



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Facilitating access to rural services in Vietnam: The invisible social capital link

Hoang Dinh Quoc*, Thomas Dufhues*, Gertrud Buchenrieder**

***Leibniz Institute of Agricultural Development in Central and Eastern Europe (IAMO)**

****Martin-Luther-University Halle-Wittenberg (associated scholar of IAMO)**

Contact author: Hoang Dinh Quoc (hoangdquoc@gmail.com)

Selected Paper prepared for presentation at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguaçu, Brazil, 18-24 August, 2012.

Copyright 2012 by Hoang Dinh Quoc, Thomas Dufhues and Buchenrieder. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Abstract: This paper investigates the effects of individual social capital on the access of rural households to services. In the context of agriculture economics, an innovative data collection approach is used to determine social capital. The approach originates from the field of sociology and entails a personal network survey. We define four social capital variables according to tie strength (bonding/bridging) and social distance (bonding_{link}/bridging_{link}) between the respondent and his/her network member. The econometric results suggest that social capital with weaker ties in combination with socially distant ties (bridging_{link} social capital) can potentially improve households' access to rural services.

Key words: rural services, social capital, rural households, Vietnam

1. Introduction

Perfect markets are characterized by efficient transactions independent of personal relationships between the market actors. However, markets are never perfect and that is particularly true for developing countries, where economically fruitful transactions may either not take place at all or be rationed because of prohibitively high transaction costs, regardless of whether they are public or private side (Williamson, 1985). Nevertheless market imperfections, such as lack of information, which are common in developing countries, may be overcome by social capital.¹ Fafchamps and Minten (2002) state that social capital may be at least as important as human capital for reaching efficiency in economies that are characterized by high transaction costs and poor market institutions. As pointed out by van Staveren and Knorringa (2007) the most general definition of social capital is that “relations matter”. But this simplistic view hardly advances our understanding of the social economy. Therefore, we go beyond simply measuring social relations and focus our work on “what kind of” social relations matter. However, research in economics

¹ As discussed further in Section II, scholars have not yet agreed upon a uniform definition of social capital.

Nevertheless, social networks or social ties are part of almost all definitions of social capital. We define social capital as interpersonal networks (ties) plus resources.

has only recently begun to pay heed to social relations or ties. Often, measurement of these ties has been rather crude, focusing for instance on role relationships like friends, relatives, or neighbors. Our approach to measuring social ties is more elaborate. We use a survey tool from the field of sociology hitherto rarely used in economics.² This technique involves the use of instruments referred to as the “name generator” and “position generator” to measure the personal network or, since this is rarely possible, a sample of the respondent’s personal network. These network data are then used to create measures of the individual social capital of the survey respondents.³

Some of the best known examples of social capital enabling access to a service are the so-called joint liability credit groups that enable people excluded from the commercial banking sector to get access to small loans. In the joint liability groups, the screening and monitoring (transaction) costs of lending are shifted from the banks to the groups. However, the general literature on social capital in relation to service access is rather sparse. Yet, most research finds that the effect of social capital, social ties, or social networks on accessing resources is positive. For instance, van Bastelaer (2000), Akoten et al. (2006), Grootaert et al. (2002), and Okten and Osili (2004) point out that social capital or social ties improves the access to credit. Furthermore, Derose and

² Exceptions include Kajisa (2007) who used a position generator tool to measure personal networks. Fletschner and Carter (2008) or Matuschke and Qaim (2009) employed name generators to create a reference group.

³ As pointed out by Glaeser *et al.* (2000) social capital can be defined at several levels: country, community, and the individual. Although social capital is a relational concept we call it individual social capital, which may sound contradictory at first. By calling it individual social capital we delineate our concept of social capital from definitions, which consider social capital to be a public good (e.g. Coleman 1988), benefiting all members in a network. We, however, follow the conceptual approach of Bourdieu (1983), who regards social capital at an individual level. In his eyes, social capital is an instrumental resource for individuals, which facilitates access to other resources.

Varda (2009) state that social capital is related to overall improved health care access, and Hoang et al. (2006) find that social networks improve access to extension services. The literature on social capital and access to services usually focuses on a single service. Nevertheless, often the lack of access to one particular service can lead to exclusion from another service. For instance, one of the factors most often cited as a reason why households do not have access to formal credit is the lack of seizable collateral in the form of land use rights (Okten and Osili, 2004). Thus, when households are excluded from gaining access to land titles they are also excluded from accessing formal credit. Furthermore, we believe that the effects of social capital on the access to specific (or general) services are quite similar. Thus, it is sensible to investigate the effects of social capital on a wider range of services simultaneously.

In Vietnam, access to public services is still a profound problem in rural areas, particularly for ethnic minorities, and the Vietnamese government has targeted several rural development programs and policies at rural areas (Baulch et al., 2010; van de Walle and Gunewardena, 2001). For instance, in the special case of access to credit, the Vietnamese government has set up a special credit institution, the Vietnam Bank for Social Policies (VBSP) to cater particularly for poorer households in rural areas. However, the majority of the poor was, and probably still is, credit constrained (Phuc, 2005). Other public services, such as access to primary school, that should be broadly available are more difficult for rural than urban households to acquire (Aikman and Pridmore, 2001). The government of Vietnam keeps trying to improve access to education by securing free access to basic education for the poor; however, ethnic minorities and women still possess only a low level of education (Bélanger and Liu, 2004). As London (2006) points out, a sizeable share of the rural youth still does not attend school because of financial problems. Another primary policy objective of the Vietnamese Government is to enable all households to receive health care services through the Hunger Eradication and Poverty

Reduction Program (HEPR) (London, 2006) and a free health card scheme for the poor (Sepehri et al., 2008). Nevertheless, in general, health care in Vietnam is still quite expensive. For instance, when hit by a serious illness in the family, an average poor household spends about 22% of its annual income on health care (London, 2008). This could prompt many poor households to shy away from health services.

In the past two decades, a growing body of work on the concept of social capital and its livelihood effects has been produced worldwide. In Vietnam too, research has been carried out on the subject of social capital (Dalton et al., 2002; De Silva et al., 2006; Ha et al., 2004; Turner and Nguyen, 2005; van Staveren and Knorringa, 2007). So far, however, no research has analyzed how social capital affects access to services in Vietnam. This paper analyses the link between access to public services of rural households and different forms of social capital.

The paper is organized in six sections. Following the introduction, Section 2 provides a literature overview on social capital and access to services. Section 3 describes the sampling, dataset and measurement of the different forms of social capital and this section also outlines how access to services is measured. Regression models and econometric issues are discussed in Section 4. In Section 5, we present and discuss the econometric results. The paper concludes with a brief summary and policy recommendations in Section 6.

2. Social capital and access to services

The standard criticism leveled at the social capital concept is that it is usually too broadly defined and it is thus analytically useless. We therefore emulate scholars such as Lin (1999a) by defining social capital more narrowly and leanly as *interpersonal networks (ties) plus resources*. The scholarly literature distinguishes three forms of social capital: bonding, bridging, and linking. Bonding social capital relates to “strong ties”, while bridging social capital relates to “weak ties”

(Woolcock and Narayan, 2000). Weak ties are characteristic of infrequent interactions and peripheral relationships among more or less dissimilar individuals. Strong ties are characteristic of the intimate social circle of individuals with rather similar characteristics, for example family and close groups of friends (Lin, 1982). The third classification is linking social capital. This refers to a person's ties to people in positions of authority, such as representatives of public (for example, the police) and private (for example, banks) institutions. In this classification, bridging social capital is horizontal. It connects people of similar economic, social and political status, such as one farmer to another farmer (Woolcock and Narayan, 2000). Linking social capital is more vertical, connecting people to key political players and across power differentials; for example, a farmer to a credit officer (Grootaert et al., 2003).

According to the theory, the economic function of social capital is to reduce the transaction costs associated with coordination mechanisms such as contracts, hierarchies, bureaucratic rules and the like (Fukuyama, 2001). In general, transaction costs decrease the efficiency of exchange relationships (Grindle, 2001). The acquisition of such information is costly. The costliness of information is the key to the costs of a transaction. Hence, reducing the cost of information implies reducing the transaction costs (Stiglitz, 1986). In this context, an important feature of social capital is the potential for information exchange that inheres in social relations. Information sharing through and within social networks reduces transaction costs and thus improves access to services see, for example (Derose and Varda, 2009; Okten and Osili, 2004). Fafchamps and Minten (2001) state that social capital may be as, if not more, important than human capital for efficiency in economies that are characterized by high transaction costs and poor public and private institutions.

In this respect, one can hypothesize that all three forms of social capital can potentially increase the access to services since social capital functions as a gateway for information of all sorts.

Nevertheless, the literature particularly highlights bridging social capital. The strength of this form of social capital lies in enabling access to information by way of connections to other networks outside one's core network. By breaking out of one's own close social circle through weak ties, one can access information not otherwise available (Lin, 1982). The strength of linking social capital might lie in providing access to those in social positions that are vertically higher in the social hierarchy. The higher the rank of the person with whom ties are formed, the more useful the ties are. One can surely draw on more resources if one has rich and influential friends than if one has poor friends far from the seats of power (Lin, 1999b). As Dale and Newman (2010) point out linking ties increase access to resources (both social and economic). However, possessing a large amount of linking social capital also increases the chance of political patronage and nepotism. While this will improve access to services for those who have such connections, it will hamper access for those who do not. It therefore comes as no surprise that, for example in the case of financial services, local elites often capture the biggest loans (Coleman, 2006). Bonding social capital may, however, also be important for the transmission of information. Persons are usually more likely to act on information received from close ties as they are perceived to be more trustworthy (Haythornthwaite, 1996). Moreover, bonding social capital can provide individuals with helpful information even when the individual has not actively searched for this information (Lai and Wong, 2002). Social capital may also affect access to services positively and indirectly via income. Access to resources and information via personal networks may also boost household income, which in turn may also boost the access to services of the household.

It is also possible, however, to construct a case in which social capital affects the service access negatively through exploitative links. Linking social capital, when connected via a weak tie, is particularly prone to producing exploitive patron-client relationships (Szreter and Woolcock,

2004). In such a set-up, vital information for increasing service access may be withheld by the party in power. But bonding social capital, too, may have negative effects, for example through excessive claims from personal network members connected via strong ties, thus lowering the household's asset base (Portes and Landolt, 2000). Finally, over-investing in any form of social capital can create negative indirect effects via income. When the costs of creating or maintaining social relations are higher than the benefits, household income can be reduced, thus lowering the potential ability to pay the price and the transaction costs of services. In light of these potential ambiguities, empirical evidence is required.

3. Methodology and data

3.1. Sample and data

Our survey focuses on Son La province in Northern Vietnam. In 2007/2008, we interviewed the same households which had been previously been interviewed for the 2004 Vietnamese Household Living Standard Survey (VHLSS).⁴ According to the General Statistics Office (GSO) in Hanoi, these households are a representative sample for Son La province. However, in two districts of Son La, research permission was denied due to their sensitive border location and other security issues. Furthermore, some households could not be found again because of migration resulting from the construction of a huge hydroelectric dam. Therefore, our sample is somewhat smaller (25% fewer households) than the 2004 VHLSS for Son La.

The survey was divided into two phases (with a three to four months' time interval). There were two reasons for this. (1) The extensive interview could be perceived by the respondent as too long for all questions to be answered in one interview. (2) Some of the data from the first round

⁴ The idea behind re-interviewing the same households of the VHLSS 2004 was to save interview time by using some of the VHLSS 2004 data.

of interviews were used as input for the second round. Owing to the time lag between the two survey rounds, we also experienced a low level of attrition (below 5%) caused by migration, death, and refusal. The two survey rounds covered all information concerning social capital and social networks of the household as well as information on its income portfolio and household assets. Social capital data were provided by the household head. There are three reasons for choosing the household head as the respondent in our social capital survey. (1) The most common form of living arrangement is still the independent nuclear household without relatives from either side of the family, even in rural areas (Hirschman and Loi, 1996). (2) The collection of the personal network data from all household members was beyond the scope of our survey. In about 3% of the interviews we were unable to interview the household head and so another household member was interviewed. However, as the social capital measures for the paper are based on the characteristics of the household head we excluded these households from our analysis. Owing to the very limited number of cases, we thus believe this selection bias is negligible. The sample consists of observations relating to 411 rural households.

3.2. Personal network data collection⁵

We used the name and position generator to measure personal networks and to create four measures of individual social capital. The name generator asks questions about certain domains of the personal network, such as: ‘Whom can you ask to help you fix your motorbike?’ Then the name of this person is recorded. Later, more questions can be asked about the person, for instance to ascertain the person’s sex, age, occupation, and so forth, or to establish the relationship of this person to the respondent. This part of the survey is called the ‘name

interpreter'. The name generator has often been criticized for being biased towards strong ties because the first names that people recall are usually those of persons who have been known to them for a long time, or whom they meet more often, and so forth. As a result, the amount of bonding social capital may be overstated. The 'position generator' partly corrects for this. In its pure form it does not create names and it has no name interpreter. The respondents are asked whether or not they know persons from a sample of occupations, such as: 'Do you know a primary school teacher?' However, a simple yes/no answer does not suffice for our social capital measures. The names of the 'teacher' and so on were therefore also recorded, and a name interpreter was applied to each of the names.

Name generator: A single name generator question may generate results biased towards a single form of social capital. For instance the question 'Whom would you ask to borrow a large amount of money?' will reveal a large number of close relationships such as core family members and ultimately result in a very large amount of bonding social capital (Marin and Hampton, 2007). In the light of this, we applied ten different name generators. The name generator questions are all based on specific resources, skills or knowledge that can potentially be exchanged among rural people. This leaves little room for the respondents to interpret the questions differently. The specific items, skills, or knowledge were determined during several group discussions with farmers in northern Vietnam. The name generator questions ask only about areas important to rural inhabitants and areas in which a more or less regular exchange is taking place. We restricted the number of persons named per question to a maximum of three to limit the interview burden on the respondent.

⁵ The two methodological sections 3.2 and 3.3 are to some extent similar to our prior work in other international journals. Authors and journals are not yet disclosed to maintain anonymity. For the exact wording of the our name generator questions and the list of occupation used in the name generator we refer to these publications.

Position generator: The position generator was primarily applied in order to measure weak ties. This data collection tool builds on a sample of occupations and asks respondents to indicate contacts in each of the occupations. The position generator utilizes a person's occupation as an indicator of the resources available to that person. A person's occupation is a good indicator of his/her social roles and resources, and hence the kinds of help that s/he might be able to provide. The sample of occupations should range widely in prestige and represent different sectors of the economy in order to meet the theoretical goal of measuring access to different parts of the social structure and their differing resources. The occupations should have fairly large populations since few people, if any, will know anyone in a very rare occupation. The occupations should have clear titles that all respondents will understand. Erickson (2004) points out that 15-30 different occupations is a good number for gaining meaningful results. In Vietnam no detailed labor statistics were available. Therefore we used an occupation list with a representative sample of 26 occupations from the national 'labor force survey' in Thailand.

3.3. Operationalizing social capital

In contrast to human capital for instance, which is based on individuals, social capital resides in relationships (Coleman, 1988). Thus, relational data in the form of network data would be ideal for measuring social capital (Herrmann-Pillath and Lies, 2001). Our measurement of social capital was therefore based on the personal network of respondents. A personal network is defined as the sum of all the relationships an individual has. Only ties that are connected to resources are measured, thus enabling us to identify the resource network of the respondent. The data gathered from the personal network of the 411 household heads are used as the basis for our different measures of social capital. After excluding missing values, the network sample comprised 4,261 persons. We applied two different cluster analyses (k-means) for measuring tie strength and social distance. K-means clustering is a method of cluster analysis which aims at

partitioning n observations into k clusters in which each observation belongs to the cluster with the nearest mean.

Cluster analysis – tie strength: Bonding and bridging social capital are distinguished by the strength of the tie between the respondent and the personal network members. To measure tie strength we employed an approach similar to that of Zhao (2002), who used four different variables to estimate tie strength: role relationship (core family, other family, friend, and acquaintance); frequency of contact per month; duration of relationship in years; and closeness.⁶ In the case of tie strength, two clusters were determined upfront (weak ties, strong ties). The results are shown in Table 1.

Table 1: Cluster analysis of tie strength

Variable	Mean	Std. dev.	Min.	Max.
<i>Cluster 1, strong ties</i> N = 2,362				
Duration of relationship in years	30.34	9.84	2	70
Frequency of contact per month	16.09	13.19	0	30
Role relationship*	3.22	0.67	1	4
Closeness of relationship**	4.51	0.58	2	5
<i>Cluster 2, weak ties</i> N = 1,899				
Duration of relationship in years	16.53	11.13	1	55
Frequency of contact per month	6.19	9.97	0	30
Role relationship*	1.18	0.53	1	3
Closeness of relationship**	2.88	0.86	1	5

Notes: * Core family = 4, extended family = 3, friend = 2, acquaintance = 1

** 5-point Likert scale: 5 = very close; 1 = not close at all.

Cluster analysis – social distance: Linking social capital is differentiated by the social distance between the respondent and his/her personal network member. The indicator for social distance is the difference in occupational prestige of the household head and his/her personal network members, measured by the Standard International Occupational Prestige Scale (SIOPS) of

⁶ The respondents' perception of the 'closeness' or intensity of the relationship is a good measure of the strength of the relationship. We used a 5-point Likert scale to estimate the closeness of a relationship, with higher scores indicating greater closeness.

Ganzeboom and Treiman (1996). More specifically, social distance is generated by household head SIOPS minus SIOPS of personal network members.

Social distance can become negative (see left-hand side of Figure 1). However, small negative distances are grouped together with small positive distances (Table 2). Also, very large negative distances may exist, as in the case of linking capital on the right hand side of Figure 1. Imagine a high ranking government official in a small village. All his ties to the villagers would be across a power differential. But the social distance from his viewpoint would be negative while the social distance from the villagers' point of view would be positive. Cluster 1 can be seen as a validation of our assumption that huge negative differences in SIOPS between the respondent and his/her personal network members are rare (see Table 2). Only 4.6% of the ties fall into this category. Hence, we feel safe in stating that these ties will not create a bias in our analysis. Consequently, the three lower clusters have been grouped together (Clusters 1-3). Nevertheless, the number of bonding connections that are 'upward' is also likely to be correlated with a household having relatively low social status, and the number of bonding connections that are 'downward' or lateral is likely to be correlated with relatively high social status. The SIOPS of the household head and the percentages of bonding_{link} relationships from the total number of relationships are negatively correlated. But the correlation is not very strong (-0.35). We address this bias later in the model by controlling for the household's own status measured using the SIOPS of the household head.

To summarise, linking social capital can be connected either to bridging social capital, when the link is connected through a weak tie, or to bonding social capital, when the link is connected through a strong tie. Consequently, we have four different measures of social capital: 1. bonding, 2. bridging, 3. bonding_{link}, and 4. bridging_{link}. For the analysis, these four different measures of

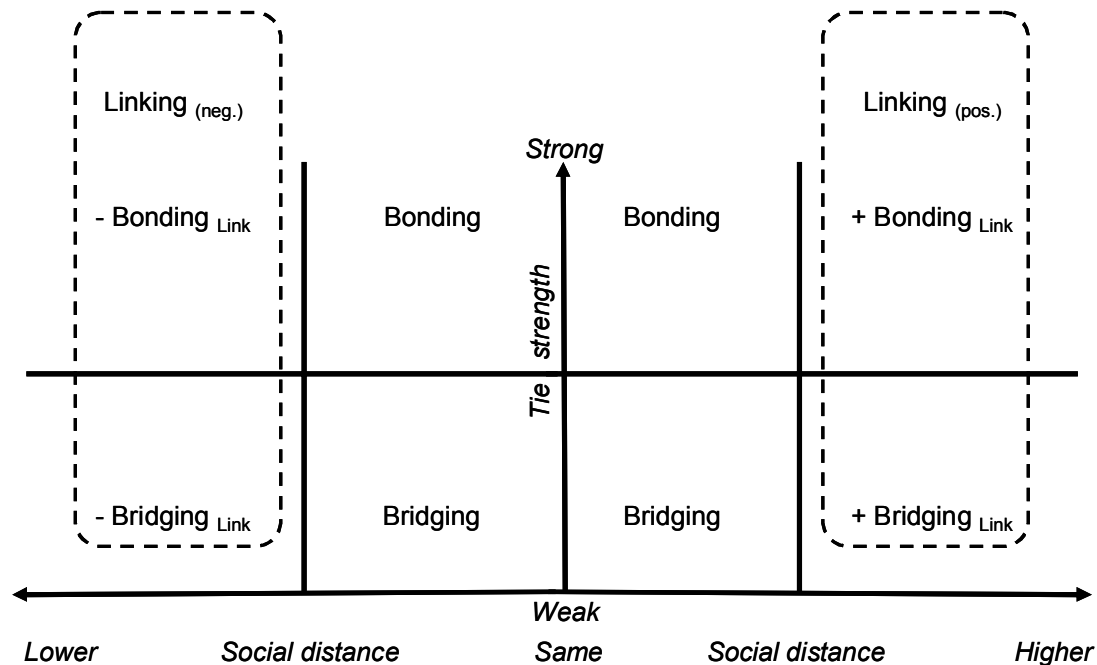
social capital are aggregated for each person in each of social capital categories, leaving us with four social capital variables.

Table 2 Cluster analysis of social distance of household head and personal network member

Variable	Mean	Std. dev.	Min.	Max.		
<i>Cluster 1, N = 200</i>						
Difference of SIOPS	-22.55	5.93	-48	-15	} Grouped into no-linking ties	
<i>Cluster 2, N = 304</i>						
Difference of SIOPS	-6.63	3.05	-14.50	-3		
<i>Cluster 3, N = 2,598</i>						
Difference of SIOPS	0.99	2.31	-2	10		
<hr/>						
<i>Cluster 4, N = 1,159</i>						
Difference of SIOPS	19.23	6.00	10.50	54	Linking ties	

Note: SIOPS = Standard International Occupational Prestige Scale

Figure 1 The different forms of social capital



3.4. Measuring access to services

In order to test our hypothesis of whether social capital facilitates access to services, we started by identifying those rural services that are well-known and most important for farmers'

livelihoods. Table 3 depicts those services and farmers' perceived access to them.⁷ We took advantage of the flexibility offered by our perceptual variables: we asked the respondents (the household head) whether or not they felt they were being excluded from a variety of different public services. If a respondent answered 'yes' for being excluded from at least one service, this person was counted as being partly excluded from public services. Table 6 in the Appendix shows that the exclusion from one service is sufficiently correlated to exclusion from other services. We realize that a distortion may occur with this proxy. Some households that assumed they would be able to access the service may not in fact succeed in doing so, while others assessed as access-constrained might ultimately have obtained access to the service. Hence the validity of this assessment may be questioned. However, as pointed out by Petrick (2005), there are no plausible arguments as to why a subjective assessment should be less valid than any other information collected in field surveys. A second bias may arise from the fact that some respondents stated that they feel excluded from a service because they are facing extreme difficulties in accessing this service, or that they only have access to a very low quality service. For instance, in the case of agriculture extension, some farmers mentioned that they feel excluded because the extension worker rarely comes to the village and then only speaks to the village headman, and hence they only receive indirect information. However, those respondents still had some access to those services – at least to a certain degree. We were able to cross-check these answers with other data from our survey. For instance, a household that currently has formal credit or access to formal agricultural extension cannot be assessed as excluded from the

⁷ The issuance of land use rights is an important service provided by local governments. Unfortunately we do not have sufficient data to include such a variable in our analysis. Nevertheless, only 5% of our households do not possess land use rights and about a third of these households are urban households without agriculture activities. Thus, one could say that this public service is actually reaching the rural population.

credit or extension service, respectively. Thus, we have two measures of access to rural services. The first is based on the self-assessment of the respondents only (subjective measure) and the second contains also objective measurement as we cross-checked it with other survey data (adjusted measure). We focus our analysis on the objective (adjusted) measure. However, both measures reveal relatively similar results, but the results of the objective measurement are more stable.⁸

Table 3: Exclusion from rural services

Service	Subjective measure		Adjusted measure	
	No.	%	No.	%
Credit (formal)	35	9	18	4
Education (primary/secondary)	51	12	15	4
Vocational training (government supplied)	47	11	28	7
Agriculture extension (government supplied)	30	7	17	4
Health care (clinic/hospital)	34	8	8	2
Excluded from at least one service	123	30	68	17

Note: N = 411

4. The econometric model

4.1. The model

We use a binary logit regression to estimate the effects of social capital on exclusion from rural services (dependent variables), where the dependent variables are one for all households that have no access to at least one service and zero otherwise. In binary logit regressions, we use two different dependent variables for assessing exclusion from services. While Y1 is based on subjective assessment alone, Y2 is an adjusted measure of Y1 based on the cross-checking with the objective survey data. Exclusion from services is determined by a function of social capital and other contextual household variables. Table 4 depicts the full list of variables.

⁸ When disaggregating the adjusted measure into single services the dependent variables do not show enough variation (Table 3). Therefore, we refrain from analyzing them.

Table 4 Descriptive values of the dependent and independent variables

Dependent variable	Mean	Std. dev.	Min.	Max.
Y1: sub_ass = subjective assessment of exclusion from services (1 = exclusion from at least one service; otherwise 0)	0.29	0.45	0	1
Y2: ob_ass = adjusted assessment of exclusion from services (1= exclusion from at least one service; otherwise 0)	0.16	0.37	0	1
Independent variables				
<i>Personal network variables</i>				
Bonding SC = Social capital bonding (number of ties)	4.73	2.49	0	12
Bonding _{link} SC = Social capital bonding-link (number of ties)	0.96	1.47	0	17
Bridging SC = Social capital bridging (number of ties)	2.33	2.25	0	11
Bridging _{link} SC = Social capital bridging-link (number of ties)	1.26	1.63	0	13
<i>Control variables</i>				
Market_clos = distance to closest market (km)*	10.27	12.59	0.01	60
Ethnic = Ethnicity of household head (Kinh/Thai = 1; non-Kinh/Thai = 0)	0.73	0.44	0	1
Sex = Sex of household head (male = 1, female = 0)	0.81	0.39	0	1
Head_age = Age of household head (years)	47.16	12.63	21	92
SIOPS of head = SIOPS of household head	40.88	6.24	21	66
Leader = Special position of household head in any group (yes = 1, no = 0)	0.18	0.38	0	1
Income = income per person per year in 1,000 VND** (data from 2004)	313.33	248.96	49	2033
HH_known= Number of households known in village (weighted number)	73.89	35.58	15.2	201.23
District dummies: six dummies for seven districts (descriptive values are not shown)				

Note: *Kilometer; **Vietnamese Dong; N = 411

4.2. Econometric issues

Simultaneity: Social ties are the basis for our social capital measures and may create a simultaneity bias and thus be endogenous to access to services. Access to public services are likely to boost social capital (Piachaud, 2002). For instance, access to services may create relationships between the household head and government officials or service provider personnel. The most well-known case is that of access to micro-credit. Micro-credit is supposed to widen the personal network of borrowers and a vast amount of literature exists on the empowerment of women via micro-credit. But this may also be true for other public services such as extension or training measures. We address the potential simultaneity problem by excluding all ties of less than five years from the analysis (about 7% of all ties). One can also

argue that the exclusion from a service may have a negative influence on farm income and wealth (Boucher et al., 2009). Basically, a farmer who is not excluded from services is likely to be less risk adverse and more able to invest in business, thus increasing the household income. If this is the case, then household income creates a simultaneity bias. However, we are able to address this problem by using income data from 2003. We believe that the time lag in both variables is big enough to eliminate any simultaneity.

Correlated unobserved variables: We apply a range of control variables to deal with the problem of unobserved variables (see Table 4). When social capital is measured on the basis of involvement with others in the community, then an omitted variable may exist as households with better leadership may also have stronger social capital and at the same time better access to services. While we could not measure leadership directly, we incorporated a dummy variable, indicating whether the household head holds a special position such as cashier in a formal or semiformal group, to proxy it.

Social and ethical attitudes may also influence network size and access to services. We cannot directly control for social and ethical attitudes. We can, however, control for total network size of households via one proxy. That is the number of households in the village known by the household head, weighted by village size. Additionally, social status may influence both the ability to access services and the size of the personal network. We control for social status using the occupation of the household head by adding his SIOPS into the model. Unobserved regional characteristics are controlled for by using district dummies in the model.

5. Exclusion from rural services in Vietnam

The regression diagnostics are all within standard range. The overall fit of the model is satisfactory and the correlation tables and the variance inflation factor showed no problems regarding multicollinearity. Table 5 presents the results of our two logit regressions using

subjective exclusion from services (Y1) and adjusted exclusion (Y2) as dependent variables. The results of these two regressions look quite similar. Hence, one may believe that both results are similar robust. However, we applied a sensitivity analysis of the logit results with respect to the variables included, following the procedure used in Barslund et al. (2007). The results are shown in Tables 7 and 8 in the Appendix. Concerning the social capital variables, the results from Y2 (the adjusted measure) are much more robust. Hence, we are focusing our interpretation on Y2.

The variable $\text{bridging}_{\text{link}}$ social capital is significant and has a negative sign in both regressions; subjective assessment and adjusted assessment of exclusion from rural services. It means that the greater the number of personal network members with a higher social status and connected through a weak tie, the lower the chance of being excluded from public services. Households having more weak ties with persons of higher social standing could use them to access new and innovative information. Thus, this result confirms the statements in Section 2, namely that linking social capital can facilitate access to services. Different social ties provide different information or help in accessing rural services. Having more $\text{bridging}_{\text{link}}$ ties reduces the chance of being excluded from one specific service (assumably via way of reducing transaction costs as we have argued in section 2 above).

Surprisingly, bridging social capital (Bridging SC) has a significant and positive effect, which means that the greater the number of personal network members with a lower social status and connected through a weak tie, the higher the chance of a household being excluded from services. This result is counter-intuitive as theory suggests the opposite. Breaking out of one's core social circle may not be enough to get the necessary information and help to prevent exclusion from some services. One also has to break out of one's own social hierarchy strata. But this does not explain why bridging social capital raises the chance of being excluded. We disassembled our social capital variables and calculated the correlation between linking ties and

non-linking ones of a respondent. Both are negatively correlated (although relatively weakly at -0.124). Hence, the result may partly be explained by the crowding out effects of ties. Lots of non-linking ties may crowd out linking ties. Nevertheless, this interpretation is very speculative as the sensitivity results in Tables 7 and 8 in the Appendix show that those results are not very robust.

The higher the occupational standing of the household head measured by the SIOPS the lower the chance of being excluded from services. This result is not surprising as high occupational standing is likely to be caused by higher educational standards and usually results in higher income, wealth, and a higher chance of having a formal employment, and thus can help in accessing services. Furthermore, such persons usually know how to deal with government officials, how to apply for services, and how to fill in forms correctly.

The positive sign of the variable 'market distance' indicates that the greater the distance from a farmer's house to the market the higher the chance of being excluded from services. Most of the time, rural services' providers are located at the market place or in rural towns (such as in community health care centers). Thus, living further away from these locations raises transaction costs for transport, for example, but also for information gathering, as markets are usually the places to meet people and exchange information. Furthermore, the greater the distance the lower the chance that government officials related to service supply will visit the village.

Belonging to an ethnic minority shows no significant results in either regression. However, with the adjusted measurement it is almost significant. Furthermore, the sensitivity analysis shows that the results with different variable set-ups produce significant results as frequently as, for instance, the variable market distance. Moreover, the coefficient signs in the sensitivity analysis are very stable. The interpretation of this variable is very straightforward. As many studies have

proved, ethnic minorities are often economically and socially disadvantaged compared to their ethnic majority neighbors.

Some of the district dummies' variables turn out to be significant and positive. This means that living in the districts of Moc Chau, Muong La, Phu Yen, and Thuan Chau increases the chance of being excluded from rural services. This can be explained mainly by the bad infrastructure and more remote location of these districts.

Table 5 Logit model of exclusion from rural services

<i>Dependent variable</i>	Y1: sub_ass			Y2: ob_ass		
	Coef.	Robust Std. Err.	P>z	Coef.	Robust Std. Err.	P>z
Bonding SC	0.07	0.05	0.109	0.06	0.05	0.269
Bonding _{link} SC	-0.02	0.07	0.757	-0.05	0.10	0.652
Bridging SC	0.16	0.07	0.016	0.15	0.09	0.087
Bridging _{link} SC	-0.18	0.08	0.028	-0.26	0.14	0.063
Market_distance	0.03	0.01	0.001	0.02	0.01	0.000
Ethnicity	-0.40	0.32	0.206	-0.53	0.33	0.103
Sex	-0.15	0.39	0.693	-0.05	0.42	0.899
Head_age	0.00	0.01	0.706	0.00	0.01	0.691
SIOPS of head	-0.08	0.03	0.010	-0.10	0.04	0.012
Leader	0.32	0.36	0.382	0.35	0.31	0.256
Income	0.00	0.00	0.538	0.00	0.00	0.294
HHs_known	0.00	0.00	0.710	0.00	0.00	0.296
Moc Chau district	1.44	0.44	0.001	1.08	0.61	0.074
Muong La district	2.03	0.68	0.003	1.84	0.58	0.002
Phu Yen district	2.99	0.52	0.000	2.06	0.58	0.000
Son La town	0.76	0.60	0.206	1.22	0.53	0.210
Thuan Chau	1.58	0.51	0.002	1.82	0.50	0.000
Yen Chau	0.42	0.49	0.392	-0.17	0.53	0.752
Constant	1.61	1.25	0.199	1.33	1.74	0.444
N	411			411		
Wald chi ² (19)	103.21			211.52		
Prob > chi ²	0.00			0.00		
Pseudo R ²	0.19			0.13		

Note: Standard errors adjusted for 35 clusters in villages

6. Conclusions and policy recommendations

Most of the literature on service access (such as access to credit) has either ignored social capital in its analysis or has applied oversimplified measures such as whether or not credit is directed towards groups. However, social capital is basically a relational concept. Thus, our measure of social capital focuses on its relational character, namely the social ties of the survey respondents.

In our analysis we distinguish two dimensions with regard to social capital: tie strength; and social distance. This leaves us with four measures of social capital: 1. bonding, 2. bridging, 3. bonding_{link}, and 4. bridging_{link}.

A higher amount of linking social capital (vertical form of social capital) when connected through a weak tie significantly (bridging_{link}) reduces the chance of a household being excluded from a public service. Obviously the relationship to persons in higher social position significantly reduces the transaction costs of households with regard to accessing services. One can surely draw on more resources and better information if one knows rich and influential persons than if one has poor acquaintances with no power. It further supports the well-known argument of Granovetter (1973) on ‘the strength of weak ties’, which highlights the informational gains to be made through weak ties which thus reduce transaction costs and the chance of exclusion from services. This result confirms our assumption at the beginning that social capital plays a role in accessing rural services.

The subjective measure of exclusion demonstrates that about 30% of the households are excluded from at least one service, indicating a severe problem. However, when considering the adjusted measure, the problem of exclusion to services dwindles. We even found no significant evidence of some of the most often quoted factors increasing exclusion from services, namely poverty (measure through income), female-headed household, and ethnic minorities. Nevertheless, we could confirm the long-held view that remoteness (distant markets) seems to increase the problem of farmers being excluded from services, since service providers place their branches in more accessible locations (see, for instance, Sharma and Zeller, 1999). Also some district dummies increase the chance of households being excluded from services; location matters. In the case of rural service provision, this not only relates to the physical infrastructure like roads, markets, etc., but also to the organizational infrastructure of service providers.

Different districts are handled by different branches of the service provider, with different staff and different approaches. Internal comparison of branches, training and exchange of staff could help to reduce the number of excluded households even more.

The significant influence of bridging_{link} social capital on access to rural services points to some basic infrastructural weaknesses in the rural financial market of Thailand. As mentioned in the introduction, in a perfectly functioning credit market, social capital would not be needed. Based on this result one could call for promoting this special kind of social capital to further reduce access constraints to services. But two arguments are against this. First, it is quite difficult to give a valid policy recommendation to government or financial organizations that social capital in general can be fostered. Second, such policy measures are likely to produce a number of unintended and unwanted side effects and may even further increase social exclusion. Hence, it seems more appropriate to give recommendations to reduce the use of social capital and to move towards a perfect market (although the ultimate goal of a perfect rural financial market will never be achieved). Therefore, we think it is more important to reduce the importance of social ties in accessing services. For instance, information on application procedures could be spread more widely and more generally to reduce the transaction costs of potential clients.

7. Reference list

Aikman, S. and P. Pridmore, 2001, Multigrade schooling in 'remote' areas of Vietnam. *International Journal of Educational Development*, **21**, pp. 521-36.

Akoten, J. E., Y. Sawada and K. Otsuka, 2006, The determinants of credit access and its impacts on micro and small enterprises: The case of garment producers in Kenya. *Economic Development and Cultural Change*, **54**, pp. 927-44.

Barslund, M., J. Rand, F. Tarp and J. Chiconela, 2007, Understanding victimization: The case of Mozambique. *World Development*, **35**, pp.1237-58.

- Baulch, B., H. T. M. Nguyen, P. T. T. Phuong and H. T. Pham, 2010, Ethnic minority poverty in Vietnam. Working Paper No. 169. Chronic Poverty Research Centre, Manchester, UK.
- Bélanger, D. and J. Liu, 2004, Social policy reforms and daughters' schooling in Vietnam. *International Journal of Educational Development*, **24**, pp. 23-38.
- Boucher, S. S., C. Guirkingner and C. Trivelli, 2009, Direct elicitation of credit constraints: Conceptual and practical issues with an application to Peruvian agriculture. *Economic Development and Cultural Change*, **57**, pp. 609-40.
- Bourdieu, P., 1983, Forms of capital. In: *Handbook of theory and research for the sociology of education* (eds Richardson, J. G), p. 241-58. Greenwood Press, New York, USA.
- Coleman, B. E., 2006, Microfinance in northeast Thailand: Who benefits and how much? *World Development*, **34**, pp. 1612-38.
- Coleman, J. S., 1988, Social capital in the creation of human capital. *American Journal of Sociology*, **94**, pp. S95-S120.
- Dale, A. and L. Newman, 2010, Social capital: A necessary and sufficient condition for sustainable community development? *Community Development Journal*, **45**, pp. 5-21.
- Dalton, R. J., P. M. Hac, P. T. Nghi and N. N. T. Ong, 2002, Social relations and social capital in Vietnam: Findings from the 2001 World Values Survey. *Comparative Sociology*, **1**, pp. 369-86.
- De Silva, M. J., T. Harpham, T. Tuan, R. Bartolini, M. E. Penny and S. R. Huttly, 2006, Psychometric and cognitive validation of a social capital measurement tool in Peru and Vietnam. *Social Science & Medicine*, **62**, pp. 941-53.
- Derose, K. P. and D. M. Varda, 2009, Social capital and health care access. *Medical Care Research and Review*, **66**, pp. 272-306.
- Dufhues, T., G. Buchenrider, D. G. Euler and N. Munkung, 2011 (forthcoming), Network based social capital and individual loan repayment performance. *Journal of Development Studies*.
- Erickson, B. H., 2004, A report on measuring the social capital in weak ties. A report prepared for the policy research initiative, Ottawa, Canada.
- Fafchamps, M. and B. Minten, 2001, Property rights in a flea market economy. *Economic Development and Cultural Change*, **49**, pp. 229-67.
- Fletschner, D., and M. R. Carter, 2008, Constructing and reconstructing gender: Reference group

- effects and women's demand for entrepreneurial capital. *Journal of Socio-Economics*, **37**, 672-93.
- Fukuyama, F., 2001, Social capital, civil society and development. *Third World Quarterly*, **22**, pp. 7-20.
- Ganzeboom, H. B. G. and D. J. Treiman, 1996, Internationally comparable measures of occupational status for the 1988 international standard classification of occupations. *Social Science Research*, **25**, pp. 201-39.
- Glaeser, E. L., D. I. Laibson, J. A. Scheinkman and C. L. Soutter, 2000, Measuring trust. *Quarterly Journal of Economics*, **115**, p. 811-46.
- Granovetter, M. S., 1973, The strength of weak ties. *American Journal of Sociology*, **78**, pp. 1360-80.
- Grindle, M. S., 2001, In quest of the political: The political economy of development policymaking. In: *Frontiers of Development Economics - The Future Perspective* (eds Meier, G. M. and Stiglitz, J. E.). pp. 345-80. Oxford University Press, Washington DC, USA.
- Grootaert, C., G. Oh and A. Swamy, 2002, Social capital, household welfare and poverty in Burkina Faso. *Journal of African Economies*, **11**, pp. 4-38.
- Grootaert, C., D. Narayan, V. N. Jones and M. Woolcock, 2003, Measuring social capital - An integrated questionnaire. World Bank Working Paper 18/2003. The World Bank, Washington DC, USA.
- Ha, N. V., S. Kant and V. Maclaren, 2004, The contribution of social capital to household welfare in a paper-recycling craft village in Vietnam. *Journal of Environment and Development*, **13**, pp. 371-99.
- Haythornthwaite, C., 1996, Social network analysis: An approach and technique for the study of information exchange. *Library and Information Science Research*, **18**, pp. 323-42.
- Herrmann-Pillath, C. and J. J. Lies, 2001, Sozialkapital - begriffsbestimmung, messung, bereitstellung. *Wirtschaftswissenschaftliches Studium*, **30**, pp. 362-66.
- Hirschman, C. and V. M. Loi, 1996, Family and household structure in Vietnam: Some glimpses from a recent survey. *Pacific Affairs*, **69**, pp. 229-49.
- Hoang, L. A., J. C. Castella and P. Novosad, 2006, Social networks and information access: implications for agricultural extension in a rice farming community in northern Vietnam. *Agriculture and Human Values*, **23**, pp. 513-27.
- Kajisa, K., 2007, Personal networks and nonagricultural employment: The case of farming village in the Philippines. *Economic Development and Cultural Change*, **55**, pp. 669-707.

- Lai, G. and O. Wong, 2002, The tie effect on information dissemination: The spread of a commercial rumor in Hong Kong. *Social Networks*, **24**, pp. 49-75.
- Lin, N., 1982, Social resources and instrumental action. In: *Social Structure and Network Analysis* (eds Peter, V. M. and Lin N.), pp. 131-45. SAGE Publications, Beverly Hills, USA.
- Lin, N., 1999a, Building a network theory of social capital. *Connections*, **22**, pp. 28-51.
- Lin, N., 1999b, Social networks and status attainment. *Annual Review of Sociology*, **25**, pp. 467-87.
- London, J. D., 2006, The political economy of education in a "socialist" periphery. *Asia Pacific Journal of Education*, **26**, pp. 1-20.
- London, J. D., 2008, Reasserting the state in Vietnam: Health care and the logics of market-Leninism. *Policy and Society*, **27**, pp. 115-28.
- Manning, P., 2010, Putnam and radical socio-economic theory. *International Journal of Social Economics*, **37**, pp. 254-69.
- Marin, A. and K. N. Hampton, 2007, Simplifying the personal network name generator: Alternatives to traditional multiple and single name generators. *Field Methods*, **19**, pp. 163-93.
- Matuschke, I. and M. Qaim, 2009, The impact of social networks on hybrid seed adoption in India. *Agricultural Economics*, **40**, 493-505
- NSO (National Statistical Office), 2007, The labor force survey - whole kingdom: Quarter 1 January-March 2007. Ministry of Information and Communication Technology, Bangkok, Thailand.
- Okten, C. and U. O. Osili, 2004, Social networks and credit access in Indonesia. *World Development*, **32**, pp. 1225-46.
- Petrick, M., 2005, Empirical measurement of credit rationing in agriculture: A methodological survey. *Agricultural Economics*, **33**, pp. 191-203.
- Phuc, H., 2005, Only eight percent of the poor households access to micro credit. Viet Bao, Vietnam [online; cited December 2010.] Available from URL: <http://vietbao.vn/Kinh-te/Moi-co-8-ho-ngheo-duoc-vay-von-quy-mo-nho/20475503/90/>
- Piachaud, D., 2002, Capital and the determinants of poverty and social exclusion. Centre for Analysis of Social Exclusion, CASE paper 60/2002. London: UK.
- Portes, A. and P. Landolt, 2000, Social capital: Promise and pitfalls of its role in development. *Journal of Latin American Studies*, **32**, pp. 529-47.

- Sepehri, A., S. Moshiri, W. Simpson and S. Sarma, 2008, Taking account of context: How important are household characteristics in explaining adult health-seeking behaviour? The case of Vietnam. *Health Policy and Planning*, **23**, pp. 397-407.
- Sharma, M. and M. Zeller, 1999, Placement and outreach of group-based credit organizations: The cases of ASA, BRAC, and PROSHIKA in Bangladesh. *World Development*, **27**, pp. 2123-36.
- Stiglitz, J. E., 1986, The new development economics. *World Development*, **14**, pp. 257-65.
- Szreter, S. and M. Woolcock, 2004, Health by association? Social capital, social theory, and the political economy of public health. *International Journal of Epidemiology*, **33**, pp. 650-67.
- Turner, S. and P. A. Nguyen, 2005, Young entrepreneurs, social capital and doi moi in Hanoi, Vietnam. *Urban Studies*, **42**, pp. 1693-1710.
- van Bastelaer, T., 2000, Imperfect information, social capital, and the poor's access to credit. Working Paper No. 234. Center for Institutional Reform and the Informal Sector, University of Maryland, College Park, USA.
- van de Walle, D. and D. Gunewardena, 2001, Source of ethnic inequality in Vietnam. *Journal of Development Economics*, **65**, pp. 177-207.
- van Staveren, I. and P. Knorringa, 2007, Unpacking social capital in economic development: How social relations matter. *Review of Social Economy*, **65**, pp. 107-35.
- Williamson, O. E., 1985, *The Economic Institutions of Capitalism*. The Free Press, New York, USA.
- Woolcock, M. and D. Narayan, 2000, Social capital: Implications for development theory, research, and policy. *The World Bank Research Observer*, **15**, pp. 225-49.
- Zhao, Y., 2002, Measuring the social capital of laid-off Chinese workers. *Current Sociology*, **50**, pp. 555-71.

8. Appendix

Table 6 Correlation of different single services

	Credit	Education	Vocational training	Agriculture extension	Health care
Credit	1.00				
Education	0.55*	1.00			
Vocational training	0.21	0.59*	1.00		
Agriculture extension	0.36*	0.35*	0.27*	1.00	
Health care	0.38*	0.56*	0.33*	0.43*	1.00

Note: *Correlation coefficients significant at the 5% level or lower. All variables are binary. Therefore, we used the Tetrachoric correlations test for binary variables; N = 411

Table 7 Sensitivity analysis of Y1 model (Subjective assessment)

Y1 model Core variables	<i>Number of regressions run for core variables: 16.350</i>						
	Max	Min	Mean	AvgSTD	PercSigni	Perc+	Perc-
Bonding SC	0.14	0.03	0.08	0.05	0.18	1.00	0.00
Bonding _{link} SC	0.06	-0.14	-0.03	0.08	0.00	0.26	0.74
Bridging SC	0.19	-0.09	0.03	0.06	0.03	0.77	0.23
Bridging _{link} SC	-0.05	-0.30	-0.16	0.09	0.41	0.00	1.00
Testing variables							
Market_distance	0.04	0.02	0.03	0.01	1.00	1.00	0.00
Ethnicity	-0.13	-1.49	-0.83	0.39	0.59	0.00	1.00
Sex	0.67	-0.12	0.20	0.38	0.00	0.94	0.06
Head_age	0.00	-0.02	-0.01	0.01	0.00	0.00	1.00
SIOPS of head	-0.05	-0.10	-0.07	0.02	1.00	0.00	1.00
Leader	0.26	-0.17	0.08	0.38	0.00	0.81	0.19
Income	0.00	0.00	0.00	0.00	0.04	0.00	1.00
HHs_known	0.00	-0.01	0.00	0.00	0.03	0.01	0.99
Moc Chau district	2.10	-0.46	0.47	0.37	0.27	0.84	0.16
Muong La district	2.25	0.03	0.77	0.66	0.14	1.00	0.00
Phu Yen district	3.22	1.09	1.78	0.48	1.00	1.00	0.00
Son La town	0.40	-2.06	-1.17	0.50	0.74	0.02	0.98
Thuan Chau	1.93	-0.48	0.46	0.46	0.16	0.79	0.21
Yen Chau	1.13	-1.50	-0.64	0.39	0.57	0.08	0.92

Note: Max, Min, and Mean are the maximum, minimum, and mean value respectively of the point estimate over all regressions. AvgSTD are averages over the standard deviations. PercSig gives the percentage times the coefficient was significant at the 5% level. Perc+ and Perc- indicate the number of times the coefficient had a positive or negative sign respectively. For a definition of the dependent and explanatory variables see Table 4. N = 411

Table 8 **Sensitivity analysis of Y2 model (Adjusted assessment)**

Y2 model	<i>Number of regressions run for core variables: 16.350</i>						
Core variables	Max	Min	Mean	AvgSTD	PercSigni	Perc+	Perc-
Bonding SC	0.14	0.02	0.07	0.05	0.03	1.00	0.00
Bonding _{link} SC	0.06	-0.14	-0.03	0.11	0.00	0.29	0.71
Bridging SC	0.24	-0.05	0.07	0.08	0.05	0.92	0.08
Bridging _{link} SC	-0.20	-0.46	-0.31	0.09	1.00	0.00	1.00
Testing variables							
Market_distance	0.02	0.01	0.02	0.01	0.32	1.00	0.00
Ethnicity	-0.03	-1.29	-0.66	0.37	0.38	0.00	1.00
Sex	0.60	-0.19	0.16	0.46	0.00	0.82	0.18
Head_age	0.01	-0.01	0.00	0.01	0.00	0.52	0.48
SIOPS of head	-0.09	-0.14	-0.11	0.03	1.00	0.00	1.00
Leader	0.33	-0.06	0.16	0.37	0.00	0.97	0.03
Income	0.00	0.00	0.00	0.00	0.06	0.00	1.00
HHs_known	0.01	0.00	0.00	0.00	0.00	0.62	0.38
Moc Chau district	1.90	-0.36	0.40	0.47	0.12	0.86	0.14
Muong La district	2.35	0.28	0.86	0.54	0.22	1.00	0.00
Phu Yen district	2.64	0.47	1.17	0.48	0.77	1.00	0.00
Son La town	0.81	-1.53	-0.77	0.48	0.39	0.06	0.94
Thuan Chau	2.22	-0.15	0.70	0.42	0.31	0.97	0.03
Yen Chau	0.79	-1.63	-0.95	0.33	0.83	0.06	0.94

Note: Max, Min, and Mean are the maximum, minimum, and mean value respectively of the point estimate over all regressions. AvgSTD are averages over the standard deviations. PercSig gives the percentage times the coefficient was significant at the 5% level. Perc+ and Perc- indicate the number of times the coefficient had a positive or negative sign respectively. For a definition of the dependent and explanatory variables see Table 4. N = 411