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ORIGINAL PAPER

You are not alone: social capital and risk exposure in rural Ethiopia

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Abstract This paper examines the impact of shocks on food security and the insurance role of social capital and informal social networks. In particular, by combining household panel data, weather data, self-reported shocks and detailed social capital information, the paper investigates the insurance role of social capital against covariate and idiosyncratic shocks. Our results suggest that both covariate and idiosyncratic shocks increase the prevalence of food insecurity. However, households with a higher stock of social capital were able to smooth consumption. We also found that food consumption is not insured through social capital when a shock affects the whole risk-sharing network. Moreover, we show that formal policy interventions such as access to consumption credit and safety nets are the only effective ways of insuring food consumption when a shock affects the entire risk-sharing network.

Keywords Consumption · Social capital · Insurance · Shocks · Ethiopia

JEL classification C23 · D12 · D71 · O12

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Introduction

Adverse shocks worsen food insecurity, malnutrition, and poverty in developing countries. Ethiopia is among the poorest developing countries that are prone to poverty and negative impacts from shocks. Most farm households in Ethiopia face frequent shocks in the form of drought, flood, pests, price changes and illness with little possibility of insurance. The lack of formal insurance mechanisms against unexpected shocks has led many smallholder farmers into persistent poverty and food insecurity traps (Dercon and Christiaensen 2011; Porter 2012). Frequent adverse shocks affect not only food security levels, but has also led people to make use of a destructive and depletive response by selling assets at prices below their real value, leading to potential poverty traps.

Among frequent adverse shocks, the occurrence of weather and market shocks are recognized as the most important factors responsible for large variation in food security and poverty among smallholder farmers in many developing countries (Dercon 2004). In this paper, we focus on rainfall, market and health shocks as these are the three most important shocks identified by households in rural Ethiopia (ERHS 2009). Examining the food security implication of these shocks is important in order to provide answers to questions that are prerequisites for safety net policies. Further, this study explicitly captures the role social capital plays in insuring consumption against the above three important shocks in the absence of formal financial and insurance markets. This is particularly relevant as previous studies on consumption insurance in Ethiopia have largely focused on the mechanisms through which differences in initial endowments and formal government policies affect consumption and food security, paying little attention to the roles of informal social ties and social capital (Demeke et al. 2011; Gertler et al. 2006; Dercon 2004;

Dercon et al. 2005). Controlling for social capital endowment is very important as heterogeneity in social capital is a significant determinant of consumption smoothing. In this study, we adopt a broad definition of social capital as the capacity for a transaction to take place between two or more individuals by virtue of their relationship, which broadly includes relationships through networks, associations and institutions. In particular, we focus on a subset of informal social capital, namely, social network size and membership in local insurance groups (*Iddir*).[1] By focusing on the above two important social capital variables, this study not only provides new evidence on the impacts of shocks on consumption and hence food security, but also examines the extent to which heterogeneity in social capital may affect households' ability to insure consumption against shocks.

This paper contributes to the growing literature on consumption insurance and food security in several ways. First, we explicitly captured the role of social capital on the premise that in countries like Ethiopia where formal credit and insurance arrangements are very limited, the role of social capital in consumption smoothing will be crucial. Second, unlike previous studies that use self-reported rainfall shocks and treat such shocks as exogenous, we used an exogenous measure of rainfall shock by using actual village level rainfall data. Third, we extended the scope of the literature by considering a shock which affects not only individual farm households but also the entire risk sharing networks. The remaining five sections of the paper are organized in the following sequence: The link between social capital, shocks and consumption smoothing; Data sources, shock and social capital measures and the specific econometric strategy; Results and discussion; Conclusion, open questions and future research.

Social capital, shocks and consumption smoothing

Households living in developing countries are often exposed to shocks (Di Falco and Bulte 2013; De Weerdt and Dercon 2006; Fafchamps et al. 1998; Fafchamps and Lund 2003). A growing body of literature has also examined the extent to which households are able to insure consumption against shocks (Islam and Maitra 2012; Gertler et al. 2006; Gertler and Gruber 2002; Wagstaff 2007; De Weerdt and Dercon, 2006; Asfaw and Von Braun 2004; Dercon and Krishnan 2000; Carter and Maluccio 2003; Carter et al. 2007; Townsend 1994). In general, the aforementioned studies examined whether a household's ability to maintain consumption is affected by past shocks (Debebe et al. 2013). For instance, Islam and Maitra (2012) examined the effect of health shocks on household consumption and how access to microcredit helps households cope against illness in rural Bangladesh. Asfaw and Von Braun (2004), as well as Dercon and Krishnan (2000), investigated the effect of health shocks on a household's ability to smooth consumption in rural Ethiopia. They pointed out that health shocks have a statistically significant and negative effect on purchased food consumption. Similarly, De Weerdt and Dercon (2006) rejected the full risk-sharing hypothesis against health shocks in rural Tanzania. In the words of Kazianga and Christopher (2006), the general conclusion from the empirical evidence so far is that "*most households succeed in protecting their consumption from the full effects of the shocks but not to the degree required by a Pareto efficient allocation of risk within local communities*."

However, many of the tests for risk-sharing to date were conducted at the village level (De Weerdt and Dercon 2006). This has some drawbacks, especially in capturing the full effects of social capital, since risk-sharing through social ties may also take place between households living in different villages. The role of self-protection through social capital as a mechanism to smooth consumption against shocks has been the subject of debate in the literature (Fafchamps and Lund 2003; Gertler et al. 2006). Empirical studies in many developing countries have confirmed that social capital plays a significant and positive role in enhancing consumption (Wetterberg 2007; Tegebu 2008; Grootaert and Narayan 2004). Social ties have been found to help even the poorest in times of stress (Wetterberg 2007). Often a particular tie is successful at providing resources or decreasing risk, but this does not imply that all social ties have the same effect. While it is increasingly clear that informal and formal social relationships outside the market have some effect on consumption smoothing, it is likely to be heavily contingent on the specific norm being considered, the type of resources required for insurance and the features of the social structures themselves.

In this regard, Di Falco and Bulte (2011) demonstrated that extensive networks and social capital can be associated with lower consumption, showing a possible dark side of social capital. In particular, households with large stocks of social capital (such as relatives), may evade sharing obligations by accumulating durables that are non-sharable at the expense of durables that may be shared and by reducing savings on liquid assets that would be important for consumption smoothing. Similarly, Gertler et al. (2006) did not find any statistical relationship between social capital and a household's ability to smooth consumption. On the other hand, Witoelar (2013) found evidence of complete consumption risk sharing within extended families among households in Indonesia. In addition, Carter and Maluccio (2003) found that South African households with more social capital were able to cope against economic shocks. In light of these mixed results, this study examines the extent to which households may rely on informal social ties and links in order to smooth consumption against shocks. The frequency of unexpected shocks and

[1] *Iddirs* are informal institutions established for providing mutual aid during death of members (Dercon et al. 2006).

underdevelopment of formal insurance markets in Ethiopia make this analysis particularly interesting.

In the case of Ethiopia, previous studies on consumption smoothing reported the absence of full risk-sharing at the village level (e.g., Dercon 2004; Asfaw and Von Braun 2004; Dercon and Krishnan 2000), albeit without taking into consideration the effect of social capital and sharing norms on a household's ability to insure consumption against shocks. Considering the role of social capital is particularly important if households are engaged in a variety of non-market and informal networks to insure themselves against shocks (Tegebu 2008). We consider whether social capital can help households insure consumption against both idiosyncratic and covariate shocks.[2] So far, the literature on consumption smoothing against covariate shocks is limited, with the presumption that informal insurance functions are most effective for idiosyncratic shocks (Carter and Maluccio 2003). It is argued that households willing to insure others against covariate shocks share similar livelihoods and living standards, leaving them unable to insure consumption fully (Carter and Maluccio 2003). Furthermore, since covariate shocks affect all suffering households in the same way, highly localized social networks with very limited resources cannot be used to insure consumption. However, a strand of the recently growing literature, such as Carter and Maluccio (2003); Wetterberg (2007); Tegebu (2008) and Witoelar (2013), have found evidence that self-protection and risk-sharing via informal community and extended kinship networks are important in smoothing consumption against both idiosyncratic and covariate shocks. Moreover, Rosenzweig (1988) found that network ties help households insure consumption in the face of covariate shocks through implicit insurance-based cash and in-kind transfers. Similarly, Grimard (1997) found partial risk-sharing among the same ethnic groups of rural and urban households in Côte d'Ivoire.

In the case of Ethiopia, some forms of informal social links and organizations have an explicit insurance component against shocks. For example, *Iddir* provides in-kind and financial assistance in times of hardship with no to very low interest rates (Wossen et al. 2013, 2015). Furthermore, some aspects of social capital and extended kinship networks help to insure consumption against shocks through moral obligation, sharing and redistribution of resources (Di Falco and Bulte 2013). Given that formal risk-sharing mechanisms are largely limited in Ethiopia, we expect social capital to be helpful in maintaining consumption in the face of shocks. In particular, funeral insurance networks (*Iddir*) are commonly found to be important sources of resources at times of hardship (Dercon et al. 2006; Wossen et al. 2015). In addition to providing insurance in the case of death of family members, *Iddirs* have been observed providing support in times of shock and offer credit to members (Hoddinott et al. 2009). The potential for these informal networks to reduce the vulnerability of member households and provide credit in the absence of formal markets makes them highly relevant for consumption insurance. Indeed, the services they provide and the wide levels of participation in *Iddirs* observed in Ethiopia means they are commonly considered potential resources for consumption insurance and as providers of additional risk-mitigation services (Berhane et al. 2013; Dercon et al. 2006). Additionally, as *Iddirs* straddle the line of informality and formality, and as they are often composed of a mix of strong and weak ties in terms of network heterogeneity (Hoddinott et al. 2009), they represent extremely relevant points of departure for studying social capital effects on consumption insurance. The main contribution of this article is therefore to fill the research gap by investigating whether social capital measured by network size and membership of an *Iddir* help households insure consumption against shocks.

Data source and econometric strategy

Data sources

We used data from the 2004 and 2009 rounds of the Ethiopian Rural Household Survey (ERHS)[3] that covered a number of villages in rural Ethiopia (Dercon and Hoddinott 2004). The data was collected by Addis Ababa University in collaboration with the International Food Policy Research Institute (IFPRI) and the Oxford University Center for African Economies. It covered fifteen Peasant Associations (PA) in four major administrative regions (Tigray, Amhara, Oromia and southern nations and nationalities and peoples region) of the country. A total of seven rounds of data collection were conducted from 1989 to 2009, in which newly emerging and important issues were included in each successive round. We made use of the 2004 and the 2009 rounds of the ERHS, since the social capital measurements on which our analysis is

[2] A shock is considered as idiosyncratic if the effect is confined to the household and covariate if it affects at least some other residents in the village. In the survey the following questions were used to determine a given shock as covariate and idiosyncratic: "How widespread was the shock? i) only affected my household, ii) affected some households in this village, iii) affected all households in this village, iv) affected this village and other nearby villages

[3] These data were made available by the Economics Department, Addis Ababa University, and the Centre for the Study of African Economies, University of Oxford and the International Food Policy Research Institute. Funding for data collection was provided by the Economic and Social Research Council (ESRC), the Swedish International Development Agency (SIDA) and the United States Agency for International Development (USAID); the preparation of the public release version of these data was supported, in part, by the World Bank, AAU, CSAE, IFPRI, ESRC, SIDA and USAID

based, were only included in these survey rounds. The survey contains detailed information on a variety of individual and household socio-economic attributes, such as food and non-food consumption, assets, social capital and household demographics. Data on food consumption was collected for more than 80 food items in the survey based on a 1-week recall period. To capture consumption for infrequently consumed food items, consumption for the last 4 months prior to the survey time was also collected. Household food consumption was reported in terms of the total quantity consumed from own production, total value bought from the market and total value obtained from gifts. The quantity of consumption from own production was converted into imputed values using prices collected at community level. We used both food and non-food[4] consumption values to capture the role of social capital in insuring consumption against shocks.

Shock measures

For this study, shocks are defined as adverse events that led to a loss of household income, a reduction in consumption and/or a loss of productive assets. These include shocks such as death of a family member, illness of husband, wife or family member, divorce and dispute with extended family members, drought, flooding, and large increases in food and input prices. Figure 1 depicts the major shocks that households faced in the past 5 years that led to a loss of productive assets, a loss in household income and a reduction in household consumption. The three most important shocks that affected households in the last 5 years prior to the survey were drought, market shocks (rising food prices) and health shocks (illness of husband, wife or family member). In the survey, about 52 % of households reported experiencing drought shocks while 62 % reported experiencing market shocks (rising food prices). A significant portion of households (29 %) also reported facing health shocks.

Health shocks were measured through self-reported illness of husband, wife or another person within the family. The use of self-reported health shock is not without difficulties, since previous research has indicated that the measurement of illness shock variables has important effects when analysing the impact of illness on consumption. As pointed out by Asfaw and Von Braun (2004) and Dercon and Krishnan (2000) using the earlier rounds of the same data set, the use of self-reported health shocks is problematic. First, there is a high measurement error since what is considered "healthy" is quite different among different individuals (Asfaw and Von Braun 2004; Islam and Maitra 2012). Second, the problem of self-reported bias in reporting illness due to differences in education or wealth might be substantial (Dercon and Krishnan 2000). Islam and Maitra (2012), for example, found differential effects of health shocks on consumption when using short-term and longer-term measures of health shock and recommended using long-term measurements. Unlike Asfaw and von Braun (2004) who measured illness by self-reported health status of the household head in the last 4 weeks prior to the survey, our measure of health shock corresponds to long-term measures, as it captures illness in the last 5 years that led to a serious reduction in asset holdings, caused household income to fall substantially or resulted in a significant reduction in consumption.[5] A similar measurement approach was used for the case of Tanzania by De Weerdt and Dercon (2006).

As noted by Gertler et al. (2006), another potential problem with our measurement of health shocks is that they could be related to rainfall shocks. For example, a rainfall shock leading to flooding could cause malaria. A rainfall shock may also lead to a bad harvest and hence lower consumption, which in turn might lead to illness. In this case consumption shocks will be the cause of health shocks, rather than the other way round (De Weerdt and Dercon 2006). However, in our case the Spearman

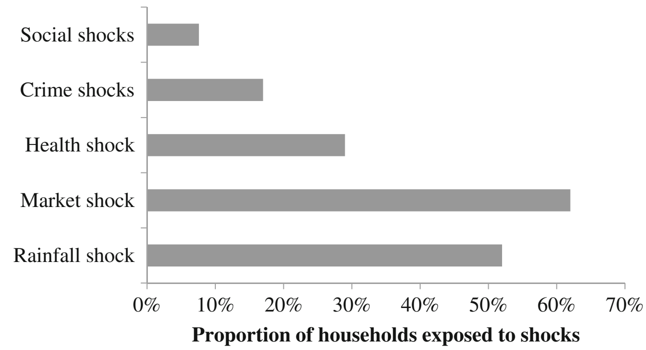

Fig. 1 Percentage of households that experienced shocks in the past 5 years

[4] Our measure of non-food consumption excludes expenditure on health and medical care. Expenditure on health and medical care was deducted from non-food consumption. Previous studies on health shocks by Gertler, Levine and Moretti 2006; Gertler and Gruber 2002; De Weerdt and Dercon 2006; Islam and Maitra 2012; Asfaw and von Braun 2004 also used similar measurement of non-food consumption.

[5] We assumed health shocks to be exogenous for the following reasons: Our measurement of health shocks can be regarded as being transitory and unpredictable. Our identification strategy relied heavily on this assumption. In addition, since we used fixed effects, any time invariant unobserved household characteristic (e.g., early childhood nutrition) that may affect consumption and health outcomes were eliminated. However, time-varying unobservable factors may affect both health and consumption outcomes. For example, wealthy farmers may have better health outcomes (through the purchase of health inputs, including better nutrition and healthcare) and consumption. However, in our measurement of consumption, we excluded health expenditures. Though we tried to address the issue of identification using fixed effects, we acknowledge that identification might still be a problem with health shocks. While the consistency of the results reported in this paper supports the absence of consumption smoothing against health shocks, the results may need to be interpreted with caution.

correlation coefficient between the two shocks was very low (Spearman correlation coefficient between the two was 0.05, $p = 0.0000$).[6]

Similarly, the incidence of self-reported bias in the measurement of rainfall shocks could also introduce bias. To avoid self-reported bias in the measurement of rainfall shocks, we opted to use actual village level observed rainfall shocks instead of self-reported drought shocks. The correlation between self-reported drought shocks and the actual village level rainfall measures was 0.76, implying that our measure of rainfall shocks is meaningful in capturing weather shocks. Previous studies have shown that rainfall variability affects agricultural production in general and the food security level of households in particular (Dercon 2004; Porter 2012). To estimate the effects of rainfall shocks, we matched observed rainfall values from the weather station closest to ERHS villages with socio-economic data. Following Dercon (2004) and Porter (2012) a bad rainfall shock is defined as one in which the rainfall levels in the village in the 12 months preceding the survey fell one standard deviation below the mean.

The final measure of shock is related to the prevalence of market shocks - especially those of food and input price shocks. In particular, the shock module of ERHS collected data on input and output price related shocks that affected household income. Herein, market shock was measured by a dummy variable which takes a value of one if the household reports a large increase in input prices or decrease in output prices as occurred in the worst shocks in the last 5 years. In this paper, we consider market shocks as covariate shocks since they affects individuals beyond a given village. The impact of market shocks on food security is, however, not always negative. Market shocks such as higher food prices might be a threat to food security as many farm households are net food buyers. Yet, higher food prices may also provide an opportunity for net seller farmers. The net effect of higher food prices therefore depends on the market position of households (net buyer vs. net seller, see Wossen and Berger 2015).

Social capital measures

Although a subject of much debate, empirical studies have used various ways of measuring social capital, for example through measuring local links quantified by membership in local informal and formal networks (Wossen et al. 2015). In our analysis, we focused on informal social capital measures which include: i) Network size, defined as the number of individuals that a given household knows and could depend on in times of hardship and (ii) membership in funeral insurance arrangements (*Iddir*). The first component of social capital captures the size of the household's network. This form of social capital reflects the self-reported relationships with individuals whom a given household considers to be very important at times of hardship, from both within and outside the village. It should be stressed that extending this component non-locally is quite novel. Considering relationships beyond the village domain has important implications for consumption smoothing since individuals living far apart might have different livelihood strategies. However, households with larger network sizes may refrain from helping others by accumulating durables that are non-sharable at times of hardship (Di Falco and Bulte 2011). Similarly, as pointed out by Baland et al. (2011), some households with large network sizes may pretend to be poor through excessive borrowing to imply their inability to provide financial assistance for other network members at times of hardship. If the adverse incentive effects of sharing norms are sufficiently strong, such networks may have little effect on households' ability to smooth consumption.

Our second measure of social capital is labelled as "membership in funeral insurance arrangements," which is measured from the participation of an informal arrangement locally known as "*Iddir*". *Iddir* is established for providing mutual aid during death of members (Di Falco and Bulte 2013; Dercon et al. 2006). *Iddir* also serves as an insurance mechanism by providing money and in-kind assistance for its members at times of hardship. There are often written rules for participation, contributions, payouts and punishments (Dercon et al. 2006). As *Iddirs* are extremely important institutions in Ethiopia, omitting them from models of rural Ethiopia risks missing their role in smoothing production and consumption. For a long-term model, especially one that considers outputs such as consumption smoothing, the widespread use of informal insurance is likely to have an effect by which households are able to avoid shortages when a shock in the family affects labour supply or when the costs of traditional funerals exacerbate resource constraints. Including risk-sharing networks as fixed effects estimates from econometric analysis can capture these important effects. As *Iddirs* have been seen as highly successful informal institutional arrangements, there is great interest in replicating their success elsewhere. The contribution of this paper is therefore a significant one, in that it represents a first step at explaining how well-structured networks like *Iddirs* may affect consumption smoothing behaviours in developing countries.

[6] However, the problem of reverse causality between (food) consumption and health shocks may extend beyond the correlation between rainfall shocks and health shocks. This would be an important area of future research and is beyond the scope of this paper.

Econometric strategy

Our estimation strategy first focuses on the effect of shocks on a household's ability to smooth consumption. We then introduce a framework to capture the effect of social capital on a household's ability to insure consumption against unexpected shocks. As mentioned above, the effect of shocks on a household's ability to smooth consumption is examined following the approach of Grootaert and Narayan (2004). We address this relationship in the context of a simple econometric specification as follows.

$$\Delta \ln\left(\frac{C_{ijt}}{H_{ijt}}\right) = \alpha_0 + \beta S^h_{ijt} + \pi S^m_{ijt} + \gamma S^r_{jt} + \vartheta X_{ijt} + \varepsilon_{ijt} \quad (1)$$

Where C_{ijt} is the real consumption of household i in village j at time t. H_{ijt} measures household size. Similarly, S^h_{ijt} and S^m_{ijt} captures health and market shocks faced by household i in village j at time t while S^r_{jt} measures rainfall shocks faced by village j at time t. X_{ijt} includes a vector of household and village level variables. Next, we test the effects of social capital on a household's ability to insure consumption against unexpected shocks following the approach of Dercon (2004); Gertler et al. (2006); De Weerdt and Dercon (2006) and Islam and Maitra (2012). The empirical specification of the risk sharing model is presented as follows: $\Delta \ln\left(\frac{C_{ijt}}{H_{ijt}}\right) = \alpha_0 + \beta S^h_{ijt} + \pi S^m_{ijt} + \gamma S^r_{jt} + \theta Z_{ijt} + \vartheta X_{ijt} + \varepsilon_{ijt}$ (2)

Z_{ijt} measures changes in social capital. The above equation is the most widely used econometric specification of consumption insurance. If complete insurance against shocks exists, we expect $\beta = 0$, $\pi = 0$ and $\gamma = 0$. In the above specification, social capital can be potentially endogenous since unobservable factors influencing changes in social capital may also influence consumption directly. Wealthier households, for instance, might have more opportunities to develop larger network sizes as well as better consumption smoothing ability compared to poorer households. Endogeneity of social capital in the above specification further implies that if the correlation between consumption levels and social capital is sufficiently high, then estimated results will be biased. The availability of panel data can, obviously, help to deal with this problem. A fixed effect specification will provide consistent estimates of parameters in the presence of correlation between the time invariant unobservables and social capital variables. In particular, the use of a fixed effect estimator sweeps out the effects of any time-invariant factors which determines both social capital formation and ability to smooth consumption (De Weerdt and Dercon 2006; Gertler et al. 2006). The inclusion of a time dummy can control for elements of heterogeneity that are common to all the areas of the study. There still could be, however, some correlation between time varying unobservable variables and the variables of interest.

Our identification strategy is therefore to implement an Instrumental Variable (IV) regression approach. Finding suitable instruments is notoriously challenging. Previous studies have shown that people who were born and raised in the same village tend to have more extensive social connections and are characterized by stronger social ties (Wossen et al. 2015). We therefore used the number of trips the household head made outside the village as instruments for the social capital variable network size. We hypothesize that this variable affects a household's ability to smooth consumption only through its effect on network formation. This variable is closely related to the formation of local networks but does not directly affect consumption. One factor that is closely related to the formation of *Iddir* in the Ethiopian context is trustworthiness. In particular, Dercon et al., (2006) showed that generally *Iddirs* are quite inclusive, but membership is often based on trust. In particular, households that trust others in their village are more likely to be members of *Iddir*. As a result, we used trustworthiness as a potential instrument for *Iddir*. This variable directly affects membership of *Iddir* but not consumption ability smoothing directly. Trust is measured based on the respondent's perception of trustworthiness of people in the village. Trust in people is captured as a dummy variable with a value of one if respondents think that people in general are trustworthy and zero otherwise.

In order to test if households with better social capital levels are able to buffer the consumption implications of different types of shocks, we extended specification (2) by adding an interaction term between shocks and social capital measures.[7]

$$\begin{aligned}\Delta \ln\left(\frac{C_{ijt}}{H_{ijt}}\right) &= \alpha_0 + \beta S^h_{ijt} + \gamma S^r_{jt} + \pi S^m_{ijt} \\ &\quad + \rho\left(S^h_{ijt} \times Z_{ijt}\right) + \varphi\left(S^r_{jt} \times Z_{ijt}\right) \\ &\quad + \theta Z_{ijt} + \vartheta X_{ijt} + \varepsilon_{ijt} \qquad (3)\end{aligned}$$

The coefficient of interaction between social capital and the shock variable (ρ) and (φ) represents the effect of social capital on a household's ability to insure consumption against shocks. If $\rho > 0$ and $\varphi > 0$, social capital will have a positive role in insuring consumption against shocks. According to Nizalova and Murtazashvili (2014), OLS estimates of the coefficient on the interaction term between the exogenous

[7] Measuring the interaction effect between market shocks and social capital is beyond the scope of this paper. Theoretically, market shocks may not adversely affect food security and hence the role that social capital may play cannot be specified a priori.

variable (rainfall shock) and the endogenous variable (social capital) should be consistent even without implementing an IV strategy. In our empirical specification (Eq. 3) of the interaction between rainfall shock and social capital variables, the OLS estimates of φ and ρ should therefore be consistent even in the presence of endogeneity bias from Z_{ijt} as far as S^{r}_{jt} is strictly exogenous.

Descriptive statistics

Definition and descriptive statistics for social capital and other control variables used in the regression analysis are presented in Table 1.

In the survey, the mean number of individuals that the household perceives to be very important at times of hardship increased from 10.29 individuals in 2004 to 14.94 individuals in 2009. On the other hand, membership of an *Iddir* increased marginally from 81 to 85 %. In addition,

Table 1 Variable list and descriptive statistics

Variable	2009 Mean	2009 SD	2004 Mean	2004 SD
Demographic characteristic				
Age (Age of the household head in years)	54.5	15.3	51.8	15.3
Education (1 = household head is literate)	0.53	0.49	0.37	0.48
Household size	5.9	2.48	5.8	2.43
Assets and resource constraints				
Farm size (in ha)	0.4	1.15	1.6	1.9
Access variables				
Access to safety nets (1 = has access to safety net)	0.23	0.42	0.44	0.49
Access to credit (1 = has access to credit)	0.62	0.48	0.53	0.49
Access to Off-farm (1 = has access)	0.47	0.52	0.36	0.41
Outcome variables				
Non-food consumption (Birr/monthly)	240.1	312.9	109.6	161.1
Food consumption (Birr/month)	817.9	639.3	419.4	417.9
Total consumption (Birr/month)	1058	822.9	528.2	503.2
Real per capita food consumption (Birr/month)	51.1	62.4	70.4	45.3
Social capital variables				
Iddir (1 = member of Iddir)	0.85	0.35	0.81	0.39
Total network size	14.94	15.16	10.29	10.69
Weather variables				
Mean rainfall (mm)	993	304.2	1210	288.5
Anomaly index	−0.73	0.89	0.17	1.15
Instrument variables				
Trust	0.29	0.45	0.28	0.45
The number of journeys	2.4	4.3	1.9	4

Table 1 reports the average monthly food, non-food and total consumption of each respondent. Average household monthly food consumption varied from 419 birr in 2004 to 817 birr ($45) in 2009. As in many other developing countries, food consumption accounted for about 78 % of total household consumption. Similarly, total consumption increased from 528 birr in 2004 to 1058 birr in 2009. In order to make reasonable comparisons across rounds, we followed the approach of Tefera et al. (2012) and converted all nominal expenditures into real expenditures by deflating each price variable with a weighted price index using the 1994 survey period as a reference. In our regression analysis, we used real per capita consumption instead of nominal expenditure values.

In terms of independent variables, we included several household characteristics, such as age, that capture the effects of experience in dealing with shocks and educational attainment. Average household size ranged from 5.8 members in 2004 to 5.9 members in 2009, while the proportion of literate households increased from 37 % in 2004 to 53 % in 2009. We further included non-farm income as a proxy for the capacity to cope with shocks. In addition, we included institutional and access variables, such as access to credit and access to safety nets, because of their relevance for consumption insurance, especially when a given shock affects the entire risk sharing network.

Results

Social capital and consumption smoothing

We first present the result of a baseline regression where we considered the empirical question of whether households are able to withstand the effect of shocks. Next we present the results of our regression analysis, undertaken to examine whether social capital and sharing norms have any effect on a household's ability to insure consumption against shocks. The effects are separately presented for food consumption (Table 2), non-food consumption (Table 3) and total consumption (Table 4). Moreover, in each specification, we first ran a baseline regression without including social capital variables and household characteristics as regressors. We then included social capital variables as additional controls along with the interaction terms of social capital and shocks to analyse the effects of social capital.

Our first result is presented in Table 2 (Model 1), where we estimated the effect of shocks on food consumption without including social capital and other controls. As expected, rainfall shock has a negative and statistically significant effect on household food consumption growth, implying the inadequacy of self-coping mechanisms against this type of shock. In particular experiencing a rainfall shock which is one standard deviation below the long term mean reduces food consumption growth by 16.65 %. This finding is particularly relevant in the context of Ethiopia as agriculture is predominately rain-fed with limited irrigation coverage. Similar results have also been reported by Dercon et al. (2005); Porter (2012) and Demeke et al. (2011). Similarly, experiencing health shocks among family members reduces food consumption growth by 11.2 %.

Our results further show that health and market shocks affect food consumption growth negatively. This result is in line with Dercon et al. (2005).[8] Next, we examined whether households with better social capital are able to smooth food consumption against both covariate and idiosyncratic shocks by examining interaction effects.[9] For the interaction term between the endogenous variables (social capital) and the arguably exogenous variable (rainfall shock), we did not implement IV regression. In particular, Nizalova and Murtazashvili (2014) proved that OLS estimates of the coefficient on the interaction term between an exogenous variable and an endogenous variable are consistent. In our case, OLS estimates of the interaction term between rainfall shock and social capital variables should be exogenous in the presence of endogeneity bias from specific social capital variables. Looking into the interaction effects, we found three interesting results. First, the interaction term between rainfall shock and network size variable is positive, while the direct effect of rainfall shock is negative, implying some mitigating effects of social ties. Second, the interaction term between rainfall shock and *Iddir* is positive and statistically significant, showing the important insurance functions of *Iddir*. This result implies that experiencing a rainfall shock which is one standard deviation below the long term mean does not reduce food consumption growth for *Iddir* members. Third, the interaction term between health shock and network size variable becomes positive and statistically significant, while the direct effect of health shock is negative. This implies that reduction in food consumption due to health shocks is compensated for by gifts from others in the network. These results underscore the important insurance roles of social capital against the implications of shocks. Finally, the interaction term between health shocks and *Iddir* is positive but insignificant. This result suggests that while *Iddir* has some mediating effects, the effects are not large enough to insure consumption against health shocks. Note that the main function of *Iddir* is to cover funeral expenses (which are very high in Ethiopia). However, they also provide credits at times of shocks including illness. While looking into *Iddir* payouts across space and time in all of our villages, we found that payouts for illness were close to zero while payouts for shocks (other than illness) were quite high. In addition, for idiosyncratic shocks -other than death- households tend to rely on their kin and networks (see Debebe *et al*. 2013). However, it must be noted that, for shocks that affect the whole risk sharing network such as drought, we did not find any significant effect for *Iddir* and network size (see Table 5).

Our results stand in contrast to earlier studies, which tended to document little support for the hypothesis that social capital helps households to insure consumption against health shocks (e.g. in Indonesia; Gertler et al. 2006). Our results are, however, not surprising for Ethiopia, since strong family attachments and altruism are essential parts of traditional Ethiopian life. In particular, Debebe et al. (2013), using the same data set, pointed out that households tend to rely on asset sales (mainly livestock) and borrowing from relatives and neighbours when facing health shocks. In addition, membership of an *Iddir* implies a commitment to specific normative behaviour, such as helping other members, due to social and peer influence. Model 3 in Table 2 presents IV-regression results. In terms of the effect of social capital, we find consistent results in terms of the direction and the magnitude of effects in our IV specification.[10]

Overall, our results reaffirm that social capital matters in insuring food consumption against shocks. Moreover, it is reassuring to observe positive signs for all our social capital variables, as the empirical relevance of each effect is not only related to the significance but also the sign of the impact estimated for different social capital indicators. In this regard, our results clearly support the hypothesis that a higher level of social capital is associated with better household food consumption levels. However, the evidence presented on food consumption smoothing against rainfall shocks must be taken with caution. We do not consider the possibility of consumption smoothing against complete collapse, such as drought, which affects not only individual farm households but also the whole risk sharing/social capital network. However, the results here are informative in the sense that current levels of rainfall shocks could be insured through informal social capital and networks. In fact, using data on network-wide shocks we document the absence of insurance against shocks that affect the entire risk sharing networks (see Robustness checks section).

[8] Using the 2004 rounds of ERHS data, Dercon et al. (2005) reported that experiencing a health shock reduces consumption growth by 9 %.

[9] Note that, we did not include an interaction term between market shocks and social capital variables as the social capital proxies we considered here are not designed to serve against market shock

[10] First stage regression results are presented in Table 9, Appendix I

Table 2 Food consumption growth and shocks

Variables	No Controls 1	With Social capital 2	With IV 3	With interaction terms 4	All controls 5
Rainfall shock	−0.144*** (0.048)	−0.152*** (0.047)	−0.1665*** (0.048)	−0.21*** (0.069)	−0.186*** (0.07)
Health shock	−0.114** (0.052)	−0.115** (0.05)	−0.112** (0.051)	−0.39*** (0.113)	−0.392*** (0.114)
Market shock	−0.109** (0.049)	−0.099** (0.048)	−0.116** (0.051)	−0.091* (0.048)	−0.09* (0.048)
Network size		0.0076** (0.0012)	0.0092*** (0.003)	0.0049** (0.0019)	0.005** (0.0019)
Membership of Iddir		0.467*** (0.087)	0.477** (0.22)	0.41*** (0.091)	0.417*** (0.094)
Rainfall shock*Iddir				0.459*** (0.119)	0.433*** (0.12)
Rainfall shock* Network size				0.0003 (0.0044)	0.0004 (0.0044)
Health shock*Iddir				0.172 (0.121)	0.176 (0.124)
Health shock* Network size				0.0119** (0.0038)	0.0117*** (0.0038)
Time dummy	Yes	Yes	Yes	Yes	Yes
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000
N	1888	1888	1888	1888	1888

The dependent variable is change in log real food consumption between survey waves of 2004 and 2009. Robust standard errors are reported in parentheses. * Significance at the 10 % level. ** Significance at the 5 % level. *** Significance at the 1 % level. List of controls: age, education, farm size, off-farm, access to safety net and access to credit

Next we tested the full risk-sharing hypothesis using non-food consumption. We employed a parsimonious specification as before by using standard controls as regressors at first and then introducing our social capital variables as well as their interactions with the shock variables (Table 3). We found that the effect of rainfall, market and health shocks on non-food consumption growth is insignificant but negative, implying that we cannot reject the hypothesis that non-food consumption is at least partially insured. Similar results were also reported by De Weerdt and Dercon (2006) and Islam and Maitra (2012) for the cases of Tanzania and Bangladesh, respectively. In terms of social capital, neither the interaction term between shocks and network size variable nor the

Table 3 Non-food consumption growth and shocks

Variables	No Controls 6	With Social capital 7	With interaction terms 8	All controls 9
Rainfall shock	−0.0019 (0.0041)	0.0014 (0.0027)	−0.0058 (0.0038)	−0.0053 (0.0038)
Health shock	0.0045 (0.003)	0.0028 (0.0022)	0.008 (0.01)	0.008 (0.0107)
Market shock	0.0014 (0.0033)	0.00076 (0.0025)	0.0008 (0.0024)	0.0005 (0.0025)
Network size		−0.0007*** (0.00014)	−0.0009*** (0.00016)	−0.0009*** (0.00016)
Membership of Iddir		0.114*** (0.013)	0.112*** (0.0133)	0.109*** (0.0133)
Rainfall shock*Iddir			0.0078 (0.007)	0.0072 (0.0066)
Rainfall shock* Network size			0.0007 (0.0022)	0.00068 (0.0022)
Health shock*Iddir			−0.0087 (0.0106)	−0.0085 (0.0106)
Health shock* Network size			0.00019 (0.0003)	0.00017 (0.00032)
Time dummy	Yes	Yes	Yes	Yes
Prob > F	0.0000	0.0000	0.0000	0.0000
N	1888	1888	1888	1888

The dependent variable is change in log real non-food consumption between survey waves of 2004 and 2009. Robust standard errors are reported in parentheses. *Significance at the 10 % level. ** Significance at the 5 % level. *** Significance at the 1 % level. List of controls: age, education, farm size, off-farm, access to safety net and access to credit interaction term between *Iddir* and shocks become significant when considering non-food consumption. Note that, since we did not find any significant effect of shocks on non-food consumption growth, it is logical to find insignificant effects for social capital variables. Moreover, in our data, non-food expenditure does not include medical expenditures due to endogeneity bias. Non-food expenditure excluding medical expenses constitutes less than 10 % of the total food expenditure. In addition, the variance of non-food expenditure was very low across survey rounds, villages and among households. The lack of significant effect is therefore related to the lack of variation in non-food expenditure due to the pervasive nature of poverty in rural Ethiopia.

Finally we present our estimated results using total consumption. We follow a similar strategy as before, where we introduced control variables at first and then our social capital variables along with the relevant interactions to estimate the role of social capital. The results are presented in Table 4. Our first result shows that total consumption is not insured against shocks. For instance, experiencing a rainfall shock which is one standard deviation below the long term mean reduces total consumption growth by 14.8 %. The results are quantitatively similar to that of food consumption, albeit different from that of non-food consumption. This, however, is not surprising, since food consumption accounts for nearly 80 % of the total consumption in the survey. In terms of social capital roles, the results are numerically similar in terms of the magnitude and direction of the effects to that of food consumption.

Robustness checks

While examining the role of social capital, we did not consider the possibility of consumption smoothing against complete collapse such as drought, a prominent feature of Ethiopia. Here we extend our analysis by considering a network-wide shock that affects not only individual farm households but also the whole risk sharing/social capital networks. Note that extreme rainfall shock is measured at village level and hence does not affect the whole risk sharing network as *Iddir* membership and network size were not strictly restricted to village level. As a result, we used a sub-sample of our data in which membership of an *Iddir* and *size of network* measured at village level to measure how social capital may buffer the implications of shocks that affect the whole risk sharing network. Such analysis is extremely useful for designing appropriate safety net policies. Interestingly, we found that consumption (food, non-food and total) is not insured through social capital when a shock affects the whole risk sharing network. Moreover, we show that formal policy interventions such as access to consumption credit and safety nets are the only effective ways of insuring consumption.

Table 4 Total consumption growth and shocks

Variables	No controls	With Social capital	With IV	With interaction terms	All controls
	10	11	12	13	14
Rainfall shock	−0.137*** (0.0499)	−0.157*** (0.048)	−0.148*** (0.048)	−0.189*** (0.069)	−0.166** (0.07)
Health shock	−0.12** (0.053)	−0.118** (0.051)	−0.119** (0.05)	−0.396*** (0.116)	−0.401*** (0.118)
Market shock	−0.112** (0.05)	−0.115** (0.051)	−0.10** (0.048)	−0.092* (0.048)	−0.091* (0.048)
Network size		0.011*** (0.0034)	0.0091*** (0.002)	0.0069***(0.0019)	0.007*** (0.002)
Membership of Iddir		0.504*** (0.22)	0.603*** (0.0902)	0.543*** (0.094)	0.55*** (0.097)
Rainfall shock*Iddir				0.45*** (0.122)	0.424*** (0.123)
Rainfall shock* Network size				−0.00137 (0.0044)	−0.0013 (0.0044)
Health shock*Iddir				0.181 (0.123)	0.185 (0.126)
Health shock* Network size				0.0116*** (0.0039)	0.0114*** (0.0039)
Time dummy	Yes	Yes	Yes	Yes	Yes
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000
N	1888	1888	1888	1888	1888

The dependent variable is change in log real total consumption between survey waves of 2004 and 2009. Robust standard errors are reported in parentheses. * Significance at the 10 % level. ** Significance at the 5 % level. *** Significance at the 1 % level. List of controls: age, education, farm size, off-farm, access to safety net and access to credit

Table 5 Robustness check using network-wide shocks

Variables	Food consumption 15	Non-food consumption 16	Total consumption 17
Network-wide rainfall shock	−0.44*** (0.0092)	−0.021*** (0.0011)	−0.59*** (0.0062)
Size of network	0.00014 (0.0023)	0.0023 (0.0044)	0.034 (0.06)
Membership of Iddir	0.0462 (0.0541)	−0.432 (0.219)	0.024 (0.032)
Network-wide rainfall shock *size of network	−0.0142 (0.0532)	−0.0324 (0.055)	−0.0532 (0.0871)
Network-wide rainfall shock *Iddir	−0.048 (0.059)	−0.341 (0.233)	−0.143 (0.139)
Access to safety nets	0.46*** (0.018)	0.129*** (0.007)	0.309*** (0.098)
Access to credit	0.356*** (0.021)	0.163*** (0.014)	0.243***(0.0131)
Access to safety nets* Network-wide rainfall shock	0.21*** (0.043)	0.103*** (0.003)	0.189*** (0.037)
Access to credit* Network-wide rainfall shock	0.134** (0.05)	0.092*** (0.0019)	0.119** (0.04)
Time dummy	Yes	Yes	Yes
N	460	460	460
Prob > F	0.0000	0.0000	0.0000

Robust standard errors are reported in parentheses. * Significance at the 10 % level. ** Significance at the 5 % level. *** Significance at the 1 % level. List of controls: age, education, farm size, off-farm

The next section then probes the robustness of our results by considering positive rainfall deviations from the long term mean as a measure of rainfall shock. In our previous analysis, we defined bad rainfall shock as one in which the rainfall levels in the village in the 12 months preceding the survey fell one standard deviation below the mean. However, some of the villages in our study area experienced positive (too much) rainfall. In our main analysis, we examined only negative rainfall shock, as Dercon et al. (2005) indicated that only bad rainfall shocks caused consumption reductions. Moreover, according to ERHS (2009), only 8 % of the households mentioned flooding and too much rainfall as causing a significant decline in income. Nonetheless, as a robustness test we constructed a positive rainfall shock when total rainfall levels in the village in the 12 months preceding the survey exceeded one standard deviation above the long term mean. We found that such shocks had no significant negative effect on consumption growth (Table 6).

In our third robustness check, we estimated the effect of shocks using a different indicator of food security besides growth in food consumption. In particular, we examined the

Table 6 Food consumption growth and positive rainfall shocks

Variables	No controls 1	With social capital 2	With IV 3	With interaction terms 4	All controls 5
Positive rainfall shock	−0.0655 (0.093)	−0.0740 (0.094)	−0.0784 (0.0921)	−0.0484 (0.095)	−0.0428 (0.099)
Health shock	−0.1042* (0.053)	−0.1054** (0.052)	−0.2891** (0.109)	−0.3427*** (0.115)	−0.3549*** (0.116)
Market shock	−0.0943* (0.050)	−0.0839* (0.049)	−0.0904** (0.0512)	−0.0796 (0.048)	−0.0799* (0.048)
Network size		0.4489*** (0.086)	0.412*** (0.094)	0.4099*** (0.091)	0.4261*** (0.095)
Membership of Iddir		0.0079*** (0.002)	0.008*** (0.0025)	0.0078*** (0.002)	0.0076*** (0.002)
Rainfall shock*Iddir				0.3802*** (0.121)	0.3629*** (0.120)
Rainfall shock* Network size				−0.0094*** (0.003)	−0.0077** (0.003)
Health shock*Iddir				0.1323 (0.124)	0.1423 (0.126)
Health shock* Network size				0.0117*** (0.004)	0.0115*** (0.004)
Time dummy	Yes	Yes	Yes	Yes	Yes
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000
N	1888	1888	1888	1888	1888

The dependent variable is change in log real food consumption between survey waves of 2004 and 2009. Robust standard errors are reported in parentheses. * Significance at the 10 % level. ** Significance at the 5 % level. *** Significance at the 1 % level. List of controls: age, education, farm size, off-farm, access to safety net and access to credit

Table 7 Consumption growth using calorie intake

Variables	No controls 1	With social capital 2	With IV 3	With interaction terms 4	All controls 5
Rainfall shock	−0.1200*** (0.039)	−0.1281*** (0.038)	−0.1480*** (0.042)	−0.1713*** (0.056)	−0.1689*** (0.057)
Health shock	−0.0798* (0.041)	−0.0782** (0.040)	−0.0737* (0.040)	−0.3089*** (0.096)	−0.3213*** (0.098)
Market shock	−0.0815** (0.040)	−0.0761* (0.039)	−0.0912** (0.040)	−0.0716* (0.039)	−0.0743* (0.039)
Network size		0.3551*** (0.071)	0.2756 (0.189)	0.3154*** (0.077)	0.3104*** (0.079)
Membership of Iddir		0.0046*** (0.002)	0.0043* (0.003)	0.0015 (0.002)	0.0015 (0.002)
Rainfall shock*Iddir				0.2020** (0.088)	0.1908** (0.088)
Rainfall shock* Network size				0.0019 (0.003)	0.0019 (0.003)
Health shock*Iddir				0.1272 (0.102)	0.1394 (0.104)
Health shock* Network size				0.0119*** (0.003)	0.0118*** (0.003)
Time dummy	Yes	Yes	Yes	Yes	Yes
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000
N	1888	1888	1888	1888	1888

The dependent variable is change in log real food consumption between survey waves of 2004 and 2009. Robust standard errors are reported in parentheses. * Significance at the 10 % level. ** Significance at the 5 % level. *** Significance at the 1 % level. List of controls: age, education, farm size, off-farm, access to safety net and access to credit

effect of shocks on calorie intake. We found that food consumption growth (in calories) is negatively affected by shocks (Table 7).

Our final robustness check captures the effect of household level idiosyncratic rainfall shocks. In the shock measurement section, we argue that the problem of self-

Table 8 Consumption smoothing and idiosyncratic rainfall shock (using self-reported rainfall shocks)

Variables	No Controls 1	With Social capital 2	With IV 3	With interaction terms 4	All controls 5
Idiosyncratic rainfall shock	−0.1303** (0.056)	−0.1113** (0.054)	−0.1293** (0.056)	−0.1038* (0.054)	−0.0916* (0.055)
Health shock	−0.0959* (0.052)	−0.0970* (0.051)	−0.0901* (0.052)	−0.3235*** (0.116)	−0.3395*** (0.117)
Market shock	−0.0896* (0.050)	−0.0785 (0.048)	−0.0924* (0.050)	−0.0753 (0.048)	−0.0761 (0.048)
Network size		0.4395*** (0.087)	0.4645** (0.231)	0.4030*** (0.091)	0.4195*** (0.094)
Membership of Iddir		0.0077*** (0.002)	0.0085** (0.003)	0.0076*** (0.002)	0.0075*** (0.002)
Rainfall shock*Iddir				0.4078*** (0.120)	0.3837*** (0.120)
Rainfall shock* Network size				−0.0090*** (0.003)	−0.0075** (0.003)
Health shock*Iddir				0.1230 (0.125)	0.1354 (0.126)
Health shock* Network size				0.0112*** (0.004)	0.0111*** (0.004)
Time dummy	Yes	Yes	Yes	Yes	Yes
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000
N	1888	1888	1888	1888	1888

The dependent variable is change in log real food consumption between survey waves of 2004 and 2009. Robust standard errors are reported in parentheses. * Significance at the 10 % level. ** Significance at the 5 % level. *** Significance at the 1 % level. List of controls: age, education, farm size, off-farm, access to safety net and access to credit reported bias in the measurement of rainfall shocks introduces measurement error in our estimation. Measurement errors in self-reported rainfall shocks arise since the definition of a shock may differ from household to household within a given village or across villages due to unobserved and observed differences among households. Even though the use of a fixed effect specification sweeps out any time-invariant sources of bias, endogeneity bias may still persist as a result of time variant sources of bias. This is quite obvious in the data, as households within the same village reported the occurrence of drought shocks differently. This measurement error in self-reported rainfall shock can arise due to difference in experience, education, type of crops grown by the farmer etc. However, by using village level rainfall shocks, we may fail to capture household-level effects of drought as we did not control for farm level diversification strategies, such as irrigation, due to lack of data. The result shows that idiosyncratic rainfall shocks have a negative effect on consumption growth (Table 8).

Conclusion

The paper provides an empirical analysis of the impact of different social capital indicators on a household's ability to smooth consumption in Ethiopia, a very shock prone country. In particular, the interaction effect between different social capital indicators and shocks experienced by farm households were investigated. We used data from the 2004 and 2009 rounds of the Ethiopian Rural Household Survey (ERHS) to estimate different panel model specifications explaining the determinants of consumption smoothing. In particular, we estimated a fixed effect panel model to examine the empirical question of whether households with high levels of social capital are better-off. Moreover, we undertook an IV-estimation, instrumenting the social capital indicators for controlling potential endogeneity problems. In addressing the effect of social capital and sharing norms on a household's ability to insure consumption against shocks, we employed the standard risk-sharing econometric specifications.

Based on our econometric analyses, we draw the following conclusions: First, consistent with previous findings, we find that shocks affect household food security adversely. Second, in terms of a household's ability to smooth consumption, we found that households were unable to protect themselves from both covariate and idiosyncratic shocks. Our results further show that households with better social capital are able to smooth consumption. In particular, we found an empirical confirmation that social capital enabled households to smooth consumption in Ethiopia where formal credit markets are limited. However, further research should examine how qualitative differences between the types of social network ties may affect consumption smoothing. Further, our results suggest that when a shock affects the entire risk sharing network, informal-coping mechanisms through social capital strategies will be ineffective in shielding households against the implications of shocks. Policy interventions designed to improve the asset-base of farm households will be very important. In addition, well-targeted consumption credits, such as food for work and other production-oriented safety nets, will be important in reducing the impacts of shocks. This is particularly the case when a shock affects the entire risk sharing networks and access to credit and safety nets become the main mechanisms for consumption smoothing.

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Appendix I

First stage regression results.

Table 9 First stage regression results

Variables	Membership to Iddir 1	Network size
Network size	0.000 (0.001)	0.000 (0.001)
Membership of Iddir		0.854 (0.619)
Age	−0.002*** (0.001)	−0.002 (0.014)
Education	0.077*** (0.016)	1.336*** (0.435)
Access to credit	0.048*** (0.016)	0.205 (0.427)
Access to safety net	−0.123*** (0.017)	−0.687 (0.473)
Farm size	0.021*** (0.005)	−0.138 (0.136)
Access to off-farm employment	0.153*** (0.016)	0.781* (0.452)
Rainfall shock	−0.136*** (0.019)	0.733 (0.521)
Health shock	0.019 (0.018)	0.484 (0.476)
Market shock	−0.037** (0.016)	−1.367*** (0.432)
Trust	0.187*** (0.017)	
Number of journey the household head made outside the village		14.453*** 0.486
N	1888	1888

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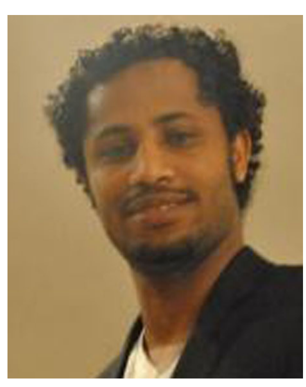

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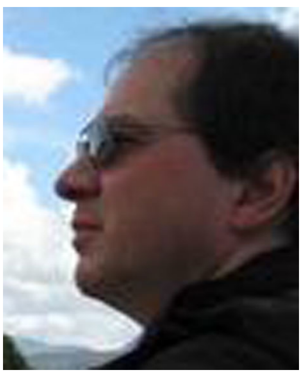

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