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Here, Raymond Gradus, Elbert Dijkgraaf and Martijn Schoute revisit an article Gradus and Dijkgraaf wrote for *LGS* Vol 33 No 4: 'Collusion in the Dutch Waste Collection Market', in which they found that in 2002, collusion among providers of waste collection in the Netherlands produced a high degree of concentration in the market, which increased costs and (partly) offset the advantage of contracting out the service. Here, Gradus, Dijkgraaf and Martijn Schoute take a look at the degree of concentration in the Dutch waste collection market in 2010, and at what had happened to the cost advantage of private provision.

Is there still collusion in the Dutch waste collection market?

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ABSTRACT
Concentration indexes based on regional markets show that the Dutch market for refuse collection is highly concentrated in 2002 and 2010. Similar to earlier work in 2007, the results indicate some evidence that high concentration increases costs and therefore (partly) offsets the advantage of contracting out. In 2002, results with respect to concentration are somewhat less robust. In 2010, the cost-advantage effect of private provision becomes smaller. However, for this year, we have a stronger indication that the cost advantage of private provision depends negatively on regional concentration measured by the Hirschman–Herfindahl Index.

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Introduction

In 2007, a special issue of *Local Government Studies* on 'Local Government Reform: Privatisation and Its Alternatives' was published. The papers collected in this volume explored what factors cause local governments in North America and Europe to privatise or not and showed that 'privatisation is by no means a panacea'. As part of this special issue, the degree of concentration in the Dutch waste collection market was explored, and the effect of concentration on costs was estimated (see Dijkgraaf and Gradus (2007)). It was shown that the Dutch waste collection sector exhibits significant market concentration that is associated with higher total costs and may reflect collusion. Empirically, it was presented that savings with tendering are significantly higher if the regional market is competitive. In addition, private firms are more cost-effective when public (i.e., municipality-owned) firms operate in the same territorial area.

Nevertheless, the current evidence for cost savings from contracting out or private provision is more mixed. In an overview article, Bel, Fageda, and Warner (2010) conduct a meta-regression analysis, mostly based on the refuse collection literature, and show that there is no unambiguous evidence for obtaining significant cost savings from private production. The literature has increasingly turned its attention to factors that might undermine savings from contracting out, such as hefty transaction costs (Brown and Potoski 2005) and market concentration (Dijkgraaf and Gradus 2007). As contracting out refuse collection is a dynamic process, with sometimes a more competitive and sometimes a more monopolistic market structure (see also Dijkgraaf and Gradus (2008a)), in this article we give an update for 2010 and compare this with the results for 2002. We include, compared with the former study, a slightly different and improved measure for concentration.

The relation between concentration and costs

In the work by Dijkgraaf and Gradus (2007), the factors which determine the total costs of refuse collection in Dutch municipalities for the year 2002 were analysed. This study used the same approach as employed by Dijkgraaf and Gradus (2003) to explain total costs of refuse collection at the municipal level: total costs is dependent on the number of collection points (measured by the number of households), density of collection points, household size, characteristics of recycling and mode of production (private firm, public firm,[1] inter-municipal cooperation or in-house production). According to this estimation, private collection was 17% cheaper than collection by municipalities. This result is in accordance with earlier results found by Dijkgraaf and Gradus (2003). Moreover, the difference between collection by public firms or inter-municipal

cooperation and collection by the municipality itself was small and insignificant.[2] Moreover, a series of concentration indicators at the provincial level were included to analyse the extent to which the strength of competition affects the impact of contracting out on costs. The concentration indicators used were the Hirschman–Herfindahl index (HHI), the C3-ratio (the market share of the three largest companies) and the presence of competitors (private or public) in municipalities within the same geographical area. Some evidence to suggest that cost savings with contracting out depended on the degree of concentration at the provincial level was found: the higher the concentration, the lower the cost savings associated with contracting out.[3] In addition, we took into account that in the Netherlands contracting out may involve both public and private companies and found that the presence of public (but not private) companies as competitors in neighbouring municipalities seemed to have a positive effect on the cost savings achieved with contracting out. In the work by Dijkgraaf and Gradus (2008b), also data for the year 2006 were included. Interestingly, the positive relation between concentration and prices was now highly significant, which strengthened our case that the costs of private provision are increasingly dependent on regional concentration.

The Dutch waste collection market in 2010

Let us first describe the market in 2010 and compare it with 2002. In 2010, 16 private and 25 public firms were active in the Netherlands. This is remarkably different from 2002 with 25 private and 12 public firms. The share of municipalities using private firms decreased from 37% in 2002 to 33% in 2010 and the share of public firms increased from 18% in 2002 to 34% in 2010. Also, in 2010, there were only two private companies that served more than nine municipalities. But while the largest company (i.e. SITA) had a contract with 87 municipalities in 2002, this was only 53 in 2010. For van Gansewinkel the number of municipalities slightly decreased from 42 in 2002 to 40 in 2010. For Afvalverwerking Rijnmond (AVR), a public firm in 2002 and privatised in 2006, the decrease was larger from 22 to 8. Interestingly, the number of municipalities using public firms increased substantially from 87 in 2002 to 146 in 2010. Although the market share of public firms had increased in 2010, there seem to be fewer reasons to think that public firms behave as competitors for private firms in local waste contracts. Besides the privatised AVR, most of the public firms already existing in 2002 only served the municipalities that own the shares of these firms in 2010.[4] Therefore, there is less reason to assume that public firms are involved in a tender.

Before 2002, due to (past) Dutch legislation, there was evidence that the relevant market was the province. However, today there is reasoning to

Table 1. Descriptive statistics for concentration indexes.

		Average	Std dev	min	max	N
2002	HHI30	0.56	0.22	0.17	1.0	453
	HHI50	0.46	0.20	0.17	1.0	453
	C3-30	0.95	0.08	0.60	1.0	453
	C3-50	0.90	0.08	0.60	1.0	453
2010	HHI30	0.50	0.25	0.19	1.0	392
	HHI50	0.39	0.21	0.16	1.0	392
	C3-30	0.93	0.09	0.68	1.0	392
	C3-50	0.86	0.10	0.58	1.0	392

assume that the relevant market is a circle around a municipality as waste policy is no longer at the provincial but national level. In this article, we calculate for 2002 and 2010 the HHI-index for an area with a radius of 30 kilometres (i.e., 18.6 miles) or 50 kilometres (i.e., 31.1 miles).[5] We calculate the HHI-index as the sum of the squared market shares of private companies.[6] Furthermore, we calculate the C3 ratio, an alternative measure for concentration, which is defined by the sum of the market shares of the three largest private companies in the relevant market. Table 1 contains the descriptive statistics for these variables.

Based on these HHI's and C3's, we conclude that the Dutch waste collection market is still highly concentrated. Compared with a value of 0.18 used by the US Antitrust Division to indicate concentrated markets, nearly all markets are concentrated indeed (see Shepherd (1997)). If the relevant market has a radius of 50 kilometres, the average HHI-index for private competitors is 0.46 in 2002 and 0.39 in 2010.[7] Notice that the concentration is not evenly spread over the country. Some municipalities have only one private collection firm in their neighbourhood whereas others have many.[8] If the relevant market is 30 kilometres, the average HHI-index is higher with 0.56 in 2002 and 0.50 in 2010. For C3 a similar picture occurs, although this concentration ratio is higher than HHI. It should be noticed that in 2010 the concentration indexes are somewhat lower than in 2002.

Estimations

Table 2 presents our estimation results for 2002 and 2010.[9] First, we estimate the basic model without a concentration effect (see first column). Second, we include HHI for 30 or 50 kilometres (see second and third column). Third, we include C3 ratios for 30 or 50 kilometres (see fourth and fifth column). In these estimations, we multiply HHI and C3 indexes by the private ownership dummy as we are interested in the effects of concentrated markets on the behaviour of private firms.[10]

According to the first column, private collection was 22% cheaper in 2002 and 10% in 2010 than collection by municipalities, although this 2010-

Table 2. Estimation results: effect on total costs of waste collection.

2002	Basic model	HHI30	HHI50	C3-30	C3-50
Collection inter-municipal coop.	0.03	0.03	0.03	0.03	0.03
Collection public firm	0.02	0.02	0.01	0.02	0.02
Collection private firm	−0.09***	−0.14***	−0.16***	−0.15	−0.26***
Concentration effect		0.09	0.15**	0.07	0.18
2010	Basic model	HHI30	HHI50	C3-30	C3-50
Collection inter-municipal coop.	0.00	0.01	0.01	0.01	0.01
Collection public firm	0.04	0.04*	0.04	0.04*	0.04
Collection private firm	−0.04	−0.13***	−0.11***	−0.33**	−0.10
Concentration effect		0.21**	0.20**	0.33**	0.08

*/**/*** means significant at the 10%/5%/1% level.

coefficient is not significant.[11,12] In addition, in line with Dijkgraaf and Gradus (2007), collection by a public firm or an inter-municipal cooperation is not significantly cheaper than collection by municipalities.[13] For 2002, the estimations for the concentration effect are similar to Dijkgraaf and Gradus (2007), if we take regional HHI50 instead of HHI based on provinces.[14] Let us explicate the working of this index. At the average value of the HHI50 index, i.e., 0.46, the net effect of private provision on collection costs is now −22%. When a monopoly is present (implying a HHI of 1), total costs decrease with 3% compared with municipal collection. At the other hand, the results imply that the cost advantage of private collection might be much higher if enough competition is present as a Herfindahl index of zero results in an estimated cost decrease of 37%. For HHI30 and C3's, we do not find significant effects anymore. A possible explanation for C3's can be the rather low standard deviations.

Interestingly, private collection becomes significant in 2010, if we take into account the concentration of regional markets. For HHI30 and HHI50 we even find stronger effects that the cost advantage of private provision is offset by regional concentration than for 2002. When a monopoly is present (implying a HHI of 1), total costs increase (with 22–23%) compared with municipal collection. For C3's, we get more mixed results.

Discussion

If we compare the results of a former *Local Government Studies* paper with the results for 2010, there is still some indication that highly concentrated regional markets, especially measured with a HHI-index, result in barriers for local governments to effectively obtain benefits from contracting out. Although these results are appealing, they should be interpreted with caution, because data for the private side of the market are only available for 2002 and 2010 and we use cross-sectional analyses. Cross-sections have their limitations as the complexity of competition issues ideally involves data analysis over time. Based

on panel data, some authors have stressed the dynamic and the complex pattern of the waste collection market. Analysing compulsory competitive tendering (CCT) in the UK, Szymanski (1996) shows that contracting out yields cost advantages, but that there is some indication that cost advantages become smaller in the second round of tendering.[15] It seems that local information is important, which gives the incumbent an advantage above new entrants. If panel data become available, it would be worthwhile to investigate the dynamic relation in these markets further.

Another issue is the use of the HHI's. In his seminal IO-textbook, Shepherd (1997, p. 342) describes US trash removal as a typical case study of tight collusion with a high market share of two private companies (i.e., BFI and WMX) and that 'effective competition in it may simply not be viable'. Interestingly, the Netherlands has a similar structure and the widely used Hirschman–Herfindahl index is a nice way to capture this phenomenon as it is mostly determined by the largest firms. Nevertheless, the market size of the largest firm in the Netherlands, i.e., SITA, has become smaller if we compare 2010 with 2002. Therefore, in future work it is worthwhile to investigate other concentration indexes as well. Ginevičius and Čirba (2009) show some other concentration indexes, but emphasise that all have their weaknesses and their strengths as a measure for competition.

Conclusions

In this article, we calculate concentration indexes based on regional markets and show that the Dutch market for refuse collection is highly concentrated in 2002 and 2010. Furthermore, similar to Dijkgraaf and Gradus (2007), we use these concentration indexes to evaluate the relation between costs, concentration and the institutional mode. For 2002, the relation between costs and concentration is less robust, but for 2010 we find some more evidence that regional concentration offsets the advantage of contracting out. If we compare the estimation results between 2002 and 2010, two trends emerge. First, the cost-advantage effect of private provision seems to become smaller in 2010. Second, for 2010 we have a stronger indication that the cost advantage of private provision depends negatively on regional concentration measured by HHI. Therefore, data for recent years should be investigated, on whether these trends are continuing. This makes it also possible to use panel data, which is an improvement as in that case fixed-effects can be applied. Finally, it can be worthwhile to investigate other measures for concentration as well.

Notes

1. It should be noted that these public firms operate under Dutch commercial law, while their shares are owned by municipalities.
2. In the work by Dijkgraaf and Gradus (2007), two estimations for public firms were included (one with and one without reducing the 2002-costs of public companies for VAT). In the latter case, presented here, the coefficient for public companies was insignificant and all other coefficients are the same (see Dijkgraaf and Gradus (2007, footnote 13)).
3. The results for other variables were in line with results found by Dijkgraaf and Gradus (2003). The coefficient for number of collection points was somewhat lower than 1, but a Wald test of coefficient restrictions did not falsify the constant returns to scale hypothesis. This in line with, for example, Bel and Costas (2006).
4. We checked this for two large public firms (i.e., Omrin and ROVA), and others stayed more or less constant with respect to the number of municipalities.
5. We thank Jaap Boter (Vrije Universiteit Amsterdam) for calculating (using ArcGIS) the mutual distances among (the household-weighted centres of) all Dutch municipalities for us.
6. The total market in such a case was defined as the number of households which was treated by private companies in a region with a stray of 30 kilometres or 50 kilometres around a municipality.
7. It should be noticed that not all Dutch municipalities have private companies within 30 or 50 kilometres. Similar to the work by Dijkgraaf and Gradus (2007), we assume that in such a case the concentration indexes HHI and C3 are equal to one, which can be interpreted as no competition.
8. In 2010, the minimum for HHI50 is 0.16 and in 2002 the minimum is 0.17, which can be interpreted as approximately six private companies of equal size competing within 50 kilometres.
9. We present only the estimations for the institutional dummy and the concentration indexes. Results for other variables are available upon request.
10. From an econometric point of view, one can argue that the main effect should be included in the regressions as well. As results (which are available upon request) are similar, we do not present them here.
11. As the estimations are in logs, the effect can be calculated using e^x-1 and by multiplying this by 2.5 as collection costs are on average 40% of total waste costs.
12. It should be noted that the 2002 data and the model used here are slightly different from the data and the model used by Dijkgraaf and Gradus (2007) as we include provincial dummies instead of dummies for which incineration plants municipalities use and we have a different definition of HHI.
13. This result is thus different from Dijkgraaf and Gradus (2013), where inter-municipal cooperation has become the most cost-advantage alternative. It should be noted that this estimation is based on a large panel data set (1998–2010) and includes municipal fixed effects.
14. In the work by Dijkgraaf and Gradus (2007), based on HHI and C3 for provinces, significant effects for HHI (at 10% level) and for C3 (at 5% level) of the same magnitude were found.
15. Szymanski (1996) was among the first to use a large panel data set to analyse the waste collection market.

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Disclosure statement

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