farm only explains the variations in the use of manure application and corm paring, with a negative effect on both practices (significant at ten percent). The negative effect of slope on the use of manure is surprising and contradicts the findings from other studies that slope is positively associated with perceptions about soil fertility problems that in turn encourage the use of soil fertility management practices (Mwakubo et al., 2004; Shiferaw and Holden, 1998; Ervin and Ervin, 1982). One possible explanation for this finding relates to the properties of the technology. While the erosion potential may induce the use of erosion control technologies such as conservation structures, it may at the same time act against the use of technologies whose benefits are likely to be lost when the erosion potential is high. Such is the case with the use of manure in banana production. At steeper slopes, the water run-off can easily wash the manure out of the plantation, thus reducing its benefits.

Similarly, a higher level of awareness about soil fertility at steeper slopes may discourage the use of management practices such as corm paring, which are not related to soil fertility management. This expectation is further supported by the negative effect of the measurement of poor drainage conditions on the plot, where perceptions about banana diseases are also expected to be high (Tushemereirwe et al., 2003). Poor drainage conditions may discourage the use of corm paring, a measure for controlling pests before planting, if farmers fear that the effort put into implementing the practice may be futile because of disease damage. This result suggests that the increase in biotic pressures in the banana production environment is likely to reduce the use of management practices not directly related to the management of the biotic factors.

Poor soil drainage conditions also affect the probability that a household will apply manure. However, the estimated effect is in the opposite direction to that estimated for corm paring (Table 34). The positive association between poor drainage conditions and the probability of using manure lends itself to the same explanation as that given for the findings regarding slope. The two results taken together suggest that soil moisture complements the use of manure. Poor drainage conditions in banana plots can also have an effect on us of manure through its effect on disease risk, since manure application and hence good plant nutrition increases plant vigour, which in turn enhances the tolerance for banana leaf spot diseases.

The capacity of the soil to retain moisture is a statistically significant factor only as regards the probability of using mulching practices. A possible explanation for the negative sign is that farmers may perceive soils with a low soil moisture retention capacity as naturally less fertile. The benefits of incurring the high costs of mulching may be slight when the farmers perceive the soil to be less fertile. Combined, the two results suggest a “Malthusian scenario,” where people may perceive a soil fertility problem but do nothing about it.

While landholding size increases the availability of mulching materials, thus enabling farmers endowed with this physical asset to overcome the problem of missing markets, the scale of production (represented by the banana mat count) may increase

the incentive for mulching by reducing the fixed costs of information acquisition per unit area (Feder and O'Mara, 1981).

9.1.3. Effect of market factors and characteristics

Market factors are highly significant across all the equations. Village prices (for banana and labour) and the physical access to markets in general are important factors that explain variations in banana management among farmers. The banana price relative to the unskilled labour wage rate in the village was positively significant in all technologies included in the analysis, thus underscoring the crucial role played by market incentives in banana management decisions. After controlling for market prices, the probability of using an improved management practice seems to decrease with the distance from paved roads, except in the case of corm paring. The negative effect of the distance from paved roads on the probability of using soil fertility management practices may be related to low farmer perceptions of soil fertility on farms with poor access to markets for bananas. On plots near to paved roads, intensive banana production for commercialisation purposes may accelerate soil fertility depletion, which in turn stimulates farmer perceptions of the soil fertility problem, thus inducing a higher probability of using soil fertility management practices. Nkonya et al. (2004) found a similar result for the effects of market access on soil nutrient depletion in eastern Uganda. The positive effect of the distance from paved roads on the decision to use corm paring is not supported by the existing information. This could be a statistical anomaly.

9.1.4. Effect of information diffusion parameters

Information diffusion parameters included in the analysis were the exposure to new banana varieties and extension (formal diffusion mechanisms), as well as experience in years with the technology and social capital variables. Among the formal information diffusion mechanisms, exposure to new banana varieties seems to be the most important determinant in decisions regarding banana plantation management. Households in villages that were exposed to new banana varieties in the early 1990s are more likely to manage their banana plantations using the recommended de-suckering, corm paring and manure application practices.

The number of cumulative contacts with extension agents had the expected sign in most technologies but did not significantly shape management decisions. This is not surprising since most of the households in the survey had never had contact with extension agents regarding the management of banana groves. On average, each farmer reported an overall cumulative number of contacts with extension agents of only 2 times, a level too low to make any significant impact on decisions regarding the use of knowledge-intensive technologies.

Informal mechanisms of information diffusion were more important than extension. The farmer's relevant experience with the technology positively and significantly influences its use with a larger magnitude. The results also suggest that social capital, another informal mechanism that facilitates information diffusion, is important in the choice of banana management practices.

9.1.5. Effect of social capital

The effect of household-level social capital, represented by the intensity of household membership in associations and the characteristics of those associations (in terms of leadership heterogeneity and norms of decision making), was estimated. The importance of private social networks in overcoming different market constraints was captured through the inclusion of bilateral transfers in the estimation. The definitions and measurements of these social capital variables are presented in Chapter 7.

The results suggest that the number of household members that join associations has no effect on the probability that a household will use a given management practice. On the other hand, results support the hypothesis that the education and wealth status of leaders in village associations is positively associated with the probability of use. This variable was statistically significant in manure application, corm paring and de-suckering. As argued by Rogers (1995), leaders act as opinion leaders, and when they are more educated and wealthier they are likely to bring in more information from outside the village because they are connected to better social networks. Broeck (2004) found that farmers in Tanzania with secondary education and those with larger landholdings were more likely to seek information from outside their villages. Another possible explanation is that leaders who are educated and wealthier may

generate positive externalities for technology adoption in the community because they are likely to adopt these practices and because people are likely to emulate their leaders.

Decision-making norms were also important in shaping household decisions regarding the management of banana plantations, but the direction of association differs across practices. Participatory norms that encourage consultations among members had a positive and significant association with mulching and manure application, but a negative association with corm paring. The positive association is consistent with the findings of Isham (2000) in rural Tanzania that consultative norms positively influence the adoption of fertilizers. There is no prior information to support the negative association. Nonetheless, it seems reasonable to expect that decision-making norms can have either positive or negative effects on the adoption of a practice. Negative effects may arise if psychological factors are important impediments to technology choice. This research did not investigate the psychological factors but the finding can also be explained based on information from other sources. Some farmers believe that when the corm of a young sucker is completely peeled (corm-pared), it will not germinate[3]. Such beliefs may have negative consequences for the adoption of the technology in communities with strong consultative norms.

Bilateral transfers show a weak association with the probability of using manure. Households that have better access to durable consumer goods from their social networks are more likely to use manure. This result can be interpreted to signify that households with better access to durable consumer goods[4] have more access to social insurance from their social networks, which reduces risk aversion and hence promotes the use of more resource-intensive technology. However, the magnitudes of the coefficients in both equations are too small. Net transfers were not significant in mat management practices.

[3] The author heard some of these beliefs expressed during her interaction with farmers before this research.
[4] Durable consumer goods (such as cloth, kitchenware, books) were among the more expensive items exchanged within a social network. Exchange of livestock was very rare.

9.1.6. Likelihood ratio test of joint significance of groups of factors

The hypothesized relationships embodied in the decision-making model developed in Chapter 5 were tested jointly, using a likelihood ratio test for each management practice. The probability values showing the level of significance are summarized in Table 35. The first hypothesis seeks to test whether market imperfections are important in banana management decisions. The null hypothesis is that consumption and production decisions are separable. A lack of separability of consumption and production decisions may result from imperfections in the output market, factor markets or a combination thereof. As argued in Chapter 5, banana producers may face a combination of market imperfections (both output and factor markets).

The common approach used to test for market failures is that of testing the joint significance of household characteristics. The joint significance of household consumption characteristics (age, gender, education, household size, dependency ratio) was tested for each practice separately. Results show that joint significance tests of all household consumption characteristics hold for manure application (at ten percent), post-harvest pseudo-stem management (at five percent) and corm paring (at one percent). However, the rejection of the null hypothesis of separable consumption and production decisions in these practices does not clearly indicate which market imperfections are important. As already noted, these results may imply imperfections in the output market or the labour market. The results should therefore be interpreted with caution.

On the other hand, the joint significance test of consumption and production decisions supports the hypothesis of separability for mulching with grass or crop residues and de-suckering. This finding suggests that market failure in banana production is technology-specific. Edmeades (2003), in her study of banana variety choice, also concluded that market failure was cultivar-specific.

Table 35. Results of the likelihood ratio test of the joint significance of hypothesized factors in the decision to use specific management practices

	P-value for the computed Likelihood Ratio for the joint significance of the specified factors				
Factors	Manure	Mulching	Residue management	De-suckering	Corm paring
Household characteristics	0.084^	0.284	0.029*	0.119	0.001**
Farm production assets	0.000**	0.003**	0.000**	0.206	0.075^
Market factors	0.046*	0.004**	0.000**	0.033*	0.000**
Institutional information factors	0.000**	0.000**	0.028*	0.000**	0.000**
Exogenous income	0.000**	0.002**	0.065^	0.000**	0.006**

** Significant at 1%, * significant at 5% and ^ significant at 10%.

The joint significance test of physical farm capital (livestock units, landholding and land quality) reveals the importance of household endowments in banana production management decisions. The endowments of livestock capital and landholding highlight the importance of missing markets for mulching and manure materials in banana management decisions. As Pender and Kerr (1996) demonstrate, when perfect markets exist, factor endowments will have no effect on production decisions.

Statistical tests suggest that physical farm capital is more important in explaining variations in banana production management than household characteristics. Physical farm capital variables are jointly important in the use decision of all practices except de-suckering. These results suggest that endowments in production assets matter in use decisions, providing support for the notion that the non-tradability of some production inputs constrains banana management decisions. The statistical lack of significance of physical farm capital for the use of de-suckering may be associated with certain characteristics of this practice that could make farm endowments irrelevant to its use decisions. De-suckering is typically implemented by labour and farm-purchased implements (a panga or a hoe), which do not depend on physical farm capital.

Market factors and information diffusion mechanisms are highly significant and more important than household or physical farm factors in explaining variations in farmer decisions regarding the probability of use of management practices. The statistical

significance of the combined market factors in all equations reflects the high importance of market incentives in banana production. This finding is an indication that banana production management decisions respond to market incentives.

Similarly, information diffusion factors that include formal institutions (exposure and extension) and informal information diffusion mechanisms were also jointly statistically significant in all the practices, supporting the assertion in Chapter 2 that banana management technology is knowledge-intensive. Although these technologies are typically not new to Ugandan communities, they have been subjected to frequent modifications by researchers to enable farmers to cope with the increases in biotic pressure, thus making the continued dissemination of information relevant to their adoption.

The joint significance tests of exogenous income combine variables related to bilateral transfers with net cash from rentals or interest. The statistical test results indicate that, although bilateral transfers appear less important when examined individually, they are jointly significant in all technologies. This is a key finding, given the scant information on the role of this form of social capital in technology adoption. An exception is the work of Hogset (2005) in a related study of soil conservation in Kenya.

9.2. Extent of use of management practices

The second aspect of the use decision for a divisible technology is the extent of use. The extent-of-use decision, or plantation share to which the practices are applied, is observed here only for mulching, manure application and post-harvest pseudo-stem management practices. Extent of use was estimated using two methods: ordinary least squares regression and the Heckman model. The Heckman regression model was estimated in the case of manure to account for the selection bias associated with missing observations for a given sub-sample due to the truncated nature of the dependent variable. The motivation underlying the use of either the ordinary least squares or the Heckman regression model is dependent on their statistical performance, i.e. whether or not the null hypothesis of sample selection bias was rejected. Results are summarized in Table 36 with reasonable measures of fit (R^2

=0.43 for mulching, 0.47 for manure application and 0.49 for post-harvest pseudo-stem management) for cross-sectional estimates. Full results can be found in Appendices C.6 to C.8.

Overall, estimation results show that most of the factors that were significant in the discrete decision to use management practices were also significant in the extent-of-use decisions. Some factors show contrasting effects in the two decisions. Results from the estimation of the extent of use are also technology-specific and are discussed accordingly.

9.2.1. Effect of household characteristics

Individual household characteristics show a weak effect on the extent-of-management decisions. As in discrete decisions, the effect of household characteristics on the extent of use is technology-specific. Among the household demographic characteristics, only household size is significant in two equations (manure application and residue management practices). Although household size was not statistically significant in the probability of use, it positively influences the extent of manure application and residue management practices, perhaps due to the relatively labour-intensive nature of these technologies. Household size can influence extent-of-use decisions through two mechanisms. In the presence of labour market imperfections, when the cost of hired labour falls within the price band, the household supply and demand for labour may be non-separable. This means that household size, which is a measure of the family labour endowment, could particularly affect the use of labour-intensive technologies. Household size can also affect production decisions for a staple crop through its influence on the consumption demand when the markets for the output are imperfect. So it is unclear which market imperfections the results imply.

Other household demographic variables (age, gender of the primary production decision maker and household size) were significant in only one equation. Older farmers are likely to allocate a smaller share of their banana plantations to manure application because of their high time preferences (Shiferaw and Holden, 1998). Age was also significant in the probability of using manure with a negative sign, reflecting

the important role of time preference in the use of this practice.

Table 36. Estimation of the factors influencing the extent of use of selected banana management practices

	OLS Model: Mulching		Second step Heckman model: Manure application		OLS Model: Post-harvest pseudo-stem	
Variables	Coefficient	Std. Err.	Coefficient	Std. Err.	Coefficient	Std. Err.
Household characteristics (Ω_{HH})						
Age	0.000	0.001	-0.004^	0.002	-0.002	0.002
Gender	0.054^	0.031	-0.004	0.044	0.025	0.052
Education	0.009*	0.004	0.005	0.006	0.013*	0.007
Household size	0.007	0.007	0.021^	0.011	0.020^	0.011
Dependency ratio	0.134	0.084	0.039	0.112	-0.045	0.118
Livestock unit	-0.001	0.009	0.068*	0.029	-0.021	0.016
Per capita cultivable land	0.020*	0.009	0.009	0.012	0.039**	0.015
Income from private assets	0.000	0.000	0.000**	0.000	-1.6E-06	1.8E-06
Physical farm characteristics (Ω_F)						
Elevation	-0.111^	0.062	0.056	0.093	0.295**	0.090
A dummy for poor drainage conditions	-0.011	0.034	0.062	0.061	0.061	0.054
A dummy for poor moisture retention	-0.001	0.043	0.049	0.053	0.062	0.061
A dummy for slope	0.121**	0.038	-0.077	0.064	0.238**	0.063
Age of the banana grove	0.0001	0.001	0.0001	0.002	0.004*	0.002
Number of banana mats	-0.0001**	5.3E-05	-0.0002*	8.7E-05	0.000	0.000
Market factors (Ω_M)						
Distance from paved roads	0.003	0.003	0.002	0.004	-0.023**	0.004
Price/labour wage ratio	1.648**	0.571	1.487	0.950	3.310**	0.906
Information diffusion parameters (Ω_D)						
Relevant experience (τ)	0.037	0.103	0.409	0.349	0.206**	0.057
Exposure	0.037	0.039	0.147*	0.061	-0.040	0.063
Extension contact	-0.004	0.007	0.033**	0.012	-0.001	0.013
Social capital (Ω_{SS})						
Household membership density	4.5E-02*	1.8E-02	-0.027	0.028	-0.047	0.031
Leadership heterogeneity	9.6E-02**	3.2E-02	0.204**	0.068	-0.030	0.051
Participatory decision-making norms	-2.8E-02	5.9E-02	0.124	0.105	-0.037	0.077
Net labour transfers	1.4E-06	8.8E-07	5.1E-06**	1.8E-06	2.1E-06	2.2E-06
Net cash transfers	1.0E-08	2.7E-07	1.6E-07	3.7E-07	-4.0E-07	4.7E-07
Net transfers of consumer durables	-6.1E-07	5.6E-07	8.7E-07	1.4E-06	-1.2E-06	1.1E-06
Mills ratio	0.028	0.062	0.268^	0.143	6.7E-19	7.3E-19
_Constant	-0.542	0.381	-1.224	0.742	0.562	0.570
Number of observations (n)	213.000		128.000		257.000	
F (26, n)	5.380		3.39		9.030	
Probability > F	0.000		0.000		0.000	
R-squared	0.429		0.466		0.494	
Adjusted R-squared	0.349		0.329		0.440	

** Significant at 1%, * significant at 5% and ^ significant at 10%.

Male decision makers use mulching technology more extensively compared to their female counterparts. None of these demographic characteristics influence the extent of post-harvest pseudo-stem management. Similarly, the dependency ratio is not important in decisions regarding the extent of use of management practices included in the analysis.

As expected, education is positively related with the extent of use of management practices, but only statistically significant in the mulching and post-harvest pseudo-stem management equations. Other studies have also found a positive association between education and the adoption of soil conservation technologies (Mwakubo et al., 2004; Ervin and Ervin, 1982).

Household wealth (in terms of livestock units and landholding) is also an important determinant of the demand for improved management practices. Households with more livestock units allocate a larger share of their banana plantation to manure application. The greater availability of animal manure reduces the costs of manure application, thus stimulating demand. Exogenous income was not significant in most of the technologies, except in manure application. This could feasibly be explained by the fact that the implementation of manure application requires expensive implements, such as a wheelbarrow and a spade, which may impede a household with liquidity constraints from extensive use of the technology.

Estimation results also show that farmers with relatively large areas of cultivable land per capita mulch using grass or crop residues on a larger share of banana plants than those with less land (Table 36). As already discussed, the absence of a market for organic mulch materials explains the link between landholding and the demand for mulching practices. Farmers with large areas of cultivable land per capita also use post-harvest pseudo-stem management more extensively than those that are land-constrained. This result can be interpreted in the same way as in the case of discrete use decisions. The expected social rewards that society accords a farmer for good sanitation are likely to be higher among larger landholders because of their higher social status in the community. These two results suggest that an increase in population pressure will reduce the extent of mulching (with crop residues or with grass) and post-harvest pseudo-stem management but has no apparent effect on the

use of manure. Thus, in the absence of appropriate technologies and policy incentives, a decrease in cultivable area per capita (a measure of population pressure on land) alone may not be sufficient to increase land-improving investments in these areas using mulch, contrary to Boserup's (1965) hypothesis.

9.2.2. Effect of farm characteristics

Location-specific variables (the elevation and physical characteristics of the farm) are also statistically significant in decisions regarding the extent of use of management practices. Elevation, a factor that generally defines the production environment, has conflicting effects among technologies related to mulching. Households in high elevation areas have a larger proportion of post-harvest pseudo-stems managed by stumping and chopping techniques but a smaller share of their banana plantation grown under grass and crop residue mulch. One feasible explanation could be related to the farming system, which could affect the access to the crop residues for mulching. The growing of annual crops is more common in low elevation areas, which could improve access to crop residues for mulching in these locations relative to the high elevation areas. This could, in turn, stimulate a greater demand for the recycling of banana residues in high elevation areas, also a mulch-related technology, to compensate for low access to other mulching materials. Hence the extensive use of the stumping and chopping of pseudo-stems practices, which are used to accumulate the residues for recycling. Elevation does not appear to be important as regards the extent of manure application.

Among the physical land factors, only the slope of the farm appears to be important with regard to the extent of management. The variable effect was positively related to the extent of mulching with crop residues and grass as well as post-harvest pseudo-stem management practices, both technologies related to mulching, which resulted in a greater magnitude (0.121 for mulching and 0.238 for pseudo-stem management) in both equations (Table 36). This result indicates that the soil erosion potential that threatens the loss of topsoil (which is also the most fertile soil) in high elevation areas will stimulate more extensive use of technologies related to mulching.

The age of the banana plot, another proxy for perceptions on biotic factors (i.e. pests, diseases and low soil fertility) has a positive effect on the extent of post-harvest pseudo-stem management practices. Long-established banana plantations may be associated with a greater accumulation of banana residues and consequently a higher awareness of pests and diseases, stimulating extensive use of pest and disease management practices such as post-harvest pseudo-stem management. The significance of this effect underscores the importance of the time component in the benefits derived from some management practices.

Although the scale of production had no effect on the probability of use of most management practices, it does influence the extent of soil fertility management using mulch. Households with larger banana plantations are more likely to mulch with crop residues or grass but less likely to apply soil fertility management practices (mulching and manure) to a larger proportion of their banana plantation. This finding probably reflects the lower economic impact of soil depletion on farms with bigger banana plantations. The finding is consistent with the prior information that agricultural growth in Uganda, as in many other sub-Saharan African countries, has tended to rely on expansion in area rather than on increased productivity (MAAIF and MFEP, 2000).

9.2.3. Effect of market factors and characteristics

Findings confirm that market-related characteristics are important determinants of the extent of use of improved management practices. Estimates of the variable "price/wage ratio" indicate that the greater the returns in regard to banana production relative to the opportunity cost of labour, the more use will be made of land productivity-enhancing practices, which require labour. The variable was positive in all three equations and significant in mulch-related practices (mulching with grass or crop residues and post-harvest pseudo-stem management). The results also suggest that the demand for post-harvest pseudo-stem management is likely to respond more to market incentives than to soil fertility management practices.

Most improved banana management practices are labour-intensive and higher costs of hired labour relative to the banana market prices will have a negative effect on the intensity of management. This means that rural development trends such as

urbanization, which increase the opportunity cost of labour, are likely to have negative consequences for the management of the banana crop.

After controlling for market prices, the distance from paved roads is not significant at conventional levels in mulching with grass or crop residues and manure application, suggesting that a general increase in market access has no effect on the extent of use of these practices (Table 36). Instead, general physical access to markets appears to stimulate intensification techniques of recycling banana production residues. This is supported by the negative effect (significant at one percent) of the distance from paved roads, a proxy for physical access to markets, on the extent of post-harvest pseudo-stem management.

9.2.4. Effect of information diffusion parameters

Formal information diffusion does not appear to be important in the extent of use of improved management practices, except in the case of manure. Both extension contact and exposure were positively and statistically significant only as regards the extent of manure application. Experience with the technology, an informal mechanism of information diffusion, is also important only as regards the extent of post-harvest pseudo-stem management. The lack of statistical importance of experience in decisions regarding the extent of use of mulching and manure application implies that the observed partial use of these technologies can be explained by factors other than experimentation with the technology.

9.2.5. Effect of social capital variables

Results also indicate that social capital is an important determinant of the extent of soil management in banana production. The direction of association between social capital variables and management decisions has few patterns that are common across technologies. Household density of membership in associations was positively associated with the extent of mulching, but the effects were not statistically significant for manure and post-harvest pseudo-stem management. The finding that household membership density in associations influences the extent of mulching but does not influence the probability of use is interesting. It suggests that this aspect of social

capital operates through various complementary mechanisms to influence the use of this technology. Mwakubo et al. (2004) also found that in the marginal areas of Kenya membership density increased the intensity of soil conservation technologies. One possible explanation is that households whose members have more participation in associations may have better access to the resources needed to implement mulching from their neighbours because, through associations, they learn to trust other people and also how to approach them (i.e. gain self-confidence). Since manure may require more expensive farm implements, such as a wheelbarrow, which are owned by very few households in rural areas, this kind of externality does not influence the adoption of manure application. Other practices are typically implemented with labour only, which is already controlled for in the analysis, and a panga, which is owned by almost every household. Also, households in villages where association leaders are wealthier or have higher education are likely to apply soil management practices to a larger share of mats in their banana plantations for the same reason as that given in the case of the discrete decision.

The role of bilateral transfers from social networks in decisions regarding the extent of mulching and manure use was also assessed. Net transfers of labour, cash and other durable consumer goods were included as measures of resources accessed from social networks. Most forms of bilateral transfers from social networks were not significant in the extent of their influence on use decisions, though net transfers in the form of labour were positively associated with manure application. Hogset (2005) also found a positive but weak relationship between bilateral transfers and the adoption of soil conservation technologies in Kenya. The weak effect of bilateral transfers on extent-of-use decisions may imply that although households use their social networks to reduce market constraints, the transfers are too small to stimulate extensive use of most management practices.

9.2.6. Joint significance test of a group of factors

The Chow test was used to determine the joint significance of a set of related factors for decisions regarding the extent of use of improved management practices. The same block of variables jointly tested in the case of the discrete decision was again used, as shown in Table 37. Results indicate that the extent of use of the three

management practices is explained by different factors, with only two factors common across equations. Among the five groups of variables, market factors and institutional information factors are jointly statistically significant across all equations, thus underscoring the importance of information diffusion and market incentives in banana management. The importance of market factors as regards the extent of use of all management practices clearly indicates that banana management is driven by market incentives.

In addition to these two factors, variations in the demand for manure application, a soil fertility management practice, are also explained by exogenous income. On the other hand, the extent of use of technologies related to mulching (mulching with grass or crop residues and post-harvest pseudo-stem management) is explained by household characteristics and physical farm capital, in addition to market factors and institutional information factors.

The joint importance of household consumption characteristics in the mulching and post-harvest pseudo-stem management equation suggests that the demand for these practices is influenced by market imperfections. But, as already pointed out, the results do not identify which market imperfections are important. Results also show that the separability of production and consumption decisions holds for the extent of manure application, implying that the extent-of use decisions for this practice are not influenced by household consumption preferences.

The statistical significance of physical farm capital in the extent of use of mulching and post-harvest pseudo-stem management practices suggests that households with fewer endowments are constrained, using less of these management practices. This finding supports the assertion that the demand for banana management practices depends heavily on factor endowments. The importance of physical farm capital for the extent of use of these management practices may also be associated with perceptions regarding biotic factors. The quality of the land does have an influence on the perception of these biotic factors but can also affect demand directly by affecting the productivity of inputs. Hence the results should be interpreted with caution.

Finally, the hypothesis about the importance of exogenous income as regards the extent of banana management is of particular interest. The joint significance of all exogenous income variables (income in-flow from private assets and bilateral transfers from social networks) is tested. The hypothesis test suggests that exogenous income is only important in regard to the demand for manure but not in the case of mulching or post-harvest pseudo-stem management practices. This result suggests that liquidity constraints are binding only for manure application. This could be associated with the reliance on family endowments to implement most mulching practices, while manure application requires the purchasing of some implements for its implementation.

The importance of social support in the crop management decisions of banana farmers was then tested by excluding income from household private assets[5]. All variables representing bilateral transfers were jointly tested for their significance in regard to the extent-of-management decisions. Again, these variables are jointly important in respect of the extent of manure application but not in the case of other management practices. The lack of importance of bilateral transfers with regard to the use of other management practices could be attributed to the fact that they are too small to have any effect on the extent of use (see Chapter 8). This was also the finding of Hogset (2005) in a study of the effect of social networks on the adoption of soil conservation practices in Kenya.

Table 37. Results from the F-test of the joint significance of hypothesized factors in the extent of use of management practices

	P-values for the computed F-statistics for a joint significance		
Factors	Manure application	Mulching	Post-harvest pseudo-stem management
Household characteristics	0.241	0.003**	0.066^
Physical farming capital	0.314	0.003**	0.035*
Market factors	0.089^	0.000**	0.015*
Institutional information factors	0.003**	0.009**	0.012**
Exogenous income	0.007**	0.336	0.421

** Significant at 1%, * significant at 5% and ^ significant at 10%.

[5] Results not reported but can be made available on request.

9.3 Determinants of household social capital

The results presented in the previous sections of this chapter highlight important associations between social capital and crop management decisions. The significant role of social capital in production decisions justifies any interest in its determinants. This section is devoted to just that. It should be noted that the selection of variables was based on literature that comes from other countries, and that variables that are unique to Uganda may therefore have been omitted.

The important challenge in estimating the determinants of social capital is its lack of a common definition. Participation in associations is a commonly used indicator of social capital (Alesina and LaFerrara, 2000; LaFerrara, 2002; Haddad and Maluccio, 2003; Godquin and Quisumbing, 2005) and was also used in this study. In keeping with the conceptualisation and definition of social capital in Chapter 4, household participation in another type of social capital called "private social networks" was also examined.

The regression explaining the probability that a household with specified characteristics will participate in a particular association was estimated with a standard Probit. Poisson and negative binomial regression models were used to estimate the probability for a count of memberships in associations or the number of trusted friends directly linked to a household. These models are suitable when the dependent variables take non-negative integer values, with some zeros for a given set of explanatory variables (Greene, 2000). The choice between a Poisson model and a negative binomial model was based on their statistical performance regarding whether the data inhibits the equi-distribution of variance and the conditional mean (Maddala, 1983; Greene, 2000). In the light of its statistical performance, a negative binomial model that allows for over-dispersion in the data was used to estimate the intensity of private social networks (Wooldridge, 2002; Greene, 2000). The results are summarized in Tables 38 and 39. To facilitate the easy presentation of results, this section is divided into two subsections. Factors that influence the decision to join associations are discussed in the first subsection and the estimation of the intensity of participation follows in the second subsection.

9.3.1. Membership in associations

Table 38 examines the probability of participating in at least one association in general as well as in specific associations[6] (social, informal revolving saving and credit associations and agriculturally oriented associations). The estimates presented are marginal effects, measuring the change in the probability of membership in the association for a given change in the explanatory variables, computed at the mean values. For convenience, table 38 presents summaries of the results while full results are presented in Appendices D.1 to D.4.

About 55 per cent of the sub-sample reported membership in at least one association, which is relatively low compared to the 74 per cent computed for the whole sample. However, given that the sub-sample used for the analysis comes from villages in close proximity to each other, the low variation in village-level variables restricts more thorough investigation as to why participation in this particular sub-sample is low. Nevertheless, the data provides some important insights into the variability of social capital at the household level. Comparing types of associations, participation in social associations (burial, religious and culture-based associations) was the highest, estimated at 32 per cent, while membership in credit associations (formal and informal) was the lowest, with 14 per cent of the households reporting membership in revolving saving and credit associations and 12 per cent of the households participating in formal credit associations. However, the combined membership in any form of economic association (formal or informal or other) was 38 per cent.

Membership in other economic associations was also recorded, but there was almost universal non-membership in these associations. As such, these associations were excluded from the analysis. They included non-agricultural production associations and formal credit associations. Formal credit associations were those that had affiliations with formal credit institutions. Members in these associations obtained their loans from formal credit institutions but required a group guarantee to access the

[6] It should be noted that specific associations are not mutually exclusive. Most social associations also provide informal economic services and functions, such as access to information that reduces the costs of transactions. Likewise, economic associations may provide the opportunity for people of similar beliefs to interact. Therefore the classification adopted here is based on the degree of orientation and is meant to simplify the exposition.

loans. Although formal credit associations do exist in the study area, very few households in the sample seek formal credit. Indeed, only five per cent of the households included in this analysis and 13 per cent of the total sample sought formal credit.

Table 38. Probit estimation of the factors influencing membership in associations (standard errors in parentheses)

Variables	At least one association	Socially oriented association	Agriculturally oriented association	Revolving saving and credit association
Age of the household head	-0.006^	-0.014*	0.002	-0.005*
	(0.007)	(0.006)	(0.004)	(0.002)
Number of household members below 15 years of age	-0.005	0.028	0.021	-0.010
	(0.028)	(0.024)	(0.016)	(0.011)
Number of household members aged between 16 and 50 years of age	-0.088	-0.121*	-0.002	-0.022
	(0.058)	(0.058)	(0.034)	(0.019)
Number of household members aged above 50 years of age	-0.166	-0.014	-0.052	0.037
	(0.139)	(0.140)	(0.085)	(0.046)
Gender of the household head	-0.167	-0.315*	0.043	-0.062
	(0.147)	(0.171)	(0.079)	(0.081)
Education of the household head	0.035*	-0.001	0.020^	0.015**
	(0.018)	(0.015)	(0.011)	(0.008)
Landholding in 2001	0.049*	0.030*	0.025	0.002
	(0.024)	(0.018)	(0.016)	(0.006)
Livestock capital in 2001	0.063	0.073*	-0.027	0.019*
	(0.049)	(0.035)	(0.021)	(0.010)
Number of years in the village	0.002	0.004	-0.001	-0.001
	(0.004)	(0.0040	(0.003)	(0.002)
Distance from home to nearest post office	-0.049	-0.037	-0.001	0.002
	(0.059)	(0.041)	(0.021)	(0.007)
Number of relatives	0.009	0.001	0.035**	-0.001
	(0.017)	(0.011)	(0.012)	(0.004)
Farm production orientation	0.066	0.237*	0.165*	0.084^
	(0.146)	(0.099)	(0.065)	(0.044)
Number of NGOs operating in the village	-0.017	0.096	0.009	0.056*
	(0.083)	(0.068)	(0.059)	(0.031)
Education heterogeneity in the village in 2001	-0.071	-0.055	0.024	0.049*
	(0.067)	(0.059)	(0.045)	(0.031)
Ethnic fragmentation in the village 2001	0.620	1.042**	-0.486	-0.098
	(0.504)	(0.451)	(0.314)	(0.194)
Observed probability	0.539	0.311	0.189	0.144
Predicted probability	0.561	0.238	0.104	0.038
Likelihood ratio chi sq (15)	26.15	31.7	33.92	22.04
Probability chi sq	0.037	0.0071	0.0035	0.1067
Pseudo R2	0.213	0.284	0.3889	0.297
Log likelihood =	-48.34	-39.9505	-26.652743	-26.14

** Significant at 1%, * significant at 5% and ^ significant at 10%.

Both household characteristics and village attributes influence membership in associations. The age of the household head is negatively associated with membership in saving and revolving credit associations as well as participation in socially oriented associations. This result is consistent with the prior expectation and findings in the literature. Alesina and LaFerrara (2000), Haddad and Maluccio (2003) and Godquin and Quisumbing (2005) have all reported a negative relationship between age and membership in socially oriented associations. Households with more members between 16 and 50 years of age are also less likely to participate in socially oriented associations, perhaps due to the high opportunity cost of time for this age group.

The gender of the household head was in most cases negatively associated with membership in associations, suggesting that male-headed households were not likely to join associations, though this variable was only significant in socially oriented associations (i.e. religious, burial or culture-based associations). There is no prior information to support the significance of gender in these associations. One possible explanation is that religious associations, culture based-associations and burial societies may provide emotional support to female-headed households.

Overall, the education and wealth of the household (in terms of landholding) appear to be the most important factors associated with the decision regarding participation in associations. Households headed by better-educated individuals and those with larger landholdings are more likely to join an association. However, education appears to be important only in decisions regarding economic associations and not in the case of socially oriented associations. The positive role of education in the decision to participate in associations has been reported elsewhere (Haddad and Maluccio, 2003; Godquin and Quisumbing, 2005). Education may facilitate the acquisition and processing of information about the benefits of collective action as well others' willingness to help and their reliability, thereby enhancing trust in other people.

Both indicators of wealth (livestock capital and landholding) were positively associated with membership in social associations (significant at five percent) but only livestock capital was significant in the case of informal credit associations. The positive association with wealth in socially oriented associations disappears when

burial societies are excluded from social associations, implying that the effect of wealth comes from the higher propensity to participate in burial societies. This suggests that associations such as burial societies that provide social insurance against unexpected deaths in rural areas are normal goods. Since burial societies require their members to contribute resources, the budget constraint may limit the poor households from participation. Godquin and Quisumbing (2005) also found in Philippine communities that individuals in the highest wealth quartile were more likely to participate in burial societies.

Production orientation is another variable that is associated with the decision to join associations. Households headed by full-time farmers are likely to join associations regardless of group orientation, compared to households headed by someone employed off-farm in a full-time capacity. There are alternative explanations for this result. First, the opportunity cost of time devoted to interactions in social associations is likely to be higher for household heads employed off-farm than for full-time farmers, which would constrain their membership in such associations. Another possible explanation is that off-farm employees are likely to deal with emergencies more easily than full-time farmers, since the former are likely to hold more liquid cash, thus reducing the incentive to participate. Agriculturally oriented households may have a higher demand for informal credit to finance their basic needs because they have a seasonal cash inflow. A less optimistic explanation is that agriculturally oriented producers are constrained from accessing formal credit since formal institutions prefer to lend to micro business enterprises while agriculture is considered risky[7].

The number of relatives living nearby and interacting with the household has a positive and significant effect on the decision to join an agricultural association, implying a positive interaction between private social networks and institutional forms of social networks. The number of relatives may reduce the aversion to risk and hence increase household willingness to participate in associations whose benefits are less clear to individuals. Households that interact closely with more relatives are also likely to be better informed about the benefits of the association and hence to join

[7] This information was gathered from informal sources through interactions with community members during the data collection period.

agricultural associations, since entry is free of charge. As already indicated, most agricultural associations were initiated through the influence of external agents whose main motive was to use farmer groups to promote new farming methods.

Village economic and social heterogeneity also show some positive correlation with membership in associations but the variables were not significant in most of the estimations. The lack of statistical significance may be attributed to the low variation in these variables. Village heterogeneity in terms of education was positively and significantly associated with participation in saving and revolving credit associations, perhaps reflecting the notion that community heterogeneity may result in more participation by encouraging the population to stratify into homogeneous groups. As the descriptive information presented in Chapter 8 indicates, credit associations tend to be homogenous along the economic dimension. Similarly, ethnic fragmentation is positively and significantly associated with participation in social associations. As for educational heterogeneity, the positive association can be interpreted as indicating that higher ethnic fragmentation encourages the formation of socially homogenous groups and consequently increases the rate of participation in socially oriented associations.

9.3.2. Social capital intensity at the household level

The results of both the Poisson and negative binomial estimations of the factors that influence the intensity of household membership in associations and private social networks are summarized in Table 39. Full results the respective estimations are presented in appendices D.5 and D.6. Each model was statistically significant at less than one per cent.

Estimation results indicate that factors that were important in the decision to join associations were also important in determining the intensity of membership. Age reduces both the probability of joining social and economic associations as well as the intensity of membership, while education increases the probability and the intensity of membership. Education is also positively associated with the intensity of private social networks. According to the literature reviewed in Chapter 4, education has been consistently positive in its effect on the accumulation of social capital. As discussed

earlier, education enables individuals to obtain and process information about the benefits of networking and the willingness of others to cooperate. It is also possible that education enhances the productivity of social capital. Godquin and Quisumbing (2005) found a positive relationship between education and network density in the Philippines. In contrast, Bolin et al. (2003) found that education did not have an effect on whether an individual had a friend or not. The contrast in results reflects the differences in the measurement of social capital and highlights the importance of a sound methodology in studies of social capital.

Table 39. Factors affecting the intensity of membership in associations and private social networks at the household level

	Associations (Poisson model)		Private social networks (Negative binomial)	
Variable	Coefficient.	Std. Err.	Coefficient.	Std. Err.
Age of household head	-0.029**	0.014	-0.002	0.008
Number of household members below 15 years of age	0.023	0.047	-0.058*	0.033
Number of household members aged between 16 and 50 years of age	-0.097	0.107	0.107	0.073
Number of household members aged above 50 years	0.090	0.293	0.302**	0.176
Gender of household head	-0.357	0.308	0.211	0.183
Education of household head	0.075**	0.031	0.103**	0.021
Landholding in 2001	0.063*	0.034	-0.019	0.025
Livestock capital in 2001	0.034	0.047	-0.048	0.035
Number of years in the village	0.001	0.009	-0.004	0.005
Distance from home to nearest post office	-0.182	0.158	-0.014	0.029
Number of relatives	0.027*	0.014	0.007	0.012
Farm production orientation	0.430	0.262	0.246	0.171
Number of NGOs operating in the village	0.191	0.151	-0.060	0.107
Educational heterogeneity in the village in 2001	-0.301*	0.138	-0.397**	0.085
Ethnic fragmentation in the village 2001	-0.551	0.803	-0.269	0.593
_Constant	1.960	1.006	3.784	0.624
Number of observations	90.00		89.000	
LR chi sq (15)	76.19		46.110	
Probability chi sq	0.00		0.000	
Pseudo R2	0.247		0.067	
Log likelihood = -116.300				
Likelihood-ratio test of alpha=0 Chi sq 2(01)			0.000	

** Significant at 1%, * significant at 5% and ^ significant at 10%.

Household wealth measured by landholding influences the intensity of household membership in associations. On the other hand, the results show no evidence of association between wealth indicators and the household intensity of private social networks. Social capital endowment, represented by the number of relatives, is positively associated with household intensity of social capital but only significant in the number of household memberships in associations. The number of relatives can influence the intensity of memberships through two mechanisms. First, relatives can persuade household members to join associations they belong to, hence acting through peer pressure. Another explanation is that since relatives may provide a form of social insurance, households that have many relatives are less likely to be risk-averse and therefore more willing to participate in different associations.

The results also suggest that households living in villages with high educational heterogeneity participate in fewer associations and private social networks. This result is consistent with the findings from a number of other related studies conducted elsewhere. To mention but few examples, Alesina and LaFerrara (2000) found that in United States localities, social participation was lower in more unequal and more ethnically fragmented localities. LaFerrara (2002), in a separate study of Tanzanian rural communities, found that inequality at the village level has a negative impact on the likelihood of membership in any group. As already discussed, heterogeneity at community level may reduce trust and cooperation, thereby constraining the formation and management of associations. No significant correlation between ethnic fragmentation and the intensity of participation in associations or private social networks is revealed by the econometric analysis.