Waste disposal and households' Heterogeneity. Identifying factors shaping attitudes towards source-separated recycling in Bogotá, Colombia

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A R T I C L E I N F O

Article info
Received 9 January 2017
Revised 27 November 2017
Accepted 28 November 2017
Available online xxxx

A B S T R A C T

Solid waste management in many cities of developing countries is not environmentally sustainable. People traditionally dispose of their solid waste in unsuitable urban areas like sidewalks and satellite dumpsites. This situation nowadays has become a serious public health problem in big Latin American conurbations. Among these densely-populated urban spaces, the Colombia’s capital and main city stands out as a special case. In this study, we aim to identify the factors that shape the attitudes towards source-separated recycling among households in Bogotá. Using data from the Colombian Department of Statistics and Bogotá’s multi-purpose survey, we estimated a multivariate Probit model. In general, our results show that the higher the household’s socioeconomic class, the greater its effort for separating solid wastes. Likewise, our findings also allowed us to characterize household profiles regarding solid waste separation and considering each socioeconomic class. Among these profiles, we found that at lower socioeconomic classes, the attitudes toward solid waste separation are influenced by the use of Internet, the membership to an environmentalist organization, the level of education of the head of household and the homeownership. Hence, increasing the education levels within the poorest segment of the population, promoting affordable housing policies and facilitating Internet access for the vulnerable population could reinforce households’ attitudes towards a greater source-separated recycling effort.

1. Introduction

Separating solid waste is a fundamental condition to reversing its negative environmental impacts (Adeniran et al., 2017; Akil et al., 2015). Globally, the growing waste production threatens public health and city environments in developing countries (Dedinec et al., 2015; Vergara et al., 2015). It is expected that in less than a decade, solid waste production (measured in tons/day) in Africa, Latin America and the Caribbean grew 160% and 66%, respectively. These figures are quite high compared with other regions of the world. An important fraction of the total municipal solid waste is generated by the households (Suthar and Singh, 2015). In fact, the amount of household waste produced has been increasing in developing countries as a direct result of rapid population growth and urbanization (Ghani et al., 2013; Gundupalli et al., 2017).

Due to the absence of state-led planning controls, waste recycling at the household level is becoming a worrisome issue in developing countries. Espinoza et al. (2010) find that in developing countries separation of solid waste at the household level is becoming a worrisome issue in developing countries. Espinoza et al. (2010) find that in developing countries separation of solid waste at the household level is becoming a worrisome issue in developing countries. Espinoza et al. (2010) find that in developing countries separation of solid waste at the household level is becoming a worrisome issue in developing countries.

The countries of South Asia and Sub-Saharan Africa have an average solid waste generation of 0.45 and 0.65 kg/per capita/day, respectively. Latin America and the Caribbean region’s solid urban waste projections for 2025 are above most regions of the world (Africa 0.85%, East Asia and Pacific 1.5%, Europe and Central Asia 1.5%, Middle East and North Africa 1.43%, and South Asia 0.77%), except for OECD countries (Hoornweg & Bhada-Tata, 2012, p. 10).

For our purposes, source-separated recycling is defined as the process of separating solid waste by type at home so they can be recycled.
such as Brazil, which achieved 7.3% in 2006, and even below low-middle-income countries like the Philippines, which in 2006 reached a percentage of 28%, and Malaysia, which attained a percentage of 9% in 2012 (Aki et al., 2015). Yet, in the latest years, Malaysia has seen a progressive increase of source-separated recycling, and it has projected a city participation rate of 25% for 2020 (Zen et al., 2014).

This is all consistent with population growth projections. For Latin America, the World Bank projects population growth of 17% by 2005–2025 (Hoornweg and Bhada-Tata, 2012). In fact, high population growth is a primary cause of fast-increasing solid waste production (Minghua et al., 2009; Dedinec et al., 2015). Like other Latin American countries, Colombia's waste production has kept pace with intense demographic and economic growth of the last years and follows the direction of the National Policy for the Integral Management of Solid Waste (CONPES 3874, 2016). Bogotá, Colombia's capital, has a population growth rate of 1.4% per year (Bolivar and Moreno, 2013). The increase in Bogotá's population has necessarily generated higher levels of solid waste production, which local environmental authorities send to its only landfill, Doña Juana. In 2013, Doña Juana received 6516.44 tons of this waste per day, up from 5000 tons thirteen years earlier (OAB, 2015). Waste disposal was at approximately 0.30 tons per capita yearly between 2001 and 2014 (OAB, 2015). The recycling rate is unsurprisingly very low at less than one ton per inhabitant per day (Piha and Martínez, 2014). The population has no cultural inclination to source-separated recycling and the city depends almost exclusively on open-pit disposal (Bolivar and Moreno, 2013). Thus, the city urgently needs to develop a culture of caring for the environment through household recycling incentives.

Notwithstanding, in order to design and implement an urban policy that encourages incentives for recycling at the household level, direct information from the households is required. In that sense, the lack of studies on the issue of source-separated recycling is abyssal in Colombia. This study is a first attempt. In it, we use a survey concerning the separation of solid waste and a broad set of individual variables for Bogotá's households. The aim of our study is to explore factors associated with source-separated recycling there while considering households' socio-economic classes (SECs). The SECs geographically identify sectors with different socioeconomic characteristics. In Colombia, SECs 1, 2 and 3 correspond to households with the lowest incomes, which are beneficiaries of subsidies in utilities; SECs 5 and 6 correspond to households with higher incomes, which must pay an additional contribution on the value of public utilities; while SEC 4 is not a beneficiary of subsidies nor does it have to pay overcharges. The households in SEC 4 pay the fair market value of utilities.

The evidence accrued elsewhere on the influence of socioeconomic conditions as a driver of change to improve environmental quality confirms our results, through which some unique households' characteristics are also revealed. For instance, we found that the greater the SEC, the greater the probability of source-separated recycling. Likewise, our results allow for establishing a profile of source-separated recycling per SEC. In such a sense, this study is a step forward in the literature for estimating the households' preferences in solid waste management alternatives and their corresponding attitudes towards source-separated recycling in a Latin American metropolis. This would contribute to rectify the lack of research on the recycling chain in developing countries, and, pari passu, would provide useful information for policymakers about the households' incentives to perform recycling at the source.

This study is organized into five sections including this introduction. In the second section, we conduct a literature review and a research approach about the dynamics of waste collection, management and recycling in Bogotá. In the third section, we describe our data sources and explain the econometric strategy. We present the results and a discussion on the subject in the fourth and fifth sections of the paper. Finally, we highlight the main findings and their implications for public policy.

2. Literature review and research framework

2.1. Literature review

Consumption and production processes are directly related to the generation of solid waste (Pandey, 2017; Widyantingih et al., 2015). Due to changes in consumption patterns and increased production, the management of solid waste is now one of the cities' challenges (Kolekar et al., 2016). In fact, these aspects are part of the Sustainable Development Goals (SDG) declared by the UN in 2015. Among other objectives, the SDG propose the transformation of cities into sustainable territorial entities as well as the promotion of consumption and production systems in accordance with the balance of the ecosystems in which these sub-national spaces are located. Given the current concern of the world community for the increasing amount of waste generated, several urban initiatives have been proposed to reduce the problem. One of them is the zero-waste program, which has been applied in cities such as Nova Scotia (Greyson, 2007); San Francisco, Toronto, and Canberra (Veleva et al., 2017); Adelaide and Stockholm (Zaman and Lehmann, 2011). Likewise, the source-separated recycling has gained a strong momentum in the last decade and today local governments of cities such as Nagoya (Zheng et al., 2017) and Seoul (Lee and Paik, 2011) have been implementing it with relative success. As has been shown, the analysis of the link between solid waste production and municipal urban waste management programs has not gone unnoticed in the literature. In another context, the study by Miezah et al., (2015) is a sample of the effectiveness of source-separated recycling in a developing country. These authors estimate that the percentage of households in the cities of Ghana that resort to source-separated recycling is approximately 80%.4

As in the case of Ghana, the evidence about the implementation of solid waste management programs oriented to households in other developing countries has barely emerged in recent years. Verma et al. (2016), for example, find that due to population and economic growth as well as changes in the lifestyle of residents of Ho Chi Minh, solid waste generation has intensified. Other cities in Southeast Asia do not have efficient waste management programs due fundamentally to the lack of adequate information on the operation of these programs, although there are some notable exceptions. Cities such as Surabaya, Bangalore, Quy Nhon, and Matala are a model of efficiency in solid waste management (Aeluia and Ferrão, 2016).

There are other models of solid waste management implemented within institutions that could serve as a reference for potential applications at the urban level. Zen et al.,’s (2016) study on the solid waste management plan implemented inside the Universiti Teknologi Malaysia—a small city on its own—brings out useful insights. The study presents two components. The first is the generation and characterization component whose objective is to obtain information for good practices in solid waste management through the opening of a ‘green’ office. Results in 2011 showed a decrease in waste production from 3.47 to 0.83 kg per person. The second component is based on participating in governing and institutionalizing waste minimization (Zen et al., 2016; p. 1407). As per these results, implementing an environmental sustainability program empowers governments and one of its elements is the evaluation of good practices within public management.

4 It is worth noting that Ghana generates 12,710 tons of urban waste per day, mostly composed of organic material (65%) and plastic (14%). For more details on Ghana’s waste composition, see Miezah et al., (2015).
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