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Estimating the public's value of implementing the CO_2 emissions trading scheme in Korea

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HIGHLIGHTS

- Korea initiated the CO_2 emissions trading scheme (ETS) in January 2015.
- We assess the public's willingness to pay (WTP) for implementing the ETS.
- To this end, a contingent valuation survey of 1000 households was conducted.
- The WTP per household is estimated to be KRW 1873 (USD 1.6) per month.
- Its national value amounts to KRW 409.2 billion (USD 363.4 million) per year.

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ABSTRACT

The Korean government set out the carbon dioxide (CO_2) emissions reduction target as 30% below business-as-usual by 2020. The CO_2 emissions trading scheme (ETS) was initiated in January 2015 to meet this target. We attempt to estimate the public's value of implementing the ETS for CO_2 emissions reduction. We apply the contingent valuation (CV) method using the willingness to pay (WTP) data obtained from a national CV survey of 1000 randomly selected households. The survey was conducted via in-person interviews. Value judgments required of the respondents were within their abilities. The mean WTP to achieve the stated target of CO_2 emissions reduction using ETS is estimated to be KRW 1873 (USD 1.66) per household per month, which is statistically significant at the 1% level. The aggregate national value amounts to KRW 409.2 billion (USD 363.4 million) per year. Thus, even though Korea has no obligations to cut emissions under the Kyoto protocol, the public is willing to bear a financial burden to implement the ETS. If its cost is less than this value, implementing the ETS can be socially profitable. The results of this study can serve as a basis for further policy discussions and decisions.

1. Introduction

Korea has recently started making efforts to develop into low carbon and sustainable economy. The government announced the Framework Act on Low Carbon and Green Growth in 2010. Through the Framework Act, Korea set out the carbon dioxide (CO_2) emissions reduction target as 30% below business-as-usual (BAU) by 2020, which equates to 4% below the 2005 levels. The CO_2 reduction target includes 60% of CO_2 emitted nationally. The reduction target is clearly challenging and it needs a considerable push for abatement from the many sectors.

The Act on Allocation and Trading of Greenhouse Gas Emissions Allowance, enacted in 2012, introduced the emissions trading scheme (ETS) that will be implemented from January 2015. Although there exist several policy instruments to reduce CO_2 emissions, the government considers ETS as a key policy instrument because of its relatively lower economic costs. ETS called cap and trading ("cap" means a legal limit on the quantity of a certain chemical an economy can emit each year) is a market-based approach used to control pollution by providing economic incentives for achieving reductions in the emissions of pollutants.

ETS is considered as a cost-effective approach to abate CO_2

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emissions with optimum social costs, since it has been proven to be an economically efficient way to reduce emissions (Organization for Economic Cooperation and Development, 2011). Furthermore, ETS helps the CO_2 reduction target to be easily achieved. ETS provides a system by which a company can select a strategic option to reduce CO_2 emissions with the lowest cost. Companies can select the most optimal approach through direct or external mitigation, permits-trading, and permits-borrowing. In addition, ETS leads a shift towards a low carbon economy. For instance, the EU witnessed 0.2% reduction in CO_2 emissions, while its economy grew by 0.7% in 2008; it shows that the EU is developing into a low carbon economy with less CO_2 emissions contrary to the common knowledge.

The Korean government announced 1.687 billion KAU (Korean allowance unit equates to 1 t of CO_2) will be traded between 2015 and 2017. 1.598 billion KAU will be allocated to 525 companies, which respectively produced more than 125,000 t a year between 2011 and 2013. These companies were regarded as the biggest emitters of CO_2, producing 66% of the total emissions. The remaining allocation, 0.089 billion KAU, will be reserved to prepare for an overheating of the market.

The Federation of Korean Industries estimated the maximum damage for identified 525 entities will be KRW 12.7 trillion and sought redressive measures from the government. After comprehensive discussions between the government and the industry representatives, the corrective actions were taken to cope with the increased economic cost burden. In order to prevent the loss of business activity and to provide a boost to emissions permit trading, the government decided to provide tax benefits, financial incentives, and supportive funding. Therefore, the introduction of ETS is bounded to impose an additional public burden.

Given that the discussions on climate change or green growth policy have often focused on the costs of taking preventive action, it is necessary to consider the public's value of achieving CO_2 emissions reduction target. In the context of economics, the public's value is measured as the public's willingness to pay (WTP) for implementing the ETS (Yoo and Kwak, 2009; Kotchen et al., 2013). Contingent valuation (CV) is a widely used survey method for estimating WTP. In addition, the CV method seems to fit comfortably within the traditional concept of microeconomics, anchored squarely in individual preferences (Fisher, 1996).

Under the CV method, an appeal is made directly to citizens for evaluation of various policy options. Eventually, ordinary citizens are the ones, who bear the costs and reap the benefits of any policy option; therefore, the citizens are the most qualified either to make the decision or to have a direct influence on the decision. Public acceptance of ETS introduction is an important antecedent for soft-landing of ETS implementation in Korea. An attempt to implement ETS without strong public support can result in a failure.

Although citizens' understanding of policy details (such as costs or CO_2 reduction effectiveness) may not be essential (Rhodes et al., 2014), ETS has been recognized as a main policy instrument. The Korean government has tried to achieve CO_2 emission reduction target through trading emissions permits as well as enabling voluntary mitigation efforts. The annual mean WTP of household for cap-and-trade has been used as a basis for measuring the value of policy action (Carlsson et al., 2010; Kotchen et al., 2013).

Through the CV method, the public's WTP can be easily measured (Jang et al., 2014; Lim et al., 2014). Thus, this paper attempts to estimate the public's value of the 30% CO_2 emissions reduction policy using the CV method.

2. Methods

2.1. CV design

A stated preference method so-called CV can be employed for estimation of public's WTP (Vehkatachalam, 2004). Further, The CV estimates in this paper are based on quantitative data collected from a stated preference questionnaire survey of nationally representative sample conducted in July 2013. Under the recommendations of the National Oceanic and Atmospheric Administration's (NOAA) Panel, CV studies produce reliable estimates, which can be used as a starting point for administrative and judicial determinations (Arrow et al., 1993; Fisher, 1996). In order to enhance the validity and accuracy of estimated WTP, this survey was designed in accordance with the recommendations of the NOAA panel in following five aspects.

First, the respondents were randomly selected and 1,000 interviews were conducted by a professional polling firm. Second, this survey employed face-to-face interviews with trained interviewers in order to familiarize interviewees with the relevant issues. Third, we did not use an open-ended questionnaire, but a dichotomous choice (DC) questionnaire which has “yes” and “no” voting options. Fourth, our survey included a few other questions to help interpret how respondents' socio-economic characteristics affected their WTP. Finally, the questionnaire was pre-tested by a focus group in order to improve the understanding of the respondents and to set the range of bid amounts.

The CV method requires a contingent market setting. It is necessary to recognize the current status, specific policy instruments, and identify policy objectives in a referendum scenario. As stated earlier, the policy objectives are represented by the reduction target of 30% below BAU in 2020 and the specific policy instrument consists of CO_2 emissions cap management and trading system. In order to clearly explain the referendum scenario to the respondents, we used not only descriptive texts but also graphical descriptions as depicted in Fig. 1.

To measure the public's WTP, a suitable payment vehicle should be used. The payment vehicle in this survey was designed as income tax and value-added tax, which is included in the price of goods. This payment vehicle is appropriate for our analysis and is also familiar to the respondent. We asked each household to pay an additional tax every month for the next ten years using a DC questionnaire format.

2.2. One-and-one-half-bounded DC model

The elicitation format employed in this study is a DC question. Empirical CV studies usually apply one of the two DC questionnaire formats: the single-bounded (SB) DC model or the double-bounded (DB) DC model. While the SB DC model asks each respondent only one close-ended question, the DB DC model presents each respondent a sequence of two bids and asks the question twice. Although each model has both merits and demerits, the SB DC model has lower statistical efficiency, whereas the DB DC model can manifest a correlation between the responses to the two bids (McFadden, 1994; Bateman et al., 2001; Cooper et al., 2002).

One-and-one-half-bounded (OOHB) DC model suggested by Cooper et al. (2002), however, can reduce the potential for response bias in multiple-bound formats, such as the DB model, and can improve the efficiency. This new model should significantly reduce the risk of such a survey by moving into a bargaining setting in which the interviewer proposes a follow-up bid, and the interviewee is given two prices upfront and is informed that the exact cost is uncertain but known to be bounded by the two extreme prices. Therefore, we employ the OOHB DC model.