The impact of social capital on willingness-to-pay for hard engineered coastal defences in south-east England

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Abstract

Globally, one of the most common approaches to protect coastal areas from flooding and erosion is to construct hard engineered defence structures. However, it is now widely acknowledged that constructing and maintaining 'hard' defences is both financially and environmentally challenging for public authorities and national governments. Here we seek to investigate the willingness of residents in rapidly eroding coastal zones facing flooding risks to contribute towards the costs of maintaining and constructing such structures. Our analysis examines the influence of social capital parameters on respondents' willingness to pay, which have been identified as influential in recent studies. Fieldwork was conducted in Romney Marsh, south-east England, a low-lying coastal area experiencing adverse impacts from sea level rise that are expected to escalate in future under current climate change projections. The study found 45.6% of respondents were willing to pay an average monthly premium of £3.53 to subsidise coastal defence expenditure. Our study demonstrates that generalised and particularised forms of trust clearly exert a positive influence on WTP, which could be used by policy actors to enhance and possibly to increase public acceptability in cases where financial contributions are likely to be requested in future from the public by government. On the other hand, the fact that social networks function in a negative way indicates that policy makers should contribute to discussion and debate in local social networks and explore how information influences citizens' perceptions positively and negatively.

Keywords: Sea defences; protest responses; trust; networks; Romney Marsh.

JEL classification: Q54; Q48.

1. Introduction

Planning policies for coastal management due to climate change impacts is a difficult and challenging task. A variety of factors should be taken into consideration when planning and implementing such policies including environmental and socio-economic issues (Halsnaes & Traerup, 2009; Mearns & Norton, 2010). This is because coastal management policies are often accompanied from significant opposition from local communities resulting to conflicts between locals and management actors (Apine, 2011; French, 2006; Roca & Villares, 2012; Roth & Warner, 2007; Myatt et al., 2003).

One way of minimizing social conflicts and increasing social acceptability of proposed coastal management policies is the investigation of social impacts and citizens'

potential reaction prior to policy implementation (Jones & Clark, 2013). This type of investigation is even more important when a financial burden on citizens is considered by policy-makers, such as a users' tax. One way of exploring such issues is to estimate the Willingness to Pay (WTP) of citizens for the maintenance and construction of defences in order to protect their property and the natural environment surrounding them. Some studies have been presented aiming to evaluate willingness to pay of citizens in the wider field of climate change mitigation (Longo et al., 2012; Solomon & Johnson, 2009).

Also, literature has been recently developed exploring WTP for making changes in homes in order to protect them from flooding and also for the estimation of insurance cover (The Consumer Council, 2013; Botzen et al., 2013). However, to our knowledge, very limited studies attempt to estimate how much citizens would be willing to pay in order to increase or reconstruct sea defences on coastal areas (e.g. Landry et al., 2011). Furthermore, apart from exploring the intention and willingness of individuals to pay, it is equally important to explore the factors that determine citizens' valuation.

The present paper aims to contribute to this discussion by exploring the WTP of individuals for the construction and maintenance of sea defences and analysing the impact of social factors, focusing mainly on social capital, on this specific evaluation. In order to examine the above issue we selected as a case study the area of Romney Marsh in South-East England. The specific area faces significant impacts from climate change which are expected to escalate in the future. In the next section we will briefly identify the main links between social capital and WTP before presenting the methods and results of our research.

2. Methods

2.1 Description of the research area

In order to investigate WTP for the construction and maintenance of sea defenses, an empirical survey through the distribution of a structured questionnaire was conducted. The area were the questionnaire was distributed was Romney Marsh (South-East England). The main reason for selecting the specific case study was because it currently faces impacts from climate change which are expected to significantly increase in the next years (Shoreline Management Plan, South Foreland to Beachy Head, 2006). Romney Marsh is a reclaimed land and the majority of it is under sea level. Due to the specific geomorphology of the area, a potential flooding incident on the coast could result to extended flooding in the marsh. For this reason, strong defenses have been built in several parts of the coast. The current management plan proposes to continue maintaining these defenses. However, in order to continue maintaining the current defenses and constructing new ones, there is a high need for further funding.

Questionnaires

The total sampling frame of the area was 22,000 households and a sample of 1000 households was selected through random sampling processes. The response rate was 16% resulting to 160 usable questionnaires. A questionnaire was created aiming to investigate citizens' perceptions on climate change, their opinion on a proposed coastal management policy and to explore certain social factors, connected mainly with trust and networks, in the area.

Specifically, on coastal management issues, a hypothetical policy was presented to respondents which is similar to the one currently applied with the only exception that citizens would have to contribute financially directly through a tax. Specifically, respondents were asked to suppose that as a community they have the following option:

to maintain the current coastal defenses and construct new ones wherever it is necessary in order to minimize the impacts from climate change. Participants were also informed that these new defenses were going to be partly funded by a new governmental tax. The WTP question was then presented asking if they would you be willing to pay an amount per month as a household through this new tax. For those respondents who replied positively, a payment card with four options was presented to them which is regarded an efficient technique to elicit reliable estimations in CVM (Blaine et al., 2005; Solomon & Johnson, 2009) (£1, £3, £5, £7). An open-ended choice was also available to respondents in case they wanted to state a different amount from the ones proposed.

Furthermore, regarding the social factors questions, four main parameters were investigated which are commonly explored in the literature: a) institutional trust, b) social trust, c) participation in social networks and d) social norms (Woolcock &Narayan, 2000; Jones et al., 2012).

2.2Data analysis

Data were analysed through the use of SPSS 21.0 statistical software. The estimated through a non-linear function WTP amount was based on three distinct samples: in the first estimation we included all WTP responses of the sample. In the second estimation we excluded those answers that we regarded as 'protest responses' retaining in the final estimation only the 'true zeroes'. Specifically, respondents who refused to pay due to financial constraints or due to low personal valuation were considered 'true zeroes' (e.g. protection from flooding is not important to them) (Afroz et al., 2009). All other justifications, such as objection to the policy or payment vehicle, were considered as protest responses. A third evaluation of WTP was based on a sample including only the positive responses on WTP.

In order to explore the influence of factors on WTP we conducted an exploratory factor analysis (EFA) to reduce dimensionality of the initial explanatory variables in the questionnaire and of which connection to the WTP is to be tested. . Specifically, EFA reduced the initial independents to a total of 7 latent constructs combining risk perceptions (RISK, Cronbach a: 0.934), benefits for the proposed policy (BENEFITS, a: 0.743), disadvantages of the proposed policy (DISADVANTAGES, a: 0.716), trust in institutions (INST TRUST, a: 0.777), trust in other people (SOCIAL TRUST, a: 0.859), participation in social networks (NETWORKS, a: 0.682) and the two questions referring to social reciprocity (SOCIAL RECIPROCITY, a: 0.884). The seven extracted factors were added to the rest of the observed items including: demographic characteristics (gender, age, educational level, income level, owner of property in the area), concern on climate change (CONCERN), how serious they consider the impacts of climate change on global (GLOBAL) and local (LOCAL) level, the level of awareness for the proposed policy (AWARE) and whether they think that this approach will protect them from flooding (PROTECT). They were all subsequently entered as predictors for the WTP estimation. Specifically, three multiple generalized linear regression models (GLMs) were utilized for the estimation of WTP based upon the three samples described previously, namely a GLM where only positive WTP responses are included in the analysis, a GLM analysis including only the "true zeros" and finally we fitted a GLM including only positive WTP responses as the dependent. GLM analysis is a suitable approach since it provides us the advantage of simultaneously including as independents both continuous and categorical variables.

3. Results

3.1 Descriptive analysis of the data

Perceptions for climate change and the proposed coastal management policy. According to the preliminary analysis of the selected sample, a mean score of 3.4 (maximum values: 5, st. dev (d.v.): 1.25) was presented regarding the level of concern for climate change. Furthermore, respondents were more concerned for the impacts of climate change in the area of Romney Marsh (mean: 3.9/5, s.d.: 1.18) compared to the impacts on global level (mean: 3.42/5). Regarding risk perceptions 'water shortage' and 'deterioration in water quality' were the two most important risks for respondents. The least important risks were 'rising temperatures' and also 'soil erosion'.

Regarding citizens' perceptions for the management policy presented to them, 51.9% of the sample declared that they are aware of it. Furthermore, the same percentage of respondents stated that they regard that this approach can protect them from flooding in the future. Finally, on a 5 point Likert scale, respondents presented a mean score of 3.6 (s.d.=0.93) for their level of agreement for the proposed policy. Concerning the benefits of the proposed policy (all measured in 5 point Likert scale with higher values representing higher importance), the most important were connected with 'protection of properties/houses' (mean: 4.49, s.d.: 0.78) and 'protection of agricultural lands' (mean: 4.33, s.d.:0.95). Lower scores were presented for 'Protecting biodiversity' (mean: 3.9, s.d.: 1.10), 'retaining public access to beach' (mean: 3.56, s.d.:1.12) and 'maintenance of recreation activities' (mean: 3.3, s.d.:1.23). Regarding the disadvantages, there were no differences between their evaluation as they all presented a similar mean score ('tax burden on citizens': mean 3.55, s.d.: 1.36; 'high maintenance cost': mean: 3.66, s.d. 1.23; 'possible biodiversity loss', mean: 3.63, s.d.: 1.15).

Social factors

Regarding the level of institutional trust, specifically for coastal management issues, the highest levels of trust were presented for the Environment Agency (mean: 5.94, s.d.: 2.71), followed by Natural England (mean: 4.66, s.d.: 2.77) and local councils (mean: 4.59, s.d.: 2.6). Lower scores were presented for the remaining institutions (European Union: mean: 2.19, s.d.: 1.64, National government: mean: 3.38, s.d.: 2.21, Local NGOs: mean: 3.75, s.d.: 2.26, DEFRA: mean: 4.43, s.d.: 2.44). All variables were measured on a 10 point Likert scale with higher values representing higher levels of trust. Regarding generalized trust a mean score of 4.63 (s.d.: 2.28) was presented. This was increased when investigating particularized trust towards neighbours (mean: 5.79, s.d.: 2.65) and people of the local community (mean: 5.67, s.d.: 2.15). When the level of trust was specified towards the local community for managing coastal management issues a mean score of 4.4 (s.d.: 2.54) was presented.

In addition, concerning fairness, the mean score for the sample was 4.99 (s.d.: 2.42). Concerning social networks, 31% of the sample declared that they are a member in at least one NGO and of these 18.4% stated that their membership is in an environmental NGO. Furthermore, 9.6% stated that they are a volunteer in at least one NGO and from these 8.9% is in an environmental NGO. 17.1% declared that they have participated in local community groups and only 4.4% have participated in some coastal defence action group in the area. Finally, regarding social reciprocity, 82.3% of the respondents declared that they believe that their neighbours will help them if their home was in danger of flooding. This percentage if increased when this help is from family and close friends (88.5%).

3.2 Willingness to Pay

Regarding the WTP question, respondents were asked to state whether they would be willing to pay an amount for the construction and maintenance of defences through a local tax which would be paid monthly by households in their area. According to the study 53.1% of the sample declared a negative answer (45.6% stated that they would be willing to pay some amount). Willingness to pay was estimated in three different ways. Initially, WTP was measured for all respondents, including all zero responses. A second estimation included only those who declared a positive answer. In a final estimation, we calculated all responses excluding protest responses. In the first case where all responses were included, the mean WTP was approximately £2/month (Table 1). By excluding protest responses this amount increases to £3.52. Finally when estimating WTP only from positive responses, this is £4.46 (Table).

Table 1: Willingness to pay

	N	Minimum	Maximum	Mean	Std. Deviation
All responses	160	0	10.00	2.01	2.69
Positive and true zeroes responses	91	0	10.00	3.53	2.71
Only positive responses	72	1.00	10.00	4.46	2.26

Econometric analysis: Factors influencing WTP through GLM regression analysis

We conducted GLM analysis in order to explore the potential factors influencing WTP. Our main focus was on social factors and also on variables measuring perceptions for coastal management issues. We estimated WTP based on three samples according to responses on WTP (GLM1: All responses, GLM2: excluding protest responses and GLM3: only positive responses). Generally, there were three variables which influenced WTP in all of the fitted models. These were the income level, how serious respondents consider the current impacts of global climate change and the aggregate measurement of risk. All these variables influenced WTP in a negative way.

More analytically, the estimated coefficient parameters for each independent variable of the three GLM derived models are shown in Table 2 along with the associated significance (p-values). Estimates for the non-statistically significant explanatory variables are not shown due to word limitations.

Table 2: Parameter estimates for the three GLM models

	GLM 1 all responses		**GLM 2 true zeros**		**GLM 3 positive responses**	
Predictor	**Parameter Estimate**	**p-value**	**Parameter Estimate**	**p-value**	**Parameter Estimate**	**p-value**
Constant	4.624	n.s.	2.388	n.s.	-2.934	n.s.
INST TRUST	1.513	0.002***	1.651	0.001***	--	--
SOCIAL TRUST	1.351	0.024**	1.151	0.019**	--	--
NETWORKS	-1.184	0.002***	-0.835	0.075*	--	--
RECIPROCITY	-21.728	0.054*	--	--	-49.966	0.003***
BENEFITS	--	--	--	--	--	--
DISADVANTAGES	--	--	--	--	--	--
RISKS	-0.903	0.085*	-1.395	0.032**	-2.371	0.037**
CONCERN Reference category: very						
Not at all	--	--	7.155	0.083*	--	--

2	--	--	1.822	n.s.	--	--
3	--	--	1.224	n.s.	--	--
4	--	--	1.562	n.s.	--	--
GLOBAL						
Reference category: very						
Not at all	-2.293	n.s.	-10.603	0.031**	-8.076	0.006***
2	-6.619	0.012**	-10.809	0.003***	-5.854	n.s.
3	-1.048	n.s.	3.942	0.042**	-4.602	0.008***
4	-2.077	n.s.	-3.184	0.033**	-2.053	n.s.
LOCAL						
Reference category: very						
Not at all	-0.326	n.s.	3.453	n.s.	--	--
2	1.338	n.s.	5.823	0.002***	--	--
3	-5.337	0.003***	-1.816	0.098*	--	--
4	-4.1	0.008***	-2.979	0.014**	--	--
AWARE						
Reference category: yes						
no	--	--	1.891	0.018**	2.603	0.005***
PROTECT						
Reference category: yes						
no	--	--	--	--	-2.737	0.057*
AGREEMENT						
Reference category: totally agree						
disagree	-3.468	0.018**	--	--	--	--
Neither agree nor disagree	-0.399	n.s.	--	--	--	--
agree	-0.855	n.s.	--	--	--	--
OWNER						
Reference category: yes						
no	--	--	--	--	6.908	0.017**
EDUCATION	--	--	--	--	-0.144	0.095*
AGE	--	--	0.063	0.049**	--	--
INCOME						
Reference category: >£70,000						
≤£12,000	0.381	n.s.	-2.563	n.s.	-5.723	0.035**
£12,001-£30,000	-0.005	n.s.	-1.665	n.s.	-3.411	n.s.
£30,001-£70,000	-3.987	0.037**	-5.022	0.001***	-6.035	<0.001***
R^2	0.785	(R^2 adjusted: 0.564)	0.954	(R^2 adjusted: 0.843)	0.977	(R^2 adjusted: 0.899)

(*) Coefficient is significant at a 10% significance level
(**) Coefficient is significant at a 5% significance level
(***) Coefficient is significant at a 1% significance level
n.s.: non-significant
Dependent Variable: Amount of willingness to pay for coastal defences

We observe from the results of Table 2 that in the first model including all respondents, in addition to the three items found statistically significant in all fitted models, the seriousness of the current impacts of climate change in Romney Marsh is also statistically significant (with a negative sign) along with the level of agreement with the proposed policy (highest level of agreement results to lower economic valuation). Furthermore, all social capital variables have a statistically significant influence on WTP. Citizens with higher levels of social (beta coefficient=1.351, p-value<0.05) and institutional trust (beta coefficient=1.513, p-value<0.01) are more willing to pay while citizens with higher involvement in social networks and higher sense of reciprocity are less willing to pay. Finally, citizens who tend to perceive lower risks are also less willing to pay based on the model where all responses are included (GLM1).

When exploring the model where only positive responses and true zeroes were included (GLM2), apart from income, seriousness of climate change impacts on global level and risk perceptions, additional factors were found to have a statistically significant effect on WTP. Specifically, how serious individuals consider the current impacts of climate change in the area of Romney Marsh is an influential factor. Furthermore, the level of awareness of the proposed approach is positively connected with WTP (individuals who know the policy are more willing to pay). Regarding social capital parameters, institutional trust and social trust are both positively associated with WTP while social networks and risk perceptions are negatively associated. Finally, age is positively associated with WTP (beta=0.063, p-value<0.05). This means that older individuals (age was measured through year of birth) are more willing to pay for the defences in the area, at least when considering the specific respondents' group.

Finally, in the last model where only the positive responses are included, apart from the three common factors mentioned above, we found additional different factors which influence WTP. Specifically, reciprocity - found to be non significant in the other two models - influences negatively WTP (beta=-49.966, p-value<0.01), accompanied also by the educational level of the participant (beta=-0.144, p-value<0.1). Furthermore, awareness of the proposed policy has a positive influence on WTP while the idea that this approach will protect them from sea level rise is connected with WTP in a negative way. Individuals who tend to think that it is not an efficient policy are WTP more money from the construction and maintenance of the defences.

As concerns model fit, the model's R^2 value including all WTP responses is 0.785 (R^2 adjusted: 0.564), whereas the fit of the other two models was found to be considerable better [GLM2 R^2: 0.954 (R^2 adjusted: 0.843); GLM3 R^2: 0.977 (R^2 adjusted: 0.899)] indicating that through the selected items we have managed to explain a large part of the variance in the answers of respondents on their WTP.

4. Conclusions

The findings of the present study are very important taking into consideration the limited funds that currently exist for the construction of sea defences. Although other type of softer mitigation and adaptation policies can be applied, in some cases the maintenance of this type of constructions is essential, due to the high value of a community concerning social, economic and environmental aspects. Consequently, it is possible that in the future, communities will be asked to contribute financially in order to be protected from climate change impacts. In the case of Romney Marsh, the average WTP was estimated to £3.53 per month. A positive influence of trust on WTP was presented which could be used by management actors in a positive way in order to increase public acceptability in case financial contribution is requested from the public.

An indicative example, is the participation in the deliberation techniques of all actors including those which are most trusted by the public (such as the EA) and at the same time those who are least trusted in order to increase the level of trust towards them (e.g. national government). On the other hand, the fact that social networks function in a negative way indicates that policy makers should investigate the information that flows on local social networks and explore which information influences citizens' perceptions in a negative way. The application of such techniques is essential in order to understand the reaction of local communities and incorporate their knowledge and opinions in policy planning processes. Such efforts would significantly increase the level of social acceptability for coastal management policies, necessitating the financial contribution of citizens.

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