The political cost of residual municipal solid waste taxation: perception versus reality

By:
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Abstract
In this paper we set up a stylized theoretical model of consumers’ preference regarding the price for residual municipal solid waste collection and processing services set by the local municipalities. As we are not sure about the information content taken into account by the electorate when judging the incumbents performance, we distinguish between three scenarios prevailing in the political economics literature. In the first scenario a representative consumer maximizes its utility subject to its waste balance equation and its budget constraint. Inspired by the median voter literature, the second scenario adds the local policy makers budget constraint to the basic consumers’ choice problem. In the third scenario we assume the representative consumer compares the price for residual municipal solid waste they pay with the price in neighbouring municipalities and use this price as a yardstick when judging the performance of their incumbent. The predictions from our models are tested using observation for all 308 municipalities in Flanders (Belgium) in 2006 and 2009. The results clearly indicate that consumers hold the local policy makers responsible for residual waste prices, but they do so without using prices in neighbouring municipalities as a yardstick. Political costs in terms of popularity scores rather seem to depend on absolute price levels and (recent) changes in the price levels. Our data also show that local policymakers engage in price mimicking, but apparently this has little influence on re-election chances.
1 Introduction

This paper aims at adding to the political economy literature by analyzing if and how consumers hold their municipal incumbents responsible for the residual municipal solid waste (MSW) pricing policy. As the political economy literature puts different theories forward regarding the information content taken into account by the electorate when judging the incumbents performance, we model and test empirically the three most common scenarios. In the first scenario the basic consumers’ choice problem is based on the models introduced in the seminal work by Kinnaman and Fullerton (2000) and Fullerton and Kinnaman (1995). The representative consumer maximizes its utility subject to its waste balance equation and its budget constraint but ignores the budget constraint local policymakers face when deciding on residual MSW prices. In this setting, consumer’s utility will decrease as residual MSW prices increase. Inspired by the median voter literature (see for example Downs, 1957), the second scenario assumes consumers understand municipalities must finance the cost of waste processing and disposal services, but also understand lump sum transfers within the municipality can play a role. The resulting model specification shows utility maximizing residual MSW prices depend on the consumer’s relative level of MSW generation. If the consumer produces less (more) residual MSW than the average residual MSW production in his municipality, utility increases (decreases) as the price increases. For the third and final scenario, we assume consumers compare the MSW price they pay with the price in neighbouring municipalities and use this price as a yardstick. Consumers (voters) would use this yardstick because of a lack of information (cf Besley and Case, 1995) to judge whether the residual MSW price in their municipality is acceptable.

We test empirically the predictions from each scenario using prices for residual MSW collection and disposal services and popularity scores for all 308 Flemish municipalities in 2006 and 2009. The test results allow us to determine which of the above scenarios is supported by the data. This is particularly relevant as numerous empirical studies in the field of strategic income and property tax policy interaction among local governments have shown the existence of spatial policy interaction (see for example Ashworth et al. 2006, Asworth and Heindels, 1997, Bosh and Solé-Ollé, 2007, Solé-Ollé, 2003, Revelli, 2001, 2002, Bordignon et al., 2003, 2004, Geys and Vermeir, 2008, or Brueckner (2003) and Wilson 1996 for a review). For Belgium for instance, Heyndels and Vuchelen (1998) show that local income and property tax policies are strongly correlated among neighbouring municipalities. In addition, De Jaeger et al. (2009) find that local jurisdictions also strategically interact with each other when deciding on the waste price. A municipality counters a fall in the waste price of its neighbouring municipalities of 1 by decreasing its own price by 0.23. Testing the
predictions from our model in the third scenario will allow us to verify if such residual MSW price mimicking has any advantage in terms of re-election chances.

The impact of tax variables on popularity scores of the incumbents and vote shares of policy makers in general, has received a substantial amount of interest over the last decades.\(^1\) Although most authors focus on nationwide or state data, empirical evidence on local level (e.g. municipal level) exists as well. Several papers use the concept of yardstick voting when empirically testing political costs of taxes on sub-national level. For instance the results from Bosch and Solé-Ollé (2007) suggest that an increase in the property taxes have an impact on the incumbent’s share of the vote in Spanish municipalities. However, political costs of an increase in the property taxes seem to be conditional on the tax policy in neighbouring municipalities. To our knowledge, the only empirical analysis on Flemish data is reported in Vermeir and Heyndels (2006). Analyzing municipal elections in Flanders for the period 1982-2000 they find that the cost in terms of re-election chances indeed depends on local income and property tax rates (the two categories of taxes generating the most revenue) in neighbouring municipalities. The impact of residual MSW prices on incumbents’ popularity rates and vote shares however, has never been analysed.

One could argue consumers simply don’t care about waste prices as the cost for residual solid waste collection and processing services only represents a marginal fraction of total household expenses (based on the municipal accounts and income statistics we estimate only 0.17% of average income in 2006 in Flanders is spend on costs for waste disposal and processing). However in Flanders, and many other regions and countries, a unit based pricing schedule is used. Residents have to buy special waste bags for kerbside collection in local shops. This ‘reminds’ the residents of their price each and every time they buy the bags. Moreover, it makes these prices easy to compare across municipalities, which in turn could induce yardstick competition. We therefore believe, residual MSW prices can have an impact on the incumbents’ popularity scores and vote shares.

The remainder of this paper is organized as follows: in the next section we present our model of consumers’ preference regarding the local municipalities’ residual MSW pricing policy under each scenario. In sections 3 and 4 we discuss the data and methodology. Section 5 presents the empirical estimates of and finally section 6 concludes.

\(^1\) An overview of empirical evidence can be found in Vermeir and Heyndels (2006).
2 The model

We start from a basic consumption choice model for a representative consumer in a given municipality $i$. The consumer observes the price for residual MSW disposal services (henceforth called waste price) set by the local municipality and decides on the level of his consumption and waste generation accordingly. Next, the representative consumer will use the waste price to assess the relative performance of local decision makers. However, we are uncertain which information is known and taken into account by the representative consumer when judging the pricing policy of the incumbent. Therefore we explore three scenarios in which the information content for the consumer differs. In the first scenario, the model set-up of the basic consumers' choice problem is based on the models introduced in the seminal work by Kinnaman and Fullerton (2000) and Fullerton and Kinnaman (1995). Only the waste prices in municipality $i$ are taken into account by the consumer. When judging the incumbent, the consumer looks at his utility which he maximizes with respect to his own budget constraint. The second scenario is inspired by the median voter literature (Downs, 1957 for technical details on the median voter model or Cogleton, 2003 for an introductory review). We build on the previous model, but this time consumers are assumed to take the local policy makers' budget constraint into account as well. Consumers realize that policymakers have to finance the costs for waste disposal services, but also understand lump sum transfers within the municipality can play a role. For the third and final scenario, we introduce the concept of yardstick voting (cfr Besley and Case, 1995). The price may differ from the one preferred by the representative consumer but the consumer assesses the incumbent based on the difference in utility in the event the price was to be equal to a certain benchmark. As consumers have probably imperfect information we assume they either use the price in neighboring municipalities or historic prices in their own municipalities as a benchmark.

2.1 Scenario 1

The set-up of the basic consumers' choice problem is based on the models introduced in the seminal work by Kinnaman and Fullerton (2000) and Fullerton and Kinnaman (1995). We assume a consumer who derives utility from consuming a composite consumption good $x$ but also experiences disutility from the total volume of waste within his municipality $(W)$.\(^2\)

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\(^2\) For later reference we define the total volume of waste $W$ as $\bar{w} \cdot n$, with $\bar{w}$ average amount of waste generated per resident and $n$ the number of residents in the municipality.
Evidence suggests for instance that waste processing facilities have a negative impact on the value of real estate (Kiel and McClain, 1995). Also, external costs associated to traffic from collection might increase disutility (for an extensive overview of potential external costs related to landfilling and incineration of solid waste see Eshet et al., 2006). We further assume consumption of $x$ gives rise to an amount $w = \alpha(e) \cdot x$ of solid waste. The parameter $\alpha > 0$ is the average waste-to-consumption ratio and depends on the effort level $e \in [0,1]$ provided by the representative consumer to reduce its waste-to-consumption ratio.

As it becomes increasingly difficult to further reduce the average waste-to-consumption ratio we assume $\alpha' < 0$ and $\alpha'' > 0$. Reducing $\alpha$ is costly and time consuming. It takes time to engage in at home recycling or to find a substitute consumption good which generates less waste. We therefore assume that the consumer must incur a cost to provide effort. We further assume that this cost is increasing in the quantity of effort provided: $c(e)$ with $c(0) = 0$, $c' \geq 0$, $c'(0) = 0$ and $\lim_{z \to 1} c'(z) = +\infty$. Consumers have a limited budget $\bar{y}$ that they can use to finance consumption and ensuing waste disposal or reduction activities. The representative consumer maximizes its utility subject to its waste balance equation and its budget constraint. Using the subscript to indicate the scenario (1,2 or 3) we can represent the consumers’ choice problem as:

$$\max_{x_i, e_i, \lambda_i} u_i(x_i, W_i)$$

s.t. 
$$\alpha_i(e_i) \cdot x_i = w_i$$
$$1 \cdot x_i + p_w \cdot w_i + c_i(e_i) \leq \bar{y}$$

where we normalize the price of the composite consumption good to one (numéraire good). $p_w$ is the price for disposing one unit of waste in the regular way (i.e. presenting it at the kerbside in the mandatory recipient like a bag or bib). The Lagrange function for this consumer problem is given by:

$$L_i(x_i, e_i, \lambda_i) = u_i(x_i, W_i) - \lambda \left[1 \cdot x_i + p_w \cdot (\alpha_i(e_i) \cdot x_i) + c_i(e_i) - \bar{y}\right]$$

(2)

Necessary first-order conditions for a solution to this problem are given by:

$$\frac{\partial L_i}{\partial x_i} = \frac{\partial u_i}{\partial x_i} - \lambda \cdot 1 - \lambda_i \cdot \alpha_i(e_i) \cdot p_w = 0 \quad \Rightarrow \quad \frac{1}{\lambda_i} \cdot \frac{\partial u_i}{\partial x_i} = 1 + \alpha_i(e_i) \cdot p_w$$

$$\frac{\partial L_i}{\partial e_i} = -\lambda_i \cdot p_w \cdot \frac{\partial \alpha_i}{\partial e_i} \cdot x_i - \lambda_i \cdot \frac{\partial c_i}{\partial e_i} = 0 \quad \Rightarrow \quad \frac{\partial c_i}{\partial e_i} = -p_w \cdot \frac{\partial \alpha_i}{\partial e_i} \cdot x_i$$

(3)

Notice we only consider the interior solution as we assumed $\lim_{z \to 1} c'(z) = +\infty$.
The first condition says that marginal utility (in monetary terms) of consuming an additional unit of the composite good should be equal to the price of the unit (normalized to 1) plus the cost of disposing its waste \((x_i \cdot e_i \cdot p_w)\). The second condition states that marginal benefit of effort equals the disposal cost saved. Combining conditions (3) and the total derivatives of the constraints, one can show demand for the consumption good \((x_i)\) decreases and effort \((e_i)\) increases in the price for waste disposal services \((p_w)\). Note effort \((e_i(p_w, \bar{y}))\), demand for the consumption good \((x_i(p_w, \bar{y}))\) and waste \((w_i = x_i(e_i) \cdot x_i)\) are endogenously determined in our model.

\[
\begin{align*}
    dx_i &= -w_i \cdot dp_w - p_w \cdot x_i \cdot de_i - p_w \cdot x_i \cdot dx_i - c_i'(e_i) \cdot de_i \\
    \Rightarrow \frac{dx_i}{dp_w} \cdot (1 + p_w \cdot \alpha_i) &= -w_i - p_w \cdot x_i \cdot de_i - c_i'(e_i) \cdot \frac{de_i}{dp_w} \\
    \Rightarrow \frac{dx_i}{dp_w} &= -\frac{w_i}{(1 + p_w \cdot \alpha_i)} < 0
\end{align*}
\]

and

\[
\begin{align*}
    c_i'' \cdot de_i &= -(x_i \cdot e_i \cdot p_w + p_w \cdot x_i \cdot de_i + p_w \cdot x_i \cdot dx_i) \\
    \Rightarrow \left(c_i'' + p_w \cdot x_i \cdot e_i \right) \cdot \frac{de_i}{dp_w} &= -x_i + p_w \cdot x_i \cdot \frac{dx_i}{dp_w} \\
    \Rightarrow \left(c_i'' + p_w \cdot x_i \cdot e_i \right) \cdot \frac{de_i}{dp_w} &= -x_i + \frac{(1 + p_w \cdot \alpha_i)}{(1 + p_w \cdot \alpha_i)} + \frac{p_w \cdot x_i \cdot x_i}{(1 + p_w \cdot \alpha_i)} \\
    \Rightarrow \left(c_i'' + p_w \cdot x_i \cdot e_i \right) \cdot \frac{de_i}{dp_w} &= \frac{-x_i}{(1 + p_w \cdot \alpha_i)} \\
    \Rightarrow \frac{de_i}{dp_w} &> 0
\end{align*}
\]

In order to integrate the above results into the incumbent’s popularity functions, we follow the so-called responsibility hypothesis (see for instance Powell and Whitten, 1993 or Revelli, 2002). As Vermeir and Heyndels (2006) argued the responsibility hypothesis has been the starting point of the empirical literature on vote and popularity functions. This hypothesis states voters vote for the party or politician for which they expect the highest utility gain. These expectations can depend on the politicians’ electoral platform, but are often based on incumbents’ past performances. Following the rationale from this hypothesis, we can state
the popularity score of the incumbent (denoted $V'_i$) will depend on the utility of its electorate $(V_i(u_i))$ with $V'_i(u_i) > 0$. Given the focus of our paper, we are mainly interested in the impact of the waste price on popularity score of the incumbent. However differentiating utility $u_i(x_i, W_i)$ with respect to the waste price $p_w$ and using the comparative statics of our model shows $du_i/dp_w$ cannot be signed:

\[
du_i = \frac{\partial u_i}{\partial x_i} \cdot dx_i + \frac{\partial u_i}{\partial W} \cdot dW
\]

\[
du_i = \frac{\partial u_i}{\partial x_i} \cdot dx_i \cdot dp_w + \frac{\partial u_i}{\partial W} \sum_{j=1}^n \left( \alpha_{i,j} \cdot e_{i,j} \cdot x_{i,j} + \alpha_{i,j} \cdot \frac{\partial x_{i,j}}{\partial p_w} \right) \cdot dp_w
\]

\[
\frac{du_i}{dp_w} = \left[ \frac{dx_i}{dp_w} + \sum_{j=1}^n \left( \alpha_{i,j} \cdot e_{i,j} \cdot x_{i,j} + \alpha_{i,j} \cdot \frac{\partial x_{i,j}}{\partial p_w} \right) \cdot \Pi_i(x_i, W) \right] \cdot \frac{\partial u_i}{\partial x_i}
\]

With $\Pi_i(x_i, W) = \frac{\partial u_i}{\partial W} \left/ \frac{\partial u_i}{\partial x_i} \right.$. The change in utility depends on two opposite effects. First, as consumption of $x_i$ decreases in the waste price (see expression (4)), $dx_i/dp_w$ is negative in (6). Secondly, an increase of the waste price reduces overall waste production and associated external costs. In other words, the model in scenario 1 predicts the impact of the waste price on popularity scores depends on a consumption effect and the external costs of waste collection and processing.

### 2.2 Scenario 2

At this point we have not yet taken any budget constraint of the local policy maker into account, as we implicitly assumed the representative consumer is only concerned about the waste balance equation and its own budget constraint. However one could argue consumers understand municipalities must finance the cost of their services provided (see for example Tresch, 2002). In particular, the total revenue from residual MSW pricing should cover the cost of waste disposal and processing services ($G = g \cdot W_2 = g \cdot \overline{W}_2 \cdot n$) and, finances a lump sum transfer $(T)$ to each individual. The local government’s budget constraint is then given by:

\[
p_w \cdot \overline{W}_2 \cdot n = g \cdot \overline{W}_2 \cdot n + T \cdot n
\]
Where \( p_w \) is, as before, the price for disposing one unit of waste, \( \bar{w} \) the average amount of waste generated per resident \( n \) the number of residents and \( g \) cost for municipalities to collect and process one unit of waste. Notice the transfer can be positive or negative depending on the coverage of the total cost by the total revenue (\( g \cdot \bar{w} \cdot n \) versus \( p_w \cdot \bar{w} \cdot n \)). A positive transfer can take the form of a reduction in other municipal taxes, while a negative transfer can be manifested by increasing municipal taxes. Since we assume in this scenario the consumers understand that municipalities must finance their waste program, the consumers budget should account for resulting transfers:

\[
1 \cdot x_2 + p_w \cdot w_2 + c_2(e_2) - T \leq \bar{y}
\]

\[
\Rightarrow 1 \cdot x_2 + p_w \cdot (\alpha_x \cdot x_2) + c_2(e_2) - (p_w - g) \cdot \bar{w}_2 \leq \bar{y}
\]

(8)

As consumers will not consider their impact on the lump sum transfer when deciding on their optimal levels of waste \( w \) and effort \( e \), condition (3) will still hold in scenario 2. However, the impact of the price on consumption of the composite good will be different:

\[
dx_2 = -w_2 \cdot dp_w - p_w \cdot \alpha'_x \cdot x_2 \cdot de_2 - p_w \cdot \alpha_z \cdot dx_2 + (\bar{w}_2 + p_w \cdot \bar{w}_2' - g \cdot \bar{w}_2') \cdot dp_w - c_2 \cdot de_2
\]

\[
\frac{dx_2}{dp_w} = \frac{(\bar{w}_2 - w_2') + \bar{w}_2' \cdot (p_w - g)}{(1 + p_w \cdot \alpha_z)}
\]

(9)

The above expression shows that 2 effects can be distinguished: the sign of \( dx_2/dp_w \) depends on the consumer’s relative level of waste generation \( (\bar{w}_2 - w_2) \) and the cost recovery rate \( (p_w - g) \). The first effect \( (\bar{w}_2 - w_2) \) says that if the consumer generates less waste than the average waste production \( (\bar{w}_2) \) in his municipality \( (\bar{w}_2 > w_2) \), consumption of the composite good increases as the price for waste disposal facilities increases. In the reverse case, if the consumer produces more waste than the average amount in his municipality \( (\bar{w}_2 < w_2) \), consumption of \( x_2 \) decreases as \( p_w \) increases. This result is intuitive as for consumers with \( \bar{w}_2 > w_2 \), the additional costs for waste disposal due to an increase of the price, will be more than compensated by the change in the lump sum transfer (if we ignore the cost recovery rate). For consumers with \( \bar{w}_2 < w_2 \), on the other hand, the additional cost of an increase of \( p_w \), will not be covered by the change in the lump sum transfer. Notice if \( \bar{w}_2 = w_2 \Rightarrow dx_2/dp_w = 0 \), or the changes in the cost will exactly be compensated by the changes in the lump sum transfer. The second effect \( (p_w - g) \) is driven by the fact that a
change in price has an impact on the average waste generation \( \bar{w}_2 \) and corresponding total cost of waste disposal and processing services \( G \). If the variable waste price is insufficient to cover the cost for waste disposal services, a reduction in average waste production will reduce the lump sum transfer from consumers to the municipality and hence increase consumption of \( x_2 \). If the variable waste price more than compensates the costs for waste disposal services, a reduction in average waste production will reduce the transfer from the municipality to the consumer, thus reducing consumption of \( x_2 \).

Differentiating utility with respect to the waste price and using the comparative statics derived above allow us to determine the sign of the marginal utility in the second scenario:

\[
\frac{du_2}{dp_w} \left[ x_2(p_w) \right] = \sum_{j=1}^{n} \left( \tilde{\alpha}_{ij}^+ \cdot \tilde{e}_{2,j}^+ \cdot x_{2,j}^+ + \tilde{\alpha}_{ij}^- \cdot \frac{\partial x_{2,j}^-}{\partial p_w} \right) \cdot \tilde{\Pi}(x_{2,t}, W) \cdot \frac{\partial u_2}{\partial x_2} 
\]

The model in scenario 2 predicts the impact of a change in the price on popularity scores of the incumbent will depend on the consumer’s relative level of waste generation, the cost recovery rate and the external costs associated with total waste generation.

2.3 Scenario 3

In third scenario consumers compare utility using different benchmarks for the price \( p_w^b \). The price may differ from the one preferred by the representative consumer. The utility loss due to this difference can be expressed as (Solé-Ollé, 2003):

\[
\pi = u_t(x_t(p_w)) \cdot (x_t(p_w) - x_t(p_w^b))
\]

We assume they either use the price in neighbouring municipalities (scenario 3a) or historic prices in their own municipality as a benchmark (scenario 3b). Notice the consumer compares waste price levels, but ignores any differences in lump sum transfers. If the consumer uses the previous price in his own municipality, \( p_w^b \) for period \( t \) is simply the price in period \( t-1 \). In the yardstick model, the representative consumer uses prices and levels of garbage in a neighbouring municipality to assess the relative performance of local decision makers. In terms of expression 10, he compares the utility change in the hypothetical event he or she lived in the neighbouring municipality, where \( p_w^b \) is charged for waste disposal services. As in Solé-Ollé, (2003) the utility loss due to the divergence between the real and
benchmark policy is the indicator the consumer uses to evaluate the incumbent’s performance. Therefore, in this scenario, the popularity scores no longer depend on the absolute utility levels (as in scenarios 1 and 2), but on the utility loss \( V'_i(\pi) \) with \( V'_i(\pi) < 0 \). It is easy to show both scenario 3a and scenario 3b predict the popularity score will increase as the benchmark increases for a given on price, and decrease as the own price increases for a given benchmark.

3 Data

In Flanders (i.e. one of the three Belgian regions), the 308 local municipalities and city councils organize the collection and disposal of household waste. They can decide in a sovereign way on many of the practical details of the waste collection system such as recycling programs, information campaigns and, most importantly, financial contribution schemes. In the subsequent analysis we will focus on the variable price for residual MSW disposal services (i.e. the weight or volume based price henceforth simply called (waste) price), defined as the average variable price (in eurocents) charged by the municipality to collect and process 1 liter of residual MSW.\(^4\) For municipalities using a weight based pricing scheme, we converted the average price for 1 kg to the price per liter using the official conversion table of OVAM. The prices range between 0.4 and 7.4 eurocents per liter (see Table 1). On average prices in 2009 are higher compared to prices in 2006.

To assess political costs we need information on vote shares or popularity scores for the incumbents. As Geys and Vermeir (2008) point out, the potential political cost of taxation consists of two, often strongly related, components. First, taxes might influence the politician’s popularity. Second, taxes might jeopardize the probability of being elected for the next term of office. In this paper we focus on the first component, as the highly fragmented political landscape and local parties on municipal level make it difficult to compare vote shares between different elections. Often, political parties on municipal level split up or merge with another party. In addition some parties completely disappear or change their names between elections. Popularity ratings on the other hand, are available for 2006 and 2009 for all municipalities. The ratings are based on an online questionnaire administered by the online research bureau iVOX (in association with a Flemish newspaper called ‘Het

\(^4\) Residual MSW consists of: (1) all residual waste presented by households at the kerbside, (2) bulky household refuse, and (3) municipal waste. Note that solid waste generated by companies, schools, hospitals, prisons etc is collected by private waste collection and processing firms and is not included in the definition of residential solid waste (OVAM, 2002).
Nieuwsblad’ and a radio station called ‘Radio 2’). With more than 140,000 respondents, the sample comprises about 2.3% of the total population in Flanders. Each respondent was asked to rate his/her satisfaction with the entire local authority by giving a score between 0 and 10. The average scores in Flanders (see Table 1) are similar in both reference years (approximately 6.7).

Table 1: Descriptive statistics for the dependent variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Observations</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste price 2006 [in c/l]</td>
<td>306</td>
<td>2.003</td>
<td>0.722</td>
<td>0.354</td>
<td>7.381</td>
</tr>
<tr>
<td>Waste price 2009 [in c/l]</td>
<td>306</td>
<td>2.263</td>
<td>0.667</td>
<td>0.417</td>
<td>5.000</td>
</tr>
<tr>
<td>Score local council 2006</td>
<td>306</td>
<td>6.672</td>
<td>0.378</td>
<td>5.000</td>
<td>7.600</td>
</tr>
<tr>
<td>Score local council 2009</td>
<td>306</td>
<td>6.727</td>
<td>0.422</td>
<td>5.300</td>
<td>7.700</td>
</tr>
</tbody>
</table>

Legend: prices are in eurocents per litre and scores can theoretically range between 0 out of 10.

As mentioned in the introduction, recent empirical evidence presented by De Jaeger et al. (2009) has shown waste prices and waste quantities in Flanders exhibit spatial clustering. In particular, the authors argued waste prices depend endogenously on waste prices in nearby municipalities since local policy makers engage in tax mimicking. We have no reason, however, to assume popularity scores endogenously depend on the popularity scores in other, geographically close, municipalities (i.e. popularity scores have no direct effect on scores on neighbouring municipalities). On the other hand, we can think of several sources – observed or unobserved – which might cause spatial variation of the popularity scores. An obvious candidate is the waste price itself. If residents hold the government responsible for the price of waste disposal services relative to prices in neighbouring municipalities (see scenario 3a), popularity scores might also be spatially correlated. Other possible sources like regional political preferences could have a similar impact on the waste quantities.

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5 The results of the questionnaire are available at: [http://www.nieuwsblad.be/burgemeester](http://www.nieuwsblad.be/burgemeester) [in Dutch].
6 In order to avoid bias arising from a over- or underrepresentation of certain population related characteristics, a proportionally interlaced stratified sample of the population is used.
In Figure 1 we display waste prices and popularity scores on so-called choropleth maps of Flanders: municipalities are shaded in proportion the level of the variables of interest. A closer inspection of the figures reveals that waste prices indeed tend to be geographically clustered; i.e. municipalities located in each other’s proximity appear to have similar waste prices. The situation for the popularity scores is less clear. Although the scores in some regions appear to be similar, overall spatial correlation seems rather low. Fortunately several statistics which quantify the departure from spatial randomness are available. We report the Moran’s I statistic in Table 2. This measure is a spatially weighted correlation coefficient, so a positive value for the statistic points towards spatial clustering, while a negative value is a sign of spatial dispersion. A spatial value of zero indicates the spatial pattern is completely random.\footnote{For more details on the Moran’s I statistic see Anselin and Kelejian (1997).} For all four variables we find a significant positive Moran’s I statistic, indicating both waste prices and popularity scores are geographically clustered. Notice the statistic is relatively higher for the waste prices compared to the statistic for the popularity scores, confirming the observations from the choropleth maps.
Table 2: Moran’s I statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Statistic</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste price 2006</td>
<td>0.32</td>
<td>0.00</td>
</tr>
<tr>
<td>Waste price 2009</td>
<td>0.34</td>
<td>0.00</td>
</tr>
<tr>
<td>Score local council 2006</td>
<td>0.06</td>
<td>0.03</td>
</tr>
<tr>
<td>Score local council 2009</td>
<td>0.10</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Following the predictions from our model, we also need a proxy for the external costs associated to waste collection and processing. As we do not have exact estimates for such external costs on municipal level, we will use a general ‘quality of living’ index. In particular, we will include a satisfaction score based on the same iVOX questionnaire (see supra). For this variable respondents were asked to rate their satisfaction (on a scale from one to ten) with the general living quality (including air quality, odour and noise nuisance, general neatness, etc.) in their municipality. Clearly, with this variable we cannot single out the particular effect of the external costs on the popularity scores, but it will allow us, to certain extent, to control for this effect in the regressions.

Recall our model also predicted the cost recovery rate for waste disposal and processing services can have an impact on popularity scores. We will therefore also include the difference between revenues generated through variable MSW pricing and total cost for MSW collection and processing per kg as an additional variable. All cost and expenditure data are retrieved from public Flemish municipal accounts. Notice reported cost and revenues figures theoretically include all revenues and costs linked to the collection and processing of MSW, including recyclable waste fractions. Since our dependent variable, the waste price, only captures residual MSW prices (see infra), the cost recovery rate used in our estimations, has to be seen as a proxy.

Although not explicitly modelled, revenue generated through variable waste pricing can also be used to finance other public services (e.g. public swimming pools, recreation facilities, cultural events, etc.). Since the provision of public goods can have a positive impact on popularity scores, we will use the total municipal expenditure per capita as one of our independent variables in the second scenario. Next to the waste prices, satisfaction rates and municipal finances, we also include a vector of municipal characteristics thought to influence popularity scores. Finally our analysis requires a set of variables to instrument the price. We select typical cost drivers like a set of dummy variables indicating which waste processor is used, a proxy for average processing costs and the collection frequency.

---

8 Obviously, computing the Moran’s I statistic requires a matrix specifying the geographical relation between each observation. For a definition of this matrix, see section 4.1.
4 Estimation strategy

As indicated by Kinnaman and Fullerton (2000), policy choices in the context of municipal waste management are potentially endogenous in waste related models. Clearly the waste price falls within this category. If, for example, the decision to increase the price is correlated with unobserved characteristics that influence also the popularity scores, chances are the estimates of the policy’s impact are biased. To circumvent this problem, we estimate waste prices in a first stage and use, in a second stage, the predicted prices as an independent variable in our popularity functions. Although this method circumvents the endogeneity problem, the use of 2SLS builds on quite heavy data requirements. 2SLS estimates are generally inconsistent if the instruments are correlated with the error term in the equation of interest. In addition so-called ‘weak’ instruments, i.e. instruments that are poor predictors of the endogenous variable in the first-stage equation, can result in predicted values with very little variation, again resulting in biased estimates. Consequently, to avoid endogeneity problems of the price, we need a set of instruments which is able to explain at least part of the variation in the prices, but has, conditional on the covariates, no impact on waste generation. We expect the municipal waste transport and processing cost drivers mentioned in the data section are good candidates to meet these conditions.9

4.1 Stage 1: Price equation

Estimating the price in a first stage imposes additional challenges. Controlling for all observable spatially correlated variables which influence waste prices might be insufficient to explain the observed geographic variability of the prices. It is well established that ignoring any remaining spatial structure can lead to inconsistent estimates of the standard errors and, in the case of spatial interdependence of the dependent variables, biased coefficient estimates (see for example LeSage and Pace, 2009). Fortunately we can fall back on the spatial maximum likelihood (ML) techniques developed by Anselin (1988) to estimate our spatial models. These spatial ML techniques offer a variety of ways to deal with spatial correlation in the data. By far the most estimated spatial model is the SAR or spatial autoregressive model, which includes a spatial lag of the dependent variable as one of the regressors. In our case such a lag could emerge in the equation as an additional

9 Various diagnostic tests such as the Sargan-Hansen test of overidentifying restrictions (see Sargan, 1958 and Hansen, 1982) and weak identification tests (Stock and Yogo, 2005) allow us to verify if these conditions are indeed met. Results of the tests indeed show our instruments are exogenous and able to explain variation in the price.
independent variable consisting of a spatially weighted average price in neighbouring municipalities. Based on empirical evidence presented in De Jaeger et al. (2009), we expect this SAR model will best fit our data. In addition, including a spatial lag in the price equation will allow us to test for spatial price interaction. To ensure the SAR model is indeed the best option, we use the robust Lagrange Multiplier (LM) tests for spatial autocorrelation and spatial lag dependency developed by Anselin et al. (1996). As expected the test results, discussed in the next section, point to the spatial lag model as the one best fitting the data:

\[ p_w = \gamma_0 + \gamma_1 \cdot W \cdot p_w + \theta \cdot R + v \]  

with \( v \) independent identically distributed \((v \sim iid(0, \sigma_v^2))\) and \( p_w \) as before, waste prices. \( W \cdot p_w \) is the spatially weighted average of prices in other municipalities and results from the pre-multiplication of \( p_w \) with a spatial weight matrix. A general weight matrix \( W \) consists of \( N \times N \) weight elements \( w_{ij} \), with \( N \) the number of municipalities. Each element \( w_{ij} \) measures the strength of the link between municipality \( i \) and municipality \( j \). The diagonal elements of \( W \) are zero, i.e. \( w_{ij} = 0 \) if \( i = j \). The rows of the weighting matrix are normalized so that elements \( w_{ij} \) sum up to one in every row. We assume that spatial price interaction is mainly confined to neighbouring municipalities. Therefore we give the elements \( w_{ij} \) of \( W \) a value of 1 if municipalities \( i \) and \( j \) share a border and 0 otherwise. This specific structure of the spatial weight matrix gives rise to the desired interpretation of \( W \cdot p_w \) as the average price from neighbouring observations to each municipality. If municipalities indeed mimic each other’s prices, \( \gamma_1 \) should be positive.\(^{10}\) Finally \( R \) is the set of cost drivers mentioned in the previous paragraph.

### 4.2 Stage 2: Popularity functions

In the second stage we estimate our popularity functions for each of the three scenarios. We first deal with scenario 1 and 3. Econometric details for estimation of scenario 2 are presented at the end of this section. An overview of the expected signs of the coefficients under each scenario is given in Table 1. Recall that in the first scenario consumers ignore

\(^{10}\) We can also use other definitions of geographical closeness, such as the inverse of the distance between municipalities \( i \) and \( j \) or the inverse of distance squared. We used these weight matrices as a robustness check, but finally choose the weight matrix \( W \) as it best explains spatial clustering in the disturbances (highest log likelihood value).
the local policy makers’ budget constraint, which leads to a negative relation between popularity and M SW prices if we control for the external effects (here captured by the quality of living ($l$)). We therefore estimate the following model specification:

$$V = \alpha_0 + \alpha_1 \cdot \hat{p}_w + \alpha_2 \cdot y + \alpha_3 \cdot l + \alpha_4 \cdot W \cdot \hat{p}_w + Z \cdot \phi' + \epsilon$$ (13)

With $V$ the popularity score for the entire council and $\hat{p}_w$ the predicted price from the first stage estimation results. If the predictions from the model in scenario 1 hold, $\alpha_1$ should be significantly negative and $\alpha_3$ significantly positive. Notice we added the spatial lag of the predicted price ($W \cdot \hat{p}_w$) as one of the regressors in our estimation equation. This allows us to test if the predictions from our model in scenario 3a hold. If consumers use the prices in neighbouring municipalities as a yardstick when judging their incumbents’ pricing policy, $\alpha_4$ should be significantly positive (i.e. higher average waste prices in neighbouring municipalities are favourable for the incumbents). Since the political economy literature states incumbents are held responsible for economic progress (see for example Vermeir and Heyndels, 2006), we include per capita income ($y$) as one of the explanatory variables. Obviously we expect income to have a positive effect on popularity scores (i.e. $\alpha_2$ is significantly positive). Finally $Z$ consists of two additional municipal characteristics (unemployment rate and population density) thought to proxy economic welfare. Since general prosperity and wellbeing probably leads to higher approval with the incumbents’ policy, we expect, as in Vermeir and Heyndels (2006), the unemployment rate will negatively affect the incumbents’ popularity scores. Population density is included to test for the effect of urbanization on popularity scores. We expect residents living in densely populated areas feel less sympathetic towards the incumbents and local policy makers in general, as poverty is often concentrated in large cities. Notice we do not include local income and property taxes, as they are probably endogenous as well. Since the correlation between (predicted) waste prices and local income and property taxes are low (the highest correlation coefficient in absolute values is 0.15), we believe that this will have no significant impact on coefficient estimates for the price variables.

Recall we also argued consumers might use historic waste prices in their own municipality as a yardstick (scenario 3b). To test this assumption, we relate the change in popularity scores ($\Delta V = V_{09} - V_{06}$) to the change in waste prices ($\Delta \hat{p}_{w,t} = \hat{p}_{w,t} - \hat{p}_{w,t-1}$):

$$\Delta V = \beta_0 + \beta_1 \cdot \Delta \hat{p}_{w,09} + \beta_2 \cdot \Delta \hat{p}_{w,08} + \beta_3 \cdot \Delta \hat{p}_{w,07} + \beta_4 \cdot \Delta y + \Delta Z \cdot \phi' + \tau$$ (14)
With $\Delta y = y_{09} - y_{06}$ and $\Delta Z = Z_{09} - Z_{06}$ the changes of the municipal characteristics (i.e. per capita income, quality of living, cost recovery rate, per capita municipal expenditures, unemployment rate and population density) between 2006 and 2009.\textsuperscript{11} According to our model, any increase in the price should result in a decrease in the popularity score (i.e. $\beta_1$, $\beta_2$ and $\beta_3$ are negative), but it is more likely that recent changes in price have a higher impact in absolute values. We therefore specifically distinguish between the periods when the changes occurred. Note the constant $\beta_0$ captures the overall difference in popularity scores between 2006 and 2009.

In order to test the predictions from the second scenario, where residents take the local government’s budget constraint into account, we first need to make an important assumption. Recall the model in scenario 2 predicted the impact of a change in the waste price on popularity scores of the incumbent depends among others on the consumer’s relative level of waste generation $(\bar{w}_2 - w_2)$. As we only observe the average waste generation per capita on municipal level, and not on individual level, we have no information on the distribution of waste generation within each municipality. Fortunately however, waste generation data on individual level are available for some other countries. For example Tucker (1999) argues that measured waste generation rates appear to be quite well fitted by log-normal distributions. More recently, the data of an OECD household survey revealed the distribution of waste generation (expressed as the number of waste bags presented) is strongly skewed to the right for 9 out of the 10 countries included in the survey Kwan-Yim (2009). Although there seem to be some regional differences, data for all European countries in the sample reveal a similar right tailed distribution. Therefore we will assume the average waste level will be higher than the median waste level within most Flemish municipalities. In other words if we draw a random sample in each municipality, most respondents will produce less waste than the average amount in their municipality. Recall our model predicted if $\bar{w}_2 > w_2$ ($\bar{w}_2 < w_2$) an increase in the price for waste disposal will have a positive (negative) impact on popularity scores if we control for cost the recovery rate and the external effects of waste collection and processing. Therefore, if scenario 2 holds and assuming the distribution of

\textsuperscript{11} The literature provides evidence that politicians adapt their policies according to their stock of popularity in some circumstances (see for instance Frey and Schneider, 1978 or Schneider and Pommerehne, 1980). If incumbents with high popularity scores are more likely to increase the waste price, estimates based on exact level of the popularity score can be biased. We therefore estimate the entire equation in changes, and not only the price.
waste generation is skewed to the right, the majority of the respondents will prefer an increase over a decrease of the price for waste disposal facilities. Still, if the popularity score of incumbents decreases linearly in the utility loss of the respondents, average popularity score will be zero. To see this, first note our model derived in the previous section states utility linearly depends on the difference between the consumer’s waste level and average waste level. Secondly, for a randomly drawn group of respondents within a municipality, the expected average distance to the mean waste level will be zero, even if the distribution for waste generation is strongly skewed. Therefore average utility loss due to a change of the price will be zero as well. As we only acquired the average popularity score for each municipality, we cannot test the predictions from the model in scenario 2 in case of linear popularity scores. However we believe respondents’ approval of the pricing policy mainly relates to the sign of the impact on their utility and less on the magnitude of the impact. It is indeed likely residents react more on the fact incumbents policy affects their utility than on total utility change. In particular this assumption implies marginal popularity $V'(u_i) > 0$ and $V''(u_i) < 0$. Therefore, if scenario 2 holds, we expect average popularity scores increase as the price increases. To test the predictions from this model specification, we can actually turn to the estimation results for our other scenarios. If an increase in the prices results in an increase in the popularity scores, $\beta_1$, $\beta_2$ and $\beta_3$ should be significantly positive. Notice this opposite of what we expect in scenario 3b (see Table 1).

Table 1: Expected signs coefficients for each scenario

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3a</th>
<th>Scenario 3b</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha_1 &lt; 0$</td>
<td>$\beta_1 &gt; 0$</td>
<td>$\alpha_2 &gt; 0$</td>
<td>$\beta_1 &lt; 0$</td>
</tr>
<tr>
<td>$\alpha_3 &gt; 0$</td>
<td>$\beta_2 &gt; 0$</td>
<td>$\beta_2 &lt; 0$</td>
<td>$\beta_3 &lt; 0$</td>
</tr>
<tr>
<td>$\beta_3 &gt; 0$</td>
<td>$\beta_3 &gt; 0$</td>
<td>$\beta_3 &lt; 0$</td>
<td>$\beta_3 &lt; 0$</td>
</tr>
</tbody>
</table>

Before we turn to the results, some econometric issues merit discussion. First, Figure 1 and Moran’s I statistics in Table 2 revealed a moderate degree of spatial clustering of the popularity scores as well. Controlling for all observable spatially correlated variables which influence popularity scores might still be insufficient to explain the geographic variability of the popularity scores. As argued before, ignoring the spatial structure can lead to biased coefficient estimates and inconsistent estimates of the standard errors. Therefore we draw on the Lagrange Multiplier tests for spatial autocorrelation and spatial lag dependency to
detect spatial autocorrelation after controlling for observable covariates (in our case the regressors). Fortunately, as the results discussed in the next section show, spatial correlation is no longer present when estimating the above model specification. Second, we cannot use $\gamma_i$ to calculate the fitted values of the waste price since the variable $W \cdot p$ is not exogenous either. We did include the variable in the first stage because we are interested in $\gamma_i$ from our theoretical model but also because otherwise the other coefficients could suffer from an omitted variable bias. Finally, since we use fitted values for the price in our popularity function, the covariance matrix of the estimator in this step includes noise induced by the first-stage estimates. Therefore we use the limited information maximum likelihood procedure to correct the covariance matrix. Consequently the final estimation procedure involves 4 steps:

1. We estimate the price equation using the spatial MLL method of Anselin (1988);
2. We use only the estimated coefficients of the exogenous variables, to calculate the fitted value $\hat{p}_w$ of the price variable $p_w$. Notice estimation of our model predictions in scenario 2 and 3b also requires the separate predictions for the year by year changes of the price. Regressors in the latter case are simply the year by year changes of the independent variables used to predict the prices in levels.
3. We estimate the popularity function replacing the price variable $p_w$ by its fitted value $\hat{p}_w$;
4. We use the limited information maximum likelihood procedure to correct the covariance matrix.

With this procedure we circumvent the endogeneity problem, while still retrieving the desired information on tax mimicking and popularity functions across municipalities.

5 Estimation results

In the following paragraphs we present and comment on the estimation results. We start by briefly discussing the model specification statistics (Table 1). Next we turn to the first stage regression results (Table 2) and finally we have a look at the estimation results for the popularity scores (Table 3). As mentioned in the previous section, we use the Lagrange Multiplier (LM) tests to check if the above spatial model specifications fit our data. In the price equation a lag of the dependent variable was already theoretically assumed. Both the robust and non-robust LM statistics for the presence of a lagged dependent variable are significantly positive. Clearly, a model with a spatially lagged dependent variable is to be preferred over a model without the spatial lag. For the popularity equations we had no theoretical reason to
assume popularity scores endogenously depend on the popularity scores in other geographically close municipalities, but spatial variation could also emerge from other sources (see data section). Following the LM test statistics however, we find no proof for spatial correlation, indicating the proposed model specification in the previous section is the most relevant for our data set.

<table>
<thead>
<tr>
<th>Table 1: Model specification tests$^{12}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagrange multiplier</td>
</tr>
<tr>
<td>Statistic</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>2006 waste price</td>
</tr>
<tr>
<td>2009 waste price</td>
</tr>
<tr>
<td>Change price</td>
</tr>
<tr>
<td>2006 popularity score</td>
</tr>
<tr>
<td>2009 popularity score</td>
</tr>
<tr>
<td>Change popularity score</td>
</tr>
</tbody>
</table>

5.1 Price Equation

Table 2 shows the results for the price equation, the first step in our estimation procedure. We display the result without the spatial lag of the dependent price variable, estimated by ML in column 1 for 2006 (denoted ML 2006) and in column 3 for 2009 (denoted ML 2009); and with the spatial lag of the price variable, estimated by spatial ML in column 2 for 2006 (denoted ML LAG 2006) and in column 4 for 2009 (denoted ML LAG 2009). Recall, estimation of our model predictions in scenario 2 and 3b also requires the separate predictions for the year by year changes of the price. As the latter estimates and inferences are similar across the three year by year differences, we choose only to report estimates for the overall price changes (price 2009 – price 2006) as an example (column denoted ML LAG Change).$^{13}$ Notice variation of the waste processors over time is almost nonexistent. Therefore the processor dummies are not included as regressors in the last estimation.

$^{12}$ We also tested the spatial error and spatial Durbin model. The LM tests for spatial autocorrelation and the spatial Hausman test reveal both model specifications are not supported by our data. For more details on the tested models, see Anselin (1988). A detailed description of the model specification tests can be found in Anselin et al. (1996) (LM tests for spatial autocorrelation) and LeSage and Pace (2009) (spatial Hausman test).

$^{13}$ Interested readers can obtain detailed estimation outputs upon simple request.
The spatial lag of the price variable Wp enters all the relevant equations significantly. For 2006 we find a value of 0.29 for the spatial lag parameter. This implies that when the average waste price at the neighboring of municipality i increases with 1 eurocent, the price in municipality i increases with 0.29 eurocents. For 2009 the coefficient is somewhat lower,
but still significant at the 1 % level. The value of approximately 0.23 suggests a municipality
counters change of 1 eurocent between 2006 and 2009 by a change of 0.23 eurocents. These results suggest municipalities both mimic price levels as changes in price levels in
neighbouring municipalities.

Coefficients and inferences for the other variables appear to be quite similar between OLS and LAG estimates. However the observation year seems to make a difference. The unemployment rate has the expected significant negative sign for 2006, but for the 2009 and change estimates we no longer find a significant effect. Contrary to what we expected, average income cannot significantly explain variation in prices or changes in prices. Apparently local policy makers do not take prosperity of their incumbents into account when deciding on the waste prices. The average cost variable is significantly positive for the 2006 and change estimates, indicating municipalities tend to charge their residents for the costs they face for disposal and processing of waste. Coefficients for 2009 have the expected positive sign, but are no longer significant. The collection frequency seems to have a negative impact on the prices, except for the estimates in differences. This could indicate municipalities benefit from increasing returns to scale. However it is also possible waste bags might be less full because of more frequent waste collection, which in turn could lead to lower waste bag prices. The effect of the waste processor differs as well between the observation years. Only processors 8 and 13 have the same significant effect on prices in both years.

5.2 Popularity scores

We now turn to the estimation results of the popularity equations (Table 3), the second stage
of our estimation procedure. In columns 1*4 we display ML estimation results for 2006 and
2009. Columns 5-6 display the ML results for the changes in popularity scores. Recall from
our theoretical models, we identified 3 mediating variables which could influence the impact
of waste price on popularity scores. In particular we selected 3 proxies: the quality of living
(scenario 1-3), the cost recovery per kg MSW collected and processed (scenario 2) and
investments in public goods per capita (scenario 2). In Table 3 we report the estimation
results with the mediating variables (ML -2006(b), ML -2009(b) and ML-change(b)) and
without the mediating variables ((ML -2006(a), ML -2009(a) and ML-change(a))).
Table 3: Estimation results for the popularity scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>ML -2005(a)</th>
<th>ML -2006(b)</th>
<th>ML -2009(a)</th>
<th>ML -2009(b)</th>
<th>ML-change(a)</th>
<th>ML-change(b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price [in c/l]</td>
<td>-0.107***</td>
<td>-0.091***</td>
<td>-0.068*</td>
<td>-0.071**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.023)</td>
<td>(0.041)</td>
<td>(0.036)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Wp</td>
<td>-0.157</td>
<td>-0.109</td>
<td>-0.133</td>
<td>-0.006</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.106)</td>
<td>(0.095)</td>
<td>(0.115)</td>
<td>(0.104)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Price change 2009 [in c/l]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.094**</td>
<td>-0.093**</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.043)</td>
<td>(0.042)</td>
<td>-</td>
</tr>
<tr>
<td>Price change 2008 [in c/l]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.095*</td>
<td>-0.086*</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.054)</td>
<td>(0.052)</td>
<td>-</td>
</tr>
<tr>
<td>Price change 2007 [in c/l]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.025</td>
<td>-0.024</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.054)</td>
<td>(0.052)</td>
<td>-</td>
</tr>
<tr>
<td>Quality of living</td>
<td>-</td>
<td>0.290***</td>
<td>-</td>
<td>0.217***</td>
<td>-</td>
<td>0.132**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.034)</td>
<td></td>
<td>(0.026)</td>
<td>-</td>
<td>(0.029)</td>
</tr>
<tr>
<td>Cost recovery rate [in €/kg]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.135</td>
<td>-</td>
</tr>
<tr>
<td>Public goods [in €1000/cap]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.755)</td>
<td>-</td>
</tr>
<tr>
<td>Unemployment rate [in %]</td>
<td>-0.026**</td>
<td>-0.038***</td>
<td>-0.056***</td>
<td>-0.076***</td>
<td>-0.020</td>
<td>-0.021</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.012)</td>
<td>(0.017)</td>
<td>(0.015)</td>
<td>(0.030)</td>
<td>(0.029)</td>
</tr>
<tr>
<td>Average Income [in €1000]</td>
<td>0.003</td>
<td>0.001</td>
<td>-0.007</td>
<td>-0.009</td>
<td>-0.025</td>
<td>-0.006</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.007)</td>
<td>(0.010)</td>
<td>(0.009)</td>
<td>(0.036)</td>
<td>(0.037)</td>
</tr>
<tr>
<td>Population density [in pop/km²]</td>
<td>-0.175***</td>
<td>-0.173***</td>
<td>-0.115**</td>
<td>-0.102**</td>
<td>-3.273*</td>
<td>-2.864</td>
</tr>
<tr>
<td></td>
<td>(0.052)</td>
<td>(0.045)</td>
<td>(0.062)</td>
<td>(0.056)</td>
<td>(1.926)</td>
<td>(1.893)</td>
</tr>
<tr>
<td>Constant</td>
<td>7.298***</td>
<td>6.037***</td>
<td>7.681***</td>
<td>6.729***</td>
<td>0.103**</td>
<td>0.120***</td>
</tr>
<tr>
<td></td>
<td>(0.260)</td>
<td>(0.275)</td>
<td>(0.277)</td>
<td>(0.273)</td>
<td>(0.045)</td>
<td>(0.044)</td>
</tr>
</tbody>
</table>

| Estimation statistics          |             |             |             |             |             |             |
| Observations                   | 306         | 306         | 306         | 306         | 306         | 306         |
| Log likelihood                 | -114,318    | -81,634     | -149,954    | -119,001    | -73,937     | -63,417     |

Legend: Robust standard errors between brackets. Socio-demographic variables are in changes (2009-2006) for the last column. Price variables are instrumented.
From our theoretical model, we are mainly interested in the impact of the price variables on popularity scores. If we look at the estimates in levels (columns 1 and 4), we immediately see the prices have a significantly negative impact on the popularity of the incumbent. Notice the spatial lag of the price variable $W_p$ enters none of the relevant equations significantly. This implies the hypothesis consumers use prices in neighbouring municipalities as a yardstick when judging their own pricing schedule, is not supported by our data. The coefficient estimates for the year by year changes in the prices (column 3) reveal only the most recent changes in the price have an impact on the change in popularity scores. Apparently consumers have a short memory and only hold the incumbent responsible for recent policy actions. It is interesting to see local policy makers seem to take this into account. If we look at timing of an increase in the waste price, we see most municipalities changed their price in the three years after the election (see Table 4). In terms of our scenarios, we can conclude that scenarios 1 and 3b are supported by the data. Consumers seem to look at both absolute levels and recent changes of the prices when judging the incumbent. The price levels in neighbouring municipalities and the policy makers’ budget constraint appear to be less important.\textsuperscript{14}

As in the price equations, average income seems to have no impact on the dependent variable. Possibly consumers realize economic policy is mainly a federal and regional responsibility and municipal policy makers are not able to interfere. Coefficients for the unemployment rate and population density on the other hand, do have the expected negative sign, although the effect is not significant for the unemployment rate in the ML change estimate. The latter result could be the consequence of a general negative attitude towards incumbents of the consumers living in more difficult circumstances. Of our mediating variables, only the quality of living has the expected significant positive sign. Note that inclusion of the mediating variables seems to have a limited impact on the waste price coefficients, indicating that the indirect effects of an increase in the waste price (less external costs, the impact of cost coverage on transfers and more investments in public goods) are not taken into account by the consumer when judging their incumbents.

\textsuperscript{14} Recall however we had to assume a nonlinear functional form in order to check the implications of the model in the second scenario. As we do not have any evidence to support such an assumption, we tested the same equation, using vote shares instead of popularity scores as dependent variables. The advantage of this approach is we no longer have to assume a nonlinear functional form, as a small change in utility for a lot of consumers will have a bigger impact on vote shares than a big change in utility for a few voters. The results of this regression reveal a similar story: changes in prices have a negative impact on vote shares and not a positive impact as put forward by the model in the second scenario.
<table>
<thead>
<tr>
<th>Years before election</th>
<th>% municipalities price increase</th>
<th>% municipalities price decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3.92</td>
<td>0.33</td>
</tr>
<tr>
<td>1</td>
<td>5.88</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>2.29</td>
<td>0.98</td>
</tr>
<tr>
<td>3</td>
<td>19.28</td>
<td>2.29</td>
</tr>
<tr>
<td>4</td>
<td>16.01</td>
<td>1.31</td>
</tr>
<tr>
<td>5</td>
<td>11.11</td>
<td>5.23</td>
</tr>
</tbody>
</table>
6 Concluding remarks

In this paper we set up a simple theoretical model of consumers’ preference regarding the local municipalities’ municipal solid waste (MSW) pricing policy choice. The predictions from this model are tested using observation for all 306 (out of 308) Flemish municipalities in 2006 and 2009. The results clearly indicate residents hold the local policy makers responsible for residual waste prices, but do so without using the prices in neighboring municipalities as a yardstick. Political costs in terms of popularity scores rather seem to depend on absolute price levels and changes in the price levels.

These findings also imply the observed waste price mimicking among municipalities has no advantage in terms of reelection chances. So what is the real motive for basing the waste prices on prices in neighboring municipalities? Other sources of waste price mimicking, like tax competition, seem rather unlikely as it is doubtful that residents would emigrate because of the price they have to pay for their waste bags. De Jaeger et al. (2009) tested if waste exports could lead to spatial correlation in price levels. They argued a much lower waste price in neighboring municipalities could induce the residents to engage in so-called waste tourism (or waste export), meaning that the residents present their residual waste for collection in the adjacent cheaper municipality. If local decision makers set the waste prices close to their neighbors’ to prevent such tourism, waste prices would indeed be spatially correlated. However, no proof of waste streams driven by difference in price levels was found, indicating local policy makers probably don’t take waste export into account when deciding on their waste pricing schemes.

One could argue however, as long as politicians believe voters try to overcome information asymmetries by comparing the local policies with neighboring municipalities, policymakers will probably react accordingly. Such a belief can in fact be sufficient to observe upward sloping tax reaction functions in the data. Ashworth and Heyndels (1997), for example, use a sample of Flemish politicians to investigate the politicians’ opinions on local property and income taxes. They find evidence that tax policy in neighboring jurisdiction affects the perceived political cost of one’s own tax rate. Additional empirical evidence indeed shows local property and income taxes are strongly correlated among neighboring municipalities in Belgium (see Heyndels and Vuchelen (1998)). Note, the politicians’ perception in this case seems justified, as research by Vermeir and Heyndels (2006) reveals that electoral punishment depends on the property and income taxes in neighboring municipalities. Given the evidence for yardstick voting for property and income taxes, it seems plausible local
policy makers also believe the political cost of waste prices depends on price levels in neighboring municipalities, inducing them to engage in yardstick competition. Clearly, further research and data collection is needed for more conclusive results in this respect.
References


### Appendix: Descriptive statistics

#### Table A.1: Descriptive statistics independent variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment rate 2006 [in %]</td>
<td>6.413</td>
<td>2.004</td>
<td>3.260</td>
<td>15.370</td>
</tr>
<tr>
<td>Unemployment rate 2009 [in %]</td>
<td>5.748</td>
<td>1.835</td>
<td>2.780</td>
<td>14.600</td>
</tr>
<tr>
<td>Proxy total cost 2006 [in €/kg]</td>
<td>0.119</td>
<td>0.041</td>
<td>0.000</td>
<td>0.240</td>
</tr>
<tr>
<td>Proxy total cost 2009 [in €/kg]</td>
<td>0.122</td>
<td>0.044</td>
<td>0.000</td>
<td>0.260</td>
</tr>
<tr>
<td>Collection frequency 2009 [in collections/year]</td>
<td>36</td>
<td>13.694</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>Quality of living 2006</td>
<td>5.853</td>
<td>0.586</td>
<td>3.900</td>
<td>7.200</td>
</tr>
<tr>
<td>Quality of living 2009</td>
<td>6.059</td>
<td>0.660</td>
<td>3.500</td>
<td>7.800</td>
</tr>
<tr>
<td>Cost recovery rate 2006 [in €/kg]</td>
<td>-0.097</td>
<td>0.036</td>
<td>-0.251</td>
<td>0.000</td>
</tr>
<tr>
<td>Cost recovery rate 2009 [in €/kg]</td>
<td>-0.098</td>
<td>0.042</td>
<td>-0.234</td>
<td>0.000</td>
</tr>
<tr>
<td>Public goods 2006 [in €1000/cap]</td>
<td>0.783</td>
<td>0.227</td>
<td>0.421</td>
<td>2.129</td>
</tr>
<tr>
<td>Public goods 2009 [in €1000/cap]</td>
<td>0.855</td>
<td>0.286</td>
<td>0.000</td>
<td>2.376</td>
</tr>
<tr>
<td>Population density 2006 [in pop/km²]</td>
<td>0.524</td>
<td>0.448</td>
<td>0.053</td>
<td>3.138</td>
</tr>
<tr>
<td>Population density 2009 [in pop/km²]</td>
<td>0.530</td>
<td>0.451</td>
<td>0.053</td>
<td>3.137</td>
</tr>
</tbody>
</table>

The average income in 2009, the proxy for the total cost in 2009 and the expenditures for public goods in 2009 are partly based on provisional data as not all observations have undergone the final check by the responsible authorities.