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A conjoint analysis of corporate preferences for the sectoral crediting mechanism: a case study of Shanxi Province in China

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ABSTRACT

It is crucial to understand corporate preferences in designing and planning new market-based instruments. Using the method of conjoint analysis, this paper evaluates corporate preferences for policy alternatives of the sectoral crediting mechanism aiming at supporting its discussions and development. Data were collected from 94 companies in all 11 prefecture-level cities of Shanxi province, China. The results confirm that companies are most concerned about three policy attributes; domestic policy instruments, the relationship with the clean developing mechanism, and the principle of Common but Differentiated Responsibilities. From the viewpoint of the Chinese businesses surveyed, the ideal policy alternative has a domestic policy instrument in which installations with voluntary targets receive tradable units, while co-existing with the clean developing mechanism, and providing opportunities to get financial and technical assistance from developed countries. Meanwhile, the coverage of the sectoral crediting mechanism could be expanded to small companies that are the most inefficient and thus have the lowest abatement costs in some sectors. The results of this study are important in light of ongoing discussions and developments of the sectoral crediting mechanism in China.

1. Introduction

The need for a new market mechanism (NMM) was defined at the Durban Climate Change Conference in 2011, which is meant to scale up mitigation activities across broad segments of the economy; may operate at sectoral and/or project level; and aims to achieve a net decrease and/or avoidance of greenhouse gas emissions (UNFCCC, 2012). Since Durban, discussions on the NMM have not reached a consensus, which largely results from the fact that it may not be possible for Parties to give their final decision on the nature of the NMM in advance of more clarity emerging under the Durban Platform for Enhanced Action (ADP) (UNFCCC, 2014). However, the new agreement of the Paris Climate Change Conference in 2015 established a new international carbon market mechanism ('Sustainable Development Mechanism') and specified some other important principles in Article 6 (UNFCCC, 2015). Some Parties (e.g. Switzerland, Mexico, Liechtenstein, Canada, Morocco, South Korea) have expressed their interest in using international credits of the NMM to achieve part of their intended nationally determined contributions (INDC) in the 2015 new agreement (Carbon Market Watch, 2015). In addition to the discussions among Parties, researchers have been discussing scaling up the existing project-based mechanisms to the sectoral level or creating a new mechanism for many years (e.g. Baron et al., 2009; Schneider and Cames, 2009; Schneider et al., 2014). Some developing countries have planned to enter into a pilot phase (e.g. Morocco, Tunisia and Mexico), which will feed into the discussions on the NMM in international negotiations. Warnecke and Fekete (2013) and Höhne et al. (2015) point out that early actions positively affect the development of market-based mechanisms and have the potential to set standards, which would provide first-mover advantages in negotiations.

One of the key factors related to the current insufficiency of climate policy in China is the lack of experience in implementing market-based instruments, particularly carbon pricing policies in order to internalize carbon emissions externalities (Liu et al., 2011). As a representative carbon pricing approach, the NMM could enhance industrial carbon mitigation in a cost-efficient manner. In

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addition to the price effects, the World Bank (2015) has already identified the relevance of NMM activities to a wide range of climate policies and strategies, including emission trading systems (ETS) and carbon tax. If the NMM activities are conducted in current non-ETS sectors, it could create readiness for an easy transition into a national ETS or even into a carbon tax in China. Moreover, given the $370 billion shortfall in 2030 needed in order to achieve peak CO_2 emissions and low carbon transformation (Amin et al., 2014), the key issue for China is to leverage low carbon investment which could be attained by piloting the NMM (NEFCO and Kfw, 2013).

The term NMM could be considered as an umbrella concept for a large-scale mechanism which enables the host country to develop tailor-made approaches at the national level to achieve a net mitigation decrease (Lehmann et al., 2014). Amongst different proposals from Parties and in the literature, a sectoral crediting mechanism (SCM) has been regarded as one of the important options (e.g. Schneider and Cames, 2009; Ecorys, 2012; Cai et al., 2012; Wehnert et al., 2013). The basis of an SCM is an approved sectoral non-binding emission target set for a certain sector. Tradable units will be issued ex-post to the host country government if emissions are subsequently reduced below the target. There will be no sanctions for the host country government if emissions are above the target due to the non-binding nature of the target. The achievement of this target largely depends on the mitigation actions of companies within the sector, which makes the acceptance of companies essential in determining the actual success of the SCM. In addition, the resistance from companies is identified as the biggest barrier to the implementation of this carbon pricing approach (Liu et al., 2015). While studies have been discussing the theoretical design of an SCM in developing countries for several years, very few studies have been conducted to clarify the opinions of companies so far.

Aiming to close this extant research gap, this paper uses the method of conjoint analysis to assess corporate preferences over the selected attributes of the SCM. Shanxi province was selected due to its position as a heavily industrialized region in China. The specific objectives of this study are to: (i) identify specific sets of attributes and attribute levels to characterize the SCM; (ii) assess the relative importance of different attributes in conditioning corporate preferences; (iii) evaluate corporate preferences towards policy alternatives of the SCM; (iv) develop policy implications for the design of the SCM.

The paper is organized as follows. Section 2 explains the theoretical basis of the conjoint analysis and the empirical model used in this survey. Section 3 describes the conjoint survey design, questionnaire development and data collection. Section 4 summarizes the results and conclusions, and policy implications are presented in Section 5.

2. Theoretical basis and empirical model

2.1. Theoretical basis of the conjoint analysis

This study uses conjoint analysis to evaluate corporate preferences for an identified set of attributes of the SCM in China. The term ‘conjoint analysis’ refers to an overall approach and group of quantitative techniques that can be used to determine respondent preferences for attributes that make up a product or service, in which the total worth of a product is determined by the part-worths of its attributes (Sayadi et al., 2005). This approach stems from an important hypothesis that the utility of a product or service can be broken into part-worths relating to the different attributes of that product or service (Lancaster, 1966). Therefore, conjoint analysis allows product or service attributes to be considered jointly rather than in isolation, thus enabling trade-offs to be made among attributes. As a traditional consumer research method, the conjoint analysis approach has been widely used in the fields of marketing, transportation and health care, where it has been used to understand respondent preferences for products and services (e.g. Cattin and Wittink, 1982; Luce, 1996; Daniels and Hensher, 2000). Recently, the number of application of the conjoint analysis in environmental policy introduction and design has started to grow (e.g. Huh et al., 2014; Alcon et al., 2014; Cleland et al., 2015). Liu et al. (2015) and Gevrek and Uyduranoglu (2015) respectively explored the corporate and public preferences for carbon tax attributes in China and Turkey using conjoint analysis.

The implementation of conjoint analysis involves four steps. The first step is to define the attributes and their levels. Identifying appropriate attributes and their levels is important for conjoint analysis, which is helpful to mimic the real decision context with a view to elicit the true preferences of the respondents. Only a limited number of key attributes were considered since including too many attributes generates a large number of policy alternatives, which would make the survey cumbersome for the respondents and difficult for implementation (Liu et al., 2015). Pilot surveys could be used to test the trade-offs between the possibility of omitted variable bias, task complexity and cognitive burden placed on respondents (Schkade and Payne, 1994). The second step is to design the policy alternatives, which is concerned with how to create the policy alternatives in an efficient way (Alpízar et al., 2003). A full factorial design would allow for the estimation of main and interaction effects independently, but this would also generate a large number of policy alternatives, and hence be a burden to the respondents. Therefore, a fractional factorial design is usually used. The third step is the questionnaire development. During a typical conjoint analysis study, the questionnaire usually requires respondents to rate or rank policy alternatives generated by the fractional factorial design. Previous studies have shown that rating and ranking policy alternatives would produce similar results (Boyle et al., 2001). Rating scales are used in this study as it can express the intensity of the preference (Gustafsson et al., 2013), while also being more convenient for respondents. Data collection is the last step. A pilot survey is necessary to test the presentation and comprehension of the questionnaire, and identify the appropriate answer formats. During the field survey itself, it is necessary to explain the possible effects of different attributes and their levels to the respondents in order to get valid evaluations.

2.2. Empirical model

The scales used by respondents for evaluating the policy alternatives can be divided into metric and non-metric variants (Green and Krieger, 1993). A metric scale level is assumed for rating scales, and a non-metric scale level for ranking scales. In this study, companies were asked to rate each policy alternative on a five-Likert scale in terms of the likelihood of their acceptance (1-completely unacceptable, 2-hardly acceptable, 3-moderate acceptance, 4-relatively acceptable, 5-fully acceptable). Consequently, we choose to use a metric estimation method. As a typical metric estimation method, the ordinary least squares (OLS) method is used most frequently in conjoint studies as it is easy to apply and commonly available (Wittink et al., 1994). The use of this method presumes that the rating scale satisfies the numerical property associated with interval scales, that is, the individual respondent is able to use rating scales to provide meaningful differences between policy alternatives, and the units of the rating scales shows equal differences (Louviere et al., 2005). In general, the rating scale used in the conjoint analysis is ordinal and whether the units of the rating scales satisfy equal differences is uncertain. However, previous literature indicates that the Likert scale of five or more classes

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