

# **The institutional choice of refuse collection**

## **Determining variables in the Netherlands**

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## **Abstract**

General empirical evidence suggests that contracting out refuse collection results in a cost decrease in the order of 20%. However, although the method of contracting out refuse collection has become more popular, it is still less common than in-house provision. This paper investigates the reasons behind this phenomenon.

Recently, López-de-Silanes et al. (1997) tried to explain the reservedness of local authorities towards contracting out with US-data and show that political patronage is an important explanation. In this article we give such an empirical assessment using Dutch data.

We base our empirical research on the combination of the theories around efficiency, interest group influence and ideology. To test these theories we model the choice between private and public provision of refuse collection on the one hand side and the choice between in-house and out-house provision on the other side. Data are available for nearly all Dutch municipalities.

A most striking conclusion is that nearly all political parties in the Netherlands do have a preference for public and in-house provision of refuse collection. We find only modest evidence for the hypothesis that a high level of real estate tax (proxy for the soundness of municipal financial affairs, the efficiency argument) or a low level of unemployment (the interest group argument) raises the probability of private and out-house provision. We find more evidence for the assumed relation between the size of municipalities and private collection. In all cases a smaller municipality has a higher chance of private collection. Therefore, scale effects are important for the choice between public and private provision. For the choice between out-house and in-house collection in relation to scale less evidence exists.

Compared with other studies we estimated more general models, allowing for higher order effects and heteroskedasticity. We show that the standard Logit model is too restrictive, both for the choice between private and public provision and the choice between in-house and out-house provision. Signs and significance do differ between the different models. Especially, for the choice between in-house and out-house provision the applied model matters. In this case, only unemployment and municipality size has influence. Thus, more attention is needed for the implications of model choice for the explanation of the raised questions.



# 1. Introduction

There seems evidence that contracting out government services saves taxpayers money, and sometimes a lot of money, relative to public provision. In a recent overview, Domberger and Jensen (1997) show that contracting out a broad field of government services suggests cost savings in the order of twenty percent without sacrificing the quality of services provided.

Also Tang (1997), in a critical assessment of the existing literature, comes to the conclusion that the private sector is found to be more efficient in refuse collection, fire protection, cleaning services, and capital intensive waste-water treatment, while in sectors as water supply and railways the results are more mixed.

Especially, the cost savings of private refuse collection have been discussed at length in the literature. Based on UK-data Domberger et al. (1986) published a study on the effects of contracting out household refuse collection in the United Kingdom. They concluded that there are cost saving of 22% for contracting out to private companies. Szymanski and Wilkins (1993) and Szymanski (1996) have confirmed these results, based on an extension (in years) of this database. Kitchen (1976) estimates a cost decrease of Canadian \$ 2.23 per capita when private firms collect household waste with data for 48 Canadian municipalities. Stevens (1978) arrives at a cost decrease between 7% and 30% due to contracting out for the USA, where the magnitude of the effect depends on the size of the municipality. Recently, Dijkgraaf and Gradus (1997) show similar cost savings between 15% and 20% for the Netherlands, in case Dutch municipalities are contracting out refuse collection. Moreover, Ohlsson (1998) reports almost the same estimations for Sweden.

Although the method of contracting out refuse collection has become more popular, it is still less common than in-house provision. In the United Kingdom only 30% of the contracts for refuse collection is placed out-house (see Szymanski (1996)). In the Netherlands 40% of the municipalities use private collectors for refuse. However, due to the fact that private collectors are especially active in small villages only 20% of total tonnages are in private hands (see Dijkgraaf and Gradus (1997)). Only Ohlsson (1998) finds for Sweden that private provision is slightly more common than public provision.

Furthermore, a recent study by López-de-Silanes et al. (1997) shows the reservedness of local authorities towards contracting out. Based on data in 1987 and 1992 for 3042 counties for twelve services as water supply, landfills, libraries etc. only 25% of the services in 1987

and 35% in 1992 has placed out-house. Moreover, in this article a nice empirical investigation of the mode of providing government services is given, where three leading theories (namely, efficiency, political patronage, and ideology) are investigated. The evidence presented in this article indicates that state clean government laws and state laws restricting county spending encourage privatization, whereas strong public unions discourage it. This points to the important roles played by political patronage and taxpayer resistance to government spending in the privatization decision.

In this article, we examine for the Netherlands the determinants of the provision mode of refuse collection. Data are available for 554 (i.e., almost all) Dutch municipalities. We find evidence for efficiency and ideological elements as a ground for contracting out, and to a lesser extent on political patronage. Moreover, we extend the existing literature by investigating more general specifications. Especially, the often applied linear Logit model seems rather restrictive. Here, with the support of nonparametric techniques, we construct extended parametric models, which give a better fit for this type of studies. Thereby, a better explanation of the determinants of contracting out can be given.

The remainder of this paper is organized as follows. In Section 2 we discuss the relevant theoretical issues. In Section 3 we describe the data we use. Section 4 contains the estimation results based on linear Logit. In Section 5 we investigate the robustness of these results, using nonparametric techniques, resulting in extended parametric specifications. Section 6 contains a study of the effects of changes in the votes for the political parties. Finally, Section 7 concludes.

## **2. Theoretical issues**

Before we specify the data and the empirical results it is worthwhile to discuss theoretical issues concerning the contracting out decision (see López-de-Silanes et al. (1997), Tang (1997)). An interesting point has been raised by Hart, Shleifer and Vishny (1997). They argue that private contractors might fail to pursue goals that politicians want to attain. Especially, in circumstances such as health care and prisons where politicians cannot write a complete contract that specifies exactly what contractors are supposed to do in all circumstances, it may not be straightforward to contract out.

The logic suggests some potential efficiency benefits of in-house government services to ensure quality. However, it is not clear how important such benefits are for refuse collection. Hart et al. (1997, p. 1154) argue that in the case of refuse collection the damage

to quality can be offset by a good contract, so that “private provision is superior.” Nevertheless, according to a Dutch inquiry, such elements are still available and some municipalities put forward that quality is the reason for in-house provision (NG (1998)). A prediction following from this kind of reasoning is that the wealth of local government decreases the likelihood of contracting out. A poorer government is less likely to care about quality and is more interested in cost savings. Furthermore, there are some indications that, especially for small municipalities, the production function represents economies of scale (see, for example, Kitchen (1977) and Stevens (1978)). Kitchen finds that the maximum scale in refuse collection occurs in cities of about 324,000 inhabitants. Stevens (1978) finds increasing returns to scale, if the city population is less than fifty thousand and constant returns to scale if the city population is larger than fifty thousand. Therefore, to check for the efficiency arguments the number of inhabitants should be included in the empirical setting.

An alternative view of the contracting out decision focuses on public choice theory (see Buchanan (1987)). This approach explains social behavior as the product of free choices of individuals. Because self-interested politicians, bureaucrats and unions have a stake in in-house provision since in doing so, they can maximize their status. López-de-Silanes et al. (1997) argue that in the United States the main political factor favoring in-house provision seems to be the public employee unions. Moreover, the role of unions becomes more important and, therefore, in-house provision becomes more beneficiary if unemployment in a municipality is high. This interest group theory has clear empirical implications.

The third theory stresses the importance of voter ideology. To evaluate this view, one should control for voting patterns in different municipalities. Hereby, it is assumed that the contracting out decision is simultaneously determined by the degree of voters’ anti-government sentiment. This laissez-faire sentiment is most available by right-wing parties. Therefore, also this voter ideology has clear empirical implications.

### **3. Data**

The analysis of this article is based on a 1998 census of the Dutch Association for Refuse and Cleansing Management (NVRD). In general, three modes of provision are used in this dataset. The first mode is private provision (42%). The public provision is divided into two modes. The second mode is collecting waste through its own service organizations (28%). The third mode is collecting waste through the organization of an other municipality or external public organizations (30%). Moreover, municipalities’ characteristics are available

from Statistics Netherlands (CBS) and consists the fraction of voters in a municipality for several parties. For 554 of the Dutch municipalities (98.5% of all municipalities) figures are available.<sup>1</sup>

**Table 1. Descriptive statistics database**

Variables	Average	Maximum	Minimum	Standard dev.
No private provision (%)	58	100	0	49
In-house provision (%)	28	100	0	45
Employment (per 100 inhabitants)	41	93	17	11
Real estate tax (ECU per inhabitant)	97	315	39	29
Inhabitants (* 1000)	27	722	1	51
Mayor Conservative Liberals (%)	19	100	0	39
Mayor Social Democrats (%)	28	100	0	45
Mayor Progressive Liberals (%)	4	100	0	20
Conservative Liberals (%)	16	52	0	9
Christian Democrats (%)	25	68	0	10
Orthodox Protestants (%)	4	52	0	8
Social Democrats (%)	16	49	0	10
Progressive Liberals (%)	8	34	0	7
Green Left (%)	4	34	0	6

#### *Efficiency variables*

In the López-de-Silanes et al.-study clean government variables and budget constraints are included to test for the trade-off between efficiency and social arguments. However, contrary to this study clean government data are only available at a national level and, therefore, cannot be included in our dataset. Moreover, the freedom of Dutch municipalities to collect their own taxes is very restricted. In general, the single source of tax revenue for local government is a real estate tax, with as tax-base the value of dwellings. There is a great variation in the level of this real estate tax. The average municipality raises a tax of 97 euro per inhabitant per year while the cheapest municipality has a tax of 39 euro and the most expensive municipality a tax of 316 euro. A poor local government has to raise a high level of this real estate tax and it could be expected that such a local government is more willing to contract out refuse collection. Therefore, the total level of local real estate tax is included in the estimation.

#### *Interest group variables*

Also finding data for the interest group variables seems hard. No data are available for the number of public employee unions in a municipality. Similar to López-de-Silanes, it is

<sup>1</sup> For 8 municipalities data are lacking for the real estate tax, for 3 municipalities data are lacking for the unemployment rate and for 1 municipality data are lacking for the parties.

possible to include labor-market conditions as an approximation of interest-group variables. In general, we should expect that in-house provision becomes more beneficiary if unemployment in a municipality is high. Therefore, the unemployment level is included in our estimations.

#### *Political variables*

We include the fractions of the following parties, based on the local elections of May 1994<sup>2</sup>: green left, social democrats, progressive liberals, christian democrats, and orthodox Protestants.<sup>3,4</sup> In addition, we looked at municipality-level voting in the 1994-election for Parliament as alternative measures of the electorate's ideological orientation. Nevertheless, the local elections seem to be the best measure of predicting the probability of private contracting.

The electoral system is based on proportional representation. In most of the municipalities, no single party holds a majority in the municipality-council. Therefore, the municipality-government, which actually rules the municipality, consists, in general, of a coalition of parties. An important player in the municipality-council is the mayor, who is not elected but is approved by the central government. Therefore, the political color of the mayor is included in our dataset.<sup>5</sup>

## **4. Estimation results: linear Logit**

We start our estimations with a standard logit analysis for two models.<sup>6</sup> In the first model, the choice between public and private provisions is estimated as dependent on a number of explaining variables. In the second model the choice between in-house and out-house provision is the dependent variable. In both models, all explaining variables are initially the same. Thus, the basic model is:

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<sup>2</sup> There were new elections in May 1998.

<sup>3</sup> The so-called local parties are excluded.

<sup>4</sup> Green left: Groen Links + SP, social democrats: PvdA, progressive liberals: D66, Christian democrats: CDA, orthodox protestant: SGP + RPF + GPV. Combination of the parties is tested using a Log Likelihood test.

<sup>5</sup> The so-called Green Left have only one mayor and orthodox protestant have 8 mayors and will not be included in the estimation. Therefore, in the estimations only three dummy's are included for social democrats, progressive liberals and conservative liberals, while Christian democrats has been used as a reference.

<sup>6</sup> The probit and the OLS results are extremely similar.

$$P(\text{Dep} = 1 | x) = \Lambda(\beta^T x),$$

where:

Dep: Dependent variable,  
 model 1: dummy with value 1 for municipalities with no private collection;  
 model 2: dummy with value 1 for municipalities with collection in-house;

and where  $x$  contains the following explanatory variables (next to a constant term):

E: Employment (inhabitants per person with an unemployment benefit);  
 T: Real estate tax (guilders per inhabitant);  
 I: Number of inhabitants;  
 M: Mayor (dummy with value 1 if a municipality has a mayor of CL, SD or PL);  
 CL: Conservative Liberals (percentage of total votes in a municipality);  
 CD: Christian Democrats (percentage of total votes in a municipality);  
 OP: Orthodox Protestants (percentage of total votes in a municipality);  
 SD: Social Democrats (percentage of total votes in a municipality);  
 PL: Progressive Liberals (percentage of total votes in a municipality);  
 GL: Green Left (percentage of total votes in a municipality).

The parameter vector  $\mathbf{b}$  contains the unknown parameters, and  $\Lambda$  represents the Logit-transformation.

Results are given in Table 2. This Table contains the effects of changes in the explanatory variables on the probability of No-private collection and In-house collection, respectively. We distinguish two types of effects: a micro-effect and a macro-effect. In the former case we calculate the effects of changes in the explanatory variables by considering a single municipality, namely, the "average municipality". Thus, we calculate the effects on the probability when the explanatory variables are evaluated in their average values. The macro-effects are calculated by averaging the effects of changes in the explanatory variables over all municipalities. The micro- and macro-effects yield more or less the same results, the difference mainly being that the macro-effects are generally slightly smaller in absolute value.

First, we discuss the choice between public and private provision (the first and second column of table 2). It is interesting to notice that none of the parties (even not the conservative liberals) has a positive sign for private provision. However, for conservative liberals the mayor has a positive and significant sign towards private provision and, therefore, the overall effect can be positive. For conservative liberals, social democrats, progressive liberals and orthodox Protestants the estimated (negative) probabilities are significant. Therefore, most of the Dutch parties seem do not seem in favor of private

provision. Especially, Orthodox Protestants are strongly in favor of public provision. This can probably be explained by the strong and ultimate role the government plays in these parties.

**Table 2. Regression results basic model (Logit)**

	No-private collection		Collection in-house	
	Micro	Macro	Micro	Macro
Employment	0.27	0.21	-0.87*	-0.46
Real estate tax	0.08*	0.06*	0.11*	0.08*
Inhabitants	0.75*	0.54*	0.21*	0.15
Mayor Conservative Liberals	-10.15*	-7.59*	-3.09	-0.78
Mayor Social Democrats	5.12	3.19	-4.27	-2.14
Mayor Progressive Liberals	27.81*	17.18*	11.97	9.83
Conservative Liberals	0.62*	0.45*	0.43	0.49
Christian Democrats	0.39	0.27*	0.21	0.18
Orthodox Protestants	1.13*	0.81*	0.84*	0.62*
Social Democrats	0.61*	0.60	-0.23	-0.20
Progressive Liberals	0.87*	0.60*	1.02*	0.83*
Green Left	0.47	0.24	0.58	0.39

\* Significant at 90%.

Table 2 does confirm our preliminary results on inhabitants. As we should expect if the number of habitants decreases the probability of private provision increases. Scale effects make public provision less likely. However, the data give less evidence for the prior that a high level of real estate tax and a low level of unemployment in a municipality raise the probability of private provision.

For in-house provision the over-all results are more suggestive. Municipalities with a high level of unemployment have a higher probability of in-house provision. By in-house provision a municipality has more direct control to use the own collection unit as an employment instrument compared with a non-private collection unit. This evidence is consistent with the theory that interest group considerations are an important obstacle to out-house provision. In addition, the probability estimation for the number of inhabitants seems right. As we should have expected, if the number of habitants increases then the probability of in-house provision increases. In addition, the data give evidence for the prior that a high level of real estate tax raises the probability of in-house provision. In addition, the results for political variables are suggestive. Except the social democrats, all political parties have a positive attitude towards in-house provision. However, the estimated probability for social democrats is very small and non-significant. In addition, here we can conclude that the Dutch parties seem in favor of in-house provision.

## 5. Robustness of results

The basic Logit model presented in the previous section includes all explanatory variables in a simple linear way. However, this linear relationship may be too restrictive, possibly yielding biased results. To investigate this possibility, we considered nonparametric regressions of the dependent variable on each of the explanatory variables, together with uniform 95%-confidence bounds (see, for instance, Haerdle and Linton (1994) for the theory, and Euwals et al. (1998) for a comparable application). Figures 1 and 2 contain several of these nonparametric regressions, as illustration. For instance, figure 1a clearly suggests that the relationship between no-private collection and employment according to standard Logit may be too restrictive: the nonparametric regression seems to be too nonlinear to be fitted well by a standard linear Logit specification. Similar remarks apply to the other included figures.

To make our models more flexible, so that possible biased results will be avoided, we first experimented by including cross terms and quadratic terms. Based on Log-likelihood-ratio-tests we include quadratic terms for employment, social democrats and green left for the model with no private collection as dependent variable. The second model, with collection in-house as dependent, is extended with a quadratic term for employment, conservative liberals and progressive liberals. Table 3 presents the results with the quadratic terms.<sup>7</sup>

**Table 3. Regression results Logit model with quadratic terms**

	No-private collection	Collection in-house
Employment <sup>1,2</sup>	-0.07*	-0.87*
Real estate tax	0.05	0.08*
Inhabitants	0.48*	0.14
Mayor Conservative Liberals	-10.48*	-1.24
Mayor Social Democrats	4.10	-2.31
Mayor Progressive Liberals	20.56*	15.39*
Conservative Liberals <sup>2</sup>	0.51*	0.61*
Christian Democrats	0.26	0.16
Orthodox Protestants	0.90*	0.78*
Social Democrats <sup>1</sup>	0.61*	-0.28
Progressive Liberals <sup>2</sup>	0.65*	0.96*
Green Left <sup>1</sup>	1.20	0.34

\* Significant at 90%

1. Quadratic term of this variable is included for the no-private collection model
2. Quadratic term of this variable is included for the collection in-house model

<sup>7</sup> For all estimations the micro and macro effects are extremely similar. Therefore, from table 3 on we only present the more interesting macro effects.

A comparison of these extended Logit-results with the standard Logit-results of Table 2 reveals that the effects of most explanatory variables are quite comparable, although there are a few striking differences. In case of no-private collection the effect of employment becomes negative, and significantly so, in line with the interest-group-theory. In addition, the effects of real estate tax and Christian democrats are no longer significant, whereas the effect of social democrats becomes significant. In case of in-house provision we see that the macro-effect of employment now turns out to be significantly negative, again supporting the interest-group-theory. In addition, the variables mayor progressive liberals and conservative liberals become significant. The effect of social democrats remains, as only party, negative, but again small and insignificantly.

Including cross terms and/or quadratic terms is one way to extend the standard linear Logit specification. A simple further extension consists of allowing for heteroskedasticity. We considered heteroskedasticity of exponential form, following and included various variables (see Melenberg and Van Soest (1996) for details). On the basis of Log-likelihood-ratio-tests we found that in case of no-private collection the variable inhabitants should be included, and in case of collection in-house the variable progressive liberals. Table 4 contains the macro-effects of these extended models.

**Table 4. Regression results Logit model (quadratic terms and heteroskedasticity)**

	No-private collection	Collection in-house
Employment <sup>1,2</sup>	-0.11	-0.57*
Real estate tax	0.02	0.06
Inhabitants <sup>3</sup>	0.40*	1.23*
Mayor Conservative Liberals	-7.77*	0.28
Mayor Social Democrats	2.61	-2.53
Mayor Progressive Liberals	18.83*	9.51
Conservative Liberals <sup>2</sup>	0.63*	0.42
Christian Democrats	0.15	0.36
Orthodox Protestants	0.13*	0.37
Social Democrats <sup>1</sup>	0.71*	0.09
Progressive Liberals <sup>2,4</sup>	0.45*	0.45
Green Left <sup>1</sup>	1.29*	0.18

\* Significant at 90%.

1 Quadratic term of this variable is included for the no-private collection model

2 Quadratic term of this variable is included for the collection in-house model

3 Variable is allowed for heteroskedasticity for the no-private collection model

4 Variable is allowed for heteroskedasticity for the collection in-house model

A comparison between these results and those of the previous Logit specifications again reveals similarities, but also some further differences. In case of no-private collection the variable employment is negative, thus in accordance with the interest-group theory as we

discussed before. Furthermore, the political effects become somewhat different in magnitude. Particularly, the effect of green left is higher and significant, whereas the effect of orthodox Protestants seriously declines. In case of in-house collection, the only significant effects are now employment and inhabitants, both strongly supporting the prior views. Moreover, we see a change in the sign of the variables mayor conservative liberals and social democrats, but these effects remain insignificant.

Of course, even this more complicated model may be too restrictive, yielding possibly biased results. One way to proceed is to consider an even more advanced model, or to turn to semi- or nonparametrics. Before proceeding in such a direction, however, it makes sense to test the current model specification. We do this by using a nonparametric test, following Horowitz (1992), but modifying his Probit application to our Logit-specification. Figures 3a and 3b show the results. This nonparametric test does not reject the model specification under consideration at 95%, if the Logit-curve lies between the 95%-uniform confidence bounds. We see that the Logit curves are mostly between the confidence bounds, suggesting that our specification makes sense, and may require only minor additional modification, which we leave to further research.

Although the standard Logit model and the Logit model with only quadratic terms are rejected on the basis of Log-likelihood-ratio tests, it may make sense to quantify somehow the gain in applying the final model. We use two measures of goodness-of-fit, suggested by, for instance, Amemiya (1985). The first measure is the Log-likelihood Ratio Index (LRI), which is defined as:

$$1 - \frac{L(\text{model})}{L(0)}$$

where  $L(\text{model})$  is the log-likelihood-value of the model under consideration, and  $L(0)$  is the log-likelihood of the model with only a constant term, i.e., without explanatory values. The LRI-values are reported in Table 5.

**Table 5 Likelihood Ratio Indexes (LRI) of the various models**

	No-private collection	In-house collection
Standard Logit	0.15	0.16
Logit with squared terms	0.17	0.18
Logit with squared terms and heteroskedasticity	0.18	0.25

According to these results we see that in case of no-private collection the improvement is not spectacular, and can already essentially be assigned to going from standard Logit to

Logit with quadratic terms. In case of in-house collection the improvement seems to be more substantial, and basically due to allowing for heteroskedasticity.

The second measure is simply the percentage of correct predictions, where the prediction equals 1 if the model predicts a probability equal to or larger than a half, and where the prediction is 0 otherwise. Table 6 contains the results.

**Table 6 Percentage correct predictions of the various models**

	No-private collection	In-house collection
Model 0 (only a constant)	58	72
Standard Logit	68	75
Logit with squared terms	70	75
Logit with squared terms and heteroskedasticity	69	77

Model 0 in Table 6 refers to the Logit specification without explanatory variables, i.e., with only a constant term included. Here we see that in case of no-private collection the improvement by extending the standard Logit specification is modest. Most gain in getting better predictions is obtained by including explanatory variables, i.e., going from Model 0 to standard Logit. In case of in-house collection we see that the improvement by allowing for heteroskedasticity is comparable by the improvement obtained by going from Model 0 to standard Logit, or Logit with only quadratic terms.

## 6. Some further evidence on the influence of politics

In the former sections the effects of changes in the influence of political parties is measured in a partial way. In reality, when a specific party gets a lower part of the total votes, other parties will get more. To investigate the effects of the political parties somewhat further, we also calculated the macro effects if one party gets 1% more votes and some other party then gets 1% less. Tables 7a and 7b contain the results.<sup>8</sup>

<sup>8</sup> Notice that the tables are reasonably (anti-) symmetric, i.e., if entry (i,j) is positive, then entry (j,i) is negative and, in absolute value, more or less of the same magnitude. The matrices are not perfectly anti-symmetric, since we are calculating the effects using nonlinear models. Significancy is also symmetric, with one exception: in case of No-private-collection (extended Logit) the CD(+1%)/SD(-1%) effect is -0.58 and significant, whereas the converse effect is +0.57, but insignificant.

**Table 7a Change in probability no-private collection***Standard Logit*

		Decrease by 1%					
		SD	CL	CD	PL	GL	OP
Increase by 1%	SD		-0.47	0.12	-0.15	0.11	-0.38
	CL	0.01		0.16	-0.15	0.15	-0.34
	CD	-0.21	-0.15		-0.34	0.00	-0.55*
	PL	0.11	0.12	0.34		0.18	-0.35
	GL	-0.23	-0.06	-0.10	-0.29		-0.52
	OP	0.41	0.32	0.57*	0.22	0.43	

*Extended Logit (quadratic terms and heteroskedasticity)*

		Decrease by 1%					
		SD	CL	CD	PL	GL	OP
Increase by 1%	SD		0.03	0.57	0.25	-0.72	-0.39
	CL	-0.09		0.48	0.17	-0.73	-0.42
	CD	-0.58*	-0.53		-0.19	-1.23*	-0.97*
	PL	-0.37	-0.40	0.25		-1.07	-0.65*
	GL	0.52	0.55	1.13*	0.72		0.08
	OP	0.33	0.46	0.91*	0.69*	-0.18	

\* Significant at 90%.

In the no-private collection case with ordinary Logit, only the exchange of Christian democrats for orthodox protestant votes has a significant effect: the Christian democrats seem to be more private-minded. In the extended Logit specification this effect remains present, and becomes even more significant. In this extended specification, more significant effects appear. An increase for Christian democrats and decrease for social democrats results in a lower probability for private collection. However, the opposite exchange is not significant. The exchange between Christian democrats and green left has a relative large and significant effect. In this case the direction of the exchange does not matter, if green left gets more (less) votes the probability of private collection decreases (increases). Finally, an exchange between progressive liberals and orthodox Protestants results in a changed probability for private collection. Interestingly, because it is widely believed that this party likes private provision more than the other parties. Exchanging conservative liberal-votes for other parties does not have any significant effects.

In case of in-house provision, ordinary Logit yields two significant effects, namely green left versus social democrats and orthodox Protestants versus social democrats. In both cases, the orthodox Protestants prefer non-private provision. The significance and magnitude of these effects disappear in the extended Logit specification.

**Table 7b Change in probability in-house provision**

		Decrease by 1%					
		SD	CL	CD	PL	GL	OP
Increase by 1%	SD		-1.05	-0.29	-0.88	-0.60*	-0.79*
	CL	0.52		0.29	-0.34	-0.05	-0.24
	CD	0.35	-0.20		-0.56	-0.36	-0.43
	PL	0.98	0.43	0.59		0.45	-0.01
	GL	0.55*	0.20	0.31	-0.42		-0.21
	OP	0.94*	0.13	0.40	-0.05	0.24	
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		Decrease by 1%					
		SD	CL	CD	PL	GL	OP
Increase by 1%	SD		-0.33	-0.30	-0.42	-0.05	-0.59
	CL	0.47		0.13	-0.06	0.29	0.08
	CD	0.30	-0.10		-0.10	0.19	-0.08
	PL	0.33	0.04	0.12		0.38	0.05
	GL	0.11	-0.29	-0.17	-0.28		-0.21
	OP	0.01	-0.11	-0.03	-0.06	0.17	

\* Significant at 90%.

## 7. Conclusions

In this paper we try to explain the reasons for the fact that contracting out refuse collection is less common than in-house provision, although considerable efficiency improvements by contracting out seem achievable. We present an empirical investigation motivated by efficiency arguments, interest group theory, and ideology arguments.

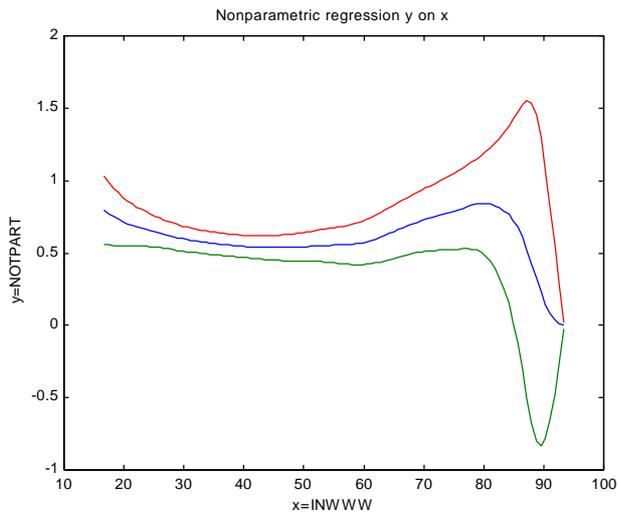
The most striking conclusion is that nearly all political parties in the Netherlands do have a preference for public and in-house provision of refuse collection. Only very specific exchanges between parties or the presence of a conservative liberal mayor can result in a higher probability of private collection.

Only modest evidence is found for the hypothesis that a high level of real estate tax (proxy for the soundness of municipal financial affairs) or a low level of unemployment raises the probability of private and out-house provision.

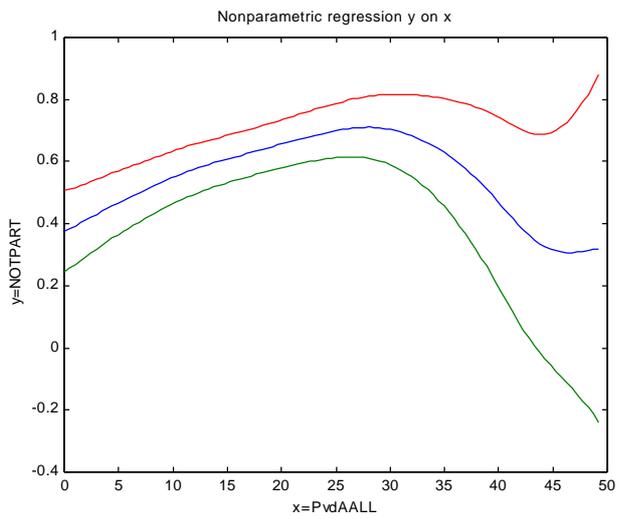
More evidence is found for the assumed relation between the size of municipalities and private collection. In all cases a smaller municipality has a higher chance of private collection. Therefore, scale effects are important for the choice between public and private provision. For the choice between out-house and in-house collection little evidence exists for the relation with size.

Compared with other studies we estimated more general models. In general there seems to be no reason why only a linear relation between in-house provision and political variables should be investigated. Therefore, other relations allowing for quadratic terms and heteroskedasticity are investigated as well. Our results show that the standard Logit model may be too restrictive, both for the choice between private and public provision and the choice between in-house and out-house provision. Especially, for the choice between in-house and out-house provision the applied model matters. In the most extended model we do not find significant effects of political parties on this choice. In this case, only unemployment and municipality size seem to have a significant influence. Thus, allowing for a more general specification might yield better results and, as a consequence, a better understanding of the contracting out decision.

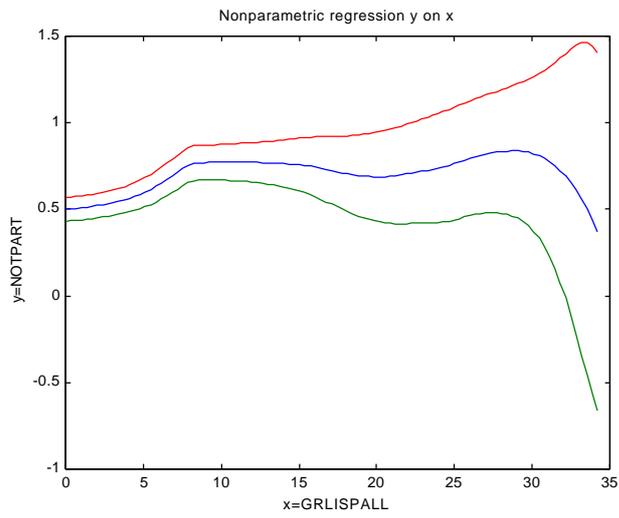
## Figures



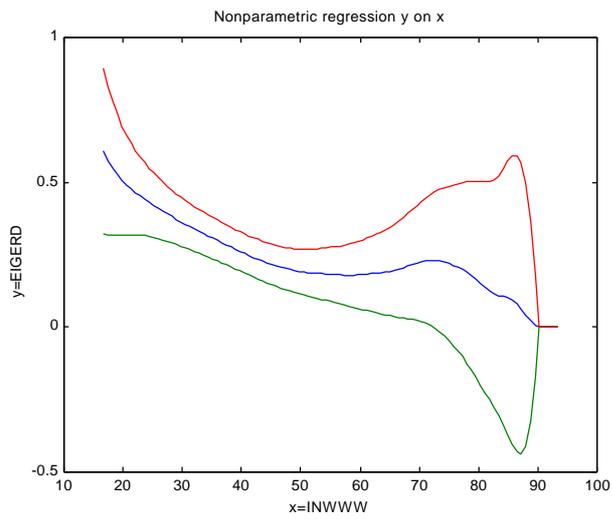
**Figure 1a. Nonparametric regression of Employment on no-private collection**



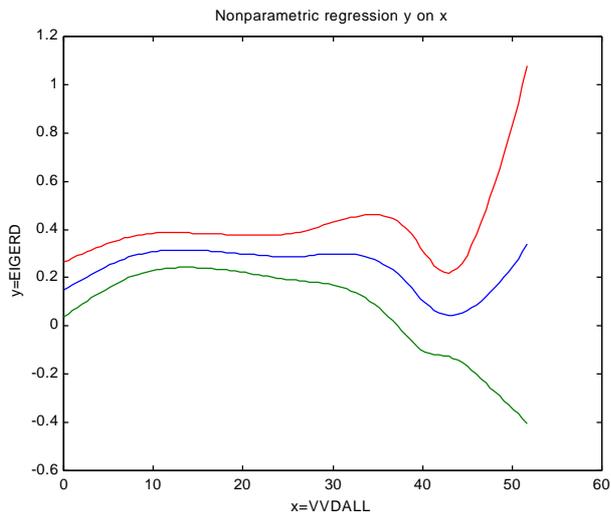
**Figure 1b. Nonparametric regression of SD on no-private collection**



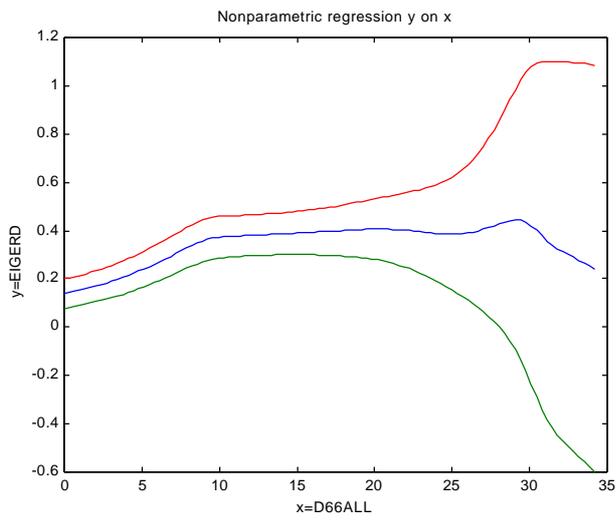
**Figure 1c Nonparametric regression of GL on no-private collection**



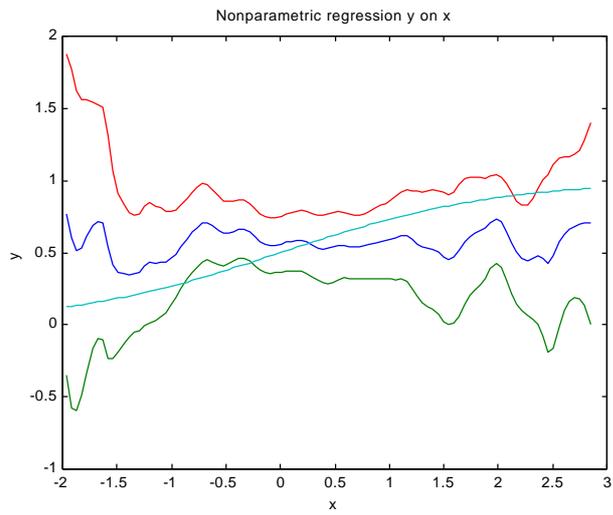
**Figure 2a Nonparametric regression of Employment on in-house collection**



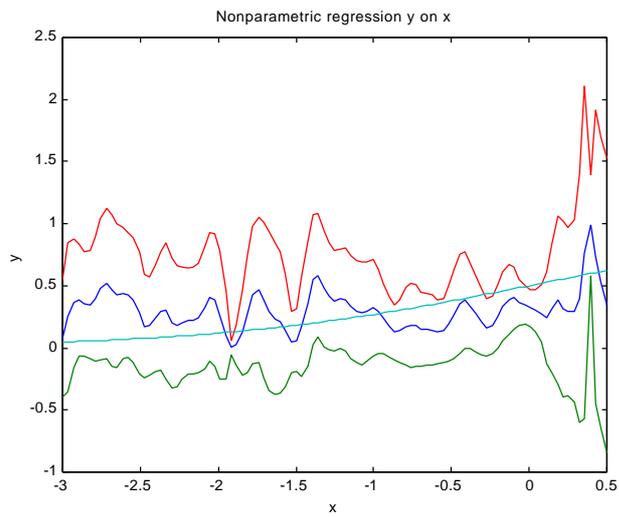
**Figure 2b Nonparametric regression of CL on in-house collection**



**Figure 2c Nonparametric regression of PL on in-house collection**



**Figure 3a. Nonparametric test of Logit estimation (basic model)**



**Figure 3b. Nonparametric test of Logit estimation (most extended model)**

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