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Inconvenience cost of waste disposal behavior in South Korea

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ABSTRACT

Pro-environmental activities, such as waste sorting, are considered inconveniencing; the higher the inconvenience, the more difficult it becomes to encourage active public participation. This study defines waste sorting behavior considering certain attributes and estimates the inconvenience costs associated with each attribute. The definition also considers how and when waste is disposed of as well as the hygiene of a disposal spot. We apply a conjoint analysis for data collection and latent class logit model to calculate the inconvenience costs. The model incorporates consumers' heterogeneity as a finite number of homogenous groups. The results show that the inconvenience cost for the hygiene of the disposal spot is generally higher than that of sorting itself; this tendency is strongest among young women. Moreover, older people report lower inconvenience costs than do younger ones. Further, some groups prefer manual sorting to an automated sorting service for food waste. Our findings offer policy implications considering such inconvenience costs.

1. Introduction

1.1. Context

Environmental problems, such as air pollution and growing waste burdens, have become increasingly serious issues in the 21st-century global society, and can be attributed to the growing global population and lack of environmental regulations in developing countries. Global solid waste generation in 2010 was 3.5 million tonnes per day, and this amount is expected to triple by 2100 (World Bank, 2013). Therefore, governments, non-governmental organizations, businesses, and academic societies worldwide are shifting focus to "sustainable development," which refers to achieving economic development, while preserving the environment (Giddings et al., 2002; Griggs et al., 2013; Hopwood et al., 2005; Lele, 1991; Pearce and Warford, 1993; Pearce et al., 2013; Redclift, 2005; Smit and Pilifosova, 2003). Businesses and governments play a key role in the successful achievement of sustainable development by, for example, producing environmentally friendly products (Welford, 2013) and designing pro-environment regulations and policies; nevertheless, this does not discount the importance of consumers' pro-environmental behavior (Korea Environment Institute [KEI], 2015a).

However, pro-environmental behavior is not widely practiced because it is generally considered an inconvenience. Thus, to promote this behavior among consumers, we need to lower the resultant inconvenience costs (Turaga et al., 2010), which is the monetary representation of the inconvenience experienced by a consumer when performing a given action. Inconvenience costs can be reduced by implementing the appropriate policies and systems. To design such policies or systems, it is important to understand the inconvenience costs associated with each pro-environmental behavior attribute. This study aims to investigate the inconvenience costs incurred by waste sorting in South Korea. Although South Korea is the most successful country in terms of recycling, achieving the highest (around 60%) global recycling ratio for municipal waste generated in 2014 (Organisation for Economic Co-operation and Development [OECD], 2016), there are still problems and room for improvement.

However, the lack of quantitative data on the extent of inconvenience consumers experienced for each attribute of waste sorting behavior hinders the effective designing of new policies that can promote people's participation and guide them in appropriately sorting waste. This study attempts to assign a monetary value to the inconvenience generated from waste sorting behavior and contribute to a more specific and reasonable policy design, such as related regulations and budget allocations. To do so, we divide waste sorting behavior into six attributes. In this study, waste sorting behavior is the whole procedure of sorting, transporting, and disposing of waste. Each step consists of sorting waste into three broad categories—general waste, food waste, and recyclables—as well as further segregating recyclables into eight categories (sort), transporting them to a designated disposal spot (transport), and appropriately disposing of them at a disposal spot (dispose). The six attributes selected account for various attributes other than sorting, such as associated costs, disposal method and time, and hygiene of the disposal spot. We adopt a latent class model (LCM)

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that considers respondents' heterogeneity and offer implications corresponding to inconvenience costs by group.

1.2. Status Quo of South Korea's Waste Disposal System

For some countries, each household makes its own contract with one of the existing waste disposal companies. However, in South Korea, individual households do not have a choice in their waste disposal plan, and they have to abide by the existing rules. If the discharger violates these rules, he/she incurs a fine of $100–$300 (Korea Ministry of Environment [KME], 2013). Fig. 1 illustrates Korea's municipal solid waste disposal system. First, the discharger must sort waste into three categories: general waste, food waste, and recyclables. Then, general and food waste[1] must be placed in volume-rate garbage disposal bags, and recyclables are further segregated into eight categories: paper, clothing, plastic, cans, glass, scrap metal, vinyl, and styrofoam. These wastes should then be disposed of at their designated disposal spots.

Disposal sites are usually designated at the roadside near the building in which the household resides and, after each household places their waste in these spots after sunset on disposal day, professional companies designated by the local government collect it late at night. Since disposal spots are designated near residential areas, problems relating to the hygiene of the spot can be crucial. According to our survey, 20% of our respondents stated that the unclean disposal spot is the most inconvenient factor in waste disposal behavior. Finally, the disposal date and time differ slightly, depending on the local government, but normally, the household can dispose of its waste on two or three designated days per week. Since each household does not individually make a contract with the waste disposal company, its expenditure for waste disposal occurs when buying volume-based waste disposal bags. The average expenditure of each household was, according to our survey, 10,947 KRW (9.26 USD[2]) in 2015.

The sophisticated and strict discharging system has dramatically changed South Korea's waste treatment structure since the 1990s. In fact, the nation recently reported the highest (around 60%) global recycling ratio for municipal waste generated (OECD, 2016). However, despite its success, the system presents certain problems; for example, recyclables are still disposed of as general waste. According to the Fourth National Waste Statistical Survey (KME, 2013), the amount of waste generated per person on a daily basis during 2011–2012 was 940 g, which is about 8.2% higher than that of the previous survey results (2006–2007). Notably, general waste disposed of in volume-based garbage bags increased by 47.7%, whereas food waste and recyclables collected decreased by 6.5% and 2.1%, respectively. According to a component analysis for collected general waste, over 70% was recyclables, including paper (41%), plastic (24.3%), metal (2.6%), and glass (2.5%). This means that a majority of recyclables are being disposed of as general waste. Although some local governments re-sort such general waste, this additional procedure incurs high costs.

Nevertheless, according to the 2015 National Environmental Consciousness Survey conducted by the KEI (2015b), 22.5% of total respondents considered the increasing waste levels as the most serious environmental problem. Moreover, when asked about the main responsible agents for environmental pollution among general consumers, businesses, and governments, 41.7% answered that general consumers are the most responsible agents. Thus, Korean consumers consider waste a serious problem and believe that necessary measures should be taken by themselves.

[1] In the case of food waste, some local governments do not use volume-rate disposal bags and, instead, use a food waste collection box in the designated disposal spots. In our survey, 46.4% of the respondents used volume-rate disposal bags and 48.7% used a collection box. Either way, the sorting must be done before disposal.

[2] 1 USD = 1182.02 KRW (average of August and September 2015).

2. Literature Review

As the waste issue raises a serious global problem, many studies concerning waste management are being actively conducted from various viewpoints. First, some studies have analyzed the social and economic impact of recycling policies. León et al. (2016) conducted a study on the selection of the waste landfill site and its economic impact; the study claims that, rather than policy selecting the landfill site far away from the densely populated area, policy promoting each household's recycling ratio is environmentally and economically more effective. Huhtala (1999) used the contingent valuation method (CVM) with a carefully designed questionnaire for the policy option of incinerating and recycling waste in the Helsinki region of Finland. The results suggest that respondents show a willingness to pay (WTP) of 14 USD/month for the recycling option, which is higher than that of the incineration option (12 USD/month). Calabro (2009) showed that waste sorting could provide positive effects for reducing greenhouse gas emissions, especially recycling plastics. Other policy-related studies, such as a case study on curbside collection policy (Wilson and Williams, 2007) and cost-benefit analysis on recycling policies (Bohm et al., 2010; Husaini et al., 2007), have also been conducted.

In addition, many studies concerning waste sorting behavior have focused on revealing the factors that affect participation in waste sorting. Specifically, Lee and Paik (2011) analyzed the factors affecting waste sorting behavior, and showed that environmental attitude, age, and income significantly affected this behavior. Many other studies have considered various factors, such as the existence of related regulation (Jenkins et al., 2003; Sidique et al., 2010), environmental attitudes and norms (Chan, 1998; Hage et al., 2009; Tonglet et al., 2004), and the government's promotion and education (Sidique et al., 2010; Chan, 1998), to investigate the factors affecting waste sorting participation.

Next, some studies have estimated the inconvenience cost of waste sorting. The estimation of the inconvenience cost of pro-environmental behavior is being pursued in various fields, such as transferring in subway systems (Guo and Wilson, 2011), transferring by bicycle (Cheng and Liu, 2012), introducing a packaging method that produces less waste (Aydinliyim and Pangburn, 2012), and using environmentally friendly vehicles (Kang and Recker, 2009).

For waste sorting, Ishikawa (2001) conducted theoretical research on the inconvenience cost of waste sorting, considering consumers' inconvenience cost in dividing the treatment cost between the local government and each household. For the empirical research, most of the previous studies have used the CVM for estimation. Bartelings and Sterner (1999) used the CVM method and estimated the inconvenience cost of waste sorting in Sweden as 38 USD/year, while Bruvoll et al. (2002) used a similar method and arrived at a value of 20 USD/year for Norway. Berglund (2006) analyzed the difference in WTP for waste sorting services according to respondents' personal motives in Denmark, while Huhtala (2010) did so using household income in Finland. Further, Yuan and Yabe (2014) explored WTP for household kitchen waste separation services in China, and show that 16.4% refused the service (WTP = 0), and those that did not were willing to pay 17 USD/year.

Although the CVM is a widely accepted method because of its effectiveness in valuing hypothetical scenarios, it cannot estimate the inconvenience costs generated from each part of the waste sorting behavior. Thus, we adopt the choice experiment method and divide waste sorting behavior into a finite number of attributes to calculate the WTP for each attribute. Few studies in the literature have actively used this method. For instance, Boyer (2006) conducted a choice experiment to analyze preferences regarding garbage disposal and recycling services in Stillwater, Oklahoma, considering the collection cycles for general waste, recyclables, yard waste, an additional fee for waste exceeding a certain threshold, and a base fee. Karousakis and Birol (2008) analyzed preferences regarding curbside recycling services in London and considered