118th EAAE Seminar
"Rural development: governance, policy design and delivery"
Ljubljana, 25-27 August 2010

THE DIMENSIONS OF SOCIAL CAPITAL AND RURAL DEVELOPMENT: EVIDENCE FROM WATER COMMUNITIES IN THE REPUBLIC OF MACEDONIA

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Paper prepared for presentation at the 118th seminar of the EAAE
(European Association of Agricultural Economists),
'Rural development: governance, policy design and delivery'
Ljubljana, Slovenia, August 25-27, 2010

Abstract

Drawing on Nahapiet and Ghoshal's (1998) distinction between the structural, relational, and cognitive dimensions of social capital, this paper analyses the performance of Water Communities (WCs) in the Bregalnica region of the Republic of Macedonia. WCs are farmer-managed local irrigation systems which are critical to livelihoods in Bregalnica. Data on the performance of the WCs and role of social capital was collected via in-depth interviews and a farm survey (n=249) of both members and non-members. Results highlight the importance of social capital in explaining the decision to join a WC, the satisfaction of members with their WC, and payment behaviour.

Key words: social capital, rural development, irrigation, rural development

JEL codes: O13, P32, Q15

1. Introduction

Nahapiet and Ghoshal (1998) distinguish between the structural, relational, and cognitive dimensions of social capital. Structural dimensions of social capital refer to the impersonal configuration of linkages between people and units, sometimes labelled network configuration or morphology (Tichy *et al.* 1979). Relational social capital is the bonds between actors (Hakansson and Snehota, 1995), particularly regarding obligations and trust. The cognitive dimension relates to shared representations and systems of meaning between parties (Nahapiet and Ghoshal, 1998). This paper analyses the importance of these dimensions of social capital for the performance of Water Communities (WCs) in the Republic of Macedonia.

WCs are farmer-managed local irrigation systems which depend on collective self-management of a common pool resource (Ostrom, 1992). Given the dependence of rural Macedonia on agriculture and substantial water deficits in summer months, the performance of WCs has a major bearing on the livelihoods of farmers and, hence, local economic development. WCs in Macedonia were established under a common legal framework, market environment and institutional status, during the period 2002-2005 as part of a project, partially funded by the World Bank, for rural regeneration.

This paper builds on previous analysis (Gorton *et al.* 2009) by specifically focusing on the role of social capital in determining variations in WC performance. It allows for a more comprehensive assessment of the dimensions of social capital, which previous studies have often found hard to disentangle (Moran, 2005), in determining the success of self-management based institutions. As Moran (2005, p.1148-1149) notes the 'contemporary social capital literature is too easily associated with network structure' and hence too narrow a focus on the structural dimension. By also evaluating the importance of relational and cognitive social capital, the analysis presents a better balanced contribution to the wider debate on the importance of social capital for rural economic development.

The paper is divided into six sections. The next section presents an overview of the literature on social capital that is pertinent to the case study. Section 3 summarises the Macedonian context. Section 4 discusses the dataset and econometric analysis and Section 5 describes the empirical results. Finally, we draw conclusions regarding the importance of social capital for successful local self-management.

2. Social Capital and Local Economic Development

Putnam (1995, p.664-5) conceptualises social capital as comprised of three primary ingredients: networks, norms and trust, which 'enable participants to act together more effectively to pursue shared objectives'. From Putnam's popularising of the concept, an array of researchers has explored the linkages between social capital and economic development (Knack and Keefer, 1997; Woolcock, 1998; Dearmon and Grier, 2009).

Drawing on Fukuyama (1995), Dearmon and Grier (2009) hypothesise that social capital plays a significant, positive role in fostering economic growth, as higher levels of social capital aid (a) the dissemination of research and ideas on how to make processes more efficient and (b) group formation and co-ordination. There is some empirical evidence to support this – Knack and Keefer (1997) found, using data for 29 countries, that trust is a significant causal component of growth. Using World Values Survey data, Dearmon and Grier (2009) discovered positive relationships between trust and input accumulation, efficiency and economic growth. In a development context, Narayan and Pritchett (1997), studying changes in income levels in Tanzanian villages found that social capital had a significantly positive influence, which was greater than equivalent changes in human capital or physical assets. However, while the possibility of a relationship between growth and social capital is generally accepted, several researchers question whether the literature to date has adequately demonstrated causality and conclude that the 'evidence appears to be suggestive rather than conclusive' (Field, 2008, p.62).

Field (2008) argues that for a better understanding of the relationship with economic development, researchers should classify types of social capital. Woolcock (2001) distinguishes between bonding social capital (ties between those in similar situations such as neighbours and immediate family), bridging social capital (links with distant ties such as workmates and business acquaintances) and linking social capital (which enables people in dissimilar situations to connect so that members of one community can leverage external resources). Nahapiet and Ghoshal (1998) offer an alternative typology, distinguishing between the structural, relational, and cognitive dimensions of social capital. This typology draws on Granovetter's (1992) division between structural and relational embeddedness. Structural embeddedness, the structural dimension of social capital, refers to the impersonal configuration or network morphology (Tichy *et al.* 1979) between people or units. It is proxied by measures such as connectivity, density and hierarchy. Relational embeddedness refers to the nature of personal relationships between people or what Hakansson and Snehota (1995) label as 'actor bonds'. According to Nahapiet and Ghoshal (1998), the key facets of relational social capital are trust and trustworthiness. The cognitive dimension refers to common systems of representation, identity and interpretation within a network, which includes shared language and codes. Nahapiet and Ghoshal's (1998) typology informs the methodological approach described in Section 4.

Several authors theorise the linkages between particular dimensions of social capital and local economic development but the literature lacks an integrated model (Moran, 2005). Structural social capital (such as robust, transparent networks that can punish opportunistic behaviour), according to Moran and Ghoshal (1999), facilitates investment in relationship specific capital. Coleman (1990) pays particular attention to the role of relational social capital in his theory of development. Trust, he argues, amounts to a public good that stimulates mutual obligations and minimises opportunistic behaviour. In particular, the fear of being ostracised from a valued social group may limit opportunistic behaviour. Such social bonds may therefore facilitate inter-community exchange and investment. Hansen (1999) links cognitive social capital with economic growth, arguing that a shared identity and mutual understanding facilitates the transfer of resources and knowledge.

A few studies consider social capital within the context of post-socialist states (Gerber, 2000; Batjargal, 2003). The main focus of this work has been the importance of elite networks, particularly centring on the former *nomenklatura*, in shaping post-socialist business and political structures. In contrast to Putnam (1995), researchers considering these countries offer a less benign view of social capital, recognizing that it is unequally distributed, often reinforcing socio-economic divisions. Co-operation between network members may be mutually beneficial but generate negative externalities. Networks can be captured by elites facilitating corrupt exchanges (Ledeneva, 1998). In fragile market economies, establishing socially beneficial co-operative networks between actors may be particularly difficult (Theesfeld, 2002). In other words there is often a tension between the public and private benefits of social capital (Leana and Van Buren, 1999).

3. The Macedonian Case Study

The Bregalnica region of the Republic of Macedonia is semi-arid and characterised by significant water scarcity. Irrigation is therefore critical to the livelihoods of farmers and rural development. The main crops grown are wheat, maize, rice, fruits and vegetables. Rice and most horticultural crops are entirely dependent on irrigation for cultivation. As fruit and vegetables are the predominant high value added crops, agricultural incomes are heavily dependent on irrigation and this is understood by farmers. From the farm survey outlined below, 94% of respondents agreed or strongly agreed with the statement that 'irrigation is very important for my livelihood'. Irrigation systems vary from flood irrigation for rice to, much more commonly, open channels and concrete tubes for arable and horticultural production.

The quality of the irrigation network deteriorated rapidly in the 1990s. Many of the concrete irrigation channels cracked and pumping stations fell into disrepair. Water can easily be stolen from such a system. For example, it is common for farmers to punch holes in the concrete channels to gain access illicitly. Peshevski *et al.* (2006) estimated that at least 20% of irrigation water was lost from the system.

In 1998 the Macedonian Parliament passed a new Water Law, linked to a project for the reconstruction of the irrigation network. The Government of Macedonia and the World Bank agreed the terms of project. The World Bank offered funding for the rehabilitation of irrigation systems in three regions (Tikves, Bregalnica and Polog), conditional on the creation of WCs. This conditionality, tying funding for investment in infrastructure to the creation of WCs is common to many World Bank and International Fund for Agricultural Development irrigation projects (Meinzen-Dick, 2007; IFAD, 2009). We focus on Bregalnica.

WCs can be formed where the participants in a given area account for more than 50% of agricultural land in the community's territory and wish to manage irrigation and drainage matters collectively. Membership is voluntary. The WC sets the prices for irrigation water and drainage to its members, which should reflect the true costs of delivering irrigation water, maintaining the network and ensuring adequate drainage. WCs negotiate the supply of water from a Public Water Enterprise. At the time of the establishment of the first WCs (May 2002), the average cost recovery rate, measured as the percentage of billed amounts for a given territory which was actually paid by farmers, was only 36%.

4. Data and Econometric Methodology

Data on the performance of the WCs and role of social capital was collected via two methods. Firstly, in-depth interviews were conducted with a senior figure for twelve WCs established in the Bregalnica region. The interviews collected information on the geographical area covered by the WC, membership, investment, main problems encountered and cost recovery. Secondly, to understand the relationships between the dimensions of social capital and (a) membership of WCs and (b) member satisfaction in greater depth, a farm survey was conducted. In total, 249 survey responses were collected through face to face interviews. Data collection occurred in 2005/6. The survey focused on performance in the first three years of the existence of each WC (years 2002 to 2004). Individual farmers were identified from contacts with local and regional authorities, village mayors, members of WC management boards, other farmers, and personal contacts. The analysis concentrates on the first batch of WCs created which collectively cover a territory of approximately 3,200 ha. Studying WCs created under a common legal framework, established in the same time period and operating in a homogenous market environment, allows scope for identifying how variations in local social capital may lead to diverse outcomes. In other words it allows for the control of many external variables.

We divide survey responses into two groups: members of a WC (n=223) and farmers within the Bregalnica region who operate within a WC area but had chosen not to join the association (n=26). Data collection from the latter group allows us to understand why some farmers failed to join their respective WC. The majority of farmers sampled farm less than 2 hectares. This is in line with other

estimates for Macedonia as a whole (World Bank, 2006). However, a detailed analysis of the representativeness of the sample is impossible because no agricultural census has been administered since 1964. Non-members operate significantly smaller farm areas.

Using the survey data we estimate, as a starting point, a Heckman selection model. First, a heteroscedastic probit model is estimated to assess causal factors, paying particular attention to the dimensions of social capital, related to a farmer's decision to join a WC. Based on these estimates we calculate the inverse Mill's ratio to account for possible selection bias with respect to the estimation of the outcome equation modelled as a heteroscedastic ordered probit model. Secondly, we investigate the determinants of farmers' satisfaction with their membership of WCs including, beside other explanatory variables, the inverse Mill's ratio from the selection equation. Finally, we model changes in payment behaviour.

It is expected that a farmer's decision to join a WC is influenced by the dimensions of social capital as well as socioeconomic characteristics at the household/farm level and the nature of the irrigation used. It is likely that, in these regards, the characteristics of WC members will differ from non-members. Unobservable characteristics affecting the decision to become a member will be correlated with the unobservable characteristics affecting a farmer's level of satisfaction with his/her WC membership. Selectivity bias would be present, therefore, if we were to draw inferences about the determinants of membership satisfaction for all farmers based on the observed level of satisfaction of the subset which is actually WC members. Heckman's two-stage sample selection model copes with such a selection problem by assuming that the farmers make two judgements with regard to membership and membership satisfaction, each of which is determined by a different set of explanatory variables (see Heckman, 1979). Hence, it is based on two latent dependent variable models, where the decision to become a member is modelled as a selection equation specified as:

$$P_i = \begin{cases} 1 \text{ if } \alpha + \sum_j \beta_j hh_{ij} + \sum_k \gamma_k soc_{ik} + \sum_l \delta_l irr_{il} + u > 0 \\ 0 \text{ otherwise} \end{cases} \qquad [1]$$

where P_i is a binary variable which takes the value one if the farmer is a member of the local WC and zero if the farmer decided not to become a member, hh denotes the vector of socioeconomic characteristics of the household/farm, *soc* captures social capital and *irr* for the irrigation technology related variables. α, β, γ & δ are the vectors of parameters to estimate, and *u* is the error term.

The modelling also incorporates WC-specific effects. While each WC has a common constitution, there are likely to be additional effects at the level of the individual WC (mainly unknown and very likely random) which could have an effect on the different variables modelled at the individual farm level. This implies that preferences for WC membership are not identically distributed, but that the process of generating choices to join or not is heterogeneous. Farmers who are able to elaborate on both the reasons to oppose and favour membership have a wider underlying distribution of choices than those expressing one-sided elaborations. For example, this could be due to differences in soil fertility, topography and distance from the head of the irrigation network. These effects may explain a good deal of the variance in the mean effects for our models and hence the error term variance and so a standard probit model would yield inconsistent estimates (see Harvey, 1976 and Greene, 1993). To address these inconsistencies we introduce a separate equation for the error variance based on variables accounting for alternative explanations of the membership decision:

$$var(u_i) = exp(Z_i\theta)^2 \qquad [2]$$

with Z denoting water community related and social capital related random factors, and θ as a vector of parameters to estimate (the corresponding log-likelihood function for [1] and [2] is given in Alvarez and Brehm, 1995).

The dimensions of social capital (*soc*) are captured via summated scales, created by combining several individual variables into single composite measures for the structural, cognitive and relational dimensions of social capital. This allows us to represent the multiple aspects of a concept in a single measure. Table 1 details the specific items included in the survey instrument and their relationships to Nahapiet and Ghoshal's (1998) dimensions of social capital. Individual items are five-point Likert scales, where farmers reported their agreement / disagreement (ranging from 1 'strongly disagree' to 5 'strongly agree') with selected statements. The construction of items drew on Nahapiet and Ghoshal's (1998) theory and a previous World Bank questionnaire designed to capture the dimensions of social capital (Grootaert et al. 2003), adapted to the specific case investigated. The summated scales were assessed in a number of regards (Table 2):

a) Dimensionality. The test of uni-dimensionality is that each summated scale should consist of items loading highly on a single factor. In each case only there was only one factor with an eiginvalue of greater than 1.
b) Internal consistency. Cronbach's alpha coefficient is a measure of the consistency of the whole scale. According to Hair *et al.* (2010) the generally agreed lower limit is 0.7 or, for exploratory research, 0.6.
c) Inter-item correlation (correlation among items). The agreed thresholds in this case are item-to-total correlations exceed 0.5 and inter item correlations exceed 0.3.

The membership satisfaction equation is given by:

$$satis_i = \mu + \sum_m \kappa_m hh_{im} + \sum_n \tau_n soc_{in} + \sum_r \omega_r irr_{ir} + \sum_s \psi_s comm_{is} + v \qquad [3]$$

where *satis* takes the values:

$\{1$: 'very dissatisfied', 2: 'dissatisfied', 3: 'indifferent', 4: 'satisfied', 5: 'very satisfied'$\}$

and *comm* denotes water community cost related characteristics. $\mu, \kappa, \tau, \omega$ & ψ are the vectors of parameters to estimate, and *v* is the error term. Given the distribution of the dependent variable, we estimate [3] as an ordered probit model and again introduce a separate equation for the error variance based on variables accounting for alternative explanations of the level of satisfaction (as outlined by equation 2, see also e.g. Rudolph 2005).

We analyse payment behaviour by considering the change in the proportion of water bills actually paid by farmers:

$$payincr_i = \mu + \sum_m \kappa_m hh_{im} + \sum_n \tau_n soc_{in} + \sum_r \omega_r irr_{ir} + \sum_s \psi_s comm_{is} + v \qquad [4]$$

Where $payincr_i$ denotes the percentage change from 2002 to 2004 in the proportion of the total water bill actually paid by the farmer. Given the bounded nature of the dependent variable, we estimate [4] as a heteroscedastic Tobit model following the reasoning given above (see Chan and Khan, 2000).

To test for small-sample bias we further investigate the robustness of our estimates obtained by [1], [3] and [4] by applying a simple stochastic re-sampling procedure based on bootstrapping techniques (Efron and Tibshirani, 1993).

5. Results

Before reviewing the econometric models, it is informative to consider key descriptive statistics on performance. As part of the farm survey respondents were asked to rate their degree of satisfaction with their WC, on a 5-point Likert scale where 1 equals 'very dissatisfied' and 5 equals 'very

satisfied'. Only 2.5% were 'very dissatisfied' with most either 'indifferent' (41%) or 'satisfied' (37%). A mere 3.8% were 'very satisfied'. By this measure, therefore, the introduction of WCs has been neither an unqualified success nor failure.

Regarding cost recovery, results are more positive. For the first three years following formation of the WCs, average cost recovery rates, measured as the percentage of billed amounts actually paid, were 72, 70.6 and 68 % respectively. While a slight downward trend is apparent, figures for all years compare favourably to the rate prior to formation (36%). However, cost recovery rates vary enormously between WCs, ranging in 2004 from 20% to 95%. Even with a common constitution, therefore, significant variations in the performance of WCs are evident at the local level.

Tables 3, 4 and 5 present the estimated models. According to the different diagnosis tests performed (Table 6) all estimated model specifications are significant with no severe signs of misspecification. These conclusions are supported by the bootstrapped bias-corrected standard errors as well as the robust estimation technique applied for the Heckman selection specification which confirms the robustness of the various estimates. The specification tests conducted with respect to the significance of social capital indicate that in all cases the null hypothesis is rejected (Table 6).

Considering the decision to join a WC (Table 3), there are significant, positive relationships with relational social capital (e.g. trust in the leader and management board of the WC) and cognitive social capital (e.g. shared representation and interpretation; farmers want to maintain irrigation equipment for long term use transparent management structure, systems for monitoring use, cutting access to non-payers etc.). Trust and a sense of shared interest are therefore crucial for persuading farmers to join a self-managing organisation such as a WC. Considering the interaction effects, the older the farmer, the more pronounced the positive effect of relational social capital on the probability of membership. Overall, older farmers appear more suspicious of WCs with trust in the president / management board being a more important risk reliever. The better educated the farmer the less pronounced the positive effect of relational social capital and the more pronounced the positive effect of cognitive social capital on the probability of membership. This suggests that for better educated farmers a sense of shared interest and willingness of farmers to manage irrigation equipment for long run use is more critical in promoting membership than trust in senior managers.

Structural social capital alone is not significant in explaining membership. Significant non-social capital related factors that explain WC membership include hectares farmed, the proportion of land used for crops, the proportion of total farmed area irrigated and the use of flood irrigation. In other words the more dependent a farmer is on arable farming and irrigation for their livelihood the more likely they are to join a WC. Commitment to WCs is higher where irrigation is more critical for livelihoods and this echoes previous work highlighting the importance of salience (Araral, 2009). Membership is not biased to a particular demographic group or related to years in education. There is little evidence of WCs, in terms of membership, being captured by particular elites.

Satisfaction with WC membership is positively and significantly related to structural social capital (transparent management structure, monitoring use, cutting access to non-payers) (Table 4). The conduct of the WC is therefore a significant determinant of satisfaction with a WC. The older the farmer the more pronounced the positive effect of the structural dimension of social capital on satisfaction. In contrast the better educated the farmer the less pronounced the positive effect of structural social capital on satisfaction. Older farmers in general have tended to be more suspicious of WCs, linked to negative experiences of 'co-operation' during the socialist era. Getting the network structure right is critical to their satisfaction.

Ordinary members are significantly less satisfied than presidents or members of the management / control board. Satisfaction is positively related to cost recovery and negatively related to the use of flood irrigation. Implementing effective sanctions to punish non-payers is more difficult in the case of flood irrigation in Macedonia as water typically flows freely between the plots of paying and non-

paying farmers. Cutting supplies of water to non-payers would negatively impact on farmers who have paid their bills.

Table 5 presents the results regarding payment behaviour. Improvements in payment rates are significantly and positively related to relational and cognitive social capital. Where farmers perceived that the president / management board set a poor example, for example by not paying their own water bill, ordinary members would also delay payment. Older farmers are significantly less likely to have improved their payment behaviour, while better educated farmers appear more responsive. The older the farmer the more pronounced the positive effect of relational social capital, and the less pronounced the positive effect of cognitive social capital on payment behaviour. For older farmers trust in senior managers plays a more pronounced role in their payment behaviour than notions of shared representation.

There is a significant positive relationship between farmers' satisfaction with a WC and payment behaviour. Perceived quality of service thus matters. The payment behaviour of those that farm smaller farm areas and are less dependent on irrigation is significantly worse. This suggests that those for whom WCs are less salient are more likely to have poor payment records.

6. Conclusion

This paper investigates the importance of social capital for local economic development utilising a case study of WCs in the Republic of Macedonia. A key finding is that the performance of individual WCs, measured in terms of both farmer satisfaction and payment records, has been highly uneven. In explaining variability, we identify the importance of structural, relational and cognitive dimensions of social capital. Even after controlling for WC-specific factors and the socio-economic characteristics of farmers and type of irrigation, membership is linked to trust in senior managers (relational social capital) and presence of perceived shared interests (cognitive social capital). Satisfaction with WCs depends on structural factors and this related to how resources are used, transparency and accountability. Good governance is essential for the long term sustainability of WCs. Payment behaviour is linked to farmers' satisfaction, relational social capital and the cognitive dimension. In particular, leaders of a WC must set a good example regarding their own payment behaviour. In many cases the importance of particular dimensions of social capital varies according to the age and level of education of the farmer.

Taken as a whole, the results refute the notion that 'network structure alone is all that need be considered in theorizing about social capital or in empirically exploring its benefits' (Moran, 2005, p.1130). The distinction between the three dimensions of social capital also has important implications for development policy. To date, the greatest emphasis by those advocating WCs has been on external or structural factors (Meinzen-Dick *et al*. 1997), for instance establishing clear property rights, management structures and markets for crops. However, the Bregalnica case illustrates that relational and cognitive factors are also important. Relational and cognitive social capital cannot be fully controlled at the national level but depend in part on the presence of trusted, community minded individuals at the *local level*. The proponents of WCs cannot therefore guarantee that sustainable communities will always emerge – much depends on local factors. The Macedonian evidence suggests that even when the external environment is rather tightly controlled, national policies to create local self-managing institutions are likely to lead to highly variable outcomes at the local level due to significant variations in social capital.

Acknowledgement
The paper derives from research conducted as part of the EU FP6 INCO Western Balkans WATERWEB Project (FP6-2002-INCO-WBC–1).

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Table 1: Dimensions of social capital and Likert scale survey items

Structural (impersonal configuration / network morphology)
The WC has a Transparent management structure
There are transparent relations between WC and the water authority
It is easy to cut access to non-payers
There is a transparent structure for conflict resolution
Use of irrigation water can be effectively monitored
WC guarantees transparent resource use
Relational (personal relations)
I have trust in the leader of the WC
I have trust in the management board of the WC
Cognitive (shared representation / interpretation)
Farmers have common view on irrigation management
Farmers maintain irrigation equipment for long-run use
I want to have a say in how irrigation water is delivered
I want to have a say in how irrigation equipment is maintained

Table 2: Assessment of summated scales

	Eiginvalue	% of variance explained by factor	Cronbach's alpha	Inter-item correlation
Relational social capital scale	1.658	82.7	0.789	0.658
Cognitive social capital scale	1.918	74.4	0.716	All above thresholds
Structural social capital scale	2.388	55.6	0.691	All above thresholds

Table 3: Stage 1 of Heckman Selection Model – Bootstrapped Heteroscedastic Probit Estimates

Water Community Membership Decision

(n = 249)	coefficient[1]	bootstrapped bias-corrected se[2]
index function for probability of membership (mean probability)		
Socio-economic characteristics		
hectares farmed	0.164***	0.053
proportion of land used for crops	0.002**	0.001
proportion of household income derived from farming	-0.001	0.001
proportion of household income derived from crops	1.23e-04	4.63e-04
gender of farmer	0.002	0.005
age of farmer	0.016	0.061
level of education	-0.178	0.061
Irrigation -related characteristics		
proportion of total farm area irrigated	1.832***	0.339
proportion of total farm area irrigated by sprinkler technology	-0.002	0.007
proportion of total farm area irrigated by flooding technology	1.739***	0.315
Social capital dimensions and related		
structural dimension	-0.069	0.178
relational dimension	0.072***	0.017
cognitive dimension	0.002***	4.98e-04
structural dim * age of farmer	-0.007	0.115
relational dim * age of farmer	0.336***	0.121
cognitive dim * age of farmer	-0.129**	0.064
structural dim * level of education	-0.069	0.126
relational dim * level of education	-0.321**	0.152
cognitive dim * level of education	0.132**	0.067
variance function (variability around the mean membership probability)		
Water community related random factors		
WC Istibanja	-0.224***	0.078
WC Vidovishte	-0.011	0.048
WC Orizari	-0.121***	0.009
WC Zrnovci	0.021	0.045
WC Oblesevo	0.019	0.043
WC Trkanje	-0.977***	0.064
WC Mustafino	0.002	0.047
WC Crnilishte	1.64e-04	0.054
WC Bregalnica	-0.215***	0.051
WC Cepenicko Pole	-0.031	2.214
Social capital dimensions related random factors		
Structural dimension	0.283	0.382
Relational dimension	-0.279	0.265
Cognitive dimension	0.078***	0.009
log-likelihood (LogL)	-66.798	
restricted log-likelihood (LogL0)	-83.336	
proportions P(0) / P(1)	0.104 / 0.896	

1: * - 10%-, ** - 5%-, *** - 1%-level of significance.

2: Bootstrapped and bias-corrected standard errors (based on 10,000 bootstrap replications).

Table 4: Stage 2 of Heckman Selection Model – Bootstrapped Heteroscedastic Ordered Probit

Satisfaction with Water Community Membership

(n = 249)	coefficient[1]	bootstrapped bias-corrected se[2]
index function for probability of satisfaction (mean probability)		
Socio-economic characteristics		
hectares farmed	4.89e-04	0.004
proportion of land used for crops	2.41e-04	0.001
proportion of household income derived from farming	-1.53e-04*	9.41e-05
proportion of household income derived from crops	2.04e-04**	1.02e-04
gender of farmer	7.75e-05	9.12e-04
age of farmer	4.66e-04	0.001
level of education	-4.33e-04	0.001
Irrigation-related characteristics		
proportion of total farm area irrigated	0.008*	0.004
proportion of total farm area irrigated by sprinkler technology	3.87e-04	0.001
proportion of total farm area irrigated by flooding technology	-0.286***	0.109
Water community related characteristics		
cost recovery	0.007***	0.002
costs per ha of land irrigated	0.74e-04***	0.28e-04
increase in water bill 2002 to 2004	-6.85e-05	5.87e-04
inverse mill's ratio *(membership prob estimated by model 1)*	-0.01***	9.31e-04
years since joining water community	-4.31e-04**	2.15e-04
position in the water community - president	-0.349	0.687
position in the water community - member of control board	-0.669	0.614
position in the water community - ordinary member	-1.866***	0.358
Social capital dimensions and related		
structural dimension	0.064***	0.016
relational dimension	0.072	0.083
cognitive dimension	-2.91e-04**	1.24e-04
structural dim * age of farmer	0.067*	0.038
relational dim * age of farmer	0.027	0.026
cognitive dim * age of farmer	-0.011	0.031
structural dim * level of education	-0.149***	0.061
relational dim * level of education	0.056	0.052
cognitive dim * level of education	0.007	0.032
variance function (variability around the mean satisfaction probability)		
Water community related random factors		
WC Istibanja	-0.009***	0.003
WC Vidovishte	-0.002	0.004
WC Orizari	-0.011***	0.002
WC Zrnovci	0.001	0.002
WC Oblesevo	-0.009***	0.002
WC Trkanje	4.84e-04	0.005
WC Mustafino	0.015***	0.005
WC Crnilishte	0.014***	0.004
WC Bregalnica	0.006	0.005
WC Cepenicko Pole	-0.113	1.261
Social capital related random factors		
structural dimension	-0.074	0.099
relational dimension	0.093***	0.018
cognitive dimension	0.013	0.055
threshold parameters for index function		
mu(1)	0.076**	0.032
mu(2)	0.419***	0.061
mu(3)	1.167***	0.079
mu(4)	2.485***	0.127
log-likelihood (LogL)	-372.253	
restricted log-likelihood (LogL0)	-380.261	

1: * - 10%-, ** - 5%-, *** - 1%-level of significance.

2: Bootstrapped and bias-corrected standard errors (based on 10.000 bootstrap replications).

Table 5: Estimates Bootstrapped Heteroscedastic Tobit

Change in Water Bill Payments 2002-04

(n = 249)	coefficient[1]	bootstrapped bias-corrected se[2]
index function for probability of payment increase (mean probability)		
Socio-economic characteristics		
hectares farmed	4.761*	2.631
proportion of land used for crops	0.078***	0.018
proportion of household income derived from farming	-0.011	0.016
proportion of household income derived from crops	0.038*	0.022
gender of farmer	0.019	0.031
age of farmer	-11.879***	3.785
level of education	11.496**	5.389
Irrigation-related characteristics		
proportion of total farm area irrigated	-0.029***	0.011
Water community related characteristics		
farmer's satisfaction with water community's structure & conduct *(level of satisfaction prob estimated by model 2)*	0.072***	0.011
costs per ha of land irrigated	-0.001*	1.82e-04
increase in water bill 2002 to 2004	-0.001***	2.89e-04
years since joining water community	-9.57e-05	0.013
position in the water community - president	45.469***	9.636
position in the water community - member of control board	-64.073***	7.544
position in the water community - ordinary member	-1.797	81.213
Social capital dimensions and related		
structural dimension	-5.8036	15.729
relational dimension	21.554***	10.603
cognitive dimension	0.049***	0.014
structural dim * age of farmer	-0.084	2.718
relational dim * age of farmer	1.486***	0.312
cognitive dim * age of farmer	-3.055***	1.037
structural dim * level of education	7.763**	3.603
relational dim * level of education	-3.679	4.547
cognitive dim * level of education	3.023***	1.068
variance function (variability around the mean probability of payment increase)		
Water community related random factors		
WC Istibanja	0.004**	0.002
WC Vidovishte	0.011***	0.003
WC Orizari	-0.002	0.002
WC Zrnovci	-0.001	0.002
WC Oblesevo	-0.084***	0.001
WC Trkanje	-0.079***	0.003
WC Mustafino	-6.79e-04	0.004
WC Crnilishte	-0.007***	0.002
WC Bregalnica	-0.304	5.691
WC Cepenicko Pole	-0.108	3.555
Social capital related random factors		
structural dimension	-0.154**	0.062
relational dimension	-0.052	0.075
cognitive dimension	0.016	0.068
Water community related random factors		
position in the water community - president	-1.747***	0.615
position in the water community - member of control board	-2.102**	0.882
position in the water community - ordinary member	-1.736***	0.349
years since joining water community	1.31e-04	1.99e-04
sigma	280.907***	81.832
threshold values	-100 / +100	
log-likelihood (LogL)	-1043.400	

1: * - 10%-, ** - 5%-, *** - 1%-level of significance.
2: Bootstrapped and bias-corrected standard errors (based on 10.000 bootstrap replications).

Table 6: Diagnosis and Model Specification Tests

diagnosis tests	
model I (probit)	
Wald test of model significance, $\chi^2(34)$	33.075***
McFadden Pseudo R-square (adj.)	0.844 (0.754)
McKelvey & Zavoina's R^2	0.641
R^2 Maximum Likelihood	0.439
Efron's R^2	0.423
A.I.C. / S.I.C.	0.665 / 0.891
model II (ordered probit)	
Wald test of model significance, $\chi^2(40)$	99.689***
McFadden Pseudo R-square (adj.)	0.385 (0.303)
McKelvey & Zavoina's R^2	0.680
Count R^2 (adj.)	0.649 (0.382)
A.I.C. / B.I.C.	2.879 / 3.274
model III (tobit)	
McFadden Pseudo R-square (adj.)	0.833 (0.713)
McKelvey & Zavoina's R^2	0.727
Cragg-Uhler(Nagelkerke) R^2	0.732
ANOVA based Fit Measure	24.164
A.I.C. / B.I.C.	9.628 / 641.737
Heteroscedasticity: Breusch-Pagan/Cook-Weisberg Test [probit / ordered probit / tobit] H_0: homoscedastic error	77.48*** / 325.15*** / 63.32*** (rejected in all cases)
specification tests	
LR-tests on groupwise insignificance [probit / ordered probit / tobit]	
H_0: socio-economic characteristics have no significant effect (chi2(7)) [probit / ordered probit / tobit]	
88.21*** / 10.73** / 49.10*** (rejected at 1%- or5%-level)	
H_0: irrigation technology-related characteristics have no significant effect (chi2(3)) [probit / ordered probit / tobit]	
9.62*** / 9.66*** / 8.55*** (all rejected at 1%-level)	
H_0: water community-related characteristics have no significant effect (chi2(8)) [ordered probit / tobit]	
13.91** / 83.73*** (rejected at 1%- or5%-level)	
H_0: social capital-related characteristics have no significant effect (chi2(9)) [probit / ordered probit / tobit]	
41.51*** / 80.89*** / 100.13*** (all rejected at 1%-level)	

1: * - 10%-, ** - 5%-, *** - 1%-level of significance.