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Analysis

Erosive runoff events in the European Union: Using discrete choice experiment to assess the benefits of integrated management policies when preferences are heterogeneous

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ABSTRACT

This paper assesses the value of mitigating erosive runoff events in a severely prone watershed of France using a discrete choice experiment approach. Good farming practices are integrated together with flood protection programs within a common management policy. The inclusion of risk exposure and socio-demographic variables in a random parameter logit model allows accounting for both latent and observed heterogeneity in preferences. Results show substantial benefits for each of the management alternatives valued. Results also identify that preferences significantly vary across respondents which suggests that policy makers should consider heterogeneity in preferences when designing policies for various area profiles in order to closely monitor welfare improvements.

1. Introduction

Since 1980, the occurrence and frequency of erosive runoff events, which include floods, mudslides and landslides, have increased in Europe (Souchère et al., 2003). In the European Union, the risks related to floods, mudslides and landslides are managed at two different scales. River basin district authorities are required by the EU Flood Directive 2007/60/EC (European Parliament and the Council, 2007) to set up flood protection programs that include communication plans and protective infrastructures such as dams and dykes, whereas within the Common Agricultural Policy framework farmers are required to reach a minimum level of Good Farming Practices (GFP) in order to receive farm payments and to get price supports (Baylis et al., 2008). GFP include specific measures against soil erosion and water runoff such as conversion to grassland or grass stripes. To date, no integrated management of erosive runoff events through GFP and flood protection programs has been implemented in the EU.

However, integrating uncoordinated management options into a single management policy may lead to a better allocation of resources. In a recent paper Duke et al. (2012) study the joint benefits of land preservation and conservation measures using a Discrete Choice Experiment (DCE) approach. They demonstrate through a stylized example that uncoordinated policies may be less cost-effective than integrated management policies. This is particularly relevant in the case of the management of erosive runoff events in Europe, where GFP and flood protection programs are not delivered through an integrated management policy (Dworak and Görlach, 2005). More precisely, the decision makers in charge of implementing flood protection programs are not required to consider the potential net benefits of GFP when selecting the areas where to implement dams or dikes. As a result, the chosen areas may achieve cost-effective protection against flood while GFP provide poor net benefits. The same applies for farmers who may select the areas

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where to implement GFP without considering flood protection programs. Integrating these management policies may hence lead to a better area selection and contribute to maximize benefits, as recalled by Joannon et al. (2004) according to whom only large scale projects organized by public authorities are likely to significantly reduce erosive runoff events.

In this paper, we examine the benefits of an integrated management policy that comprises GFP against erosive runoff events and flood protection programs in a French watershed using a DCE approach. We build on the methodology developed by Duke et al. (2012) and investigate the sources of heterogeneity in preferences for each of the management policies valued. More precisely, we integrate socio-demographic variables and stated erosive runoff events exposure levels in a random parameter logit model in order to account for both latent and observed heterogeneity in the preferences of the targeted population. Indeed, a given area may be well-suited for integrating GFP and flood protection program at a low-cost but may also provide poor benefits to the population area because of its socio-demographic characteristics or its indifference towards erosive runoff events. The benefits of a given policy may hence be raised if the characteristics of the area population are considered in addition to the characteristics of the area itself. As a result, the present study contributes to the literature by providing means to enhance public benefits beyond those available through integrated management regardless of the population area characteristics. It may also be helpful for benefit transfers (Duke et al., 2012). Moreover, we give richer insights into the benefits to the mitigation of erosive runoff events within the EU.

Stated preference methods have already been used to estimate the value of reducing soil erosion and runoff-related risks. Several applications of the Contingent Valuation method may be reported. A small sample of these studies includes Loomis et al. (2000) who investigated the Willingness-To-Pay (WTP) for five ecosystem services in an impaired river basin including erosion control, Colombo et al. (2003) who estimated the benefits of reducing soil erosion using buffer stripes and Holmes et al. (2004) who assessed the benefits that households would receive for a riparian restoration program of the Little Tennessee River, North Carolina. The DCE method has been used by Colombo et al. (2005) in order to estimate the benefits of reducing soil erosion and its off-site impacts which include flood risks. The attributes used in the study reflect the different "characteristics" of off-site impacts such as landscape desertification, surface and ground water quality and flora and fauna quality but the management practices to be used in order to reduce these impacts are not specified. Moreover, none of the attributes are specific to the management of floods. As stated above, the DCE method has also been used by Duke et al. (2012) who conducted a survey on WTP for three farming practices that impact water quality, carbon sequestration and soil erosion. However, measures specifically aimed at reducing flood risks were not considered. To our knowledge, there is no economic evidence on the benefits of policies designed for mitigating erosive runoff events that integrate both GFP and protection programs against erosive runoff events.

The results of our DCE show that respondents derive positive and significant benefits from the implementation of GFP specifically aimed at reducing erosive runoff events, the construction of protective infrastructure and the development of communication on flood risks, although the marginal WTP for this latter management option is found to be lower. The benefits are found to greatly vary depending on whether the area is urban or rural and how respondents state to be exposed to erosive runoff events, suggesting that various combinations of policies should be implemented among the case study watershed.

The rest of the paper is organized as follows: the survey protocol is presented in Section 2. Section 3 presents econometric results and welfare estimates. Concluding remarks and research suggestions are finally given in Section 4.

2. Survey Design

2.1. The Discrete Choice Experiment Method

DCE is nowadays a well-known valuation method. As recalled by Bennett and Blamey (2001), DCE roots in Lancaster's (1966) theory of demand according to which any good can be decomposed in a finite set of characteristics, referred to as attributes. Individuals derive utility not from the good itself, but from its attributes. DCE asks respondents to choose one management option within a set of several alternatives which are differentiated by attribute levels. In case none of the proposed alternatives would be chosen by the respondent, a status quo alternative is included. DCE is based on the random utility maximization framework (Manski, 1977; McFadden, 1974) which states that the discrete choices respondents make depend on the utility they derive from the alternatives they face: each respondent chooses the alternative whose attributes combination maximizes her/his utility. The inclusion of a monetary attribute allows to describe respondents' preferences in terms of WTP for each management option considered, thus helping the design of cost-effective policies.

DCE has been preferred over CV in order to study the trade-offs respondents make between different management measures of erosive runoff events and investigate the heterogeneity in preferences for these measures. Moreover, on the modeling side, accounting for heterogeneity in preferences requires to introduce specific interaction variables for each of the attributes considered as well as to use random parameter models. We acknowledge that some CV survey design could have also been appropriate, such as the design proposed by Nahuelhual et al. (2004). However, the design of such CV survey is very similar to a DCE design according to a recent common nomenclature for stated preference elicitation approach developed by Carson and Louviere (2011), in which both approaches are referred to as being DCE. The process of identifying relevant attributes and levels for the survey has been carried out as such: in order to provide WTP estimates that may be of direct use for the river basin district authorities, the first step consisted in consulting local decision makers. After having been introduced with the DCE methodology, local decision makers were asked whether they would prefer the attributes level to describe specific management options to reduce erosion and runoff risks or, in the contrary, broadly described management options. The second option was chosen. Indeed, local district authorities have expressed strong preferences for being provided with WTP for broadly defined management options. From the local authorities' perspective, the basic idea was to identify global preferences, so that they could choose afterwards which specific management practices have to be implemented depending on the topography, the existence of former protective infrastructures or local initiatives regarding communication about erosive runoff events. This design better reflects the fact that erosive runoff events are managed through packages of specific measures in order to be truly effective. Indeed, runoff and erosion processes are non-linear and scale dependent phenomena (Lesschen et al., 2009), which implies that the effectiveness of a given specific measure does not only depend on the measure itself but also on other measures implemented upstream and downstream of it. As a result, dikes located downstream may not be functional without the support of dams and absorbing parking located upstream. Hence, the use of broadly defined attributes better reflected the actual choice context, which is in line with the recommendation of Harrison (2007) on DCE design. Levels for the monetary attribute were also decided together with the watershed district authorities in order to propose alternatives that better reflect the actual choice context.

The second step consisted in identifying which management measures the residents of the VdC feel concerned about in order to identify the relevant attributes entering the survey. Residents have been consulted by the watershed district authorities through public surveys. Public surveys are simply public consultations that are similar to what is identified as focus groups in the field of DCE. Attributes were then tested