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Incentives for waste cooking oil collection in South Korea: A contingent valuation approach

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ABSTRACT

This study examines Korean households' participation in waste cooking oil (WCO) collection when an incentive is provided, which has rarely been discussed in the existing literature. Using the contingent valuation method, we examine three issues. First, we investigate factors that can potentially increase participation in WCO collection, revealing that the collection system, expenditures on cooking oil, incentive levels, and the number of family members affect respondents' participation in WCO collection. Second, we analyze the incentive level required to attract Korean households to participate in WCO collection. This level is approximated as the willingness to accept (WTA) the utility losses engendered by participation. The mean WTA value under a drop-off system is KRW 772 (USD 0.70) per liter of WCO, whereas the mean WTA under a curbside system is KRW 546 (USD 0.21) per liter. Finally, we consider the potential effects of providing an incentive for participation in WCO collection and show that this would be likely to increase WCO collection from households but would not significantly contribute to an increase in the volume of domestic feedstock for biodiesel.

1. Introduction

1.1. Overview

Waste cooking oil (WCO) has been a major feedstock for the biodiesel industry in South Korea (hereafter Korea). The Korean government is considering providing positive incentives to enhance the WCO collection participation rate of households. Before such a policy can be implemented, the government must be able to specify the appropriate incentive level and the systems and effects of incentive provision. Motivated by this necessity, this study investigates Korean households' perceptions of WCO collection and recycling. This study uses contingent valuation (CV), which is the most commonly applied method for examining public perceptions. Despite some criticism of this method, it is recognized that CV generally produces reliable and precise results because it is easily applicable and consistent with microeconomic theory (Bergstrom and Randall, 2010; Kim and Kim, 2015).

We examine three aspects of public perception of WCO collection, in particular. First, we investigate the factors that can improve participation in WCO collection, including socio-economic factors, awareness, and collection systems. Specifically, we compare a drop-off system in which WCO is collected from central locations in towns, such as supermarkets and religious facilities, with a curbside system in which local recyclers collect WCO through door-to-door visits. We then analyze average incentive levels, approximated by the willingness to accept (WTA) required to attract household participation in WCO collection and whether the incentives are appropriate, given the current WCO market price. We compare the level of WTA for a drop-off system with that for a curbside system. Finally, we calculate the effect of providing such an incentive, measured by the maximum amount of WCO collected in each case of incentive provision.

The contributions of this study are twofold. First, to the best of our knowledge, this study is the first to examine public perception of WCO collection in terms of opportunity cost. Such perceptions have seldom been investigated because most countries have limited interest in WCO collection, and policies regarding WCO recycling for biodiesel production are at a nascent stage. A notable exception is Ho et al.'s (2014) study that conducted a survey of WCO

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suppliers, WCO producers, and the potential users of biodiesel to identify the barriers and obstacles to WCO biodiesel production. However, the authors considered WCO collection from food and beverage operation companies and not from the residential sector. Applying game theory, Zhang et al. (2014) investigated the incentive effects of four subsidy modes on WCO supply for biodiesel production, that is, preferential tax treatment, feedstock subsidy, sales subsidy, and investment subsidy. They derived the subsidy mode that has the greatest impact on biofuel producers' profits, but did not consider unique policy problems concerning WCO collection. Otherwise, most prior research has investigated public perceptions of municipal solid waste (MSW) collection and recycling (Ajzen, 1991; Basili et al., 2006; Gillespie and Bennett, 2011; Jones et al., 2010; Keramitsoglou and Tsagarakis, 2013; Matsumoto, 2011; Nixon and Saphores, 2007; Tiller et al., 1997).

Second, we use WTA as the measure for waste collection instead of WTP. Most authors have analyzed the public's WTP for MSW collection systems using stated preference methods such CV and conjoint analysis. Except for Basili et al. (2006), previous studies have focused only on valuing the environmental benefits of waste collection and recycling from the public's perspective; little attention has been paid to the accompanying opportunity cost. However, the Korean public has been participating in MSW collection for several years, and most Korean households have disposed of WCO by wiping it up, which does not place a large burden on the environment (KEEI, 2011). It seems unlikely, therefore, that the utility gains from WCO collection would exceed the associated utility losses. For these reasons, we focus on the opportunity cost of WCO collection and select WTA as the measure instead of WTP.

The remainder of the paper is organized as follows. Section 1.2 presents the current status of WCO collection and recycling in Korea. Section 2 discusses our theoretical approach to measuring WTA for WCO collection and our questionnaire design. Section 3 describes the CV data, such as the basic information collected from the survey and responses to the value-eliciting questions. Section 4 presents the WTA estimation results and discusses the policy implications of providing incentives for WCO collection. Finally, Section 5 concludes the study.

1.2. Current status of WCO collection and recycling in Korea

The Korean government has promoted the use of biodiesel since 2002. The promotion of biodiesel was expected to provide three benefits: reduced greenhouse gas emissions, enhanced energy security, and improved air quality. Contrary to the government's expectations, however, biodiesel promotion has not contributed to enhancing Korean energy security because over 60% of the feedstock for biodiesel has been obtained from imported vegetable oils (KBEA, 2013). To examine the potential for cultivating biodiesel crops domestically, the Korean government launched a pilot cultivation project of canola, a key biodiesel crop, from 2007 to 2010 (MAFRA, 2011). However, this pilot project failed because of low productivity and economic infeasibility, revealing that Korea's inappropriate soil and weather conditions render it much less competitive than other countries in cultivating biodiesel crops. After this failure, the government has promoted biodiesel more passively. For example, although the government initially announced that fuel blends that include 3% biodiesel would be compulsory from 2012 (KEEI and MOTIE, 2008), this target was later lowered to 2% based both on the high price and the insufficient supply of domestic feedstock for biodiesel (MOTIE, 2010).

WCO has been proposed as an alternative feedstock for biodiesel in Korea. As shown in Fig. 1, WCO accounts for the majority of the domestic materials used in biodiesel, with its share gradually increasing from 26% to 31% over the last seven years. The sources of WCO in Korea are categorized as residential, restaurant business,

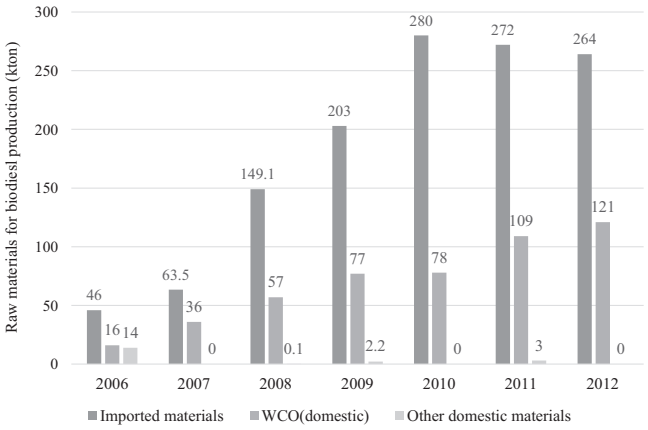

Fig. 1. Biodiesel feedstock in South Korea (2006–2012).
Source: Korea Bio-energy Association (http://www.kbea.or.kr).

and institutional food service sectors.[4] Because there are no official statistics for both the WCO feedstock amount and the WCO collection rate by sector, the only reliable reference is KEEI (2011), which approximates those statistics based on a literature review and survey. According to KEEI (2011), the annual WCO feedstock amount is 239,375 ton from the institutional food service center, 94,960 ton from restaurant business, and 11,926–77,459 ton from the residential sector.[5] The WCO collection rate is 78.6% from restaurant businesses and 98% from institutional food services but a mere 18.6% from the residential sector. Thus, the residential sector is a promising source of WCO feedstock although the WCO feedstock amount from the residential sector is small and variable. It is hence necessary to increase the WCO collection rate in the residential sector to procure a larger quantity of domestic feedstock for biodiesel production.

Currently, the policies concerning WCO collection from Korean households are based on "command and control" instruments. The government has legally designated WCO as a recyclable resource and has mandated that it must be collected separately from other recyclables (ME, 2011). Households are required to dispose of WCO in garbage cans near their residences; these cans are later collected by authorized local recyclers who resell the collected oil to biodiesel producers.[6] However, it is difficult to fine households for not recycling WCO because it is almost impossible for the government to monitor the WCO disposal of households. Korean households pour WCO down the drain or absorb it with paper rubbish and such disposal methods render the monitoring of WCO recycling difficult. Local recyclers have avoided collecting WCO from households because the amounts are too small to ensure profits.[7] Thus, WCO collection policies have not yielded significant results. The government is, therefore, considering the provision of positive incentives (Jones et al., 2010) to households to encourage participation in WCO collection.

[4] The food manufacturing sector is excluded as a source of WCO because it rarely produces WCO owing to recent changes in manufacturing processes.

[5] KEEI (2011) derived the range of the WCO feedstock amount in the residential sector by reviewing its own survey results, Kim et al. (2007) and KZWMN (2009). The great variation in the WCO feedstock amount in the residential sector results from differences in the WCO generation rate by literature.

[6] Local recyclers can sell collected WCO to refining companies, which eventually sell the refined WCO to biodiesel producers.

[7] Thus, these garbage cans containing WCO collected from households may not be delivered to biodiesel producers. In Korea, there is no official data on the share of WCO collected from households.