Public Procurement versus *Laissez-Faire*:

Evidence from Household Waste Collection[*]

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Abstract

We document that switching from *laissez-faire* production to public procurement in residential waste collection in Finland reduces the number of firms active in the local market, but induces a statistically significant and large decrease in unit prices on average. While public procurement, thus, seems to be desirable from the citizens' perspective, not all municipalities adopt public procurement. We provide descriptive evidence that municipal council composition is associated with the chosen regime. This suggests that local politics may be one obstacle for the efficient provision of local public goods.

JEL codes: C23, D72, H76, L13, L85

Keywords: Free markets, Waste collection, Public procurement.

1 Introduction

What form of market organization results in the most efficient provision of local (impure) public goods? If an efficient solution can be identified, what prevents policymakers from implementing it? We tackle these fundamental questions in the context of household waste collection, a classical example of local impure public good, using data from Finnish local governments.

The markets for household waste collection are organized very differently in different countries, and their organization may vary across jurisdictions within countries (see Simões and Marques 2012a and 2012b for overviews). The typical organizational forms can be categorized in three groups. First, at the one end of the spectrum is public provision of waste collection where local jurisdictions directly provide these services to all households using their own employees and capital, and the local government funds the service from its budget.[1] At the other end of the spectrum is a *laissez-faire* arrangement where private firms can enter and exit freely and negotiate the prices and service levels directly with the households.[2] Between these extremes exist various regulatory arrangements where private firms operate the services but local government controls to varying extent the prices, service levels, and details of production. A typical form of this market organization type is public procurement. Private firms participate in competitive bidding to resolve which firms will provide the service, and how much they are paid for that. Our paper studies the effects of switching the market organization form from *laissez-faire* production to public procurement. We show that such a switch reduces the number of firms active in the local market, but also induces a statistically significant and large decrease in unit prices.

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[1] In many countries, local governments collect waste specific taxes or fees.

[2] Even in *laissez-faire*, the market is still often subject to various kinds of regulation, for example regarding recycling, disposal and storage. We are interested in comparing different regimes of household waste collection in otherwise similar regulatory environment.

The arguments in favor of public provision typically mention better possibilities to utilize economies of scale, density or contiguity (Edwards and Stevens 1978; Stevens 1978).[3] For example, many different firms could be collecting waste from the same street resulting in suboptimal logistics under *laissez-faire*. There could also be excess negative externalities in the form of congestion and noise. On the other hand, private sector is likely to benefit from many positive incentives absent in the public provision that arise due to better performance and effort being reflected in the personal wealth of employees and owners (see, e.g., Alchian and Demsetz 1972 and Spann 1977 for a general treatise, and Bennet and Johnson 1979 in the context of waste collection). The possible issues related to the public choice models of bureaucracy, where bureaucrats are able to extract rents from public provision, are absent in *laissez-faire* (Niskanen 1971). Negotiating with each household separately is costly but allows tailoring the service levels according to heterogeneous preferences of the households. Finally, private production creates incentives to innovate and be efficient in order for the firms to survive the tests of the competitive market.

Taken these arguments together, it seems that in theory, a well-organized public procurement arrangement may be able to achieve the best of both worlds: realizing the relevant economies by well-planned contracts and the desirable incentives related to private firms operating in the competitive environment. Moreover, a bidding process may be able to induce competitive pressure even in some cases where the *laissez-faire* does not. This is important especially in the case of a natural monopoly which may often arise in waste collection services in small municipalities.[4]

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[3] Economies of scale refer, for example, to being able to use the collection vehicles to their full capacity. Economies of density refer, for example, to being able to organize the service such that one vehicle can operate in a small area. Economies of contiguity refer, for example, to being able to organize the service such that one vehicle collects waste from all the households along a given route.

[4] According to a Finnish private sector industry expert, a new entrant needs about two hundred households as customers to able to cover the investment in a single collection

In practice, public procurement may not be the optimal solution. For example, corruption or lack of expertise among the local government officials planning the contract and the procurement mechanisms may result in various inefficiencies that would be absent in the *laissez-faire* solution (Bandiera et al. 2009; Cai et al. 2013). Thus, ranking these systems in terms of performance is an empirical question. We compare prices and market structure faced by the households in public procurement and *laissez-faire*. Differentiating from previous literature (see Simões and Marques 2012a and 2012b for recent surveys), we do not compare municipalities in a cross-section. We use a difference-in-differences strategy to evaluate how changing the system affects prices relative to a price change in a control group of *status quo* municipalities. Thus, the first contribution of this article is that we are able to address at least some endogeneity issues that much of the existing evidence suffers from. We find that moving from *laissez-faire* to publicly procured waste collection reduces consumer prices by between 17 and 37 percentage, depending on the specification. This result is not that surprising given that waste collection is unlikely to suffer from the issues of incomplete contracts (Hart et al. 1997) that plague contracting out of many other types of public services (Andersson et al. 2018).

We also find some evidence suggesting that the active number of firms decreases with moving to public procurement. This result together with the price effect suggests that the public procurement system is able to maintain competitive pressure even if the market production is allocated only to one or few firms per municipality at the time.

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vehicle. This means that a new entrant would have to capture a large market share immediately in many small Finnish municipalities. This is not an easy or cheap task under *laissez-faire* given that each household needs to be attracted in one-to-one negotiations. On the contrary, in public procurement, an entrant can bid for the entire (or a large enough) market on even terms with the incumbent.

While a price reduction is arguably desirable from the citizens' and even the welfare perspective, only roughly half of the local governments have a publicly procured system.[5] In the second part of the paper, we try to shed some light on the following logical inconsistency: If public procurement is better than free markets in household waste collection, why is it that many local governments still stick to the *laissez-faire* system?

We find that municipality characteristics such as population or population density are not systematically and robustly correlated with the regime choice, nor are variables measuring municipal financial status. On the contrary, municipal council characteristics have more robust predictive power. This descriptive evidence suggests that political economy considerations may prevent governments from adopting best practices in the provision of public goods or services. A number of papers have studied the role of politics and interest groups on outsourcing decisions in general and in residential waste collections in particular (see, e.g., Bel and Fageda 2007 and 2009 for surveys concerning all services, and Dubin and Navarro 1988 and Walls et al. 2005 for studies on waste collection). We contribute to this literature by studying the decision between public procurement and *laissez-faire* instead of public provision and outsourcing as usual.

The remaining part of this paper is organized as follows. In Section 2, we review some of the previous theoretical and empirical literature. Section 3 introduces our data and the institutional framework of this study. Empirical findings are presented in Sections 4 and 5.

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[5] There are four caveats to this interpretation. First, we do not observe quality differences, in particular, collection frequencies and failures to collect. According to industry experts we interviewed there is very little variation across municipalities and regimes in this respect. Second, while a lower procurement price means lower burden for residents, it also lowers profits for the firms. However, higher price can lead to under-provision of the services from the welfare perspective. Third, there may be small differences in what services the prices contain under different regimes, such as whether washing the cans is included in the price. These small differences are very unlikely to explain the large effect of the regime on the prices. Fourth, our data does not allow us to analyze the effects in the long run.

Finally, Section 6 concludes. Auxiliary tables and figures are organized in an Online Appendix.

2 Previous Literature

Investigating the efficiency of household waste collection has interested economists and public administration researchers for long. Among the earlier studies, Hirsch (1965) analyzes the relationship between waste collection costs and the type, location and financing of services in the city of St. Louis. Kemper and Quigley (1976) study the impact of market structure on costs in Connecticut. The main, but not only, limitation of these and other studies of the era is very limited data. Stevens (1978) and Edwards and Stevens (1978) use more comprehensive data sets but conduct only cross-sectional analysis. They find that competitive contractual arrangement is associated with lower prices than either provision by public monopoly or the *laissez-faire*. On the contrary, Bennett (1979) compares private and public providers within jurisdictions and finds the private somewhat more efficient in Fairfax County, U.S.

In a more recent study, Ohlsson (2003) argues that controlling for selection in producer choice changes the results from private providers being more efficient to public ones being more efficient in Sweden, although his identification rests on functional form assumptions. Other more recent studies find no differences in costs of service delivery. Callan and Thomas (2001) provide evidence from municipalities in Massachusetts, and Dijkgraaf and Gradus (2003) study Dutch cities. Bel and Costas (2006) use data from a sample of Spanish municipalities to show that privatization of waste management may yield some cost savings in short run, but these savings are eroded over time. For comprehensive surveys, we refer to Simões and Marques (2012a and 2012b).

The results from previous literature appear to be sensitive to the quality of the data, the empirical specifications and which country is analyzed, but the majority of these studies finds that the private sector is more efficient than the public. However, a crucial weakness in previous literature is that almost no analysis using even regime changes for identification have been conducted so far, let alone as-good-as-random designs. One exception is the study by Máñez et al. (2016). They use a matching strategy to estimate the effect of switching from public provision to public procurement on costs. They find that a switch induces short term costs but is better in the long run.

Another important question in the existing literature is why governments choose certain ways to deliver the services. Bel and Fageda (2007, 2009) survey earlier literature on the determinants of privatization of public services in general. They summarize that fiscal stress and production cost concerns are associated with privatization decisions. Moreover, the pressure from interest groups has predictive power whereas political ideology does not. However, more recent work finds support for the claim that also political partisan interests matter (see Bel and Fageda 2017 for a survey). For example, Elinder and Jordahl (2013) report that political color is associated with school privatization decisions in Sweden, and Zafra-Gómez *et al*. (2016) highlight the role of politics in privatization of municipal water services in Spain.

Dijkgraaf et al. (2003), Bel and Miralles (2003), Dubin and Navarro (1988), and Walls et al. (2005) study the privatization decisions in the context of waste collection markets. Findings of Bel and Miralles (2003) and Walls et al. (2005) emphasize the importance of economic and pragmatic considerations such as fiscal stress whereas the other two studies find evidence of also political ideology and the role interest groups also predicting the decisions. Our contribution is that instead of privatization decisions, we study the economic

and political determinants of the choice between public procurement and *laissez-faire*. This is

a relevant margin especially in many non-European countries, such as the United States.

3 Institutional Framework and Data

Local governments have an important role in Finland. On average, they spend about five

thousand euros per capita annually. The local public sector employs around one fifth of the

Finnish workforce, while the central government employs only around five percent. Besides

organizing waste management, municipalities are responsible for many social and health

services, education and urban planning. In this section, we describe the institutional

framework and our data in detail.

3.1 Waste Collection in Finnish Municipalities

Municipalities organize waste management either independently or via a municipal

cooperation (*Jätelaitos*). There may be variation within the cooperation on whether the

involved municipalities use public procurement or laissez-faire, but it is quite common that

all municipalities within the same cooperation use the same system.[6] In the case of a

cooperation, contracts for all involved municipalities are typically put out to public

procurement at the same time. However, the winners for each municipality are decided

independently (no joint bidding allowed). Especially the waste collection in small

municipalities is auctioned as a single contract with single winner. Some larger municipalities

may be divided to several areas that are auctioned separately. It is also possible, although not

common, that one area in a municipality is auctioned, and another area operates under

laissez-faire. The contracts usually last for five years. In some rare cases, auction decisions

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[6] To address these correlated choices, we show the robustness of the results to clustering the standard errors at the cooperation level in the Appendix (Figures A1-A2 and Tables A8-A11).

are appealed to the Market Court. If that is the case, the contracts are auctioned as temporary contracts.

The bids are in unit prices. The winners are determined solely based on prices, but there are minimum quality and license requirements. There are different prices for collecting different types of waste (for example, general waste, glass, bio-waste, and metal). Many details of operations, such as pick-up frequencies, are predetermined. The total bid for comparison is determined by multiplying the unit prices by the number of times each type of can is emptied annually. We use data only on the unit price of emptying a general waste can.

In the period we analyze, there was one dominant firm (*Lassila & Tikanoja*), in the waste management market with about 20% percent market share. The second largest firm, *SITA*, had a market share of about 4%. Both of these firms were operating nationwide. There were also several hundred very small and local firms.

3.2 Local Politics

Decision-making in Finnish municipalities is led by local councils that are responsible for the operation and economy of the municipality. Decisions are taken by a simple majority of the council members. Municipalities in Finland do not have stable governing coalitions. Instead, the political parties form coalitions on an issue-by-issue basis. The municipal council appoints a municipal executive board to prepare decision-making, but the final decisions are made by the councils. All the parties get seats in the board proportional to their seat shares in the council. Municipal councils are elected in municipal elections that are organized every fourth year. The council's term starts at the beginning of the next calendar year and ends at the end of the next election year. The municipal elections held in 2004 were dominated by three large parties from the political left, center and right: The Social Democratic Party, the Center Party, and the National Coalition Party, respectively.

3.3 Data

Our waste collection data are constructed from various sources. The price measure employed in our main analysis is the unit cost of emptying a trash can of 600 liters. Comparable price data are available only for four years and they come from surveys conducted by the Finnish Association of Local Authorities, *Kuntaliitto* (Paajanen and Mynttinen 2005, 2006, 2007, 2008).[7] Annual information on contracting systems adapted by the municipalities comes from the Finnish Solid Waste Association (*Jätelaitosyhdistys*). These data are further merged with the number of waste collection firms in each municipality obtained from our own survey directed at local solid waste associations (Tukiainen and Mälkönen 2010).

We classify the municipalities in two groups based on the market organization they have: Municipalities with *laissez-faire*, and municipalities that have procured the household waste collection in the entire municipality or at least parts of it. The prices are higher in municipalities with *laissez-faire*, 8.31 euros ($N = 268$), than under competitive contracting, 7.64 euros ($N = 413$). Moreover, there are slightly more firms in the municipalities with free markets, 2.53 ($N = 478$), compared to 1.50 ($N = 493$) in the municipalities with public procurement.

One potential limitation of the data is that perfectly comparable price information across different systems and municipalities is hard to obtain. For example, while focusing on the unit cost of emptying a trash can of 600 liters gives a comparable unit price, it may also exclude municipalities that dominantly use smaller cans from the sample, such as

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[7] The data collection ended after 2008 when the authors Paajanen and Mynttinen both retired. Some price data is also available for years 2002, 2003 and 2004. However, a different legal regime is in place during these years, and thus, the information may not be directly comparable. In the old regime, the municipality was responsible for the waste, in the new regime, the waste producers are responsible.

municipalities with low population density.[8] It may also be that the conducted price surveys target different types of households across municipalities. These issues can be alleviated to some extent by looking at changes within municipalities over time rather than across municipalities in a cross-section. Moreover, both systems may exhibit costs not included in the prices and not present in another system. For example, washing of the bins is included in public procurement prices but may be separately charged in *laissez-faire*. Bias in an opposite direction may result from the public procurement prices excluding administrative costs related to the public procurement process and planning the contract. However, also the *laissez-faire* system excludes costs that the households have from negotiating the contract, whereas such costs are absent in the public procurement case. While acknowledging these limitations, we conclude that any possible issues remaining after we focus on the within-municipality variation are very unlikely to explain the entire effect we find.

Finally, we exploit data on population and local public finances from Statistics Finland. In order to study the political determinants of contracting systems, we also use candidate-level election results from the Ministry of Justice for the 2004 election, as well as data on candidates' municipal employment status from *KEVA* (a Finnish municipal employee pension fund).

4 Effects of Market Organization Form on Prices and Entry

4.1 Empirical Strategy

To evaluate the effects of public procurement (as opposed to *laissez-faire*) on prices and the number of active firms in waste collection, we will first show results from simple pooled OLS regressions. These estimates can be given a causal interpretation only if we have

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[8] We concentrate on the 600 liters cans, as our data have the best coverage for these prices. Nevertheless, the results are robust if we use the price of emptying 240 liters cans instead (see the Appendix Table A6).

included all municipality-level covariates that are correlated with both the outcome and the treatment dummies. This is a rather strong assumption and therefore, one should treat the estimates merely as correlations. Typically, the literature has relied on similar cross-sectional evidence. Thus, it is interesting to compare the OLS estimates to those resulting from a more reliable research design.

In order to obtain more credible results, we estimate the following generalized difference-in-differences specification:

$$Y_{mt} = \beta 1[Public\ procurement]_{mt} + \alpha_m + \lambda_t + \boldsymbol{X'}_{mt}\boldsymbol{\gamma} + e_{mt}.$$

Here, Y_{mt} is the outcome of interest, and $1[Public\ procurement]_{mt}$ is a dummy for using public procurement in the entire municipality or at least some parts of the municipality. α_m and λ_t are the municipality and time fixed effects, respectively. They capture municipality-specific time-invariant characteristics, and annual shocks common to all municipalities such as inflation. $\boldsymbol{X'}_{mt}$ is a vector of covariates, and e_{mt} is the error term in municipality m at time t. The main coefficient of interest β tells how much the prices (or the number of firms) change when a municipality switches from the *laissez-faire* to public procurement relative to a possible simultaneous price change in a municipality that maintained the *status quo* of *laissez-faire* policy. In order to facilitate the estimation of the specification with municipality fixed effects, we only include municipalities with at least two observations of the outcome. If the standard common trends assumption is satisfied, we can give the estimates a causal interpretation. Otherwise, the estimates only imply a conditional correlation.

We illustrate the switches between alternative systems in the data in Appendix Table A1. It is more common that a municipality switches the system from laissez-faire to public procurement. Effectively, the effect of public procurement on prices is identified from a smaller number of observations than the transition matrices would suggest. We have data before and after the system change from 23 municipalities, after we have made the sample

restrictions described above. We observe the number of firms before and after the reform for 48 municipalities that switch their form of market organization.

4.2 Effects on Prices

We begin our empirical assessment by plotting the average prices before and after changing the market organization form in Figure 1. We also match these data with prices in municipalities that do not switch their system during the period of our analysis. To do so, we construct weighted averages of prices where the weights are based on the number of observations concerning each year in our data. Indeed, it appears that switching to a publicly procured system reduces prices. Note that there are relatively few observations two years before changing the system as well as two years after the change. However, even looking at the prices right before and immediately after the public procurement suggests a reduction in the waste collection prices. The prices in municipalities with laissez-faire are relatively stable, but perhaps somewhat surprisingly, the prices in municipalities that always have public procurement are sloping upwards.

In Table 1, we move on to the regression analysis. First, the pooled OLS results that having a mixed system or publicly procured waste collection is negatively associated with prices (columns (1)-(3)).[9] The coefficients indicate that unit prices are between 0.72 and 0.82 euro lower in public procurement municipalities than *laissez-faire* municipalities. Relative to the constant, this implies from 10.5 to 13.1 percentage difference. In columns (4)-(6) we report the difference-in-differences estimates. They suggest that government intervention through public procurement leads to a decrease of between 1.39 and 3.05 euro in unit prices.

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[9] Restricting the pooled OLS sample to the same sample as we use in the difference-in-difference estimations affects the estimation results only marginally (see Table A2 in the Appendix).

Given that the mean price under *laissez-faire* is 8.32, the decrease is between 17 and 37 percentage.

In Online Appendix A, we report the difference-in-differences results using two alternative samples. First, we show that the estimated effect is similar in a sample that includes only those municipalities that switch from *laissez-faire* to public procurement and those that always have laissez-faire. Second, we limit our analysis to only the municipalities that switch their system at least once between 2005-2008. Again, the empirical results are similar to those reported in this section (see Table A3). In Appendix Table A4, we add data from years 2002-2004 to our estimations. We show that including these data from somewhat different regulatory environment does not alter our conclusions.

The difference-in-differences approach is valid if the common trends assumption is met, i.e., the outcomes in the switching municipalities would have evolved in the same way as those in the control group of non-switching municipalities if the switching municipalities had not switched. An indirect test for this assumption is whether there are no diverging pre-treatment trends between the treatment and the control group. We study whether this criterion is satisfied by estimating the results including municipality-specific time trends (e.g., Angrist and Pischke 2009). The estimation results controlling for the municipality-specific time trends are reported in columns (6) and (12). While the magnitude of the estimates increases after including the municipality-specific time trends, the estimated effect remains negative and statistically significant. Note that the estimation sample changes slightly from what we had before, as we need at least three observations per municipality in order to estimate a model with the municipality-specific time trends. This as well as losing degrees of freedom increases the standard errors.[10]

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[10] Another way to test the validity of the results is to include leads of the treatment variable in the estimation equation. We discuss this test in Appendix A (Figure A3). The results there are as expected and support the validity of the design.

Figure 1. Prices before and after public procurement.
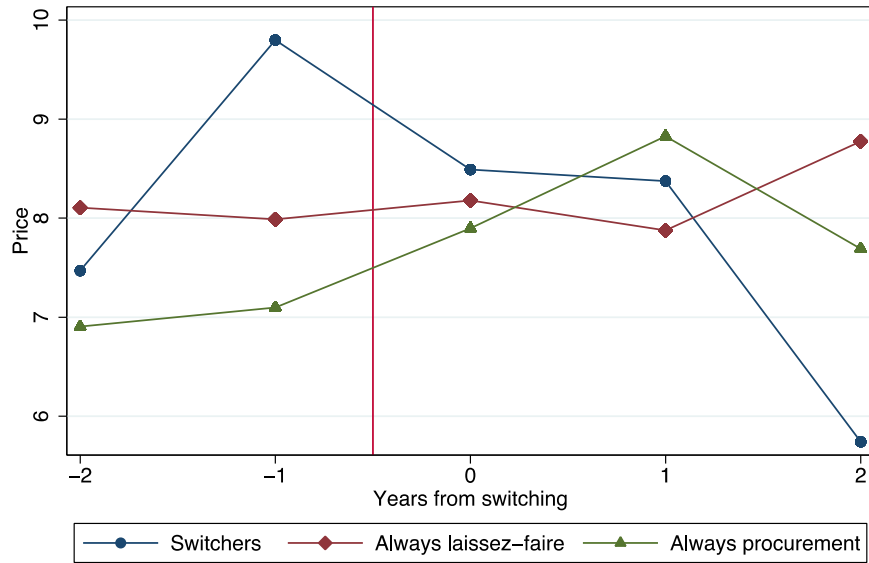
Table 1. Regression results for prices.

	Pooled OLS			DID		
	(1)	(2)	(3)	(4)	(5)	(6)
1[Public procurement]	-0.822***	-0.723***	-0.823***	-1.394***	-1.424***	-3.046***
	[0.247]	[0.235]	[0.259]	[0.243]	[0.250]	[0.487]
Constant	7.739***	5.529***	7.865***			
	[0.217]	[2.095]	[2.223]			
N	681	681	681	604	604	438
R^2	0.06	0.15	0.33	0.11	0.12	0.63
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Population controls	No	Yes	Yes	No	Yes	Yes
Region dummies	No	No	Yes	No	No	No
Municipality FE	No	No	No	Yes	Yes	Yes
Municipality-specific time trends	No	No	No	No	No	Yes

Notes: Population controls include population and squared population and share of young and old inhabitants. Standard errors clustered at the municipality level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

4.3 Effects on Number of Firms

Different practices in household waste collection may not affect only the prices but also the market structure. We analyze this aspect next. Figure 2 plots the mean number of firms before and after switching form *laissez-faire* to public procurement in household waste collection. We see that the number of waste collection firms declines slightly after a

municipality switches to publicly procured waste collection. Furthermore, it seems that there could be some anticipation of the upcoming change in the market organization form, as the average number of firms goes down already before the switch. The figure also shows that municipalities that always have public procurement have less firms than municipalities that always have a *laissez-faire* system.

We verify that having publicly procured waste collection is negatively associated with the number of firms active in the municipality in Panel A of Table 2. As before, one should think of the estimates in columns (1)-(3) rather as correlation than causal estimates. The estimates from the fixed effects specifications (columns (4)-(6)) suggest that switching from decentralized to centralized system induces a small though statistically significant reduction in the number of firms, although it should be noted that this decrease is rather small.[11]

We have also estimated an alternative model where the dependent variable is a dummy for a municipality having a monopoly or a duopoly in waste collection (see Table A7 in the Appendix). The difference-in-differences estimate without municipality-specific time trends suggests that adapting the publicly procured system increases the likelihood of having a waste collection monopoly by 19 percentage points ($p < 0.05$). Controlling for the municipality-specific time trends, this effect goes down to 15.8 percentage points ($p < 0.10$). Similarly, adopting a publicly procured system increases the likelihood of a municipality having a monopoly or a duopoly by 18.3 percentage points when not controlling for the municipality-specific time trends ($p < 0.01$), and by 13.8 percentage points when controlling for the trends ($p < 0.05$). Thus, the decrease in the number of firms could be happening at a very important margin. This also raises the concern that larger firms might be able to cause smaller firms to exit. We address this potential outcome of procurement in Panel B of Table

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[11] This result is mainly mechanical as most of the municipalities are auctioned to one firm. A better measure of competition in the public procurement case could be the number of bidders which we, unfortunately, do not observe.

2, where we check whether the contracting system makes it more likely that *Lassila &*
Tikanoja (*L&T*), the largest waste management firm active in Finland, is active in the local
waste collection market. If anything, we observe a negative association in the OLS
regression, but this relationship vanishes completely in the difference-in-differences
specification. Therefore, the public procurement system does not seem to favor or penalize
the largest firm to any noticeable extent.

In Appendix Table A5, we report the results on firm effects using the same alternative
samples as discussed in the previous subsection. We find that the effect of public
procurement on the number of firms is very similar if we drop the municipalities that always
have public procurement out of the estimation sample.

Figure 2. Number of firms before and after public procurement.
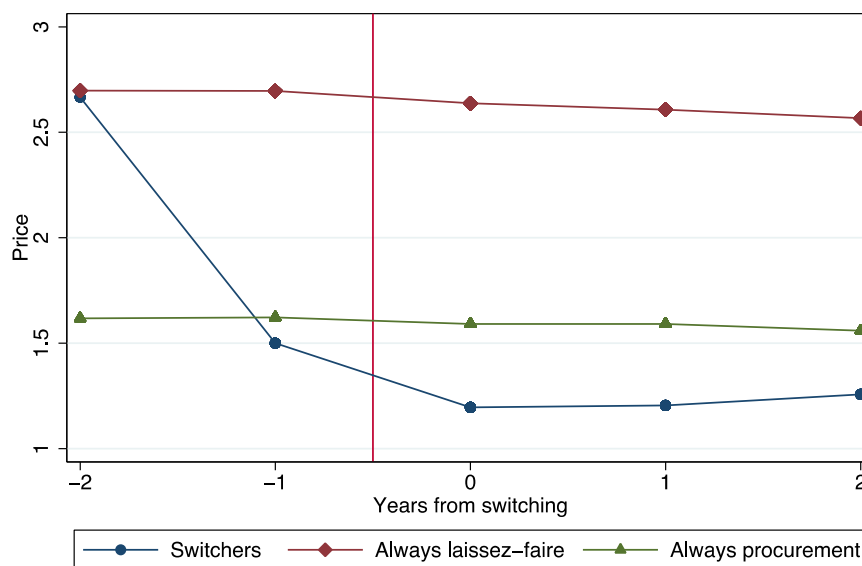
Table 2. Regression results for firms.

	Panel A: Number of firms					
	Pooled OLS			DID		
	(1)	(2)	(3)	(4)	(5)	(6)
1[Public procurement]	-1.037***	-1.160***	-1.055***	-0.350**	-0.361**	-0.290**
	[0.197]	[0.188]	[0.225]	[0.145]	[0.140]	[0.137]
Constant	2.467***	4.485***	1.91			
	[0.170]	[1.360]	[1.437]			
N	971	971	971	968	968	954
R^2	0.10	0.18	0.44	0.07	0.14	0.75
	Panel B: L&T is active on the market					
	Pooled OLS			DID		
	(7)	(8)	(9)	(10)	(11)	(12)
1[Public procurement]	-0.060	-0.096**	-0.090**	-0.013	-0.015	0.005
	[0.049]	[0.043]	[0.038]	[0.016]	[0.016]	[0.011]
Constant	0.426***	1.860***	1.584***			
	[0.036]	[0.397]	[0.424]			
N	1298	1298	1298	1292	1292	1270
R^2	0.01	0.21	0.43	0.01	0.02	0.66
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Population controls	No	Yes	Yes	No	Yes	Yes
Region dummies	No	No	Yes	No	No	No
Municipality FE	No	No	No	Yes	Yes	Yes
Municipality-specific time trends	No	No	No	No	No	Yes

Notes: Population controls include population and squared population and share of young and old inhabitants. Standard errors clustered at the municipality level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

4.4 Discussion

Publicly procured waste collection decreases the number of firms acting in the local market but also yields an economically meaningful and statistically significant reduction in waste collection prices compared to a *laissez-faire* system. Moreover, the public procurement does not seem to favor large firms over small ones.

One potential caveat in the analysis is that part of the effect could also be due to inaccuracy in the price measure and potential overestimation of prices in decentralized systems. However, it is unlikely that only these reasons would be behind the effects that are this large. Moreover, it seems that quality differences in the waste collection from the

household's perspective seem limited. It does not seem plausible that waste collection firms would behave very differently from each other in the actual process of emptying the trash cans. Moreover, in both regimes, the overall regulation in Finland is quite strict on how the waste collection must be organized. The key consideration for customers is probably how often the waste is collected. We measure unit costs, and thus, our comparison should be fairly robust to quality concerns.

Besides informing directly on the optimal form of organizing waste collection, our results have wider implications for the optimal impure public good market organization as we provide an example where government involvement seems to bring efficiency gains. Our results are also related to literature on how to run procurement auctions, for example, whether to allow more or less buyer discretion regarding which firms are allowed to bid (Coviello et al. 2017; Hyytinen et al. 2017).

5 Predictors of Market Organization Form

If public procurement of waste collection can reduce the unit prices, which is arguably desirable from the citizens' point of view, why do some municipalities stick with the worse alternative? As the decision is carried out by (elected) local politicians, one obstacle may be the political representation of groups with preferences against public procurement. Another reason to study the determinants of organization form is that the price effect we find could be overestimated if the switching municipalities have, for some unknown reason, benefited more from switching the system than the potential future switchers. We can alleviate this concern to some extent by analyzing what explains switching. If variables that are likely to affect the costs of production (for example, population density) or the benefits of switching (for example, population size) do not explain regime choice, it seems less likely that the regime change takes place substantially more in places that benefit the most.

We stress that the analysis in this section is merely descriptive. Further quasi-experimental work is needed to establish any results with a causal interpretation. Given the descriptive nature of our analysis, we do not aim to test specific hypotheses, but rather merely provide explorative evidence and *ex-post* interpretations of the patters in the data.

Table 3 provides summary statistics on the municipalities with a publicly procured market organization and those with a *laissez-faire*. There are some differences between the municipalities with different systems. For example, procurement municipalities are slightly larger than the *laissez-faire* ones. This is perhaps somewhat odd as small municipalities are likely to suffer most from the natural monopoly issues of *laissez-faire* discussed earlier. Moreover, it appears that municipalities with different market organization forms in waste collection could have a different local political landscape.

Next, we analyze the predictors of market organization form in a regression framework. The analysis in Table 4 pools together all years for which we have data on market organization form in household waste collection. However, we cluster the inference at the municipality level to avoid unnecessary precision due to using many observations of the same municipality and council term. Therefore, our analysis can be seen as looking at the average of the public procurement dummy over the electoral term. We regress a dummy for having a publicly procured system on different sets of variables, and control for year fixed effects. Some of the council characteristics have predictive power on regime type even when including the other municipal characteristics. Moreover, the R^2 increases substantially. It goes up from 0.04 to 0.11 when council characteristics are added to a model with municipal population and financial characteristics. The increase is much smaller the other way around (from 0.10 to 0.11). Overall, the evidence suggests that political considerations are more important than those related to the costs and benefits of the regime type.

In Table 5, we study the predictors of switching from laissez-faire to public procurement. We concentrate on the samples for which we observe the price, that is, the council term 2005-2008. We further limit the estimation sample to those municipalities that switch their system from *laissez-faire* to public procurement or always maintain *laissez-faire* in columns (4)-(6). First, we define a dummy that gets value 0 if a municipality does not switch from laissez-faire to public procurement during years 2005-2008, and value 1 if it does. Second, we use only one observation per municipality. Thus, the coefficients are informative about how the variables predict switching at any point during the council term. Now, population and financial characteristics seem to be as important as political characteristics as predictors of the market organization form.

While the correlational analyses in Tables 4 and 5 provide a somewhat ambiguous message, it is safe to say that the political variables predict the system choice. The single most robust predictor in these analyses is the Left Alliance seat share which seems to be negatively associated with adopting public procurement in household waste collection. When the reference group is the (center-right) National Coalition Party, increasing the Left Alliance seat share by one percentage point is associated with slightly over one percentage point reduction in the likelihood of a municipality having publicly procured waste collection (Table 4). In a median-sized council with 27 local councilor, this would mean that taking one seat away from the National Coalition Party and giving it to the Left Alliance is associated with five percentage points lower likelihood of having public procurement. The results in Table 5, on the other hand, suggest that adding one more Left Alliance councilor (and taking away one National Coalition Party councilor) would be associated with almost nine percentage points (-0.023*100*(1/27)*100) lower likelihood of switching from *laissez-faire* to public procurement in the richest specification (6). This seems perhaps unexpected, as public procurement is less market-oriented than *laissez-faire*, and the Left Alliance is the most left-

leaning party among the major Finnish parties. However, it may be that left-wing politicians consider public procurement as a case of sleeping with the enemy, and thus, dislike it the most. It could also be the case that they are more interested in preventing public procurement in important sectors, such as health care and education. Thus, they might dislike experiences with public procurement in other areas, even if it might come with positive consequences.

Table 3. Choice of organization form, descriptive statistics.

Variable	Laissez-faire			Procurement			Difference
	N	Mean	Std. dev.	N	Mean	Std. dev.	
Municipality characteristics							
Population	640	10522	20472	658	17651	52629	-7129
Population density	640	0.56	0.43	658	0.60	0.41	-0.04
Landfill	640	0.17	0.38	658	0.19	0.39	-0.02
Share of young population	640	17.37	3.85	658	17.05	3.34	0.32
Share of old population	640	19.97	4.69	658	19.75	5.11	0.22
Expenditure per capita	640	4840	791	658	4945	799	-106
Deficit per capita	640	5	219	658	-14	265	19
Municipal income tax rate	640	18.79	0.59	658	18.69	0.77	0.09
Council characteristics							
Municipal employees %	640	20.97	7.87	658	22.36	9.32	-1.39
Incumbents %	640	58.55	9.64	658	58.08	9.02	0.48
Women %	640	35.76	8.40	658	37.50	8.29	-1.74*
Center Party %	640	44.45	18.65	658	37.43	22.72	7.02***
National Coalition Party %	640	16.45	10.78	658	17.61	10.87	-1.16
Social Democratic Party %	640	19.98	12.09	658	21.98	10.65	-2.00
Left Alliance %	640	9.20	8.18	658	6.26	7.32	2.93***
Christian Democratic Party %	640	2.43	3.79	658	3.19	3.54	-0.76*
Green Party %	640	1.67	3.15	658	2.42	3.95	-0.75*
True Finns %	640	1.09	3.40	658	0.78	2.60	0.31
Other parties %	640	3.28	9.95	658	4.37	8.79	-1.10

Notes: Differences in means are tested using a *t*-test adjusted for clustering at the municipality level. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

Table 4. Predictors of organization form, regression analysis.

	(1)	(2)	(3)
Population/10,000	0.003		-0.005
	[0.017]		[0.018]
(Population/10,000)^2	0.000		0.000
	[0.000]		[0.000]
Population density	0.041		0.052
	[0.085]		[0.092]
Share of young population	-0.021*		-0.008
	[0.012]		[0.013]
Share of old population	-0.015		-0.008
	[0.012]		[0.012]
Landfill	-0.076		-0.024
	[0.064]		[0.063]
Expenditure per capita	0.000		0.000*
	[0.000]		[0.000]
Deficit per capita	0.000		0.000
	[0.000]		[0.000]
Municipal income tax rate	-0.072**		-0.036
	[0.036]		[0.036]
Center Party seat share		-0.005***	-0.004***
		[0.001]	[0.001]
Social Democratic Party seat share		-0.003	-0.003
		[0.003]	[0.003]
Left Alliance seat share		-0.013***	-0.014***
		[0.003]	[0.003]
Christian Democratic Party seat share		0.008	0.008
		[0.008]	[0.008]
Green Party seat share		0.002	-0.002
		[0.008]	[0.010]
True Finns seat share		-0.006	-0.007
		[0.008]	[0.008]
Other parties seat share		0.000	0.000
		[0.003]	[0.003]
Municipal employees' seat share		0.005*	0.005*
		[0.003]	[0.003]
Incumbents' seat share		-0.002	-0.002
		[0.003]	[0.003]
Women's seat share		0.003	0.003
		[0.003]	[0.003]
N	1298	1298	1298
R^2	0.04	0.10	0.11

Notes: Dependent variable is a dummy for having publicly procured waste collection. All specifications control for year fixed effects. Standard errors clustered at the municipality level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

Table 5. Switching to public procurement over the council term.

	(1)	(2)	(3)	(4)	(5)	(6)
Population/10,000	0.000		0.000	-0.000**		-0.000*
	[0.000]		[0.000]	[0.000]		[0.000]
(Population/10,000)^2	0.000**		0.000	0.000*		0.000**
	[0.000]		[0.000]	[0.000]		[0.000]
Population density	-0.128		-0.037	0.162		0.354*
	[0.091]		[0.094]	[0.162]		[0.197]
Share of young population	4.602**		3.209*	4.227		5.276*
	[1.772]		[1.774]	[2.582]		[2.694]
Share of old population	0.000		-0.007	-0.021		0.002
	[0.015]		[0.015]	[0.023]		[0.026]
Landfill	0.102		0.153**	0.029		0.103
	[0.067]		[0.065]	[0.138]		[0.132]
Expenditure per capita	0.000***		0.000***	0.000**		0.000
	[0.000]		[0.000]	[0.000]		[0.000]
Deficit per capita	0.000***		0.000	0.000*		0.000
	[0.000]		[0.000]	[0.000]		[0.000]
Municipal income tax rate	0.108***		0.113***	0.120		0.153**
	[0.030]		[0.031]	[0.077]		[0.072]
Center Party seat share		0.005**	0.003		0.000	-0.001
		[0.002]	[0.002]		[0.003]	[0.003]
Social Democratic Party seat share		0.001	0.003		-0.005	-0.008
		[0.003]	[0.003]		[0.006]	[0.006]
Left Alliance seat share		-0.007**	-0.010***		-0.028***	-0.023***
		[0.003]	[0.003]		[0.006]	[0.006]
Christian Democratic Party seat share		-0.025***	-0.024***		-0.025	-0.005
		[0.007]	[0.006]		[0.016]	[0.016]
Green Party seat share		0.005	-0.002		-0.007	0.000
		[0.006]	[0.008]		[0.016]	[0.017]
True Finns seat share		0.001	0.004		0.000	0.011
		[0.013]	[0.013]		[0.013]	[0.013]
Other parties seat share		0.007***	0.006**		0.003	0.006
		[0.003]	[0.003]		[0.004]	[0.005]
Municipal employees' seat share		0.002	0.001		0.004	0.006
		[0.003]	[0.003]		[0.006]	[0.005]
Incumbents' seat share		-0.005*	-0.005*		-0.003	-0.011**
		[0.003]	[0.003]		[0.006]	[0.005]
Women's seat share		0.002	0.002		0.003	-0.005
		[0.004]	[0.004]		[0.006]	[0.006]
N	219	219	219	99	99	88
R^2	0.22	0.20	0.33	0.26	0.28	0.50
Sample		Price FE regressions			Always laissez-faire and switchers	

Notes: Dependent variable is a dummy for switching to publicly procured waste collection. Each municipality is included only once. Columns (1)-(3) use data from the municipalities that are included in the price FE regressions. Columns (4)-(6) restrict the sample further to the municipalities that always have laissez-faire or switch to public procurement and for which prices are observed. Standard errors clustered at the municipality level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

6 Concluding Remarks

This paper shows that public procurement of household waste collection reduces the number of firms acting in the local market but also induces an economically and statistically significant drop in waste collection prices compared to a decentralized system. Thus, the results are suggestive that public procurement is likely to be desirable from the citizens' perspective. Yet, only around half of the local governments have adapted a centralized system.

We provide a potential explanation for this paradox by analyzing the correlates of organizational form descriptively. We show that municipal council characteristics predict the choice of organizational form. This suggests that political economy concerns may be one obstacle to efficient provision of public goods. In essence, our results speak to two fundamental questions in public finance and political economy: What should the government do, and why does this not happen.

References

Angrist, J. and S. Pischke (2009), *Mostly Harmless Econometrics*. Princeton, NJ: Princeton University Press.

Alchian, A. A. and H. Demsetz (1972), "Production, Information Costs, and Economic Organization", *American Economic Review* 62(5), 777–795.

Bandiera, O., A. Prat and T. Valletti (2009), "Active and Passive Waste in Government Spending: Evidence from a Policy Experiment", *American Economic Review* 99(4), 1278–1308.

Bel, G. and A. Costas (2006), "Do Public Sector Reforms Get Rusty? Local Privatization in Spain", *Journal of Policy Reform* 9(1), 1–24.

Bel, G. and X. Fageda (2009), "Factors explaining local privatization: a meta-regression analysis", *Public Choice* 139, 105–119.

Bel, G. and X. Fageda (2007), "Why do local governments privatize public services? A survey of empirical studies", *Local Government Studies* 33(4), 517–534.

Bel, G. and X. Fageda (2017), "What have we learned from the last three decades of empirical studies on factors driving local privatization", *Local Government Studies* 43(4), 503–511.

Bel, G. and A. Miralles (2003), "Factors Influencing the Privatisation of Urban Solid Waste Collection in Spain", *Urban Studies* 40(7), 1323–1334.

Bennett, J. T. and M. H. Johnson (1979), "Public versus private provision of collective goods and services: garbage collection revisited", *Public Choice* 34, 55–63.

Callan, S. J. and J. M. Thomas (2001), "Economies of scale and scope: a cost analysis of municipal solid waste services", *Land Economics* 77(3), 548–60.

Cai, H., Q. Zhang and V. J. Henderson (2013), "China's land market auctions: evidence of corruption?" *RAND Journal of Economics* 44, 488-521.

Christoffersen, H. and M. Paldam (2003), "Markets and municipalities: a study of the behaviour of the Danish municipalities", *Public Choice* 114(1–2), 79–102.

Coviello, D., A. Guglielmo and G. Spagnolo (2017), "The Effect of Discretion on Procurement Practices", Forthcoming in *Management Science*.

Dijkgraaf, E. and R. H. J. M. Gradus (2003), "Contracting out refuse collection", *Empirical Economics* 28(3), 553–570.

Dijkgraaf, E., R. H. J. M. Gradus and B. Melenberg (2003), "Cost savings of contracting out refuse collection", *Empirica* 30(2), 149–161.

Dubin, J. A. and P. Navarro (1988), "How Markets for Impure Public Goods Organize: The Case of Household Refuse Collection", *Journal of Law, Economics and Organization* 4(2), 217–241.

Edwards, F. R. and B. J. Stevens (1978), "The Provision of Municipal Sanitation Services by Private Firms: An Empirical Analysis of the Efficiency of Alternative Market Structures and Regulatory Arrangements", *Journal of Industrial Economics* XXVII(2), 133–147.

Elinder, M. and H. Jordahl (2013), "Political preferences and public sector outsourcing", *European Journal of Political Economy* 30, 43–57.

Hirsch, W. Z. (1965), "Cost functions of an urban government service: refuse collection", *Review of Economics and Statistics* 47(1), 89–92.

Hyytinen, A., S. Lundberg and O. Toivanen (2017), "Design of Public Procurement Auctions: Evidence from Cleaning Contracts", Forthcoming in *RAND Journal of Economics*.

Kemper, P. and J. M. Quigley (1976), *The Economics of Refuse Collection*. Ballinger, Cambridge, MA.

Máñez, J., G. Pérez-López, D. Prior and J. L. Zafra-gómez (2016). Understanding the Dynamic Effect of Contracting Out on the Delivery of Local Public Services. *Regional Studies* 50(12), 2069-2080.

Paajanen, S. and M. Mynttinen (2005), *Tietoja kuntien jätehuollosta. Kysely 2005.* Kuntaliitto.

Paajanen, S. and M. Mynttinen (2006), *Tietoja kuntien jätehuollosta. Kysely 2006.* Kuntaliitto.

Paajanen, S. and M. Mynttinen (2007), *Tietoja kuntien jätehuollosta. Kysely 2007.* Kuntaliitto.

Paajanen, S. and M. Mynttinen (2008), *Tietoja kuntien jätehuollosta. Kysely 2008.* Kuntaliitto.

Niskanen, W. A. (1971), *Bureaucracy and Representative Government.* Chicago: Aldine, Atherton.

Ohlsson, H. (2003), "Ownership and Production Costs: Choosing between Public Production and Contracting-Out in the Case of Swedish Refuse Collection", *Fiscal Studies* 24(4), 451–476.

Simões, P. and R. Cunha Marques (2012a), "On the economic performance of the waste sector. A literature review", *Journal of Environmental Management* 106, 40–47.

Simões, P. and R. Cunha Marques (2012b), "The performance of private partners in the waste sector", *Journal of Cleaner Production* 29-30, 214–221.

Spann, R. M. (1977), "Public versus Private Provision of Governmental Services", In Borcherding, Thomas (ed.) *Budgets and Bureaucrats: The Sources of Government Growth*. Durham, N.C.: Duke University Press.

Stevens, B. J. (1979), "Scale, Market Structure, and the Cost of Refuse Collection", *Review of Economics and Statistics* 60(3), 438–448.

Tukiainen, J. and V. Mälkönen (2010), "Jätekuljetuksen sopimusmallien yritysvaikutukset", VATT Valmisteluraportit 1.

Zafra-Gómez, J. L., A. M.López-Hernández, A. M. Plata-Díaz and J. C. Garrido-Rodríguez (2016), "Financial and political factors motivating the privatisation of municipal water services", *Local Government Studies* 42(2), 287-308.

Walls, M., M. Macauley and S. Anderson (2005), "Private Markets, Contracts, and Government Provision. What Explains the Organization of Local Waste and Recycling Markets?", *Urban Affairs Review* 40(5), 590–613.

Public Procurement versus *Laissez-Faire*:
Evidence from Household Waste Collection

Online appendix

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This document includes supplementary results to "Public Procurement versus *Laissez-Faire*: Evidence from Household Waste Collection".

Table A1. Transitions between *laissez-faire* and public procurement.

		t-1	
	Panel A: Full data		
		Laissez-faire	Public procurement
t	Laissez-faire	595	3
	Public procurement	58	578
	Panel B: Price observed		
		t-1	
		Laissez-faire	Public procurement
t	Laissez-faire	247	2
	Public procurement	40	361
	Panel C: Number of firms observed		
		t-1	
		Laissez-faire	Public procurement
t	Laissez-faire	462	1
	Public procurement	47	436

Table A2. OLS results restricting the analysis to the difference-in-differences sample.

	Panel A: Price		
	(1)	(2)	(3)
1[Public procurement]	-0.865***	-0.783***	-0.864***
	[0.264]	[0.251]	[0.270]
Constant	7.609***	4.593*	7.809***
	[0.208]	[2.525]	[2.675]
N	604	604	604
R^2	0.08	0.17	0.37
	Panel B: Number of firms		
	(4)	(5)	(6)
1[Public procurement]	-1.045***	-1.168***	-1.059***
	[0.198]	[0.189]	[0.226]
Constant	2.471***	4.473***	1.905
	[0.170]	[1.363]	[1.441]
N	968	968	968
R^2	0.10	0.18	0.44
Year dummies	Yes	Yes	Yes
Population controls	No	Yes	Yes
Region dummies	No	No	Yes

Notes: Population controls include population and squared population and share of young and old inhabitants. Standard errors clustered at the municipality level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

Table A3. Effect on prices using alternative samples.

	Panel A: Switchers and always *laissez-faire*		
	(1)	(2)	(3)
1[Public procurement]	-1.479***	-1.561***	-3.669***
	[0.354]	[0.380]	[0.976]
N	304	304	198
R^2	0.10	0.11	0.53
	Panel B: Only switchers		
	(4)	(5)	(6)
1[Public procurement]	-4.036***	-3.927***	-4.929**
	[1.132]	[1.209]	[2.365]
N	119	119	97
R^2	0.33	0.39	0.71
Year dummies	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes
Population controls	No	Yes	Yes
Municipality-specific time trends	No	No	Yes

Notes: Population controls include population and squared population and share of young and old inhabitants. Standard errors clustered at the municipality level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

Table A4. Effects on prices including data from 2002-2008.

	Pooled OLS			DID		
	(1)	(2)	(3)	(4)	(5)	(6)
1[Public procurement]	-0.998***	-0.916***	-0.670***	-0.716***	-0.735***	-0.776***
	[0.172]	[0.160]	[0.186]	[0.127]	[0.126]	[0.224]
Constant	6.544***	3.418**	5.482***			
	[0.172]	[1.492]	[1.534]			
N	1230	1230	1230	1049	1049	1049
R^2	0.18	0.27	0.41	0.28	0.29	0.54
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Population controls	No	Yes	Yes	No	Yes	Yes
Region dummies	No	No	Yes	No	No	No
Municipality FE	No	No	No	Yes	Yes	Yes
Municipality-specific time trends	No	No	No	No	No	No

Notes: Population controls include population and squared population and share of young and old inhabitants. Standard errors clustered at the municipality level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

Table A5. Effect on firms using alternative samples.

	Panel A: Switchers and always *laissez-faire*		
	(1)	(2)	(3)
1[Public procurement]	-0.369**	-0.364**	-0.320**
	[0.144]	[0.141]	[0.136]
N	603	603	599
R^2	0.12	0.13	0.74
	Panel B: Only switchers		
	(4)	(5)	(6)
1[Public procurement]	-0.829***	-0.816***	-0.636***
	[0.178]	[0.149]	[0.120]
N	182	182	182
R^2	0.22	0.29	0.80
Year dummies	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes
Population controls	No	Yes	Yes
Municipality-specific time trends	No	No	Yes

Notes: Population controls include population and squared population and share of young and old inhabitants. Standard errors clustered at the municipality level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

Table A6. Effects on prices using 240-liter trash can as outcome price unit.

	Pooled OLS			DID		
	(1)	(2)	(3)	(4)	(5)	(6)
1[Public procurement]	-0.499***	-0.465***	-0.498***	-0.454***	-0.451***	-0.817***
	[0.113]	[0.109]	[0.111]	[0.127]	[0.128]	[0.240]
Constant	4.558***	2.918***	3.946***			
	[0.084]	[0.820]	[0.764]			
N	637	637	637	562	562	372
R^2	0.10	0.19	0.44	0.10	0.10	0.55
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Population controls	No	Yes	Yes	No	Yes	Yes
Region dummies	No	No	Yes	No	No	No
Municipality FE	No	No	No	Yes	Yes	Yes
Municipality-specific time trends	No	No	No	No	No	Yes

Notes: Population controls include population and squared population and share of young and old inhabitants. Standard errors clustered at the municipality level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

Table A7. Effects on having a monopoly or a duopoly in waste collection.

	Panel A: Monopoly					
	Pooled OLS			DID		
	(1)	(2)	(3)	(4)	(5)	(6)
1[Public procurement]	0.253***	0.299***	0.213***	0.193**	0.190**	0.158*
	[0.058]	[0.053]	[0.055]	[0.084]	[0.083]	[0.095]
Constant	0.432***	-1.541***	-0.224			
	[0.042]	[0.416]	[0.441]			
N	971	971	971	968	968	954
R^2	0.06	0.22	0.50	0.06	0.07	0.65
	Panel B: Monopoly or duopoly					
	Pooled OLS			DID		
	(7)	(8)	(9)	(10)	(11)	(12)
1[Public procurement]	0.236***	0.276***	0.210***	0.186***	0.183***	0.138**
	[0.050]	[0.046]	[0.042]	[0.070]	[0.067]	[0.060]
Constant	0.647***	-0.238	0.393			
	[0.040]	[0.349]	[0.336]			
N	971	971	971	968	968	954
R^2	0.08	0.20	0.42	0.07	0.10	0.75
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Population controls	No	Yes	Yes	No	Yes	Yes
Region dummies	No	No	Yes	No	No	No
Municipality FE	No	No	No	Yes	Yes	Yes
Municipality-specific time trends	No	No	No	No	No	Yes

Notes: Population controls include population and squared population and share of young and old inhabitants. Standard errors clustered at the municipality level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

In Figure A1, we show in the Finnish map which municipalities have public procurement system (or the mixed system) and which have *laissez-faire*. In Figure A2, we show which municipalities switch the system between 2005 and 2008. Both of the maps indicate heavy clustering of regime choices and switching decisions. This is because many municipalities organize waste management via municipal cooperation organizations and these organizations tend to take similar decisions for all or most of the municipalities involved. This will potentially lead to issues of clustering at the cooperation level. In Tables A8-A11 we study the robustness of all the main results to clustering the statistical inference at the cooperation level. The inference is robust.

Figure A1. Market organization forms in Finnish municipalities in the year 2005.
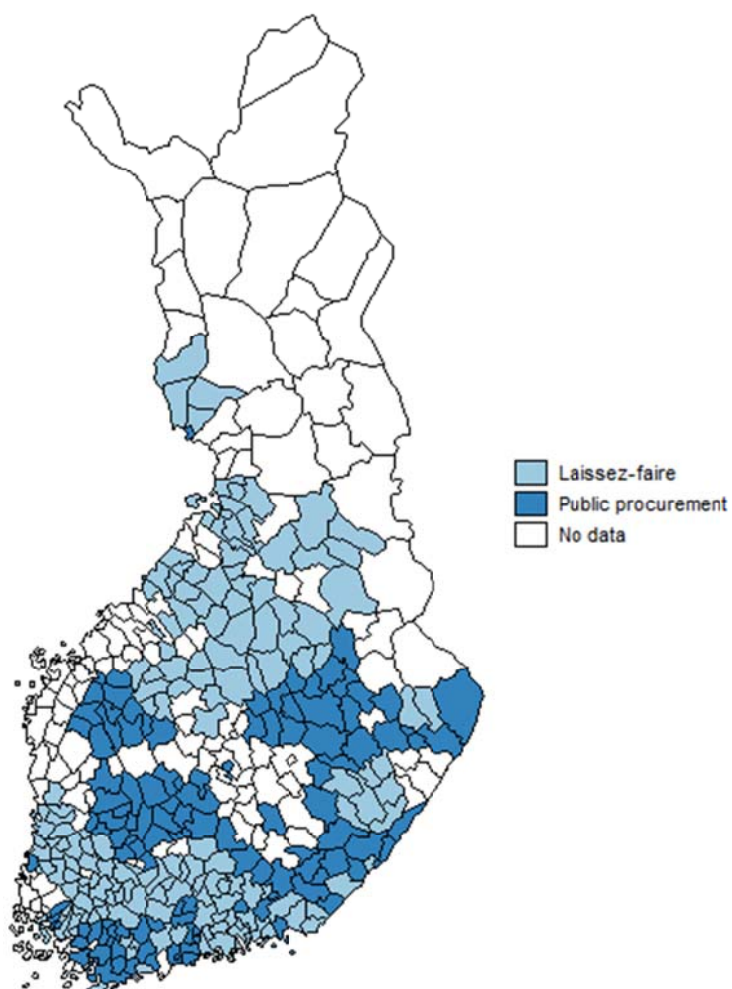
Notes: The figure shows municipalities with laissez-faire and public procurement in waste collection in Finnish municipalities.

Figure A2. Municipalities that switch from laissez-faire to public procurement between the years 2005 and 2008.
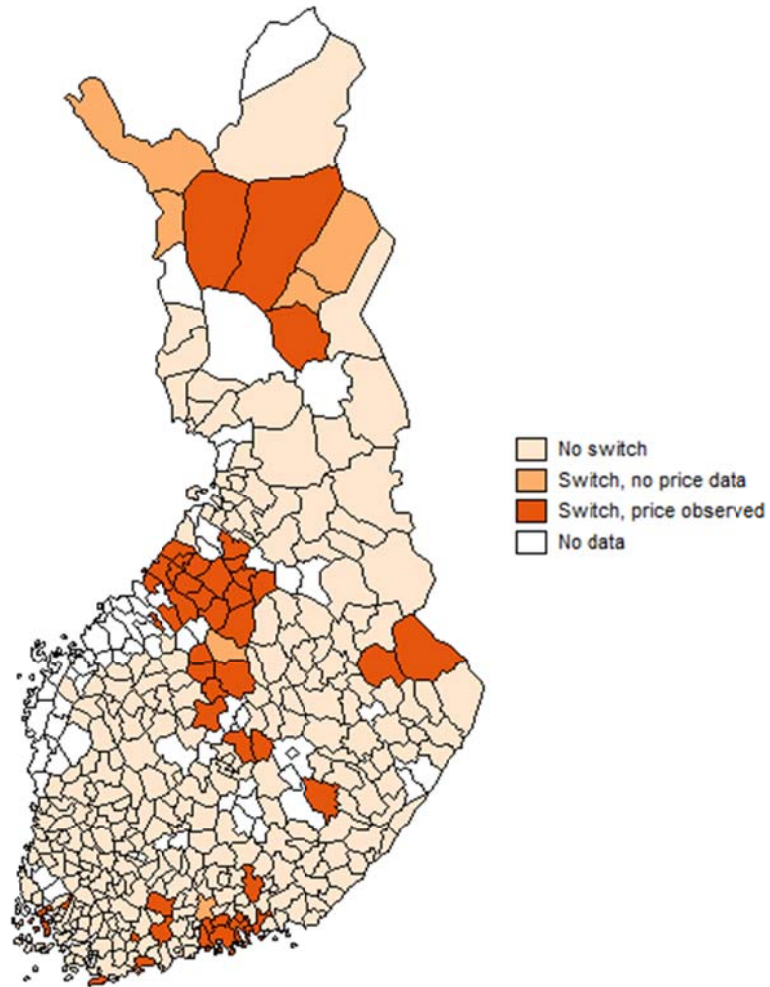
Notes: The figure shows municipalities that switch from laissez-faire to public procurement in waste collection in Finnish municipalities.

Table A8. Effects on prices, standard errors clustered at the cooperation level.

	Pooled OLS			DID		
	(1)	(2)	(3)	(4)	(5)	(6)
1[Public procurement]	-0.822**	-0.723*	-0.823***	-1.394***	-1.424***	-3.046***
	[0.407]	[0.382]	[0.282]	[0.214]	[0.230]	[0.502]
Constant	7.739***	5.529**	7.865***			
	[0.377]	[2.551]	[2.258]			
N	681	681	681	604	604	438
R^2	0.06	0.15	0.33	0.11	0.12	0.63
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Population controls	No	Yes	Yes	No	Yes	Yes
Region dummies	No	No	Yes	No	No	No
Municipality FE	No	No	No	Yes	Yes	Yes
Municipality-specific time trends	No	No	No	No	No	Yes

Notes: Population controls include population and squared population and share of young and old inhabitants. Standard errors clustered at the cooperation level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

Table A9. Effects on firms, standard errors clustered at the cooperation level.

	Panel A: Number of firms					
	Pooled OLS			DID		
	(1)	(2)	(3)	(4)	(5)	(6)
1[Public procurement]	-1.037*	-1.160**	-1.055**	-0.350	-0.361	-0.290
	[0.546]	[0.544]	[0.487]	[0.325]	[0.315]	[0.232]
Constant	2.467***	4.485***	1.910			
	[0.489]	[1.087]	[1.370]			
N	971	971	971	968	968	954
R^2	0.10	0.18	0.44	0.07	0.14	0.75
	Panel B: L&T is active on the market					
	Pooled OLS			DID		
	(7)	(8)	(9)	(10)	(11)	(12)
1[Public procurement]	-0.060	-0.096	-0.090**	-0.013	-0.015	0.005
	[0.088]	[0.074]	[0.039]	[0.021]	[0.021]	[0.015]
Constant	0.426***	1.860***	1.584***			
	[0.078]	[0.555]	[0.544]			
N	1298	1298	1298	1292	1292	1270
R^2	0.01	0.21	0.43	0.01	0.02	0.66
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Population controls	No	Yes	Yes	No	Yes	Yes
Region dummies	No	No	Yes	No	No	No
Municipality FE	No	No	No	Yes	Yes	Yes
Municipality-specific time trends	No	No	No	No	No	Yes

Notes: Population controls include population and squared population and share of young and old inhabitants. Standard errors clustered at the cooperation level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

Table A10. Predictors of market organization form, standard errors clustered at the cooperation level.

	(1)	(2)	(3)
Population/10,000	0.003		-0.005
	[0.018]		[0.022]
(Population/10,000)^2	0.000		0.000
	[0.000]		[0.000]
Population density	0.041		0.052
	[0.112]		[0.117]
Share of young population	-0.021		-0.008
	[0.020]		[0.017]
Share of old population	-0.015		-0.008
	[0.016]		[0.015]
Landfill	-0.076		-0.024
	[0.064]		[0.062]
Expenditure per capita	0.000		0.000
	[0.000]		[0.000]
Deficit per capita	0.000		0.000
	[0.000]		[0.000]
Municipal income tax rate	-0.072		-0.036
	[0.058]		[0.052]
Center Party seat share		-0.005*	-0.004
		[0.003]	[0.003]
Social Democratic Party seat share		-0.003	-0.003
		[0.004]	[0.004]
Left Alliance seat share		-0.013**	-0.014**
		[0.006]	[0.006]
Christian Democratic Party seat share		0.008	0.008
		[0.011]	[0.011]
Green Party seat share		0.002	-0.002
		[0.009]	[0.010]
True Finns seat share		-0.006	-0.007
		[0.007]	[0.007]
Other parties seat share		0.000	0.000
		[0.003]	[0.003]
Municipal employees' seat share		0.005*	0.005*
		[0.003]	[0.003]
Incumbents' seat share		-0.002	-0.002
		[0.003]	[0.003]
Women's seat share		0.003	0.003
		[0.004]	[0.004]
N	1298	1298	1298
R^2	0.04	0.10	0.11

Notes: Dependent variable is a dummy for having publicly procured waste collection. All specifications control for year fixed effects. Standard errors clustered at the cooperation level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

Table A11. Predictors of switching market organization form, standard errors clustered at the cooperation level.

	(1)	(2)	(3)	(4)	(5)	(6)
Population/10,000	0.000		0.000	-0.000**		-0.000*
	[0.000]		[0.000]	[0.000]		[0.000]
(Population/10,000)^2	0.000		0.000	0.000*		0.000**
	[0.000]		[0.000]	[0.000]		[0.000]
Population density	-0.128		-0.037	0.162		0.354
	[0.106]		[0.102]	[0.172]		[0.220]
Share of young population	4.602*		3.209*	4.227		5.276*
	[2.678]		[1.889]	[3.077]		[2.891]
Share of old population	0.000		-0.007	-0.021		0.002
	[0.020]		[0.016]	[0.029]		[0.029]
Landfill	0.102		0.153**	0.029		0.103
	[0.068]		[0.064]	[0.137]		[0.123]
Expenditure per capita	0.000***		0.000***	0.000**		0.000
	[0.000]		[0.000]	[0.000]		[0.000]
Deficit per capita	0.000**		0.000	0.000		0.000
	[0.000]		[0.000]	[0.000]		[0.000]
Municipal income tax rate	0.108		0.113*	0.120		0.153*
	[0.071]		[0.058]	[0.104]		[0.078]
Center Party seat share		0.005	0.003		0.000	-0.001
		[0.004]	[0.004]		[0.005]	[0.005]
Social Democratic Party seat share		0.001	0.003		-0.005	-0.008
		[0.003]	[0.003]		[0.006]	[0.005]
Left Alliance seat share		-0.007	-0.010*		-0.028***	-0.023***
		[0.005]	[0.005]		[0.007]	[0.007]
Christian Democratic Party seat share		-0.025*	-0.024**		-0.025	-0.005
		[0.013]	[0.011]		[0.018]	[0.019]
Green Party seat share		0.005	-0.002		-0.007	0.000
		[0.006]	[0.006]		[0.017]	[0.015]
True Finns seat share		0.001	0.004		0.000	0.011
		[0.013]	[0.012]		[0.016]	[0.014]
Other parties seat share		0.007**	0.006*		0.003	0.006
		[0.004]	[0.003]		[0.004]	[0.005]
Municipal employees' seat share		0.002	0.001		0.004	0.006
		[0.002]	[0.002]		[0.005]	[0.004]
Incumbents' seat share		-0.005**	-0.005**		-0.003	-0.011**
		[0.002]	[0.002]		[0.006]	[0.005]
Women's seat share		0.002	0.002		0.003	-0.005
		[0.004]	[0.004]		[0.006]	[0.006]
N	219	219	219	99	99	88
R^2	0.22	0.20	0.33	0.26	0.28	0.50
Sample		Price FE regressions			Always laissez-faire and switchers	

Notes: Dependent variable is a dummy for switching to publicly procured waste collection. Each municipality is included only once. Columns (1)-(3) use data from the municipalities that are included in the price FE regressions. Columns (4)-(6) restrict the sample further to the municipalities that always have laissez-faire or switch to public procurement and for which prices are observed. Standard errors clustered at the cooperation level are reported in brackets. *, ** and *** mark statistical significance at 10%, 5% and 1% levels, respectively.

To test the validity of the design, we add two leads of the treatment variable to our regressions. If the difference-in-differences approach is valid, the coefficients of these leads should not be statistically different from zero. That is to say, future reform should not affect current prices. Formally, we estimate regressions of the form

$$Y_{mt} = \sum_{\tau=-2}^{0} \theta_\tau 1[Public\ procurement]_{mt+\tau} + \alpha_m + \lambda_t + X'_{mt}\gamma + e_{mt}. \qquad (A.1)$$

If the empirical design is valid, θ_τs with $\tau < 0$ should be zero while for the first treatment year and after switching the system there may be an effect. We plot the estimates for different θ_τs in Figure A3. Panel A shows that there is a clear negative effect on the prices during the first year of publicly procured waste collection. The point estimates of the two leads are not statistically significantly different from zero, as should be the case. Based on Panel B, it seems surprisingly like there is no effect on the number of firms at all. However, the estimates also come with very wide confidence intervals. Moreover, the sparsity of our data suggests that the results should be taken with a grain of salt.
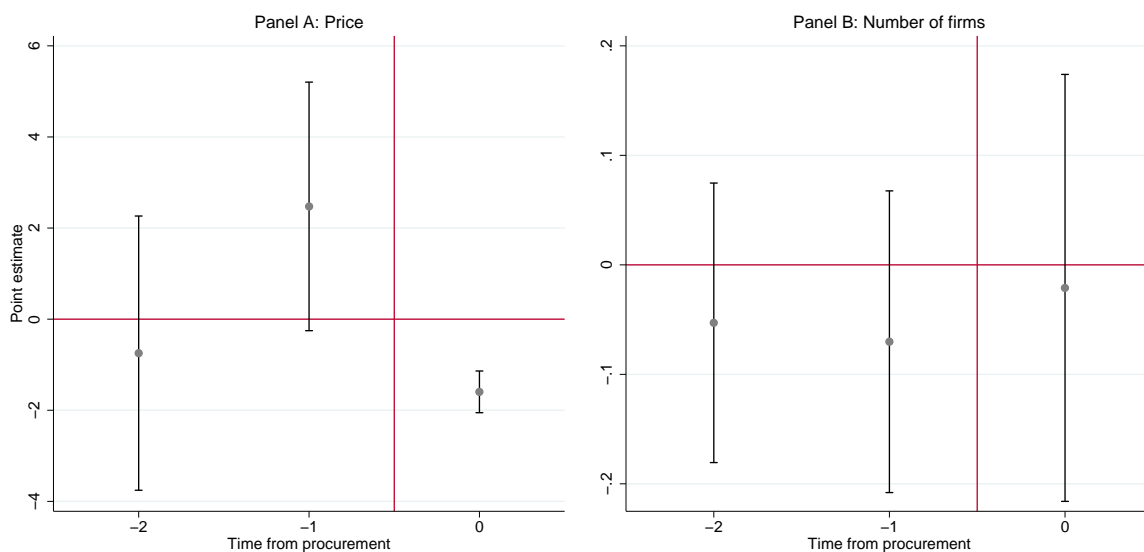

Figure A3. Regression results including two leads.

Notes: Figure shows estimated effect of public procurement for each year and their 95 % confidence intervals using specifications (5) in Tables 1 and 2. 0 marks the first year with public procurement in household waste collection. We control for population, squared population and share of young and old citizens. Moreover, specifications include municipality and year fixed effects. $N = 522$ in Panel A and $N = 854$ in Panel B.