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Evaluating the effects of unit based waste disposal schemes on the collection of household recyclables in Ontario, Canada

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ABSTRACT

This study examines the effects of pay as you throw schemes (PAYT) on municipal recycling rates in Ontario, Canada. Using a combination of panel and semi-structured survey data from provincial municipalities, focus is placed on analyzing: (a) the effects of PAYT systems on municipal recycling rates, (b) the relationship between mandatory recycling legislation and the effectiveness of PAYT policy, (c) the impact of Ontario's "one Blue Box per household" provision on PAYT schemes and (d) whether the presence of PAYT systems significantly modify household recycling behavior. The results of the analysis show that while the implementation of PAYT schemes does increase municipal recycling rates, there are opportunities for further improvement. In Ontario, the effectiveness of PAYT policy is impaired by inconsistent enforcement and the inadequate capacity of household recycling bins ("blue bins").

1. Introduction

In North America, pay as you throw and unit based pricing of residential waste has become an increasingly popular mechanism for financing residential solid waste management and encouraging household waste reduction. Under this scheme, households are charged based on the amount of waste they put out for collection as opposed to paying a fixed fee for service. The U.S. Environmental Protection Agency estimates than 26% of all communities in the United States implement some form of unit based pricing (USEPA, 2007). The intuition behind PAYT systems is that households will recycle more, generate less waste and reduce the demand for landfill and incineration services (Canterbury and Eisenfeld, 2006). Further to this point, unit based pricing ensures that municipalities do not bare an inordinate share of the costs in managing residential waste generation.

Conventional economic reasoning would support these claims, as pay as you throw pricing promotes the efficient use of waste management services. Under a fixed fee system, once the initial fee has been paid, the household marginal cost of increased waste disposal is the effort expended in sorting, storing and setting out more waste for collection. The marginal cost to the municipality as a whole is much greater, as provisions must be made for increases in waste generation (adequate landfill infrastructure, curbside collection of waste etc. Kinnaman and Fullerton (1997). This disequilibrium in the marginal cost of waste disposal gives rise to inefficiency, as households will overuse waste management services relative to the true operating cost of the system.

This research concerns itself with the effect of PAYT systems on residential recycling rates in Ontario, Canada. Presently, 125 provincial programs implement pay as you throw systems for residential waste disposal. As demonstrated by Callan (2006) in the presence of a curbside recycling program, increases in the cost of waste disposal reduces the relative cost of recycling, thereby incentivizing source separation of recyclables.

While there is significant research supporting the efficacy of PAYT systems in increasing household recycling and decreasing waste generation, this paper investigates whether the effectiveness of user pay schemes changes in the presence of recycling legislation and/or limits on household recycling. Using a combination of panel and semi-structured survey data from provincial municipalities, this research explores the following questions:

(1) Do municipalities who implement PAYT systems recycle more than those that do not?
(2) Does mandatory recycling legislation enhance or detract from the effectiveness of PAYT systems (as a tool to promote waste diversion)?

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(3) Does the provincial provision of one recycling bin per household provide sufficient recycling capacity for households in areas with PAYT systems?
(4) Does the presence of PAYT systems significantly modify household waste disposal behavior?

Of note, this study does not explore how PAYT schemes in Ontario affect household waste generation. The data used in this study pertains only to the quantities of printed paper and packaging waste recycled – at this time, information on household waste generation by municipality was not available. While a rich scholarship exists that specifically explores the affects of PAYT systems on quantities of household waste generated (see Park, 2009; Folz and Giles, 2002; Bauer and Miranda, 1996), it is recommended that additional research in this area be conducted in an Ontario context.

1.1. Literature review

The effects of municipal user pay systems on waste and recycling activity is a topic that has generated significant attention from a multitude of researchers. Early literature on the topic sought to develop a household demand function for waste services, exploring the effects of PAYT on household waste generation. Such studies include seminal pieces by McFarland, 1972, Wertz (1976), Jenkins (1993) and Repetto et al. (1992). Subsequent studies by Ebreo et al. (1999) posited that households may reduce quantities of waste disposed under a variable fee system, opting to reuse items and/or change purchasing behavior (i.e. buying durable instead of one time use items etc.). While changes in consumer purchasing behavior and waste generation are largely dependent on the magnitude of the PAYT price signal (the penalty for excess garbage must be sufficient to induce behavioral change), there is empirical evidence linking PAYT policy to reduced household generation rates and changes in household consumption. A Belgium study on the effects of PAYT schemes found that household waste generation decreased by 9.1% over a 10-year period (Flemish Waste and Institute, 2013). Similar results were observed in a review of PAYT schemes in 27 European Union states – Austria, Germany, Finland and Ireland all reported decreases in household generation and an increase in the proportion of material recycled post-implementation of PAYT policy (Bio Intelligence Services, 2012).

Tangent to this line of inquiry, an increasing number of researchers have expanded the household waste demand function to include recycling, attempting to determine the effects of PAYT on overall waste diversion (Kinnaman and Fullerton, 1997, 2000; Hong, 1999; Allers and Hoebin, 2010; Sidique et al., 2010a).

The general argument in favor of unit based pricing (e.g. Callan, 2006) is that such schemes promote the efficient use of waste management resources. Households are incentivized to generate less waste if they are forced to pay for the management of additional material.

As demonstrated by Podolsky and Spiegel (1998) and Jenkins (1993), these studies find statistical support for the negative relationship between the price paid per bag and the quantity demanded of disposal services. In a study using community level data for 149 New Jersey municipalities, pay as you throw schemes were found to significantly reduce the amount of solid waste disposed by households, while increasing the amount of material recycled (Podolsky and Spiegel, 1998). Kinnaman and Fullerton (2000) derive a similar conclusion by analyzing cross-section data of more than 900 U.S. communities. Consumers will also be less likely to dispose of items such as white goods (fridges, microwaves), waste electronics and yard waste in the residential waste stream when PAYT systems are implemented.

Brown and Johnstone (2014) also found that there is public support for garbage bag limits/unit based pricing among residents living in PAYT communities. In an analysis of environmental taxes (expressed as PAYT fees) in communities across four countries, it was found that household support for PAYT schemes was a direct function of exposure to such systems. Opposition and/or resistance to PAYT policy was observed to decrease over time, a finding that was supported by other studies examining similar forms of environmental taxation (see Schuitema et al., 2010; Dunne et al., 2008). Of note, Brown and Johnstone (2014) found an inverse relationship between support for PAYT schemes and levels of household waste generation (households with higher rates of waste generation expressed lower levels of support for PAYT policy). This result is consistent with our understanding surrounding how PAYT policies affect behavior – those most affected by garbage bag limits/unit based pricing are most likely to be opposed to its implementation. What is unknown is whether "high generation" households modified consumption and disposal behavior in response to PAYT policy over time.

Despite the extensive empirical evidence supporting the use of PAYT systems in increasing waste diversion, there remains considerable debate as to whether they benefit the community as a whole. As noted by Kinnaman (2006) and Allers and Hoebin (2010), PAYT systems may give rise to illegal dumping and in fact, may be more costly for municipalities to implement relative to a fixed fee scheme. The administrative challenges of measuring and billing individual households may be sufficient to offset any benefits from diverting material from the residential waste stream. To date, there is little consensus regarding the long term efficacy of PAYT schemes despite an increasing trend to adopt such systems in North American cities (USEPA, 2007).

This paper does not attempt to provide any definitive guidance regarding the appropriateness of PAYT systems as a waste diversion strategy. However, it does build upon the existing discourse by exploring conditions that may impact the effectiveness of PAYT in promoting household recycling. To date, this is the only study of its kind to explore the relationship between recycling legislation, recycling bin capacity and PAYT effectiveness. A further unique aspect of this research is the use of both community and household level data. This is advantageous for two reasons: (1) Using community level data allows for an easier comparison of communities with user pay and flat fee systems and (2) the use of household level data allows for the capture of local characteristics that may impact waste disposal and diversion. A combination of both data types enables meaningful and credible analysis related to effects of PAYT and user pay systems on waste diversion.

2. Materials and methods

2.1. Description of the data

For the purposes of this study, community level data for Ontario's residential recycling system was obtained from the Waste Diversion Ontario municipal data call. Each year, the WDO requests that every municipality within the province report detailed recycling and cost information regarding the management of their waste diversion programs (Waste Diversion Ontario, 2013). Data collected includes information on the amount of material recovered, the types of material recovered and whether a program imposes bag limits/user pay systems. To maintain data integrity and ensure that municipalities are correctly interpreting and answering data call questions, the WDO, in association with the Municipal Industry Program Committee (MIPC) and Stewardship Ontario, provide data call support and 3rd party verification of the information reported into the data call. Municipalities work directly with a