Waste Management xxx (2018) xxx–xxx

Contents lists available at ScienceDirect

Waste Management

journal homepage: www.elsevier.com/locate/wasman

Factors influencing the recycling rate under the volume-based waste fee system in South Korea

Seejeen Park

Department of Public Administration, Kwangwoon University, Seoul, South Korea

ARTICLE INFO

Article history:
Received 26 August 2017
Revised 30 November 2017
Accepted 3 January 2018
Available online xxxx

Keywords:
Municipal solid waste
Waste recycling
Volume-based waste fee
Unit-pricing

ABSTRACT

Since the early 2000s, the Republic of Korea (South Korea) has maintained its top-rank status for its municipal solid waste (MSW) recycling rate among OECD (Organization for Economic Cooperation and Development) member countries. The volume-based waste fee system (VWF) has been considered to be the major factor contributing to the high recycling performance, and extant research has verified the positive relationship between VWF adoption and the MSW recycling rate. Nevertheless, there exists a gap in the literature, as past research has focused more on testing the positive effects of VWF rather than on investigating the determinants of recycling rates after the adoption of VWF. The current study seeks to address this gap by investigating the various factors that affect recycling rates under the VWF system. More specifically, using data from 16 regions in South Korea over a period of 11 years, this study empirically tests the effects of VWF pricing, the citizen cost burden ratio for the VWF system, and pro-environmental behavior related to VWF on the recycling rate. The findings indicate that economic incentives such as cost savings on VWF plastic bag purchases and reduced burden from paying VWF expenses result in higher recycling rates. The findings also demonstrate that pro-environmental behavior in the VWF context positively affects the recycling rate.

1. Introduction

Since the early 2000s, the Republic of Korea (South Korea) has maintained its top-rank status for its municipal solid waste (MSW) recycling rate among OECD (Organization for Economic Cooperation and Development) member countries. The most recent 2014 OECD MSW data show that the MSW recycling rates of the top-three countries were 58.1% (South Korea), 47.6% (Germany), and 33.8% (Belgium); thus, South Korea exhibits an outstanding MSW recycling rate even among the top-tier members (OECD, 2017). The OECD data also reveal that in 2014, the average OECD MSW recycling rate was 25%. The factors that contribute to such a high recycling rate may vary, but the Ministry of Environment (MOE) of South Korea officially states that, "the most notable aspect of Korean waste management policy is without question the volume-based waste fee system (VWF)" (MOE, 2011, p. 15). Extant research has sought to test the success of VWF, which was implemented nationally in 1995, and has found that VWF did have a positive influence on increasing MSW recycling rates (Jeong et al., 2007; Lee and Paik, 2011; Park and Lah, 2015). Nevertheless, there exists a gap in the literature, as past research has focused more on testing the positive effects of VWF rather than on investigating the determinants of recycling rate after the adoption of VWF. The current study seeks to address this gap by investigating the various factors that affect recycling rates under the VWF system.

First, the current study briefly reviews past research in MSW management. Second, it explains the basic concept of VWF and related research in South Korea. Third, hypotheses are presented. Fourth, using time-series cross-sectional (TSCS) MSW data on 16 high-level government regions from CY 2005 to CY 2015, the current study empirically tests the effects of VWF pricing, citizens' cost burden ratio for VWF system management, and pro-environmental behavior related to VWF on recycling rates over time. Last, implications for future VWF research and practice are offered.

1.1. Literature review on household MSW recycling

Past research on household MSW recycling pertaining to the common goal of increasing rates can be categorized into three main streams. The first stream is related to MSW management policies that can improve recycling performance. This stream of research is interested in finding policy options that can increase recycling by providing economic incentives for recycling or by providing convenient MSW collection and recycling services. Popular research topics have included the success of VWF or unit pricing

E-mail address: sjpnpm@gmail.com

https://doi.org/10.1016/j.wasman.2018.01.008
0956-053X/

systems (Gellynck et al., 2011; Lu et al., 2006; Miranda and Aldy, 1998; Park and Lah, 2015; Sakai et al., 2008), positive effects of curbside recycling on recycling rates (Dormina and Koch, 2002; Everett and Peirce, 1993; Gamba and Oskamp, 1994; US GAO, 2006), weight-based fee systems (Bartelings and Sterner, 1999; Dahlén and Lagerkvist, 2010), and the existence of recycled product markets as a financial incentive for recycling (Park and Berry, 2013).

The second stream of research is related to recycling behavior as a product of pro-environmental attitudes. Today, pro-environmental behaviors such as recycling have become social norms; thus, the contemporary environmental behavior literature argues that social and environmental values affect the individual's behavioral intention, which results in actual behavior (Barr and Gilg, 2007; Wray-Lake et al., 2010). Therefore, it can be assumed that if the social values of a nation or a region includes compliance with public environmental goals such as recycling, it is likely that individuals in such a society will be morally obligated and motivated to follow such values. Studies interested in pro-environmental behavior have sought to investigate the relationship between pro-environmental behavior and recycling. Examples of such studies include using mass communication to promote the pro-environmental behavior of recycling (Chan, 1998), identifying the determinants of recycling as a household pro-environmental behavior (Tonglet et al., 2004), using government-issued environmental protection vehicle license plate revenue as a proxy for measuring the pro-environmental behaviors of citizens in a MSW recycling context (Park and Berry, 2013), and examining the relationship between environmental concerns and recycling (Schultz and Oskamp, 1996). As most research has indicated a positive relationship between pro-environmental behavior and recycling, some argue that public education on recycling delivered through mass media including web sites, television commercials, and advertisements on public transportation may be a useful option (US GAO, 2006).

The third stream of research is related to identifying the various demographic characteristics of individuals that may affect recycling behaviors. In general, wealth and education have been regarded as factors that strongly determine individual recycling decisions. Several studies emphasizing the positive relationship between income and recycling behavior argue that as older and wealthier individuals already participate more in recycling, education and advertisements should be targeted more toward younger generations and low-income families (Lee and Paik, 2011; Morgan and Hughes, 2006). A study by Miranda and Aldy (1998) conducted in 9 communities in different states in the U.S. found that government officials involved with MSW management in those communities believed that educational efforts within the communities had led to increases in recycling program (e.g., source reduction, curbside recycling) compliance and recycling rates.

1.2. The effect of the VWF system on the MSW recycling rate in South Korea

Variable charging (VC) programs, including Pay-As-You-Throw (PAYT) and VWF, have been well-recognized for their effects on reducing MSW as well as increasing recycling (Miranda et al., 1994; Nazari et al., 2017). For example, Yamakawa and Ueta (2002), examining the sustainability of the waste reduction effects of VC in Japanese municipalities during the period of CY 1985, 1990 and 1995, found that the waste reduction resulting from implementing VC lasted more than 10 years on average. Skumatz (2008, p. 2782), based on the work of the author conducted over the past two decades, posited that PAYT programs in U.S. communities "decrease residential MSW disposal by approximately 17%, with approximately 8–11% being diverted directly to recycling and yard waste programs, and another 6% decreased by source reduction efforts". However, research on the VWF system adopted since 1995 in South Korea has focused on examining the effects of VWF on recycling performance rather than on source reduction. In fact, Park and Lah (2015) found that from CY 1995 to CY 2012, the MSW generated in Korea increased from 47,774 tons per day to 48,990 tons per day, while the recycled MSW increased from 11,306 tons per day to 28,951 tons per day. At the same time, the recycling rate increased from 23.7% in CY 1995 to 59.1% in CY 2012.

Before 1995, MSW disposal fees were charged based on either household property tax level or building size (Kim, 2002). The volume-based fee system was established in 1995 based on the "polluter-pays" principle and has been implemented nationally to all jurisdictions without exception since then (MOE, 2015) (see Park and Lah, 2015, for a comprehensive review of VWF adoption). MOE (2011, p.16) describes the basic process of VWF for households as follows: (1) households must purchase government-issued plastic waste disposal bags from designated stores at the price set by the local governments, (2) households can fill the bags and leave them in designated areas (e.g., containers, curbside) to be collected by the local government or by contractors, and (3) all recyclables (e.g., plastic, glass bottles, paper) are to be placed in containers or separate receptacles in residential areas for free collection by the government. Therefore, households are incentivized to reduce waste and recycle more as a way of saving on the cost of buying VWF plastic bags (Park and Lah, 2015).

The consensus of extant research is that the adoption of VWF positively affected MSW recycling rates in Korea (Hong, 1999; Kim, 2002; Lee and Paik, 2011; MOE, 2011; Park and Lah, 2015). For example, Park and Lah (2015) conducted a segmented linear regression from CY 1986 to CY 2012 to investigate the policy adoption effect of VWF in 1995. The authors found that the increase in the national recycling rate was approximately 1.9% both before and after VWF, though the recycling rate increased by 6.8% temporarily within the year of VWF adoption, meaning that VWF did have an instant impact on recycling rates, but soon regressed back to the constant rate of increase of 1.9%.

Despite numerous studies supporting the success of VWF, in a majority of these studies, VWF has been treated as an independent variable affecting recycling; thus, only few studies have sought to examine the determinants of such constant increases in recycling rates after the adoption of VWF. Moreover, most of these studies focused on the VWF pricing effect, but even within this limited research, the studies showed mixed results. For instance, a study by Hong (2001) examining the implementation of VWF from 1995 to 1997 revealed that there was no significant relationship between VWF plastic bag price and MSW recycling; rather, the study claimed that an increase in disposal fees may motivate households to illegally dump waste. However, Hong's total time period for the analysis was only three years, which is a short period of time to assess the potential effects of price changes. A later study by Kim (2002) also argued that an increase in VWF bag price may motivate households to illegally dump waste rather than increase recycling (Kim, 2002). Other research revealed differing possible effects of VWF plastic bag price increases. Seo and Jung (2007) examined the effect of VWF pricing using MSW data from CY 1995 to CY 2004 in 65 Korean local governments. The authors found that an increase in VWF plastic bag price resulted in an increase in MSW recycling. Nevertheless, the authors only used the price of 20-l plastic bags to predict the pricing effect. However, in South Korea, plastic bags sizes are variable and include 2-, 3-, 5-, 10-, 20-, 30-, 40-, and 100-l sizes (MOE, 2017). Therefore, only accounting for the 20-l bag price limits the explanatory power of the VWF pricing effect on MSW recycling rates. In sum, until now, the effect of VWF pricing on recycling rates has been tested in studies constrained either by short durations or limited scope.

Please cite this article in press as: Park, S. Factors influencing the recycling rate under the volume-based waste fee system in South Korea. Waste Management (2018), https://doi.org/10.1016/j.wasman.2018.01.008