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# Does social network capital buy higher agricultural prices? A case of coffee in Masaka district, Uganda

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## Abstract

**Purpose** – The purpose of this paper is to investigate how social network capital may facilitate agricultural household market access in Uganda. Specifically, the paper investigates if social network capital has significant positive effects on the ability of households to receive higher prices for coffee.

**Design/methodology/approach** – In this paper, social network capital is modeled using a household utility maximisation problem that is dependent on consumption and social interactions. The authors assume that social network capital mediates economic benefits through its effect on information flow, market intelligence and collective bargaining. The paper uses two-stage least square econometric methods to investigate whether group involvement at the household level helps farmers to access markets with higher prices.

**Findings** – The findings indicate that social network capital, measured in form of density of participation and attendance score, and multiplicative and additive indices of these, have significant positive effects on the ability to receive higher prices for coffee.

**Research limitations/implications** – The authors realise that several weaknesses in the approach could compromise the validity of the findings. These weaknesses include: the cross-sectional nature of the data, the omitted variable bias, the endogeneity concerns of social capital, sample size and the dimensions that the paper choses to capture social network capital. Future research should explore the factors that can help households to engage more in group activities.

**Practical implications** – The findings have important implications for government policy especially in areas of agricultural development and poverty reduction. Specifically, governments should pay close attention to various social groups as they can serve as important channels to achieve better market outcomes, as is the for coffee prices in rural Uganda.

**Social implications** – Many governments in Sub Saharan Africa are constrained to provide basic public goods to the people. This is due to a combination of limited budgets and lack of good leadership. In such circumstances, the people have to rely on their collective/social effort to take advantage of markets opportunities. Such opportunities can be accessed using the existing social structures whose norms and the trust between members permit cooperation.

**Originality/value** – The study contributes to a small but growing empirical literature on social groups and how they can mediate social economic outcomes especially for rural households. The empirical estimations take into consideration the endogeinety concerns associated with social

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network capital. The paper will be useful for policy makers and researchers who may have a keen interest in the roles that group activities play in agricultural development and poverty reduction.

**Keywords** Social capital, Uganda, Markets, Coffee prices

**Paper type** Research paper

## 1. Introduction

There is increasing interest among scholars and researchers in the roles that non-traditional forms of capital play in socioeconomic outcomes. Social network capital has been at the forefront of many of these studies and now there is a voluminous amount of literature about social network capital and the ways in which it could mediate socioeconomic outcomes. In Uganda, like in many other developing countries, the state lacks adequate capacity to fully facilitate household access to markets for their farm produce. This is due to a combination of limited budgets and poor governance. In such circumstances, the people rely on their collective effort to overcome market failures and to take advantage of markets opportunities. Therefore, social network capital and group activities play a huge role in shaping socioeconomic outcomes.

The literature identifies two broad concepts of social network capital. The first concept presents social network capital as vested in norms, trust and mutual affection and care for others that permits cooperation, facilitates collective action and therefore leads to the provision of some "public goods" (Dasgupta, 2003; Fukuyama, 2001; Narayan and Pritchett, 1999; Putman *et al.*, 1993). The second concept presents social network capital as an asset that is embedded in formal and informal institutions of society and confers private benefits to groups of members (Durlauf and Fafchamps, 2004). Following the latter definition, we define social network capital based on a household's intensity of group participation. We use density, measured by the number of groups that a household is a member of, and active participation in group activities, measured by the meeting attendance scores, coupled with their additive and multiplicative indices as the basis of our measurement of social network capital. We empirically investigate whether social network capital helps households to receive higher prices for their farm produce. Specifically, we test the hypothesis that social network capital positively influences the prices that households receive for their marketed coffee.

In this paper, social network capital is modelled using a household utility maximisation problem that is dependent on consumption and social interactions. We assume that social network capital mediates economic benefits through its effect on information flow, market intelligence and collective bargaining. Instrumental variable methods of parameter estimation were used to address the endogeneity problems that are associated with social network capital. We use a set of instruments that is both exogenous and relevant and it includes: the number of years a household head has resided in the village, the numbers of years s/he has been a member of a group and number of adult household members. In our empirical models, we do not include potentially endogenous variables like land area possessed, education, access to training, quantity of farm produce and extension services but we control for unobserved effects using a set of sub-county dummy variables. The instruments pass the Basmann and the Sargan-Amemiya-Lee-Newey over-identifying restriction tests for model specification and instrument exogeneity. We show that our dimensions of social network capital that include density and active participation in group activities organisations are very important in helping households to access higher producer prices.

The remainder of the paper is organised as follows: Section 2 provides a description of the study area. Section 3 outlines the theoretical model. Section 4 presents the data

and methods of data analysis. Section 5 provides the findings and discussions. Lastly, Section 6 provides the conclusions.

## 2. The study area

With a population of over 800,000 and about 176,000 households, Masaka district is one of the oldest and biggest districts in Uganda. According to the Masaka District Local Government Council (MDLGC, 2008), about 75 per cent of the households (132,000) are agricultural based. Many farmers grow Matooke, the most important food crop that is usually inter-cropped with coffee, the most important cash crop in the area. In the early 1990's coffee production suffered greatly from the wilt disease that wiped out entire gardens. But this has been reversed in the recent years and coffee has re-emerged as the single most important cash from for most households.

There are about 200 formal groups and associations in Masaka district (MDLGC, 2008). The most prominent organisations include; production and marketing organisations; non-governmental organisations; and faith-based organisations. These groups engage in activities such as; trading of goods, credit services, prayer, marriages, funerals and other social events.

The production and marketing groups are the most common type. Households may pool resources and labour to engage in common activities that require more capital, labour or they engage in activities that are more risky for a single household. This highlights the resource and income smoothing importance of social network capital. There are potential scale economies, information sharing, market access and insurance advantages that poor people can benefit from. For example, people can produce more and if they market their produce jointly, they may obtain better prices or at least ensure that they have access to markets (Coulter, 2007).

The influx of the formal non-governmental organisations' activities in the area can be traced back to the emergency due to the spread of the HIV/AIDS virus. Because of the disease, both crop and animal production reduced substantially due to loss of productive labour. Many organisations started their operations in Masaka and neighbouring districts mainly to offer awareness, support and counselling services to the affected families and to help them start a new life (Barr *et al.*, 2005).

Faith-based organisations prominent in Masaka include; The World Vision; Caritas Maddo; and the Lutheran World Federation. They help to improve the livelihoods of the poor by providing access to farm inputs and livestock, provision of clean water, education and health services, among others. These organisations have helped to organise people into self-help groups and continue to support the activities of these groups. Such activities range from agricultural, vocational and commercial ventures in the form of small businesses and management. Most organisations will target particular groups, for example women, farmers, traders and others. Caritas Maddo, for example, helped to set up a dairy processing plant that relies on small holder farmers for milk supply.

## 3. Theoretical framework

We draw on the theoretical household model based on the work of de Janvry *et al.*, (1991) and later used by Mogues and Carter (2005) who assumed that households may gain utility from consumption of material consumer goods as well as from the benefits derived from bonding with friends in their social network. We denote these benefits as B(SN). Therefore the household utility function is of the form:

$$U = u[C, B(SN)] \tag{1}$$

Households have a total time endowment, $T$. Household total time is allocated between productive labour, $T_w$ which earns a wage $w$ per time unit and time spent participating in social organisations, $T_s$:

$$T = T_w + T_s \tag{2}$$

Both social network capital $SN$ and the benefits derived from it $B$ grow at a rate $\delta$ determined by the time committed to participating in social organisations and bonding:

$$B(SN) = (1 + \delta)T_s \tag{3}$$

Using our model we show that there are economic returns to social network capital, especially in imperfect market conditions. Earlier research has identified some of these returns to include among others; efficiency in economic exchange (Durlauf and Fafchamps, 2004); information about new technology, employment and markets opportunities (Barr, 1998; Fafchamps and Minten, 2001); access to loans for entrepreneurial activity (Grootaert *et al.*, 2002); and insurance against risks and shocks (Mogues, 2006); poverty reduction (Grootaert *et al.*, 2002); and household welfare (Grootaert and Narayan, 2004). Moreover, social capital has been shown to mediate public outcomes such as natural resource conservation (Gutierrez *et al.*, 2011; Pretty, 2003) and aids the adoption of sustainable agricultural practices (Munasib and Jordan, 2011; Birungi and Hassan, 2010). In Uganda, social capital has been shown to aid information exchange (Katungi *et al.*, 2008), poverty reduction (Hassan and Birungi, 2011) and is also associated with food security (Sseguya, 2009).

The theoretical model of social network capital formation for an individual in a given group is modelled as a utility maximisation problem that is dependent on consumption $C$ and social interactions $SN$, subject to time constraints, budget constraints and resource endowment constraints:

$$U(C, B(SN)) \equiv \max_{C,B}[C, B(SN)] \tag{4}$$

Subject to:

$$T_s + T_w = T \tag{5}$$

$$C = wT_w \tag{6}$$

$$B(SN) = (1 + \delta)T_S \tag{7}$$

The first two constraints in Equations (5) and (6) can be collapsed into one equation as shown:

$$wT_S + C = wT \tag{8}$$

The Lagrangian associated with this maximisation problem is expressed as:

$$L = U[C, B(SN)] + \lambda_1[w(T - T_S) - C] + \lambda_2[B(SN) - (1 + \delta)T_S] \tag{9}$$

The first order conditions from the Lagrangian above yield the following reduced form demand functions:

$$C = c(w, SN) \tag{10}$$

$$B = B(w, SN) \tag{11}$$

Demand functions can be derived from such a model and it may be demonstrated that at the margin the returns to time invested in networks and in direct productive activity should be equalised.

*The link between social network capital and agricultural prices*

It is commonly assumed that rural producers have little bargaining power and are therefore price takers. In addition they have to make a choice between selling at the farm gate or travel to nearby or more distant markets (Fafchamps and Hill, 2005). Selling at the market provides a higher price than selling at the farm gate. Let the farm gate price be $p^f$ and the market price $p^m$. Let the information and transportation costs to the market be denoted by $IC$ and $TC$, respectively. Therefore farmer $i$ chooses to sell at the market only if:

$$p_i^f \leqslant p_i^m - IC_i - TC_i \tag{12}$$

In cases where the households sell at home, they sell to itinerant traders who internalise the transaction costs in their price offers. But households also need market information so that they are not exploited by these traders. In this model social network capital serves to channel information and therefore the information costs are directly determined by the households' level of connectedness. Information costs are non-increasing in $SN$. Transportation costs are mainly determined by distance to roads, road quality and distance to market:

$$IC_i = IC(SN_i), IC'(SN_i) < 0 \tag{13}$$

We use distance to road variables to account for village remoteness, and control for other location-specific differences using sub-county dummy variables[1]. If effective flows exist between rural areas and market areas, prices would be expected to follow the relationship[2]:

$$p_i^f = p_i^m - IC_i(SN) - TC_i \tag{14}$$

This discussion leads to this paper's hypothesis:

*H1.* Households with more social network capital are more likely to receive higher prices for their produce.

*The dimensions of social network capital*

The paper assumes that social network capital provides benefits to participating households through its function as an avenue for sharing information about markets and other opportunities that influence socioeconomic benefits. This largely depends on the structure of the networks and their functionality.

We disaggregate social network capital into two dimensions: network density and the active participation score. Density of membership is simply the number of organisations that a single household subscribes to. The attendance score is a measure of active participation and is computed as a percentage for attending mandatory group meetings.

The density of memberships and attendance scores are aggregated both multiplicatively and additively to generate two social network indices for each household. The indices are later rescaled to lie between 0 and 100. These indices are similar to the ones developed by other researchers and scholars in social capital, most notably by Narayan and Pritchett (1999) and Grootaert *et al.*, (2002).

*The endogeneity of social network capital*

A vast amount of literature has emphasised the fact that social network capital is endogenous (Hassan and Birungi, 2011; Dasgupta, 2003; Durlauf and Fafchamps, 2004; Narayan and Pritchett, 1999). Indeed, modelling social network capital, especially using survey data, is plagued by endogeneity problems. Participation in associations is costly in terms of time and lost income in terms of foregone work. Association members are also sometimes required to make regular contributions in form of subscription fees which may be payable in cash or in kind. Moreover, it could turn out that the causality between our variable of interest and social capital is a two-way relationship. The households that receive high prices may be more able to join associations because they can afford to pay subscription fees and meet other commitments.

It could also be true that there are some unobservable individual characteristics that are correlated with social network capital. Some individuals may possess some intrinsic characteristics that make them more sociable and therefore are more likely to engage in associational life. Family background, mental ability, intrinsic leadership abilities and character are some examples of partly unobservable characteristics.

Another challenge with social network capital is that of self-selection. Basically individuals are free to choose whether to join an association or not. Those who choose to join may have similar characteristics and interests and their decisions to participate in network activities are not likely to be random. If the decisions to join a network are correlated with other explanatory variables or even our dependent variables, then we can no longer argue that the explanatory variables are not correlated with the error term.

Potentially endogenous variables are excluded from our models. Such variables include: off-farm income, credit income, land holdings, education, access to training and extension services and quantity of marketed coffee. The challenge is that if the omitted variables are correlated with one or both of our measures of social capital or other explanatory variables in the model, we could end up facing omitted variable bias in our estimates. Therefore using simple ordinary least squares procedures in all the above cases would lead to estimates that are inconsistent and asymptotically biased (Angrist and Krueger, 2001).

We therefore use instrumental variable methods of parameter estimation. The paucity of the data makes it very difficult for us to come up with excellent instruments for social network capital. However, we are able to identify the number of adult members in a household and length of continued membership in an organisation as possible instruments for social network capital. We discuss these as follows:

(1) The number of adult members in a household: we are motivated by Adong *et al.* (2013) who provide evidence that there is a positive relationship between a household's number of adult members (above 18 years of age) and participation in group activities. The intuition is that the higher the number

of adult members in a household the greater social capital a household is likely to have.

(2) Length of continued membership in an organisation: We believe that the length of membership in an organisation helps one to build social network capital through repeated interactions with other group members.

## 4. Data and methods

### *4.1 Data sources*

This study uses a rich data set collected by the Norwegian University of Life Sciences in collaboration with Makerere University's Department of Agricultural Economics. The survey was carried out in the months of June and July 2008. Data were collected at both household and community levels. The study was conducted during the first crop harvesting season of the year. The Ugandan agricultural calendar is such that the first cropping season falls between February and July and the second between August and January. Data were collected for the linkages between rural poverty, natural resources, capital accumulation and intra-household resource allocation.

Data were collected from a representative sample of 251 households in 19 villages selected from 15 sub counties from 12 to 15 households randomly selected from each village using a comprehensive questionnaire. The number of households sampled in each village mainly depending on the village population. This paper draws heavily on the sub sections of the questionnaire that involved the following; social networks and capital markets; and crop production. The summary statistics for key variables are displayed in the Table I.

### *4.2 Methods*

To evaluate the effects of social network capital on producer prices of coffee for households selling coffee, we estimate the following system of equations using the two-stage least square (2SLS) technique:

$$p_i^h = \theta + \theta_1 SN_i + \theta_2 DM_i + \theta_3 DR_i + \theta_4 Z_i^h + \theta_5 V_i^h + \varepsilon_i \quad (15)$$

$$SN_i = \alpha_0 + \alpha_1 DM_i + \alpha_2 DR_i + \alpha_3 Z_i^h + \alpha_4 V_i^h + \varepsilon_i \quad (16)$$

| Variable label | Mean | SD | Min | Max |
|---|---|---|---|---|
| Meeting attendance score | 14.5 | 27.6 | 0 | 100 |
| Group density | 0.54 | 0.85 | 0 | 4 |
| Multiplicative social network index | 7.7 | 16.2 | 0 | 100 |
| Additive social network index | 14.9 | 27.7 | 0 | 100 |
| Length of group membership in years | 4.2 | 5.0 | 1 | 31 |
| Coffee price per kilogram in (UGX) | 560 | 271 | 100 | 1,000 |
| Age of household head in years | 40.3 | 15.6 | 16 | 95 |
| Sex of household head (1 = male) | 0.79 | 0.41 | 0 | 1 |
| Education in complete years | 5.6 | 3.3 | 0 | 16 |
| Household size | 5.6 | 3.2 | 1 | 19 |
| Number of adult members (aged 18-65) | 3.0 | 2.0 | 1 | 14 |
| Distance to market in kilometres (km) | 3.2 | 2.7 | 0 | 20 |
| Distance to seasonal road in kilometres (km) | 0.28 | 0.91 | 0 | 10.3 |
| Distance to paved road in kilometres (km) | 1.3 | 1.8 | 0 | 15 |

**Table I.** Summary characteristics of key variables

where $p_i^h$ is the price per kilogram of coffee received by the $i$th household; $SN$, a measure of social network capital; $DM$, a measure of the distance to the market; $DR$, a measures of the distance to roads; $Z^h$, household characteristics; $V^h$, village fixed effects.

Equation (15) is the outcome function of interest and Equation (16) is the first stage regression in which our measures of social capital are regressed on the instruments as well as all the other covariates in the outcome equation.

We develop four models:

(1) Model A is estimated with social network density as a regressor;

(2) Model B is estimated with the attendance score as a regressor;

(3) Model C is estimated with a multiplicative social network index as a regressor; and

(4) Model D is estimated with an additive social network index as a regressor.

The first stage regressions support the validity of our instruments for all the four models (see Appendix).

## 5. Results

The econometric results from the 2SLS instrumental variable estimation of the determinants of coffee prices are shown in Table II.

Most variables have the expected signs and are consistent with theoretical expectations. For example all the four models exhibit significant coefficients for our measures of social network capital. This confirms our hypothesis that social network capital helps households to reduce market failures by lowering information and search costs thus helps households to sell at the best possible price. These results are consistent with earlier research that showed that social capital mediates socioeconomic outcomes at the household level. For examples social capital was shown to enhance the performance of agricultural traders (Fafchamps and Minten, 2001), leads to reduction of poverty (Hassan and Birungi, 2011; Grootaert *et al.*, 2002; Narayan and Pritchett, 1999), and facilitates the adoption of sustainable agricultural practices (Munasib and Jordan, 2011; Birungi and Hassan, 2010).

Further results show that degree of remoteness plays a crucial for the determination of the prices that households receive for their agricultural produce. This is highlighted by the negative and highly significant relationship between prices and distance to seasonal roads. This implies that households that are far away from a road, travel longer distances, incur higher costs and therefore receive less prices for the produce. Similarly, we controlled for regional fixed effects and discovered that location is very important for prices as can be seen from the significance of the various sub-county dummy variables. This finding is consistent with earlier research that showed that distances and location matter for agricultural market outcomes especially in rural areas (O'Kelly and Bryan, 1996).

Households that sell at the market place are in position to receive higher prices for their farm produce. This finding is consistent with the proposition set forward by Fafchamps and Hill (2005) who argued that farmers who sell their produce at the market place may necessarily receive higher prices as compared to their counterparts who sell at the farm gate.

Finally, our models indicate that household characteristics that include the age and gender of the household head play a critical role in influencing the kind of prices those

| | Dependent variable: price per kilogram of coffee | | | |
|---|---|---|---|---|
| | Model A | Model B | Model C | Model D |
| Social network density | 125.36** | | | |
| | (2.24) | | | |
| Attendance score | | 3.34** | | |
| | | (2.35) | | |
| Multiplicative index | | | 6.49** | |
| | | | (2.51) | |
| Additive index | | | | 3.31** |
| | | | | (2.36) |
| Distance to market (KM) | 4.02 | 4.86 | 4.41 | 4.48 |
| | (0.53) | (0.66) | (0.59) | (0.66) |
| Distance to seasonal road (KM) | −31.69 | −35.24* | −40.85* | −35.18 |
| | (−1.56) | (−1.80) | (−1.85) | (−1.80) |
| Coffee sold at market (yes = 1) | 173.71 | 241.14* | 222* | 239.90*** |
| | (1.29) | (1.95) | (1.80) | (1.92) |
| Age of household head | 4.17*** | 4.28*** | 3.96*** | 4.28*** |
| | (3.22) | (3.35) | (3.10) | (2.99) |
| Household head is male (yes = 1) | 109.94** | 101.17** | 95.30* | 101.31** |
| | (2.12) | (2.02) | (1.85) | (2.02) |
| Bigasa sub county (yes = 1) | 382.38*** | 329.14 | 332.67*** | 330.07*** |
| | (3.72) | (3.17)*** | (3.13) | (3.18) |
| Bukulula sub county (yes = 1) | 155.48 | 118.88 | 133.03 | 119.67 |
| | (1.54) | (1.41) | (1.52) | (1.42) |
| Butenga sub county (yes = 1) | 323.59*** | 295.65*** | 296.34*** | 296.26*** |
| | (3.82) | (3.74) | (3.68) | (3.74) |
| Buwunga sub county (yes = 1) | 107.97 | 107.91 | 119.91 | 108.08 |
| | (1.01) | (1.03) | (1.12) | (1.04) |
| Kabonera sub county (yes = 1) | 274.13*** | 254.18*** | 258.11*** | 254.63*** |
| | (3.31) | (3.24) | (3.22) | (3.25) |
| Kalungu sub county (yes = 1) | 231.85** | 190.37* | 198.88*** | 191.30* |
| | (2.08) | (1.85) | (1.89) | (1.86) |
| Kyanamukaka sub county (yes = 1) | 240.39** | 206.74** | 228.48** | 207.40** |
| | (2.25) | (1.96) | (2.09) | (1.96) |
| Kingo sub county (yes = 1) | 110.22 | 64.89 | 96.84 | 65.67 |
| | (1.11) | (0.69) | (0.99) | (0.69) |
| Kyamulibwa sub county (yes = 1) | 240.39** | 166.31 | 182.57* | 167.25 |
| | (2.15) | (1.55) | (1.65) | (1.56) |
| Lwabenge sub county (yes = 1) | 296.02** | 360.65*** | 375.23*** | 359.70*** |
| | (2.10) | (3.19) | (3.22) | (3.19) |
| Lwengo sub county(yes = 1) | 49.67 | 17.50 | 18.36 | 18.04 |
| | (0.61) | (0.22) | (0.23) | (0.23) |
| Ndagwe sub county (yes = 1) | 216.54** | 172.18* | 184.98** | 173.02* |
| | (2.12) | (1.77) | (1.85) | (1.78) |
| Constant | −352.53*** | −312.37*** | −300.33*** | −313.15*** |
| | (−3.22) | (−3.04) | (−2.87) | (−3.05) |
| Number of observations | 248 | 248 | 248 | 248 |

**Notes:** The coefficients are tabulated; *Z*-statistics are in parentheses; standard errors are corrected for predicted values; regional fixed effects have been accounted for using 15 sub-county dummy and most of them are highly significant highlighting the importance of location for prices. *,**,***Significant at 10, 5 and 1 per cent levels, respectively

**Table II.**
Instrumental variable estimation of social network capital and coffee prices

households receive for their farm produce. Specifically, male-headed households are more able to receive higher prices possibly because of their better ability to sell at the market or to negotiate for higher prices. Likewise, households with older heads are more able to receive higher prices possibly because of their experience. This finding is also consistent with the literature that shows that household characteristics including age and gender of the household head are important determinants of socioeconomic outcomes at the household level (Adong *et al.*, 2013; Hassan and Birungi, 2011; Munasib and Jordan, 2011; Grootaert *et al.*, 2002; Narayan and Pritchett, 1999).

Finally, to test the validity of the models, we employ a number of diagnostics tests. Specifically, the Wald – $\chi^2$/*F*-test examines the overall significance of our models. The null hypothesis is that models parameters are jointly equal to zero against the alternative that they are not. Furthermore, we apply the Basmann and the Sargan-Amemiya-Lee-Newey over-identifying restriction tests for model specification and instrument exogeneity. These tests are used to examine if the residuals are uncorrelated with the set of exogenous instrument. That is they test if the instruments are truly exogenous. The Hausman tests are used to check for endogeneity concerns, while the first stage *F*-statistic is used to test the strength of the instruments in our models. The test results for our diagnostic tests are provided in Table III.

The Wald $\chi^2$ tests confirm that our models are all well specified. Moreover, the instruments pass the Basmann and the Sargan-Amemiya-Lee-Newey over-identifying restriction tests for model specification and instrument exogeneity. The Hausman tests indicate that indeed our measures of social network capital are endogenous. This validates our instrumental variable estimation approach. The first stage *F*-test confirms the strength of our choice of instruments.

## 6. Conclusions

Using household-level data from 251 households and 19 villages, we have empirically examined two benefits of social network capital: rebuilding of productive assets and access to markets with higher agricultural prices. Specifically we have used coffee prices to represent the prices for household marketable products. We assume that the major pathway through which the effects of social network capital are transmitted is the access and subsequent transfer and sharing of information about markets and other opportunities.

Memberships in organisations were adopted as measurements for social network capital. We measured social network capital using density of memberships and by computing the attendance percentage score for each household as a measure of active participation in organisational activities. We then aggregated these dimensions into multiplicative and additive social network indices.

| | Model A | Model B | Model C | Model D |
|---|---|---|---|---|
| Wald $\chi^2$/*F*-test | 54.18 (0.000) | 56.61 (0.000) | 55.09 (0.000) | 56.65 (0.000) |
| Sargan $\chi^2$ | 1.14 (0.564) | 2.89 (0.236) | 1.722 (0.423) | 2.849 (0.241) |
| Basmann $\chi^2$ | 1.04 (0.563) | 2.66 (0.264) | 1.58 (0.455) | 2.62 (0.270) |
| Wu-Hausman *F*-test | 7.59 (0.006) | 3.12 (0.078) | 5.39 (0.021) | 3.17 (0.076) |
| Durbin-Wu-Hausman $\chi^2$ test | 8.02 (0.004) | 3.37 (0.066) | 5.76 (0.016) | 3.42 (0.064) |
| First stage instrument *F*-test | 38.00 (0.000) | 41.60 (0.000) | 35.32 (0.000) | 42.35 (0.000) |

**Table III.**
Model diagnostics tests

**Notes:** Tabulated are the $\chi^2$/*F*-test values; *p*-values are in parentheses

In order to address the endogeneity problem that is associated with social network capital, we have used instrumental variable methods of parameter estimation. Specifically, we have used the 2SLSs method and instrumented for social network capital using an instrument set that includes: the duration of membership in organisations and number of adult household members. We show that higher levels of social network capital are associated with an increased ability for households to achieve higher producer prices.

Our findings have important implications for government policy especially in areas of agricultural development and poverty reduction. Specifically, governments should pay close attention to various rural-based social groups and networks as they serve as important channels to achieve better market outcomes, as is the for coffee prices in rural Uganda. However, as noted by Adong *et al.*, (2013), farmer participation in groups is still low in Uganda. Therefore there is need for efforts to ensure that rural farmers are helped to join up in groups. Specifically, priority should be given to farmer education on group formation and support towards the very poor, the vulnerable such as the female headed households and those in more remote villages.

## Notes

1. A sub-county is a large administrative unit that may comprise of several villages. We have opted to use sub-counties because they are the primary planning units of local governments in Uganda.
2. The multiplicative index returns zero if a household has a zero attendance score even with a high-network density and the additive index makes strong assumptions about the choice of weights.

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## Appendix

| | Dependent variable | | | |
|---|---|---|---|---|
| | Density | Attendance | Add. index | Mult. index |
| Duration of group membership | 0.093 (6.71)*** | 3.651 (8.17) *** | 3.688 (8.23)*** | 1.191 (7.12)*** |
| Number of adult members | 0.103 (3.71)*** | 1.687 (1.88)* | 1.744 (1.94)* | 1.378 (2.56)** |
| Distance to the Market | −0.021 (−1.15) | −0.802 (−1.36) | −8.11 (−1.37) | −0.414 (−1.17) |
| Distance to seasonal road | −0.014 (−0.29) | 0.372 (0.23) | 0.360 (0.22) | 1.029 (1.06) |
| Coffee sold at the market (yes = 1) | 0.744 (2.29)** | 9.215 (0.89) | 9.646 (0.92) | 7.415 (1.19) |
| Age of household head | −0.003 (−0.094) | −0.031 (−0.28) | −0.033 (−0.29) | −0.009 (−0.13) |
| Household head is male (yes = 1) | −0.135 (−1.12) | −2.544 (−0.66) | −2.617 (−0.67) | −0.916 (−0.39) |
| Bigasa sub county | −0.118 (−0.46) | 6.570 (0.81) | 6.448 (0.79) | 3.567 (0.73) |
| Bukulula sub county | −0.311 (−1.52) | −5.044 (−0.77) | −5.217 (−0.79) | −3.911 (−0.99) |
| Butenga sub county | −0.274 (−1.14) | −6.748 (−1.09) | −6.884 (−1.11) | −2.948 (−0.79) |
| Buwunga sub county | −0.137 (−0.53) | −9.340 (−1.13) | −9.370 (−1.13) | −5.772 (−1.16) |
| Kabonera sub county | −0.310 (−1.61) | −8.865 (−1.43) | −9.012 (−1.45) | −4.631 (−1.24) |
| Kalungu sub county | −0.550 (−2.29)** | −12.673 (−1.65)* | −12.953 (−1.68)* | −6.856 (−1.48) |
| Kyanamukaaka sub county | −0.161 (−0.63) | −0.222 (−0.03) | −0.328 (−0.04) | −2.230 (−0.45) |
| Kingo sub county | −0.251 (−1.02) | 0.244 (0.03) | 0.767 (0.01) | −4.237 (−0.89) |
| Kyamulibwa sub county | −0.375 (−1.43) | −3.804 (−0.45) | −4.027 (−0.48) | −3.658 (−0.72) |
| Lwabenge sub county | 0.131 (0.49) | −15.237 (−1.77)* | −15.049 (−1.74)* | −9.258 (−1.79)* |
| Lwengo sub county | 0.071 (0.36) | 10.242 (1.62) | 10.221 (1.61) | 5.518 (1.45) |
| Ndagwe sub county | −0.237 (−0.98) | 0.994 (0.13) | 0.831 (0.11) | −0.097 (−0.02) |
| Constant | 0.552 (2.27)** | 12.783 (1.64) | 13.064 (1.67)* | 4.834 (1.03) |
| Number of observations | 248 | 248 | 248 | 248 |
| $R^2$ | 0.357 | 0.375 | 0.379 | 0.345 |
| $F$-statistic (first stage instrument) | 38.00 | 41.60 | 35.32 | 42.35 |

**Notes:** Tabulated are regression coefficients, $t$-values in parentheses. *,**,***Significant at 10, 5 and 1 per cent levels, respectively

**Table AI.**
First stage regressions

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