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Valuing cultivated land protection: A contingent valuation and choice experiment study in China

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ABSTRACT

This study is to examine the public's preferences for cultivated land protection in Wenling City of China using a dichotomous choice contingent valuation method (CVM) and a choice experiment method. An empirical comparison of the welfare measures derived from the CVM and CE was conducted. We found that the valid response rate of the CVM was higher than that of the CE, while the CE data produced a higher percentage share of supporting votes for cultivated land protection than the CVM data. The estimation results show that the mean willingness to pay from the CVM is larger than that obtained from the CE, but they are not significantly different. Our results indicate that carefully designed CVM and CE were suitable to value cultivated land protection in China. The study results can contribute to the literature on comparing the willingness to pay estimates derived from the CVM and CE and can help improve our current understandings of local public's preferences for cultivated land protection.

1. Introduction

Cultivated land is a critical resource that is indispensable to the survival and development of human beings (Liang et al., 2015). In China, the cultivated area is nearly 1.35 million km^2, accounting for approximately 13% of the national land area (Zhao et al., 2016). It plays a key and strategic role in achieving sustainable development and enhancing the food security of the country (Deng et al., 2015). However, with China's rapid economic development and urban expansion, the substantial loss of cultivated land since the 1980s has become a serious concern of the public and policymakers (Zhang et al., 2014).

Statistics have indicated that a total of approximately 222,000 ha of cultivated land was lost in China between 2009 and 2014 (National Bureau of Statistics of China, 2015). Many studies have been conducted to explore the causes of cultivated land loss and the contributing factors. Lichtenberg and Ding (2008) assessed the influence of China's farmland protection policy and concluded that China does not effectively protect its farmland. Early studies have shown that one fundamental reason for China's poor protection of cultivated land is the insignificant value of agriculture relative to other land uses (Bergstrom and Ready, 2009; Cai et al., 2006; Jin et al., 2013a; Ma and Zhang, 2014). In fact, cultivated land can generate social benefits that are not captured by ordinary markets (Johnston and Duke, 2007).

For public decision-making, the cost-benefit analysis (CBA) has appeared to be particularly promising because it is independent of the nature of relevant public policy, and it allows the establishment of simple decision rules (Arrow et al., 1996; Dachary-Bernard and Rambonilaza, 2012). From a strictly economic efficiency point of view, the CBA imposes that the calculation of the social benefit should be compared with the total cost. Thus, to design efficient policies concerning cultivated land protection, it is necessary for policymakers to find a measure for quantifying the benefit of cultivated land protection in monetary terms.

Since certain specific benefits that people derive from cultivated land protection are not fully reflected in the ordinary market, it is difficult to measure the total benefits of cultivated land protection in a typical economic analysis. Stated preference (SP) methods can create hypothetical markets to elicit people's willingness to pay (WTP) for changes in non-market goods to establish the benefits (Bateman et al., 2002). The contingent valuation method (CVM) and choice experiment (CE) are two primary means of SP methods (Carson and Louviere, 2011).

The CVM appeared as the first methodological response for non-market valuation and has become one of the most commonly used methodologies to value non-market goods in the economic literature (Carson et al., 2003). Although the CVM is widely used, it has a number of limitations (Foster and Mourato, 2003; Dachary-Bernard and Rambonilaza, 2012). For example, the CVM is not suitable in situations where multiple options and attributes are being considered (Stevens et al., 2000). For this reason, there is a need to go beyond to promote

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other valuation methods. The CE is a new non-market valuation technique for establishing the importance of a different 'attribute' in the provision of a good as well as a marginal rate of substitution among these attributes (Adamowicz et al., 1994). The inclusion of cost as an argument in the discrete choice experiment permits estimation of welfare changes from one scenario to another (Adamowicz et al., 1998).

As noted by Hanley et al. (1998), the CVM and CE share a common theoretical framework in the random utility model (Hanemann, 1984) and a common basis of empirical analysis in dependent variable econometrics (Hanley et al., 2001). Research comparing the CVM and CE has received more attention. The main objective in comparison tests is to examine the welfare estimates between the summation strategy as developed in the CE and the simultaneous valuation of the CVM (Dachary-Bernard and Rambonilaza, 2012). However, presently, there are actually few studies that compare the WTP estimates derived from the CVM and CE. Early examples include the research of Boxall et al. (1996, on recreational moose hunting in Canada), Adamowicz et al. (1998, on preserving caribou habitat in Alberta), Hanley et al. (1998, on environmentally sensitive areas in Scotland), Jin et al. (2006, on solid waste management program in Macao), Colombo et al. (2006, on soil conservation policy in Spain), Christie and Azevedo (2009, on water quality improvement in the US) and Gómez et al. (2014 on technology adoption in Chile). In the literature, no consensus exists concerning the comparability of the CVM and CE results (Lehtonen & et al., 2003). For example, Hanley et al. (1998) found that the CE values are larger than those obtained from the CVM, but they are not significantly different. Foster and Mourato (2003) found that the CE gives significantly larger results than the CVM for the more inclusive public good and significantly smaller results for the less inclusive public good.

To fully evaluate the differences between the CVM and CE, as Boxall et al. (1996) had suggested, more empirical studies comparing the CVM and CE should be explored for different goods and services to fully evaluate the differences between CVM and CE. To the best of our knowledge, the CVM and CE have never been compared with respect to cultivated land protection, especially in developing countries. Given the importance of cultivated land protection for the sustainable development of China, the comparison of the welfare estimation results of cultivated land protection derived from the two methods may offer some interesting findings. In this respect, the objective of this study is to compare the estimates of the WTP measures of cultivated land protection obtained using the CVM and CE in Wenling City, China. The application of the two methods highlights how they can be used to inform the decision-making process. Moreover, the findings of this study can add to the literature on comparing the CVM and CE estimates in the field of cultivated land protection.

2. Materials and methods

2.1. Study area

Wenling City is located on the southeast coast of Zhejiang Province where the most notable feature of rural development has been the loss and degradation of cultivated land (Skinner et al., 2001). The total area of Wenling is approximately 920 km^2. The population density of Wenling City is approximately 1288 inhabitants per square kilometer (Statistics and Census Bureau of Wenling City, 2015). It is one of the most densely populated counties in China.

In the last two decades, Wenling has experienced rapid economic growth because of the increasing rate of urbanization and industrialization. Cultivated land was thus relocated from agricultural to nonagricultural uses. The survey results of Land-Use Change in Wenling showed that the total area of available cultivated land in Wenling in 2009 was 4500 ha (13%) less than in 1996 (Jin et al., 2013b). The continued loss and degradation of cultivated land have prompted concerns regarding the sustainable development and rural planning of the City. Local government officials indicated the importance of cultivated land protection for land-use planning. To develop effective protection policies, it is important for them to know the social benefits of cultivated land protection.

2.2. Survey instrument

The survey instrument was carefully designed based on several focus group discussions and pre-test surveys. The draft questionnaire was thoroughly discussed with various groups of government officials in charge of cultivated land protection and management in Wenling City, experts on land use and management, and local residents. By means of the focus groups, we identified the best subset of cultivated land protection effects to be used as attributes. Then, the revised version of the survey was pre-tested on 100 local residents in Wenling City (40 for the CE version and 60 for the CVM version). The main purpose of this pilot survey was to evaluate the wording, extension and other survey design issues. After some corrections based on the pilot survey results, the final version of the survey was determined.

The final version of the questionnaire was structured in three sections. The first section formulated some questions on the respondents' knowledge about the benefits of cultivated land protection and their attitudes towards cultivated land protection. The second section contained the valuation scenario, the proper contingent valuation questions or the choice experiments. The respondents were first presented with a brief description of the current status regarding the cultivated land protection in Wenling City. The contingent choices/market about improved hypothetical cultivated land protection programs and the payment methods were then introduced. The last portion of the questionnaire collected some socioeconomic data regarding the respondents and their households. To avoid biasing WTP estimates and to achieve consistency, both the CVM and CE used identical formats and questions except for the valuation questions.

In the CV method, the respondents were asked to evaluate a new and improved cultivated land protection program, which mainly aims at protecting the quality and quantity of cultivated land in Wenling. Respondents were asked to indicate whether their household would voluntarily contribute to implement the program for a period of ten years. A single-bounded dichotomous question was used, which is considered to be incentive compatible (Carson and Groves, 2007). A vector of five prices was chosen for the implementation of the dichotomous choice format. Each individual randomly received one of these five bids (5, 10, 20, 40, and 60 CNY, 1 US$ approximately = 6.80 CNY) established based on the results of pilot surveys.

In the CE, the respondents were asked to choose the most preferred option from three alternatives. One was the status quo with no improvements in cultivated land protection, at no cost. The other two alternatives were improved protection programs featuring combinations of attribute levels and specific cost levels (Table 1). The attributes included were landscape, land fertility, land facility and cost, which are the same as in the CVM. The payment instrument was a household voluntary contribution for a period of ten years. We used a D-optimality

Table 1
Attributes and attribute levels in CE.

Attribute	Description	Levels
Landscape	The values of cultivated land protection.	No change, better amenity
Facility	The government will take some measures to improve land field facilities such as road and water irrigation system.	No change, better facility
Fertility	The government will take some measures to improve land fertility.	No change, better fertility
Cost	The cost for the household if the alternative was chosen (CNY/household/month).	0, 10, 30, 60