Title:

Do voluntary associations reduce hunger? An empirical exploration of the social capital - food security nexus among food impoverished households in western Nepal

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Abstract:

Using involvement in voluntary associations and the density of community groups as measures of social capital, the paper empirically examines its potential interlink with food security. To account for the potentially endogenous nature of individual social capital, we use a multi-equation recursive modeling framework allowing for contemporaneous correlation across equations. We demonstrate that strengthening social capital can be an effective way of combatting extreme food insecurity. However, our empirical findings also highlight a cautionary note that lumping all forms of social capital into one unit to force a uniform narrative about its impacts can be misleading. Using cross sectional household data from the food-impoverished western Nepal, we show that participation in finance-related associations has direct impact on hunger mitigation, whereas associations that have informational or other roles do not have such impact. Our findings suggest that community level social capital can have "environmental" affects that can lead to positive food security outcomes. On the other hand, while involvement in informational associations has no direct significant impact of the prevalence of hunger, we find that they help improve the nutritional quality of diets, thereby circuitously leading to improvements in food security status of women in Nepal.

Keywords: social capital; community associations; hunger; food security; resilience; Nepal

1. Introduction

Even after decades of culminating studies on food security, the role of social capital on alleviating food insecurity has been largely overlooked. This under-emphasis of enhancing social capital as a potential food poverty mitigating mechanism has to do with two factors: the lack of a solid theoretical framework that establishes the social capital-food security link, and an inconsistent and vague treatment of the concept of social capital. This paper, built on the premise that there exists a strong social cohesion among agrarian households in much of the developing world, hypothesizes that social capital can act as an affordable coping strategy to overcome many food security challenges. The cohesion, although runs tangentially with the economic need of cooperation and mutual assistance, is chiefly born out of cultural-traditional roots, at least insofar as economically vulnerable Nepalese households are concerned. Here, we postulate that social capital can have multifaceted roles depending on the economic needs of the respective population. While non-vulnerable households may have proportionately more socio-psychological uses for social capital, for vulnerable households, it plays a cushioning role against potential covariate and idiosyncratic shocks.

As development resilience is being increasingly adopted by food security (FS) studies as an analytical framework, some focus has begun shifting towards the multidimensional, dynamic and sporadic nature of food insecurity (Barrett and Constas 2014; Upton et al. 2016). Such conceptualization allows for the possibility to bring forward other crucial determinants that have largely remained under the veil owing to the lack of a proper conceptual framework. For instance, Barrett and Constas (2014) portray development resilience as a state variable representing some measure of wellbeing that gets depleted or enhanced based on various dynamics: exposure to exogenous negative shocks reduces resilience whereas adaptive mechanisms adds to the resilience stock. The aim of this paper is not to formalize this mechanism; nor is it to justifiably translate it into an empirical framework. In that sense, our goal is rather modest: we remain merely suggestive in that the development resilience framework can be a viable theoretical alternative that can provide a unique vantage point to excavate unexplored determinants of food security. Within that framework, we can interpret social capital as an effective adaptive mechanism enhancing tool that can add to the resilience stock, which in our empirical demonstration represents the food security aspect of wellbeing. Admittedly, a faithful adherence to the resilience framework requires conceptualization of a socio-economic system as a dynamic entity with moving parts. Therefore, as a cautionary note, it should be borne in mind that the static, cross-sectional nature of the data used in this analysis precludes the tracking of movement of the relevant parts across time.

This paper diverges from extant studies in two ways. First, we account for the endogenous nature of individual level social capital, which, although seeming apparent, has not been the norm in most empirical studies. Second, we depart from the conventional categorization of social capital into bonding, bridging, and linking types, and instead classify them according to levels of operation. Doing so allows us to scrutinize both the "compositional" and "environmental" impacts social capital on food security, which we shall elaborate later. In line with Putnam (1995), Coleman (1990), and Kawachi et al. (1997) among others, we use individual participation in voluntary groups and density of community groups as measures of individual level and community level social capital respectively. Our empirical findings confirm the link that exists between social capital and food security. We find that participation in different social groups can be an effective strategy to cope with severe food insecurity. However, we also show that not all forms of social capital have uniform impacts on all food security measures, and that generalizing social capital as a panacea for overall wellbeing improvement can be a misguiding principle.

The remainder of this paper is organized as follows. Section 2 succinctly outlines previous literature. Section 3 discusses data and measures used in the paper. Section 4 presents a conceptual and econometric framework employed for our analysis. Section 5 presents results based on empirical estimation and Section 6 concludes.

2. Literature Review

Modern studies on the relationship between social capital and health can be traced back to Durkheim (1951), who argues that higher suicide rates can be explained by the extent of social disintegration and the consequential constraints that it imposes on moral forces of collective life. Although the term 'social capital' was not used until Bourdieu (1977), Durkheim's work motivated a barrage of studies on various dimensions of what can be identified today as social capital. Among the first studies to ground the otherwise abstract, symbolic notion of social capital into an empirically testable framework is that of Coleman (1988), who presents social capital as "paralleling the concepts of financial capital, physical capital, and human capital" but one that was "embodied in relations among persons." Since its systematic conceptualization by Coleman (1988) and popularization by Putnam (1993, 1995a, 1995b), social capital has continued to garner a generous attention from researchers across disciplines: economics (Becker and Murphy, 2009; Dasgupta, 2000; Murgai et al., 2002; Ostrom and Ahn, 2008), sociology (e.g. Portes 1998; Sampson et al. 1997), psychology (e.g. Brown and Harris 1978; Kawachi and Berkman, 2001), medicine and health (e.g. Rose 2000; Runyan et al. 1998), public health (e.g. Folland 2007; Whitley 2008), and disaster studies (e.g. Aldrich 2012a, 2012b, 2012c;

88 Nakagawa and Shaw, 2004), among others.

89 In recent decades, there has been an upsurge of empirical studies connecting social capital to health outcomes. Social
90 capital has been found to positively affect self-rated health (Baron-Epel et al. 2008; Chen and Meng 2015; Kim et al.
91 2011; Poortinga 2006; Sirven 2006), mental health (Beaudoin 2009; Caughy et al. 2003; Fone et al. 2007; Harpham
92 et al. 2004; Steptoe and Feldman 2001), and mortality rates (Berkman and Syme 1979; Lochner et al. 2003; Wilkinson
93 et al. 1998). However, in areas specific to nutrition and food security, it remains relatively underemphasized. A handful
94 of studies conducted in the United States (Dean and Sharkey 2011; Martin et al. 2004; Walker et al. 2007), by
95 examining associations between social capital and food security among rural and/or low-income households, depict
96 social capital as a support mechanism to improve access and/or usage. Even fewer studies have explored the social
97 capital-food security nexus outside the United States. In a study conducted in South Africa, Tibesigwa et al. (2016)
98 suggest that the informal social capital can counteract agriculture-related shocks and sustain dietary requirements. In
99 another study in South Africa, Misselhorn (2009) argues that social capital related failures can be linked to food
100 insecurity. Sseguya's (2009) findings in Uganda are also in line with those of the former two studies. No prior studies
101 have explored this nexus in the context of agrarian households in Asia.

102 Evidence suggests that, while social capital has a significant impact on health, the reverse is also true; that is,
103 individuals with good health are better equipped to cultivate more social capital (Younsi and Chakroun, 2016). A very
104 few social capital studies pertinent to various health outcomes address this endogeneity concern using instrumental
105 variables approach (e.g. d'Hombres et al. 2010; Folland 2007; Sirven 2006). However, among the studies that establish
106 associations between social capital and food security, none have explicitly addressed endogeneity concerns. Therefore,
107 extant papers do not provide adequate evidence to establish a causal mechanism by which social capital leads to better
108 food security outcomes. This paper attempts to fill that gap by endogenizing social capital (SC) as an outcome of SC-
109 specific investments of time and public speaking variables as proxies for individual's latent capabilities.
110
111 A major challenge that can preclude generalizability of social capital impacts lies in its contextual, often inarticulate
112 treatment. There exists a significant divide in the treatment of social capital – whether to consider it as a community
113 characteristic (Kawachi et al. 1997; Varughese and Ostrom 2001) or individual and household level characteristic
114 (Rose 2000; Runyan et al. 1998). To circumvent these shortcomings and to retain policy-relevance, we include both

community and individual level variables for social capital in our analysis. Consistent with Coleman (1990), Kawachi et al. (1999) and Putnam (1993, 1995a), we employ Woolcock's (2001) definition of SC as "resources available to individuals through their social behaviors and memberships in community networks" for our analysis. We use community group density and individual participation in formal/informal groups as proxies for community and individual social capital.[1] Doing so allows us to examine both: i.) the "compositional effect[2]"(Berkman et al. 2000), and ii.) the "environmental effect[3]" of SC (Wilkinson 1992, 1996).

3. Data and Measures

The data for this study comes from the baseline population-based survey (PBS) for Feed the Future (FTF) initiative in Nepal, a project led by the United States Agency for International Development (USAID). The baseline survey was conducted by the Feed the Future FEEDBACK (FTF FEEDBACK), a project jointly implemented by Westat, TANGO International, the International Food Policy Research Institute (IFPRI), and the Carolina Population Center (CPC) of the University of North Carolina at Chapel Hill. The survey, conducted in 2013, represents the geographic areas targeted by Feed the Future interventions, and is meant to serve in the assessment of FTF intervention impacts. In order to do accomplish the proposed goals, they employ the information collected from the PBS-FTF survey to calculate indicators that measure women's empowerment in agriculture, prevalence of households with moderate and severe hunger, and women's dietary diversity that will allow them to track post-intervention progress.

The intervention-targeted geographic areas, named by FTF as Zones of Influence (ZOI), constitute 20 districts across the western, mid-western and far-western development regions in Nepal. These three development regions of Nepal are among the most food impoverished in the already "severely food deficient" country with a per capita GDP of less than $750 (2016 estimate) (The World Bank 2017). A total of 2,000 households spread across 100 clusters within the 20 districts in the ZOI were interviewed during the data collection process. Unlike other population surveys in Nepal (Nepal Demographic and Health Survey-NDHS, Nepal Living Standard Survey-NLSS), unique to the Nepal Baseline PBS (2013) questionnaire is its inclusion of special modules on prevalence of hunger within households,

[1] Many studies categorize social capital into three types: bonding, bridging, and linking. This study does not adhere to such classification for reasons discussed.
[2] At an individual/household level, community groups can provide their members with social support, information, and resources, and promote healthy behavior. This is referred to as the "compositional effect" of social capital.
[3] At a community level, social cohesion can promote overall wellbeing of the population, which is known as the "environmental effect" of social capital. Cohesive communities can coordinate collective action, have better access to resources, and can invite more external programs.

139 women's dietary diversity, and women's empowerment index. Furthermore, questions on food items for women's
140 dietary diversity are adapted to fit the local context.

141 The primary unit of analysis in this paper is at the individual level, albeit only women respondents are considered
142 because information on dietary diversity is limited to women. Accounting for missing observations for relevant
143 variables, the final data for our analysis includes 3211 observations (all women from 15-59 years of age). The variables
144 used for this study, along with descriptive statistics, are compiled in Table 1. Further details are provided in the
145 succeeding sub-section:

146 *Variables*

147 Our dependent variable is *hunger scale*, a measure of degrees of food insecurity, which has four ordered categories:
148 no food insecurity (0), low food insecurity (1), medium food insecurity (2), and high food insecurity (4). This scale,
149 developed based on a set of survey questions that are meant to elicit the frequency and intensity of the extant hunger,
150 represents the prevalence and rate of food insecurity within the household. The household member responsible for
151 food preparation is asked the following questions*: 1) In the past [4 weeks/30 days] was there ever no food to eat of*
152 *any kind in your house because of lack of resources to get food? 2) How often did this happen in the past [4*
153 *weeks/30 days]?3) In the past [4 weeks/30 days] did you or any household member go to sleep at night hungry*
154 *because there was not enough food?4) How often did this happen in the past [4 weeks/30 days]? 5) In the past [4*
155 *weeks/30 days] did you or any household member go a whole day and night without eating anything at all because*
156 *there was not enough food? 6) How often did this happen in the past [4 weeks/30 days]?* The first, third, and fifth
157 questions had binary responses (yes or no), whereas the second, fourth, and sixth allowed for a third alternative to
158 account for frequency (never, rarely, sometimes, often). Following (Ballard et al. 2011), these frequencies are
159 collapsed into three responses: never (0), rarely or sometimes (1), often (2). A composite household hunger scale is
160 created by summing the collapsed measures, producing a raw hunger scale (HHS) ranging from 0 to 6.
161 Subsequently, we use FTF conventions to categorize the raw hunger scale into four bins to indicate severities of
162 hunger: no hunger (HHS=0), low hunger (HHS=1), moderate hunger (HHS=2-3), and severe hunger (HHS 4-6),

thus creating the variable *hunger scale* that we use in our analysis.[4]

The other variable used to measure the qualitative dimension of food security is *Dietary Diversity (DD)*, which is a validated measure of micronutrient adequacy of diets (Feed the Future FEEDBACK, 2013). DD, which is the mean number of food groups consumed, is generated using questions on food consumption the prior day (that is, "yesterday during the day or night"). Adapted to fit the nutritional context of Western Nepal, FTF categorizes all consumed foods into nine groups: (1) grains, roots, and tubers; (2) legumes and nuts; (3) dairy products; (4) organ meat; (5) eggs; (6) flesh foods and other small animal protein; (7) Vitamin A dark green leafy vegetables; (8) other Vitamin A-rich vegetables and fruits; and (9) other fruits and vegetables. Note that the module containing these questions were only asked to women of reproductive age (15-49 years).

Internalizing a barrage of criticisms on the context-dependency and multifaceted nature of social capital, we use a "deconstructive" approach in that we break down the notion of social capital into its constituent levels that best illustrate the mechanisms by which it affects food security outcomes. We acknowledge that not all forms of social capital can be lumped together into a generalizable indicator of social capital in order to force a coherent narrative on the social capital-economic outcomes nexus. At an individual level, participation in social networks, groups and associations can provide members with resources and information that can lead to positive outcomes, which is referred to as the "compositional effect" (Sirven 2006). On the other hand, at an aggregate level, social capital can have "environmental effects" through buttressing social cohesion and engendering collective endeavors, which in turn could have positive behavioral outcomes (Sirven 2006; Wilkinson 1992, 1996). In order to account for both compositional and environmental effects, we use association variables based on individual participation in community groups and the density of such groups in the community in our model. To further understand the varying impacts of different types of association, we categorize community groups into three types: finance-related, informational, and other associations. *The guiding hypothesis is that, while all forms of associations can be helpful in improving other wellbeing measures, the type that best targets food security issues is finance-related.* Finance related groups include: credit or microfinance groups, trade or business associations, and mutual insurance groups, whereas informational associations

[4] The 7-point scale was converted to a 4-point measure for hunger-scale for two reasons: 1) 'Bins' with insufficient observations may result to the violation of proportional odds assumption that is required to run ordered logit regression models. To remedy this, we lumped related categories together to ensure that each bin has sufficient observations. Note that results are robust to alternate bin-assignments: for instance, when we assign 5-6 as extreme hunger instead of 4-6. 2) A 4-point scale better facilitates interpretation of hunger than the 7-point scale. The scale we adopted allows us to discuss severity of hunger in terms of no-low-moderate-severe levels, which a 7-point scale does not allow.

include agriculture, water, and forest groups. Participation in all other forms of associations (civic, charitable, and religious groups) are lumped into the third category. Each of these three variables take values that range from 0 to 2, where 0 indicates no participation, 1 represents participation in one voluntary association, and 2 represents participation in two or more voluntary associations. While the former variables represent individual level participation in community associations, the "environmental" impact of social capital is elicited using a community level variable, namely Community group density, which captures the number of such associations present in the locality.

Other variables used in the model are enlisted in Table 1.

[---insert Table 1---]

4. The Empirical Model

The conceptual framework employed in the empirical analysis is represented using a two-equation system in a recursive modeling set up, where we allow for contemptuous correlation across equations. The equations employed for empirical evaluation are:

$$FS_i = \beta_0 + \beta_1 ISC_i + \beta_2 CSC_{loc} + \beta_3 X_i + u_i \qquad (1)$$

$$ISC_i = \gamma_0 + \gamma_1 Z_i + \gamma_2 X_i + v_i \qquad (2)$$

In the first equation, FS represents two food security measures: first, the prevalence of hunger as reported by the respondent and second, women's dietary diversity. Prevalence of hunger (HS) is reported in a scale ranging from 0 to 3 with 3 referring to severe hunger. HS is determined by individual level social capital (ISC_i), community level social capital (CSC_{loc}), and household characteristics (X_i). We postulate that individual participation in voluntary associations is endogenously determined, as confirmed by many studies before ours (e.g. Glaeser et al., 2002). To account for this, we instrument it with variables indicating individual investment in social capital (variable: time allocated for social activities) and social skills (variable: comfort in public speaking). These two variables are represented in equation-2 by vector Z_i. First, we establish the relevance and exclusion criteria to justify the choices of our instruments, and proceed to further examine the strength of these instrumental variables using LR tests. These processes shall be discussed in the succeeding results section. βs and γs are parameters to be estimated. It should be noted that equation (2) in the above model represents a set of up to three equations representing different categories of individual social capital depending on the model specification. However, for representational simplicity, we depict

them as a unit. As iterated previously, the empirical framework employed for this analysis allows for contemporaneous correlation across equations, estimating equations (1) and (2) simultaneously. We assume that error terms follow a multivariate normal distribution such that:

$$\in= [u_i, v_i\,] \sim N(0, \Sigma) \text{ where, } \Sigma= \begin{bmatrix} 1 & \rho\sqrt{\sigma_{22}} \\ \rho\sqrt{\sigma_{22}} & \sigma_{22} \end{bmatrix} \quad (\text{normalizing } \sigma_{11} = 1) \qquad (4)$$

5. Results

Prior to proceeding to model estimates, we first test the appropriateness of our modelling approach, and examine the reliability of instruments employed for the analysis. To confirm the suspected case of endogeneity, we evaluate the Fisher's z-transformed correlation parameters (inverse hyperbolic tangent of rho, $\tanh^{-1}\rho$) of our full model. We reject the null hypothesis that they are equal to zero in 11 out of 12 equation match ups (Table A1 in appendix). Note that although the instrumental variables are carefully selected from among available variables based on the established convention in the extant literature (e.g. Glaeser et al. 2002)[5], no single instrument employed is sufficiently strong[6]; that is, the F-test of the excluded instruments generated a value<10, which is less than the 'rule of thumb' value of 10 (Staiger and Stock, 1997). When one (or few) instrument(s) is (are) not strong enough and the variance of the two-stage least squares is high, a natural solution is to add more instruments to reduce the variance. However, that has its costs: that is, adding instruments that add little to R-square increases the finite-sample bias even in large samples (Murray, 2006). In consideration of these issues, we employ the full-information maximum likelihood (FIML) approach that allows for contemporaneous correlation as it has better finite-sample properties and addresses these issues. Also, we choose FIML over limited-information maximum likelihood (LIML) because FIML generates standard errors that are moderately smaller than when LIML is used (West, 1986).

As in the linear simultaneous-equation model, the order condition for identification requires that the number of excluded exogenous variables (that is, the additional instruments) be at least as great as the number of included endogenous variables. This is achieved by including social capital investment and comfort in public speaking

[5] Our instruments include investments in social capital (two variables: time allocated for social activities, community events) and social skills (three variables: level of comfort in public speaking for decision, advocacy, and protest).
[6] For example: Although the variables *comfort in speaking publicly to protest* and *time spent in social activities* have higher correlation-coefficient when paired with individual social capital versus with hunger variables, the correlation (in absolute terms) is still not sufficiently strong (9% and 17% compared with ISC compared to 2% and 12% with outcomes) to justify the use of two-stage IV approaches.

variables in the ISC equation (s) that are excluded in the FS equation (s). The strength of these variables is tested using likelihood ratio (LR) test in the first stage equations comparing the restricted model with no instruments against the unrestricted model with instruments. In each case, LR (chi-squared) value was significantly large, indicating that additional variables in the unrestricted model are jointly significant (Table A2 in appendix). Alternatively, LM and CM tests is also conducted to verify LR the test results (not reported in the paper).

Social Capital and Hunger

[---insert Table 2---]

Table 2 reports recursive estimates of the impact of social capital on hunger. For robustness purposes, we test different model specifications of Eq. (1). Based on the comparison of Akaike Information Criteria (AIC) values and relative gain/loss of explanatory power, we deem that the third column (Model 2) is the preferred model. In Model 1, we only report the impact of individual participation in finance-related individual social capital, while controlling for socioeconomic and household characteristics. Results indicate that participation in finance-related associations has negative and significant impact on the prevalence of hunger. Coefficients for control variables show that agricultural land, literacy, and residential status (urban) all play positive roles in hunger mitigation. On the other hand, single-parent families with female household heads are more vulnerable to episodes of hunger. In Model 2, we add community social capital (CSC) variable, represented by the density of community groups in the household's immediate locality, to the base model (1). We find the presence of "environmental effects" of community social capital, regardless of their participation in the respective groups/associations. Model 3 includes individual SC variables of two types, financial and informational, while excluding CSC. Result for finance-related ISC remains unchanged as compared to Model 1, but we find that participation in informational groups have no significant impact on hunger mitigation. In Model 4, we expand on Model 3 to also include CSC. Results for finance-related ISC and CSC remain steady, whereas, once again, we find no significant impact of informational ISC. Model 5 excludes CSC, but includes all three forms of ISC: finance-related, informational, and others. Once again, we find that only finance-related ISC has significant impact. Model 6 expands on Model 5 by adding CSC. Results for three forms of ISC remain unchanged, and we also find steady (significant) impact of CSC.

We find that finance-related individual social capital and community social capital have consistent impacts on hunger mitigation across all model specifications. So, based on the evidence from Table 2, we can safely assert that, for households in the cusp of extreme food poverty, only finance-related associations play significant roles in hunger mitigation. We find that involvement in other forms of associations that do not directly enhance households' financial capital has no direct impact on hunger mitigation. On the other hand, community-level social capital (density of community groups) has a positive and significant role in hunger mitigation. This suggests that a community's social capital endowment can have a public good nature in that it benefits all its members, regardless of their participation in voluntary associations. Across all model specifications (Model 1-6), we find that agricultural land, literacy, and residential setting (urban vs rural) play hunger mitigation roles, whereas family type (household head: female only) seems to show inconsistent impact.

Social Capital and Dietary Diversity (Nutrition)

[---insert Table 3---]

Switching our focus to the qualitative dimension of food security indicated by the nutritional indicator, dietary diversity, results in Table 3 paint a slightly different but complementary picture of social capital impacts. Consistent with results from Table 2, the role of finance-related ISC on food diversity is robust across all model specifications (columns 2 through 7 in Table 3). That is to say that finance-related ISC not only helps with hunger mitigation but also plays a vital role in increasing nutritional quality. What is distinguishable in this analysis as compared to the results from hunger scale analysis is that informational ISC also has positive and significant impacts on nutritional quality. This reveals an interesting dimension of the causal mechanism by which different participatory associations impact food security. Consistent with the "compositional effects" hypothesis that was discussed earlier, our results support the postulate that voluntary associations can provide their members with social support, information, and appropriately incentivize them to adopt healthy behavior. While informational ISC may not have direct hunger mitigating roles, it contributes to food security through indirect channels such as knowledge-sharing, behavioral adjustment in dietary habits, and so on.

Based on an evaluation of AIC-BIC values for different model specifications and their corresponding tradeoffs in terms of interpretability, we deem that model 5 best concurs with the narrative of this paper. Nonetheless, to check for the sensitivity of our findings, Table 3 presents results across different model specifications. Models 1-6 include

socioeconomic and household controls. In Model 1, only finance-related ISC variable is included; Model 2 adds informational-ISC to the specifications in Model 1. We find that the impact of both ISCs, finance-related and informational, remain highly significant. Model 3 adds another ISC variable (other associations). This time, we find no significant impact of other ISC, but those of finance-related and informational remain unaltered. Model 4 only includes finance-related ISC and CSC; Model 5 includes both finance-related and informational ISC along with CSC, and model 6 includes all three ISCs and CSC. Results for finance-related and informational ISC remain robust across all specifications. However, the impact of CSC on dietary diversity is sensitive to model specification. When only finance-related ISC and CSC are included (Model 10), we find that CSC coefficients are significant at the 90% confidence level, but this dissipates once we include other ISC variables, so our results preclude a generalizable claim regarding the impact of CSC on dietary diversity. Inasmuch as the controls are concerned, results indicate that literacy, urban-rural divide (urban=1), age, and livestock assets positive contribute to dietary diversity. Contrasting coefficients for controls in Table 3 with those for Table 2, we see that livestock possession seems to add to the dietary diversity. This is presumably due to the increased access to certain food groups like meat, eggs, and/or milk associated with owning more livestock. On the other hand, while having more agricultural land has positive impacts on hunger mitigation, we see that it has no role on dietary diversity.

6. Conclusion

In this paper, we attempt to empirically establish the social capital effects on food security. However, the goal is not merely to link the abstract notion of social capital to improvements in food security status, but rather to explicate the mechanism by which different forms of social capital can have different roles depending on the outcome measure at hand. We do so by dichotomizing SC impacts into two levels: individual and community. We further split individual SC into financial, informational, and others. This allows us to identify how SC can have multifaceted roles in different aspects of individual lives. To further bolster a causal SC-FS relational claim, we account for the endogenous nature of individual social capital in a recursive modeling set up. In general, our findings support the assertion that social capital positively impacts food security. This complements a barrage of prior studies that overwhelming demonstrate a positive relationship between SC and various health outcomes. Results indicate that participation in finance-related associations leads to hunger mitigation, whereas participation in informational and other associations do not do so. However, informational associations do have positive effects in improving the qualitative aspect of food security—

nutrition (food diversity). At the community level, we find consistent evidence to report positive "environmental effects" that the density of formal and informal groups in a locality can have across all food security measures.

In the first section of the paper, we speculated on potential reasons why only a dearth of SC-FS studies exists. Our prime suspect was the lack of a systematic theoretical framework that can be used to formulate the SC-FS nexus. The suggested remedy was to advance development resilience as a viable framework to study food security issues, especially so in an agriculture-based developing country setting where episodes of extreme hunger are sporadic and severe. Such conceptualization helps understand extreme food poverty as a systemic or idiosyncratic shock, and various coping mechanisms, including social capital enhancement, as contributing to strengthening adaptive capacity of households to overcome such shocks. This paper less than extensively indulges in formalizing that framework, for the purpose of this paper is to empirically examine the SC-FS link. However, our findings provide a strong signal of the viability of development resilience as a possible research track that deserves more than just a cursory attention.

It needs to be borne in mind that mid- and far-western Nepal, muddled in neglect and climate-related food poverty, is no Tocquevillian paradise. Therefore, voluntary participation in community associations should not be confused as a panacea for combatting all disparities. Instead, social capital should simply be conceived as a cheap and accessible coping strategy that can boost households' adaptive capacity in the face of dire food insecurity. This paper remains silent regarding the precise mechanism dictating social capital enhancement, for that requires further analysis accounting for significant socio-cultural heterogeneity that is prevalent in western Nepal. Moreover, of the four known dimensions of food security, – availability, access, utilization, and stability – our study directly addresses only two of them: access and utilization. Therefore, the findings of this study are not conclusive and generalizable to all aspects of food security. That said, we successfully establish that social capital is an important determinant of food security that cannot not be overlooked. Taking into account the traditional norms, institutions, and deep ties to eco-system services in the region, we advocate for a customized approach to addressing food security challenges; we contend that a one-size-fits-all approach to food policy that does not acknowledge the rich social fabric that connects households in these food-impoverished regions is sub-optimal at best.

7. Conflict of Interest

350

351 The authors report no conflicts of interest in this work.

352

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357

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Table 1: Description of Variables

Variable	Description	Mean	S.D.
Dependent Variables			
Hunger Scale	Food insecurity status based on hunger levels (0=No incidents of hunger, 1= low hunger level, 2= moderate hunger level, 3=high hunger level)	.289	.797
Food Diversity	Food Diversity levels (0=low food diversity, 1= moderate to high food diversity).	.572	.494
Explanatory Variables			
Individual Social Capital	Composite index of participation in community groups		
Association-financial	Participation in finance-related community groups (micro-finance, insurance, trade and business associations)	.119	.374
Association-informational	Participation in informational groups (agriculture, water, forest groups)	.103	.357
Association -other	Participation in civic, charitable, religious groups	.090	.341
Community groups	Presence of community groups (1 if present, 0 otherwise)		
Community group Density	Number of community groups in the locality	4.212	1.923
Agricultural land (no. of plots)	Number of plots of agricultural land	2.498	2.221
Livestock (TLU)	Tropical Livestock Unit (1 TLU=1 500-kg cow, 1.25 bull, steer, or heifer, 6 sheep/goats, 3 pigs, or 200 chickens)	3.105	2.743
Household size	Number of members in the household	5.30	2.27
Family type: female head	1 if family headed by female only, 0 otherwise	.119	.324
Respondent age	Age of the respondent	41.95	13.43
Literacy	1 if literate, 0 otherwise	.529	.499
Urban	1 if urban, 0 otherwise	.125	.331

Data Source: Population-based Survey (PBS) from USAID-led project Feed the Future (FTF) Initiative in Nepal, 2013 (N=3211)

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Table 2: Recursive Model Estimates for Hunger-scale

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Individual Social Capital						
Association-financial[1]	-1.237***	-1.184***	-1.239***	-1.203***	-1.253***	-1.223***
	(0.0815)	(0.0829)	(0.0723)	(0.0728)	(0.0713)	(0.0748)
Association-informational[2]			0.156	0.189	0.155	0.192
			(0.101)	(0.124)	(0.108)	(0.119)
Association -other[3]					0.140	0.199
					(0.135)	(0.147)
Community Social Capital						
Community Group Density		-0.0520***		-0.0469***		-0.0526***
		(0.0166)		(0.0172)		(0.0161)
Agricultural land	-0.0482***	-0.0503***	-0.0450***	-0.0471***	-0.0453***	-0.0474**
	(0.0179)	(0.0189)	(0.0165)	(0.0177)	(0.0171)	(0.0185)
Livestock (TLU)	-0.00704	-0.00836	-0.00680	-0.00845	-0.00623	-0.00808
	(0.0149)	(0.0157)	(0.0135)	(0.0144)	(0.0132)	(0.0139)
Household size	0.0409	0.0408	0.0373	0.0372	0.0390	0.0387
	(0.0260)	(0.0259)	(0.0248)	(0.0250)	(0.0248)	(0.0249)
Family type: female head only	0.180*	0.199*	0.167	0.185*	0.166	0.185*
	(0.110)	(0.111)	(0.106)	(0.107)	(0.108)	(0.110)
Age of respondent	-0.00218	-0.00163	-0.00293	-0.00247	-0.00290	-0.00249
	(0.00267)	(0.00268)	(0.00265)	(0.00271)	(0.00265)	(0.00268)
Literacy	-0.172**	-0.145**	-0.154**	-0.137*	-0.173***	-0.159**
	(0.0727)	(0.0735)	(0.0713)	(0.0727)	(0.0665)	(0.0683)
Urban	-0.326**	-0.350***	-0.307**	-0.329***	-0.310**	-0.337***
	(0.139)	(0.131)	(0.127)	(0.122)	(0.126)	(0.121)
Cut-points (1)	0.716***	0.539**	0.676***	0.514**	0.693***	0.507**
	(0.205)	(0.214)	(0.202)	(0.213)	(0.202)	(0.212)
Cut-points (2)	0.843***	0.667***	0.797***	0.636***	0.815***	0.631***
	(0.201)	(0.210)	(0.199)	(0.210)	(0.198)	(0.208)
Cut-points (3)	1.091***	0.920***	1.032***	0.877***	1.053***	0.875***
	(0.176)	(0.189)	(0.177)	(0.189)	(0.174)	(0.184)
N	3211	3211	3211	3211	3211	3211
Log-Likelihood	-2686.4	-2675.8	-3591.6	-3582.0	-4341.1	-4329.9
AIC	5410.8	5389.7	7221.2	7202.1	8720.3	8697.8
BIC	5526.2	5505.1	7336.6	7317.5	8835.7	8813.2

Robust standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note: 1, 2, 3: Participation in community associations are endogenized using instrumental variables that include public speaking skills/comfort levels (3 variables related to decision, advocacy, protest), time investment in social activities, community events (2 variables), and access to communication devices (cell-phone). First-stage estimates are omitted for presentational simplicity.

Table 3: Recursive Model Estimates for Food Diversity

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Individual Social Capital						
Association-financial[1]	1.211***	0.930***	0.938***	1.172***	0.903***	0.918***
	(0.100)	(0.199)	(0.167)	(0.103)	(0.204)	(0.170)
Association-informational[2]		0.885***	0.850***		0.851***	0.826***
		(0.290)	(0.227)		(0.291)	(0.229)
Association -other[3]			-0.156			-0.183
			(0.204)			(0.197)
Community Social Capital						
Community Group Density				0.0350*	0.0298	0.0271
				(0.0212)	(0.0207)	(0.0210)
Agricultural land	0.0202	0.0189	0.0194	0.0201	0.0189	0.0193
	(0.0144)	(0.0153)	(0.0157)	(0.0142)	(0.0151)	(0.0154)
Livestock (TLU)	0.0316**	0.0304**	0.0304**	0.0318**	0.0308**	0.0307**
	(0.0152)	(0.0150)	(0.0151)	(0.0151)	(0.0149)	(0.0150)
Household size	-0.0248	-0.0234	-0.0229	-0.0231	-0.0222	-0.0218
	(0.0209)	(0.0208)	(0.0207)	(0.0211)	(0.0210)	(0.0209)
Family type: female head only	-0.116	-0.0882	-0.0880	-0.121	-0.0928	-0.0919
	(0.0971)	(0.0950)	(0.0922)	(0.0947)	(0.0926)	(0.0897)
Age of respondent	0.0161***	0.0151***	0.0159***	0.0150***	0.0142***	0.0151***
	(0.00383)	(0.00389)	(0.00393)	(0.00372)	(0.00378)	(0.00385)
Literacy	0.434***	0.382***	0.406***	0.415***	0.368***	0.393***
	(0.0826)	(0.0817)	(0.0791)	(0.0828)	(0.0812)	(0.0785)
Urban	0.598***	0.659***	0.673***	0.606***	0.664***	0.676***
	(0.121)	(0.128)	(0.128)	(0.119)	(0.126)	(0.127)
Constant	-0.745***	-0.735***	-0.769***	-0.849***	-0.823***	-0.846***
	(0.179)	(0.175)	(0.171)	(0.200)	(0.195)	(0.191)
N	3207	3207	3207	3207	3207	3207
Log-likelihood	-2008.7	-2907.8	-3653.7	-2006.6	-2906.3	-3652.5
AIC	4055.4	5853.7	7345.4	4051.3	5850.7	7343.0
BIC	4170.8	5969.0	7460.7	4166.6	5966.1	7458.4

Robust standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note: 1, 2, 3: Participation in community associations are endogenized using instrumental variables that include public speaking skills/comfort levels (3 variables related to decision, advocacy, protest), time investment in social activities, community events (2 variables), and access to communication devices (cell-phone). First-stage estimates are omitted for presentational simplicity.

Appendix

Table A1: Fisher's z-transformed correlation parameters ($\tanh^{-1}\rho$)*

Equations	Hunger-scale	Association-informational	Association – other
Association-financial	1.698***	0.518***	0.540***
	(0.151)	(0.0781)	(0.0532)
Association-informational	0.222***		0.592***
	(0.0710)		(0.0446)
Association –other	0.311***		
	(0.0701)		
Equations	Food Diversity	Association-informational	Association – other
Association-financial	-0.860***	0.536***	0.589***
	(0.156)	(0.0708)	(0.0572)
Association-informational	-0.691***		0.570***
	(0.153)		(0.0467)
Association –other	-0.181		
	(0.119)		

Robust standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Note* : $\tanh^{-1}\rho$ values for hunger-scale estimates from Model 6 (Table 2); for food diversity from Model 6 (Table 3)

Table A2: Likelihood ratio test for the strength of instruments (comparison of first-stage LR values with and without instruments)

Equations	LR (chi-squared)	Prob>chi-sq
Association-financial	82.06	0.0000
Association-informational	105.26	0.0000
Association –other	104.31	0.0000