# The Organization of Local Solid Waste and Recycling Markets: Public and Private Provision of Services

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## Abstract

We study determinants of market organization of local public services by an empirical examination of one of the most visible municipal services, residential waste management. Using a multinomial logit model and data for 1,000 U.S. communities, we explore the effect of political influence, voter ideology, environmental constraints, production costs (i.e., "economies of density"), and contracting transaction costs on a community's choice of market arrangement for waste collection and recycling. We find that cost factors are a significant determinant of service delivery method. In contrast, few of the political variables are statistically significant. These results hold for our models of both waste and recycling, lending further evidence to the conclusion that local governments emphasize costs when choosing between private and public provision.

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## 1. Introduction

In July 2002, the mayor of New York City made national headlines after announcing that he would halt the city's residential recycling program and slash waste collection services as a necessary budget cutting measure. In response to residents' angry protests, the city decided to retain some recycling services and to competitively bid a contract for collection and recycling of plastics.

The saga highlights changes that have taken place in municipal solid waste management over the past two decades. What used to be a reasonably straightforward job for local communities – essentially collecting all trash that households generated, transporting it to a local dump, and tipping it in – has evolved into a much more complicated set of decisions. City managers face a number of important questions, including the following. Should cities offer recycling services in addition to traditional refuse collection? If so, should collection of trash and recyclable materials be handled jointly by a single provider? Should the processing and sale of recyclables be managed separately from collection, specified in the collection contract (if a contract is used), or simply left to the private marketplace? Who should own and operate key assets such as the large facilities and other infrastructure that process waste material for recycling – the government or private firms – and how does this ownership affect the collection of waste and recyclables? Adding complex constraints on these decisions is a new and growing assortment of federal and state regulations and mandates, including stringent engineering and environmental performance standards for landfills, bans on disposal of particular items in landfills, targets for recycling rates, and goals to reduce the generation of waste (say, by composting). In light of the proliferation of waste management options and federal and state regulations, whether waste services are provided

by government employees, a private contractor or franchisee, or purely private markets is a key decision and one that has become increasingly difficult to make..

To our knowledge, only one study empirically analyzes the determinants of the organization of local waste collection markets (Dubin and Navarro, 1986), and no study has looked at recycling.[2]  In this paper, we fill this void by econometrically estimating a model of market organization for waste collection and recycling. While our specific focus is waste and recycling, our findings add to the general literature on local government service delivery choices and the relative importance of efficiency and cost concerns, on the one hand, and politics and patronage, on the other (Ferris, 1986; Lopez-de-Silanes, et al., 1997; Nelson, 1997). We follow previous research on the determinants of the organization of municipal services by incorporating measures of cost, voter ideology, and political influence as potential explanatory variables.  But we also include a wider set of explanatory variables than earlier studies.  For example, we include regulatory constraints facing local governments – environmental constraints, in our case.  In addition, we are the first study comparing contracts and government provision that also includes a measure of asset specificity.  We have information on the existence of government-owned landfills, waste-to-energy incinerators, and secondary material processing facilities in each community.  This information allows us to measure the extent to which transaction costs associated with asset specificity in contracts play a role in local governments' service delivery decisions.

We find that political factors play little role in the choice of market organization. Rather, the costs of providing waste collection and recycling services, and transactions costs in contracting, appear to be significantly more influential. We also find similarities across waste and recycling services, suggesting that communities consider the same factors when making decisions about how to provide both services.  The results across the services provide further evidence that costs matter when local governments make delivery choices.

In the next section of the paper, we briefly summarize two strands of literature underlying models of government choice in contracting decisions– we characterize these theories as regulatory capture/vote maximization and incomplete contracts/transaction costs.

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[2] Carroll (1995) compares the costs of recycling programs in Wisconsin cities with different market arrangements, but does not explore the factors that explain why communities choose different arrangements.

In section III we describe patterns of organization of local waste and recycling markets among U.S. communities in 1995, the year of our survey data. Section IV discusses results in previous empirical studies of local government choices related to privatization. Sections V and VI present the explanatory variables that we use in our model and the results of the estimation. Section VII provides concluding remarks.

## 2. Models of Government Choice in Service Provision

It is well-recognized, for the most part, that private markets are efficient in producing goods and providing services because competition among firms tends to reduce production costs. This conclusion suggests that communities motivated by cost-minimization should rely on private waste and recycling markets. However, if scale economies are significant, a single producer may be the most efficient outcome. By competitively bidding a contract to a single private firm, Demsetz (1968) and others have argued that the government can reap the combined benefits of competition during the bidding process with the cost savings from scale economies in production. The early literature on the costs of providing waste collection services emphasized the importance of scale economies and economies of density – i.e., average costs that fall as population density rises – and found that contracts were the least cost approach to collecting residential waste (Kemper and Quigley, 1976; Savas, 1977; Edwards and Stevens, 1978).

Contracts can have costs of their own, however, because of the transaction costs associated with their writing, monitoring, and enforcement. If a contract is incomplete, "hold-up" problems can arise if the contractor owns key assets that are specific to the relationship (Williamson, 1979; Hart, 1995; Edlin and Hermalin, 2000). Hold-up problems are exacerbated in situations where quality concerns or social goals are part of an efficient outcome and thus part of a welfare-maximizing local government's objective function (Hart, Shleifer, and Vishny, 1997; Williamson, 1999). In the case of waste and recycling services, as environmental objectives have become more and more important, it may have become more difficult for local governments to write and enforce a contract to achieve their objectives. Government provision may be the preferred arrangement in these circumstances.

Of course, other observers explain that government provision of many local services continues to exist because government is not concerned with cost-minimization and efficiency in any case. They argue that satisfying the demands of particular interest groups or maximizing the probability of reelection are more likely to be the key objectives of local decision-makers (Stigler, 1971; Becker, 1983; Boycko, Shleifer, and Vishny, 1996).

Whether one believes that governments are concerned with efficiency but contracts are incomplete, or one believes that regulatory "capture" and vote maximization more accurately characterize government objectives, in equilibrium, a variety of market arrangements will exist. If governments care about costs and efficiency, but variations in transaction costs and population density exist across communities, we are likely to see the full public-private continuum of service delivery methods. Likewise, if some governments attempt to maximize votes or appeal to particular interest groups but others attempt to minimize costs, a range of service delivery options will be chosen. In this study, as in existing empirical literature on the extent of privatization of local government services, we attempt to identify the factors – including both measures of costs and political concerns – that can explain local governments' decisions and analyze the comparative importance of these factors.

## 3. Patterns in the Organization of Waste and Recycling Markets

The survey data we use in this paper show that local governments provide waste collection and recycling services through a variety of market arrangements, ranging from pure public monopoly to a relatively laissez-faire approach using several competing private firms. Between these extremes are two types of private monopoly: a contract arrangement between the local government and a private firm; and a franchise arrangement whereby the local government awards a single firm the right, usually through a franchise fee, to provide a service in a given area. Conceptually, a franchise and contract are quite similar. In practice, they are differentiated from each other in that under a franchise arrangement, the firm directly bills and collects payment from households and businesses. Under a contract, the government bills and collects payments from its citizens and in turn reimburses the contractor.

Table 1 shows the percentage of communities that had each of these four types of service provision for waste collection and disposal in 1995.[3] Table 2 shows the same

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[3] These data are from the 1995 survey by the International City/County Management Association (ICMA) entitled "Solid Waste Collection and Disposal." We note that the 1995 survey includes a disproportionate number of mid-size cities and comparatively few small towns; it also over-represents municipalities in the north-central part of the United States. The survey has not been conducted since 1995, therefore these are the most recent data available.

information for collection and processing of recyclable materials. Although our econometric estimation focuses on residential markets, we include the commercial sector in these tables for comparison purposes.

The tables illustrate that use of private waste management is much more common in the commercial sector than in the residential sector. Commercial waste collection is handled through private contracts between businesses and waste collection firms in 56% of communities. By comparison, only 18% of communities choose the fully private option for residential waste collection. At the other end of the spectrum, public provision is chosen by only 26% of communities for commercial collection but by 38% of communities for residential collection. The popularity of the private approach in commercial waste markets may be due, at least in part, to the heterogeneity of commercial waste and waste collection services relative to that of the residential market. The types of waste and the frequency and type of service requested are likely to vary greatly among, say, a hospital, a service station, and a restaurant. Some analysts suggest that for this reason, businesses dislike government arrangement of what usually amounts to a uniform service across customers (Miller, 2001).

The tables also indicate that to some extent collection of recyclables mirrors collection of waste.[4] For example, as with waste collection, the private market is more active in the collection of commercial recyclables than the collection of residential recyclables—47% compared to 16% (see Table 2). And of the 37% of communities that involve government employees in residential waste collection, 90% of these same communities also use government employees in residential curbside recycling. These data suggest similarities in collection services for waste and recyclables and, perhaps, economies of scope in collection—i.e., if a community is providing waste collection services through a particular arrangement, costs may be minimized by organizing the same arrangement for collection of recyclables. We explore these issues further in our econometric model.

Processing of recyclable materials looks somewhat different from waste and recyclables collection. Table 2 shows that 30% of communities have a contract with a private company to provide processing. Nine percent rely on a franchise arrangement and the same

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[4] What constitutes a recyclable can vary from community to community; aluminum and tin cans, newspapers, glass bottles, and plastic soda bottles and milk jugs are the most commonly collected items, however.

percentage on government employees.  As the footnote to the table states, 28% of communities in the sample have no formal processing agreement at all.  If the government contracts with a private firm for collection of recyclables, it may leave the actual processing and sale of the recyclables to that firm without a prescribed arrangement between the government and the firm for those services.  The firm, in turn, may either have an arrangement with a third party or it may process and sell the materials itself.  The survey suggests this may be relatively common across the United States. In these arrangements, the collection contractor is typically the residual claimant for any net revenues earned from the sale of materials.

Tables 3 and 4 show collection arrangements for the residential and commercial sectors by urban, suburban, and rural locations.  The striking feature of these tables is the dominance of government provision in central cities of metropolitan areas.  Approximately 70% of the central city communities surveyed reported that government employees handle both residential waste and recyclables collection.  By contrast, only 25% to 28% of suburban communities reported using government employees to do those jobs.  In suburban locations, contracts are the preferred approach, accounting for 45% of residential waste collection and 51% of curbside collection of recyclables.

The differences by location are less pronounced for the commercial sector.  Private arrangements for both waste and recyclables collection are the most common practices, consistent with the figures reported in Tables 1 and 2 for the country as a whole, but government provision is used more frequently in central cities than in suburban locations. For example, 45% of commercial waste collection and 21% of commercial recyclables collection is handled by government employees in central cities, compared to only 15% and 10%, respectively, in suburban locations.

## 4.  Previous Empirical Research

The existing literature on local government service delivery methods covers a variety of government-provided services ranging from operation of airports and nursing homes to electricity supply and waste collection and disposal services.  The studies have slightly different conceptual views on government behavior.  Ferris (1986) argues that contracting is always less costly than public provision because a contractor operating in more than one community can exploit economies of scale in the provision of a service and because

competition in private markets lowers costs. He argues that public provision of some services in some communities is observed because there are political forces at work. In particular, there are interest groups that stand to gain when services are provided with public employees, and these interest groups exert political pressure on elected officials. Ferris does not discuss the possibility of transaction costs associated with contracting.

Nelson (1997) allows that political forces – what he refers to as "bureaucratic and institutional considerations" – may play a role in governments' decisions but argues that the transaction costs associated with contracting can be a key reason why governments produce in-house. Cost-minimizing government officials will weigh the costs of bureaucracy against the costs associated with writing, monitoring, and enforcing a contract.[5] Thus, provision of services using government employees can occur when the transaction costs of contracting outweigh the bureaucratic costs of public provision.

López-de-Silanes, Shleifer, and Vishny (1997) also consider transaction costs and highlight the issues of quality and social concerns that may lead governments to provide a service with government employees rather than with a contractor. However, they emphasize the possibility of political patronage and the political ideology of citizenry in government decisions. Under the political patronage theory, local officials are more inclined to use government employees to provide services as a way to earn political favors. Evaluating this theory is the primary focus of López-de-Silanes et al.'s empirical analysis.

All three of these studies look at a range of government services. Nelson includes waste collection and disposal services in the set of services he analyzes; López-de-Silanes et al. include the operation of landfills but not waste collection; and Ferris includes waste collection but, since he estimates the fraction of all services that are provided externally in a community, he does not analyze any effects specific to waste collection. None of the studies include recycling services.

Dubin and Navarro (1988) is the only study that focuses specifically on waste collection services and is also the only study that includes the pure private market as an

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[5] The costs of bureaucracy include internal monitoring costs and the added production costs that result because in-house employees are not residual claimants in the way that outside contractors are and thus have little incentive to keep costs down.

option along with contracting and public provision.[6]  Dubin and Navarro assume that cost

minimization is a partial objective of local government, but rent-seeking interest group

preferences and "public interest" ideological preferences are also factors.  They explore the

extent to which these factors affect communities' choices of residential waste collection

methods.  They include some of the explanatory variables included in the three studies noted

above, but they ignore the transaction costs and social goals arguments that Nelson (1997)

and López-de-Silanes et al. (1997) highlight.   Since Dubin and Navarro's data are from

1978, well before the proliferation of curbside recycling programs in the United States, they

do not address recycling issues.[7]

In general, the studies include: variables related to the local government workforce,

such as information on unionization and salaries; variables describing fiscal constraints

imposed by state governments such as limits on intergovernmental contracting, debt limits,

and balanced budget requirements; and, in some cases, ideological variables such as voting

behavior.  Technological cost information is captured in the studies by including population

to proxy the extent of scale economies; Dubin and Navarro include population density,

expecting waste collection to exhibit economies of density – i.e., a decline in average cost

with increases in the amount of material collected for a given geographic area (Edwards and

Stevens, 1978).

Economies of scale in the Nelson study and economies of density in Dubin and

Navarro are found to be significant determinants of privatization and contracting.   These

results suggest that technological cost considerations matter to local governments.  Ferris,

however, does not find any economies of scale in his study.  Nelson uses constructed

variables of citizen heterogeneity to capture transaction costs associated with contracting and

finds that these variables are significant.[8]  Voter ideology is significant in Dubin and Navarro

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[6] A franchise arrangement is also an option considered in Dubin and Navarro.

[7] Dubin and Navarro's objective is to correct a shortcoming in earlier empirical studies of the cost of waste collection services (Stevens, 1978; Kemper and Quigley, 1976).  These studies found that government provision was more costly than contracts but treated the choice of whether to have government provision or a contract as exogenous.  Dubin and Navarro estimate both a model of market organization and a model of costs.

[8] Nelson argues that it is more difficult and costly to write a contract the more heterogeneous are a community's citizens, since the contract would need to reflect the diverse set of preferences in the community.  Therefore, the more heterogenous is the population, the more likely is public provision relative to a contract.  Nelson creates indexes of heterogeneity based on educational attainment and age.

but not in López-de-Silanes et al. Ferris, Nelson, and López-de-Silanes et al. all find that higher local government salaries make contracting more likely. Fiscal constraints are found to be significant in the Ferris and López-de-Silanes at al studies -- for the most part, tax limits, state government-imposed debt limits, balanced budget requirements, and so forth increase the likelihood of contracting compared with in-house service provision. Lopez et al. claim this suggests political patronage forces at work – i.e., in the absence of the constraints, local governments would be inclined toward public provision, all else equal.

## 5. An Econometric Model of Community Waste and Recyclables Collection Methods

We use a multinomial logit procedure to estimate the likelihood that a community chooses pure private provision, a contract or franchise, or provision using government employees as a function of cost, voter ideology, and political and regulatory variables. We group contract and franchise arrangements together because franchises are used infrequently, are theoretically similar to a contract, and because preliminary results suggested that the results from grouping were not statistically different from treating the two as separate categories. We estimate models for both waste collection and recyclables collection. We use the same explanatory variables in each model and compare the results of the models.

Some communities in the sample report more than one service delivery method – for example, 96 communities report collection of residential waste using government employees as well as a contract. We estimate the model with these dual choices included but focus here on the results for the single choices of private, contract/franchise, and public. Appendix B contains the results for the dual choices.[9]

Some communities report that they do not provide one or the other of the services at all. We originally estimated the multinomial logit model with the "no-service" option included. A Hausman test for systematic differences in coefficients between models that included and excluded the no-service option was insignificant, suggesting that inclusion of the option does not violate the independence of irrelevant alternatives (IIA) assumption

associated with the multinomial logit model (Greene, 2000). Because we are focusing on the factors that determine the *method* of service delivery, however, and not on the factors that explain whether the service is provided at all, we report results for the model without the no-service option.[10] We also tested for systematic differences in coefficients between models that included and excluded each of the various service delivery methods (e.g., private market, public, and contract/franchise). These differences also proved insignificant, suggesting that our model also satisfies the IIA assumption with regard to these alternatives.

The explanatory variables can be grouped into the following categories: technological cost variables, transaction cost and asset specificity variables, fiscal constraints, environmental regulatory constraints, bureaucratic constraints and considerations, political ideology variables, and control variables.

### *5.1 Technological cost variables*

As explained above, it is likely that the collection of both waste and recyclables exhibits economies of density. We include population density as an explanatory variable and expect that higher density will make the private option less attractive relative to the government or a contract/franchise if governments are concerned with cost minimization. However, density should not affect a community's choice of government provision versus a contract or franchise.  Economies of density would lead to lower average production costs for

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[9] It is difficult to interpret the coefficients on the explanatory variables for these dual choices.  Furthermore, they are a relatively small proportion of the sample – only 7% of communities report two choices for waste and 16% report two choices for recycling.  We omit the very small number of communities that report more than two

[10] The omission of an alternative that does not violate the IIA assumption could potentially lead to inefficient estimates. Inclusion of the no-service option would add at least 18 additional coefficient estimates to the model (the number of explanatory variables we currently include), however, and perhaps even more, since by themselves the variables we include would not necessarily explain the decision to provide waste and recycling collection in the first place. Thus, it is unclear whether the potential gain in degrees of freedom would be worth the trouble; only sixteen communities report having no residential waste collection service and 76 report having no curbside recycling.  On this point, Kinnaman and Fullerton (2001) study the factors that affect a community's choice of whether to have a residential recycling program.

a single provider compared with multiple providers but would not depend on whether the single provider were the government or a private firm.[11]

## 5.2 Transaction cost/asset specificity concerns

When there are key assets that have more value within than outside a relationship the party with residual control rights to the asset can potentially exert leverage on the other party. This result can increase the transaction costs associated with writing, monitoring, and enforcing a contract between the two parties; it can also cause the parties to fail to reach agreement at all.  For this reason, the extent of asset specificity and accompanying transaction costs should affect whether a cost-minimizing government decision-maker will choose to contract for a service or provide it in-house.  We include two asset specificity variables in the model:  a dummy variable that equals one if the local government owns and operates a landfill or incinerator that was sited at least five years ago, and a similar dummy variable to indicate whether the local government owns and operates a materials recovery facility (MRF) – i.e., a facility that processes recyclable materials – that was sited at least five years ago.  We only include facilities sited more than five years ago to minimize the endogeneity problems with these variables that would likely exist, for example, if a community simultaneously chose public provision along with the construction of an MRF.[12]

## 5.3 Fiscal constraints

In many states, the state government imposes tax and budgetary limits on local governments.  The existence of these limits, in general, hardens city and county budget constraints; López-de-Silanes et al. argue that this makes contracting of services more likely than public provision.  In our model this effect may make pure private markets more likely than either contracts or government provision.  To reflect state-imposed budgetary limits we include a dummy variable that equals one if the state allows local governments to issue short-

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[11] As found by Stevens (1978) and argued again in Dubin and Navarro (1986), economies of scale in waste collection are quickly exhausted in communities and are, therefore, not an important aspect of costs; it is economies of density that are important.  We ran specifications of the model with population as an explanatory variable and confirmed this finding of previous studies – i.e., population was not significant in explaining a community's choice of service delivery method for either waste or recyclables collection.

[12] The ICMA survey asks if the community contains such a facility and then asks separately whether the facility was cited within the last five years.

term debt.  The lack of a constraint on government borrowing of this type should make private markets and contracts less likely as a service provision choice than government employees.[13]

## *5.4 Environmental regulatory constraints*

We include two measures of environmental regulatory pressures facing local governments:  a dummy variable that equals one if the state bans yard waste in landfills and a dummy variable that equals one if the state mandates that communities have recycling programs.[14]  We expect that cost-minimizing local governments facing a yard waste ban would prefer to have private markets or a contractor collect and dispose of waste – and thus take responsibility for not violating the disposal ban – rather than use government employees. A state requirement that communities have recycling programs might make government provision more likely, since this could better ensure that the requirement is met.  We do not have strong *a priori* beliefs about the effects of these two variables, however.

## *5.5 Bureaucratic constraints and considerations*

Some states impose  a number of constraints on the local government workforce.  We include three such variables:  a dummy variable that equals one if state law requires that a merit system be used for hiring local government employees, a dummy variable that equals one if state law forbids political activity by local government employees, and a dummy variable that equals one if the state sets a purchasing standard for local governments.[15]

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[13] We experimented with two other fiscal constraint variables:  a dummy to indicate whether the state mandates that local governments have balanced budgets and a dummy to indicate whether the state imposes debt limits on local governments.  Debt limits applied to nearly 94% of the communities in our sample, and there was not enough variation across communities by service provision type to include this variable in our estimation. Moreover, debt limits typically apply to loans of more than one year, which are probably not a significant factor for waste and recyclables collection services.  The balanced budget mandate variable was not statistically significant; our conclusions about the fiscal constraint variables, which we discuss in the following section, are not sensitive to the inclusion of this variable.

[14] Note that a state recycling mandate does not necessarily mean that communities must offer residential *curbside* recycling.  The state requirement may be met by offering drop-off services.  The exact language of these mandates can vary across states.

[15] These variables are from the U.S. Advisory Committee on Intergovernmental Relations (USACIR, 1993) and are from 1993, two years prior to the ICMA survey data.  These data do not exist for 1995.

The first two variables could measure the extent of political patronage in local government decision-making.  Merit-based hiring constrains the kinds of employees that can be hired in local government, and forbidding political activity by local government employees constrains employees' behavior once they are hired.  If these constraints are in place, it is more difficult for elected officials to garner political favors from government employees.  Thus, under the patronage model, government provision of waste and recycling services would be less likely than private or contract/franchise arrangements in communities subject to these constraints, all else equal.

A state-mandated local purchasing standard generally means that communities must use competitive bidding for certain types of services or for purchases over a particular dollar amount.  If the presence of local purchasing standards is found to lead to more privatization, this could also suggest political patronage forces at work.  The possible effect of this variable is less clear than the other two, however, since a purchasing standard constraint could potentially push communities toward a contract even when government provision is the least cost approach (as could be the case, for example, if the transaction costs of contracts outweighed the bureaucracy costs of government provision).

We include two other variables that relate to local bureaucracy concerns:  the percentage of the local government workforce that is unionized and a dummy variable that equals one if the local government has a city manager form of government rather than an elected mayor or city council.  Like the three dummy variables described above, the city manager variable could also capture political patronage effects.  Since managers are not elected officials, they may be less likely to make decisions on a political basis and may be more likely to make decisions based on costs (Ferris, 1986).  Thus, under the political patronage hypothesis, communities with managers are less likely to have government provision of waste and recycling services than other communities.

If a political influence model explains government behavior, then communities with a higher percentage of government workers that are unionized could be more likely to have government provision.  Unionized workers may exert more influence on local decisions than non-unionized workers.  On the other hand, unionized workers tend to be higher paid, so communities that are interested in minimizing costs may be less likely to choose government provision when a high percentage of the government workforce is unionized.  Thus, the union variable could have ambiguous effects.

## 5.6 Voter ideology

We attempt to reflect ideological factors by including a variable that measures the fraction of the population in the surrounding county that voted for the Democrat, Bill Clinton, in the 1996 Presidential election. We expect that in communities where a higher percentage of the population voted for Clinton, private market provision of waste and recycling services will be relatively less likely, since Democrats, in general, would be expected to favor various government interventions more than Republicans. We also include per capita income, and this variable may also measure ideological factors. Dubin and Navarro argue that higher income communities would tend toward private markets because of a reluctance to subsidize, through their tax dollars, the services of others in the community. We include income in our model but do not have strong *a priori* beliefs about the sign on this variable.

## 5.7 Control variables

As indicated in Table 3, service delivery methods differ among cities, suburbs, and rural areas. We include two dummy variables, one to indicate whether the community is in a central city of a metropolitan statistical area (MSA) and another to indicate whether the community is in a suburb of an MSA. The data also suggest regional differences. For example, private provision of services is almost nonexistent in the southern part of the United States, and contracts and franchises are used in a relatively high percentage of western communities. We therefore include three dummy variables to indicate the census region of the community.

Appendix A lists the sources of the data used in the estimation. Table A.1 in this appendix shows summary statistics for the explanatory variables.

## 6. Estimation Results

Table 5 shows the results of the estimation. These results suggest that cost factors play a major role in local government decisions. Population density is significant for the private option in both the waste and recycling equations. Communities with higher population densities are less likely to choose pure private market provision relative to either a contract/franchise or public provision. This result suggests that local government decision-makers recognize that, all else equal, a single provider—be it a private contractor, franchisee, or government agency—is less costly than multiple private firms in areas where density is

higher.  We find no significant effect of density on the choice between a contract/franchise and government provision, however.  These results are consistent with Dubin and Navarro (1988).

The choice of a contractor or franchisee versus government employees is determined, in part, by a different kind of cost: transaction costs.  This effect is picked up by the sunk cost and asset specificity variables, *Landwte* and *MRF*.  The greater the extent of these sunk costs, the greater the transaction costs associated with contracting, and – if the government is concerned with costs when making these decisions – the more likely is government provision. Our results uphold the theory:  we find that the existence of a government-owned and operated landfill or waste-to-energy incinerator in a community makes government provision of waste and recyclables collection services more likely than either a contract/franchise or private markets.  We also find that the existence of a government-owned and operated MRF makes it more likely that there will be government provision of recyclables collection services than either a contract/franchise or private markets; the presence of a MRF does not affect the waste collection method, however.

Political patronage does not appear to be a factor in local waste and recycling decisions.  None of the three variables that are most likely to pick up political patronage effects – *Polact, Merit*, and *Manager* – are statistically significant.  It appears that restricting political activity of government employees, mandating a merit system for hiring government employees, and the presence of a city manager have no effect on the extent to which communities privatize waste collection and recycling services.

Having a state-mandated local purchasing standard makes it more likely that a community will choose a contract or a franchise over public provision of recyclables collection services.  It also makes a contract/franchise more likely for waste collection services, though the effect is only significant at the 14% level.  A purchasing standard has no statistically significant effect on the choice of pure private markets over government provision.  The purchasing standard coefficients could indicate that political patronage forces are at work – i.e., in the absence of the standard, local decision-makers would hire government workers to garner political support – but a statistically significant coefficient could just as easily be consistent with cost-minimizing behavior on the part of government. In other words, the state-imposed constraint could simply be pushing local governments away from a cost-minimizing (government) choice and toward the choice dictated by the constraint

(a contract or franchise). In any case, we find only a small effect and only in the recycling model.

We also find no support for the "regulatory capture" theory, at least to the extent that our unionization variable can reflect such an effect. The results show that having a higher percentage of unionized workers in the government labor force has no statistically significant effect on a community's choice of government, private, or contract/franchise provision of waste and recycling services. Thus, we find no evidence to suggest that unionized government workers wield their influence to push communities toward government provision of waste and recycling services. These results differ from those of Dubin and Navarro (1986) and López-de-Silanes et al. (1997) who find that a higher degree of unionization significantly increases the probability that a community chooses government provision. We note, however, that these studies measure total community unionization, whereas our variable only measures unionization rates for local government employees.

Voter ideology could be playing a role in local governments' decisions, to some extent. As expected, we find that pure private market provision of waste and recyclables collection is less likely in communities where a higher percentage of voters voted Democratic. On the other hand, we find that a greater percentage of Democrats in a community makes a contract or franchise *more* likely than government provision. Dubin and Navarro find that both private markets and contracts are more likely than government provision when the percentage of residents voting Democratic is higher. The voting variable is not significant in López-de-Silanes, et al. Income is not statistically significant in either the waste or recycling equations. Dubin and Navarro find that higher income increases the likelihood that a community chooses private markets, an effect we do not find here.

Of our two regulatory variables, only the presence of a ban on yard waste in landfills has a statistically significant effect on communities' choices. A state mandate that all communities have recycling programs does not affect choices of how to provide either waste or recycling services. The presence of a yard waste ban makes private markets more likely than contract/franchise arrangements and contract/franchise more likely than government provision for both waste collection and recyclables collection. The ban constrains the behavior of the parties responsible for waste management, be they government or private firms. The results suggest that local decision-makers would rather let private markets or

private contractors address this restriction, all else equal, rather than incurring that extra cost in-house.

Allowing communities to incur short-term debt reduces the likelihood that private markets will be used to provide either waste or recyclables collection services but has no discernible effect on the choice between contract/franchise arrangements and government provision. This result suggests, then, that the more budgetary flexibility that local governments have in providing services, the more likely they are to provide those services themselves rather than leave it to private markets. This result is roughly consistent with López-de-Silanes et al.'s results for a wide range of local government services (not including waste or recyclable collection), though they do not look at purely private markets, just contracts versus public provision.

For the most part, the city, suburb, and regional dummy variables have, the signs and statistical significance that we expected. We find that central city communities are less likely than rural areas to have private markets or contract/franchise provision of waste and recycling services. Suburbs, on the other hand, are much more likely to have private markets or contract/franchise arrangements, and the effects are strongly significant.

All the census regions of the country are as likely to have pure private waste and recycling markets as they are to have public provision, with the exception of the South where private markets are much less likely than public (or contract/franchise) provision. Communities in the West are more likely to have contracts and franchises than are communities in other regions. The Northeast and South regions are less likely to have contracts or franchises than government provision, when compared with the North Central region (the omitted region in the model). We speculate that these regional differences are likely due to historical factors. For example, it is well-known that western communities historically have relied on the use of contracts and franchises, and that government provision is relatively more common in northeastern states. We do not examine the reasons for these historical differences here.

We find similarities in the waste and recycling econometric results, suggesting that communities largely consider the same factorswhen making decisions about how to provide the two services. Economies of density, for example, have almost exactly the same effect on waste collection service delivery methods as they do on recyclables collection methods – i.e., the coefficients are of almost identical magnitude. The transaction cost variables, *Landwte*

and *MRF*, also have similar effects in the two equations, with the only difference being that, as would be expected, the *Landwte* variable is significant in the waste equation and the *MRF* variable significant in the recycling equation. Likewise, *Yrdban*, while significant in both equations, has a coefficient of slightly different magnitude (though the same sign); this is expected, since a landfill yard waste ban has a more direct effect on waste collection than on recyclables collection. The political patronage and political influence variables are similarly insignificant in both equations, while the voter ideology variable, *Election*, is significant and its coefficients are almost identical. The regional and city versus suburb dummies have similar effects and statistical significance across equations.

Collecting waste and collecting recyclable materials are services with several characteristics in common. Most importantly, the extent of the economies of density, which are probably the most important cost factor, should be roughly the same across the two services. It is reassuring, then, that our results seem to bear this out.[16] And the similarity in the results for the two services provides further evidence that communities consider costs when making service delivery decisions.

Since the collection of household trash is a service that has been in existence in most U.S. communities longer than the collection of household recyclables, it is possible that when it came time to choose a recycling service delivery method, many communities simply chose the same type of system as they had in place for waste collection (Miller, 2002). They could have done this for a variety of reasons ranging from local officials simply "taking the easy way out" – i.e., they were familiar with a particular method of service delivery and they chose to stick with that – to the possibility that there are economies of scope associated with providing the two services in the same way. We are not able to separate out any competing hypotheses, however. We do not know when each community's recycling program was established. Moreover, changes in service delivery methods do take place in communities, and so we cannot assume that a given community's waste collection program was in place first and was thus pre-determined when the community set up its recycling program. All we

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[16] Although there are differences in the actual service provided, and although the collection of recyclables is, in general, more costly than the collection of trash (since there are often concerns about breaking materials and/or separation and sorting costs for recyclables), these differences should not necessarily be expected to lead to differences in the way that our explanatory variables affect communities' choices.

can say with our data and our results is that there are definite similarities between the two systems – for the most part, the factors that explain a community's waste collection method also explain its recyclables collection method.

The overall explanatory power of the models is relatively low, which is not that unusual for a cross-section study of this type. The pseudo $R^2$ for the waste equation is 0.19 and for the recycling equation is 0.16, thus other unobserved factors are important in determining how communities provide waste and recycling services.[17] It would be difficult, if not impossible, to find data that would overcome this problem. One particularly important point of concern is the fact that a community's service delivery arrangement may have been set up several years prior to the survey. Without knowing exactly when, however, it would be impossible to match data from the correct year.

## 7. Conclusions

We use a multinomial logit model to explore the effect of costs, political patronage and regulatory capture, voter ideology, and other variables on a community's choice of market arrangement for waste collection and recycling services. Our study is unlike previous studies of the determinants of the organization of markets for local services in three respects. We assess the importance of transaction costs associated with contracts by including variables that measure the degree of asset specificity. We also include two measures of environmental mandates facing local governments. And although one previous study has looked at waste collection, ours is the first study to examine the determinants of recycling market organization. This is a particularly timely topic for exploration, given the increase in the provision of recycling services over the past twenty years and the overlay of many federal and state regulations governing recycling.

We find very little evidence to suggest that political influence and regulatory capture arguments explain government service delivery choices. Virtually none of the variables we include to capture such effects are statistically significant. These results contrast with

previous studies that look at a wider set of government services (Ferris, 1986; Lopez-de-Silanes et al., 1997).  Our results suggest that local governments are primarily motivated by costs – both the costs of providing the services, as measured by the extent of economies of density in the communities, as well as the transaction costs associated with writing contracts, as measured by the extent of sunk costs of specific assets in the community.

We believe that our results regarding local government decision-making are encouraging in at least one dimension -- the perspective of economic efficiency.  They suggest that government officials consider costs and efficiency issues when making choices between public and private options.  The fact that managing waste has become a much more complicated exercise for most communities makes this finding even more heartening.  In future work, study of the organization of the market for processing recyclable materials would be of interest, as would further research into the structure of the waste and recycling contracts that exist between local governments and private firms.

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[17] López-de-Silanes, Shleifer, and Vishny (1997), in their probit and logit estimations of a wide range of government services, report pseudo $R^2$'s half this level. Dubin and Navarro (1986) report likelihood-ratio statistics, for joint significance of the explanatory variables, that are far below the levels that we obtain.  The LR statistic for our waste collection model is 469 and for the recycling model is 414; both are well above the chi-squared critical value at the 1% level.

**Table 1.  Waste Collection and Disposal Service Delivery Methods  in 1995
(percent of U.S. communities choosing each option)[1]**

|  | Residential Collection | Commercial Collection | Landfill Disposal |
|---|---|---|---|
| ARRANGEMENT |  |  |  |
| Government Provision | 38 | 26 | 12 |
| Contract | 36 | 20 | 16 |
| Franchise | 11 | 9 | 3 |
| Private | 18 | 56 | 6 |

[1]Numbers do not add up to100 because (1) communities may have more than one option, (2) communities may not have the service at all, or (3) communities may have an intergovernmental agreement with a neighboring jurisdiction.  For example, 32% of communities have no arrangement for landfill disposal and 19% have an intergovernmental agreement.

Source:  Compiled from ICMA survey data, 1995.

**Table 2.  Recycling Service Delivery Methods in 1995**
(percent of U.S. communities choosing each option)[1]

|  | Residential Curbside Collection | Commercial Collection | Drop-off Facilities | Recyclables Processing |
|---|---|---|---|---|
| ARRANGEMENT |  |  |  |  |
| Government Provision | 40 | 14 | 16 | 9 |
| Contract | 42 | 15 | 25 | 30 |
| Franchise | 9 | 6 | 4 | 5 |
| Private | 16 | 47 | 8 | 7 |

[1]Numbers do not add up to 100 because (1) communities may have more than one option, (2) communities may not have the service at all, or (3) communities may have an intergovernmental agreement with a neighboring jurisdiction.  For example, 30% of communities have no arrangement for recyclables processing and 14% have an intergovernmental agreement.

Source:  Compiled from ICMA survey data, 1995.

**Table 3 Waste Collection Service Delivery Methods in 1995
by Urban, Suburban, and Rural Location**
(percent of U.S. communities choosing each option)[1]

| | Residential Collection | | | Commercial Collection | | |
|---|---|---|---|---|---|---|
| | Central city MSA | Suburban MSA | Not in MSA | Central city MSA | Suburban MSA | Not in MSA |
| ARRANGEMENT | | | | | | |
| Government Provision | 71 | 25 | 50 | 45 | 15 | 38 |
| Contract | 25 | 45 | 24 | 16 | 24 | 15 |
| Franchise | 9 | 13 | 5 | 10 | 11 | 6 |
| Private | 16 | 18 | 20 | 60 | 56 | 55 |

[1]Numbers do not add up to 100 because (1) communities may have more than one option, or (2) communities may have an intergovernmental agreement with a neighboring jurisdiction.

Source:  Compiled from ICMA survey data, 1995.

**TABLE 4.  Recyclables Collection Service Delivery Methods in 1995
by Urban, Suburban, and Rural Location**
(percent of U.S. communities choosing each option)[1]

| | Residential Collection | | | Commercial Collection | | |
|---|---|---|---|---|---|---|
| | Central city MSA | Suburban MSA | Not in MSA | Central city MSA | Suburban MSA | Not in MSA |
| ARRANGEMENT | | | | | | |
| Government Provision | 69 | 28 | 49 | 21 | 10 | 18 |
| Contract | 31 | 51 | 28 | 10 | 19 | 7 |
| Franchise | 8 | 11 | 4 | 6 | 7 | 4 |
| Private | 16 | 16 | 15 | 59 | 49 | 35 |

[1]Numbers do not add up to 100 because (1) communities may have more than one option, (2) communities may not have the service at all, or (3) communities may have an intergovernmental agreement with a neighboring jurisdiction.

Source:  Compiled from ICMA survey data, 1995.

| Table 5. Multinomial Logit Results for Choice of Market Organization Alternative: Curbside Recycling and Solid Waste Collection | | | | | |
|---|---|---|---|---|---|
| | | **Waste** | | **Recycling** | |
| *Variable* | *Alternative* | *Coefficient* | *Z-statistic* | *Coefficient* | *Z-statistic* |
| **Technological costs** | | | | | |
| *Density* | Private | -0.3483*** | -3.97 | -0.3534*** | -3.60 |
| | Contract/franchise | -0.0153 | -0.36 | -0.0226 | -0.52 |
| **Transaction costs** | | | | | |
| *Landwte* | Private | -0.3831 | -1.07 | -0.0393 | -0.09 |
| | Contract/franchise | -0.7021*** | -2.64 | -0.5167* | -1.70 |
| *MRF* | Private | -0.3148 | -0.42 | -0.3944 | -0.45 |
| | Contract/franchise | -0.7152 | -1.25 | -1.7493*** | -2.39 |
| **Fiscal constraints** | | | | | |
| *Borrow* | Private | -1.2429*** | -3.76 | -0.7393** | -1.97 |
| | Contract/franchise | 0.1303 | 0.52 | 0.0445 | 0.16 |
| **Environmental regulations** | | | | | |
| *Yrdban* | Private | 0.8630** | 2.06 | 0.5555 | 1.21 |
| | Contract/franchise | 0.3307 | 1.29 | 0.5041* | 1.77 |
| *Stateman* | Private | -0.1868 | -0.57 | -0.4906 | -1.28 |
| | Contract/franchise | -0.0234 | -0.10 | -0.2157 | -0.86 |
| **Bureaucratic factors** | | | | | |
| *Polact* | Private | 0.1386 | 0.55 | -0.2742 | -0.95 |
| | Contract/franchise | 0.0220 | 0.12 | -0.0869 | -0.43 |
| *Merit* | Private | -0.3956 | -1.45 | -0.1606 | -0.53 |
| | Contract/franchise | 0.2275 | 1.10 | 0.2321 | 1.02 |
| *Purch* | Private | 0.3007 | 1.00 | 0.3345 | 1.01 |
| | Contract/franchise | 0.3106 | 1.48 | 0.5095** | 2.16 |
| *Manager* | Private | 0.1534 | 0.63 | 0.3095 | 1.12 |
| | Contract/franchise | 0.1138 | 0.61 | 0.0522 | 0.26 |
| *Union* | Private | -0.0009 | -0.24 | -0.0006 | -0.13 |
| | Contract/franchise | -0.0020 | -0.76 | 0.0008 | 0.26 |

| *Table 5 continued from previous page.* | | | | | |
|---|---|---|---|---|---|
| **Voter ideology** | | | | | |
| *Election* | Private | -0.0276* | -1.79 | -0.0286* | -1.68 |
| | Contract/franchise | 0.0137 | 1.41 | 0.0197* | 1.79 |
| *Income* | Private | 0.0062 | 0.37 | 0.0068 | 0.32 |
| | Contract/franchise | -0.0160 | -1.18 | 0.0099 | 0.62 |
| **Control variables** | | | | | |
| *City* | Private | -0.7126 | -1.52 | 0.2439 | 0.52 |
| | Contract/franchise | -.3863 | -1.39 | -0.5705* | -1.87 |
| *Suburb* | Private | 0.7740*** | 2.54 | 1.5778*** | 4.43 |
| | Contract/franchise | 1.3483*** | 6.13 | 1.4237*** | 5.84 |
| *Northeast* | Private | 0.0891 | 0.22 | -0.7984* | -1.68 |
| | Contract/franchise | -0.6392** | -2.11 | -1.2394*** | -3.70 |
| *South* | Private | -4.2939*** | -5.56 | -4.1312*** | -5.17 |
| | Contract/franchise | -0.9894*** | -3.66 | -0.9469*** | -3.17 |
| *West* | Private | -0.6402 | -1.03 | -0.3687 | -0.54 |
| | Contract/franchise | 0.7626** | 1.90 | 0.8948** | 2.01 |
| **Constant** | Private | 1.6535** | 1.91 | 1.0987 | 1.13 |
| | Contract/franchise | -1.2207** | -1.96 | -1.8384*** | -2.65 |
| | | No. of obs = 980 | | No. of obs = 912 | |
| | | LR statistic = 469.1 | | LR statistic = 413.6 | |

Notes:  ***, **, and * denote 99%, 95%, and 90% significance levels, respectively.  Coefficient estimates are relative to the public provision alternative.  The coefficients for the other alternatives (private & contract/franchise, private & public, and contract/franchise & public) are presented in Appendix 2

## Appendix A:  Data Sources and Summary Statistics for Explanatory Variables

### Table A.1.  Variables, Definitions, and Summary Statistics

| Variable | Definition | Mean | S.D. | Min. | Max. |
|---|---|---|---|---|---|
| *Income* | Per capita income in 1000s of dollars | 15.71 | 6.96 | 4.78 | 72.50 |
| *Density* | Persons per square mile in 1000s | 2.75 | 2.19 | 0.04 | 19.58 |
| *Election* | % voting for Clinton in 1996, by county | 48.0 | 9.48 | 15.73 | 77.44 |
| *Union* | % of city employees that are organized | 31.30 | 33.56 | 0.00 | 100.0 |
| *Stateman* | = 1 if state mandates that communities have recycling programs | 0.36 | 0.48 | 0.00 | 1.00 |
| *Yardban* | = 1 if state bans yard waste from landfills | 0.59 | 0.49 | 0.00 | 1.00 |
| *Manager* | = 1 if council-manager form of govt. | 0.60 | 0.49 | 0.00 | 1.00 |
| *Borrow* | = 1 if state allows local government to issue short-term debt | 0.77 | 0.42 | 0.00 | 1.00 |
| *Polact* | = 1 if state law prohibits political activity by local government employees | 0.47 | 0.50 | 0.00 | 1.00 |
| *Merit* | = 1 if state law requires a merit system for hiring local government employees | 0.44 | 0.50 | 0.00 | 1.00 |
| *Purch* | = 1 if state sets a purchasing standard for local government | 0.80 | 0.40 | 0.00 | 1.00 |
| *Landwte* | = 1 if local government owns and operates a landfill or waste-to-energy incinerator, sited more than 5 years ago | 0.12 | 0.33 | 0.00 | 1.00 |
| *MRF* | = 1 if local government owns and operates a materials recovery facility, sited more than 5 years ago | 0.02 | 0.15 | 0.00 | 1.00 |
| *City* | = 1 if central city of MSA | 0.16 | 0.37 | 0.00 | 1.00 |
| *Suburb* | = 1 if suburb of MSA | 0.59 | 0.49 | 0.00 | 1.00 |
| *(Independent)* | = 1 if independent city (not in MSA) | 0.25 | 0.43 | 0.00 | 1.00 |
| *(Northcentral)* | = 1 if in Northcentral Census region | 0.34 | 0.47 | 0.00 | 1.00 |
| *South* | = 1 if in South Census region | 0.25 | 0.44 | 0.00 | 1.00 |
| *Northeast* | = 1 if in Northeast Census region | 0.21 | 0.40 | 0.00 | 1.00 |
| *West* | = 1 if in West Census region | 0.20 | 0.40 | 0.00 | 1.00 |

Note: Parentheses around a variable name indicates that it was the omitted dummy variable category in the models.

In the following paragraphs, we describe our data and the sources that we use. Because of some missing variables or problems with the ICMA data, the final number of observations for the estimation is slightly less than the full ICMA sample of 1,071 communities. As noted in Tables 5 and B.1, the number of observations for the waste equation is 980 while the number of observations for the recycling equation is 912.

The data on market arrangements for the 1,071 communities in our sample are from the International City/County Management Association (ICMA) Solid Waste Collection and Disposal Survey of 1995.

Our 1995 population and density estimates are from the U.S. Census (*Population Estimates for States, Counties, Places, and MCDs: Annual Time Series, 2000*). We calculate density by dividing population by total land area (*Land Area, Population, and Density for Places, 1990; County Subdivisions Cartographic Boundary Files, 1990*).

We derived the variable measuring per capita income from 1990 U.S. Census data (*Census Summary Tape File 3A, 1990*).

The election data measure the percent voting for the Democratic candidate (Bill Clinton) in the 1996 presidential election by county (*David Leip's Atlas of U.S. Presidential Elections,* http://www.uselectionatlas.org, 2001).

The union variable measures the percent of 1987 full-time city workers that are organized (U.S. Dept. of Commerce, Bureau of the Census, 1991. *Census of Governments, 1987: Employment Statistics*, Washington, DC; Inter-university Consortium for Political and Social Research, Ann Arbor, MI, 1993).

The yard waste variable equals 1 if the state bans yard waste (e.g. grass clippings) from landfills, and 0 otherwise; it comes from Table 2 in Steuteville, 1995, *The State of Garbage in America: Part II, BioCycle*, 36 (5): 30 – 37.

The state mandate variable equals 1 if the state requires that cities have a recycling program; these data come from Tables 2 and 3 in Steuteville et al., 1993, *The State of Garbage in America: Part II, BioCycle*, 34 (6): 32 – 37.

The bureaucratic variables, *Manager, Polact, Merit,* and *Purch* are from the U.S. Advisory Commission on Intergovernmental Relations (1993), as is the information on whether the state allows local governments to do short-term borrowing.

The presence of a government-owned landfill, waste-to-energy incinerator, or MRF in the community that was not built in the past 5 years is from the ICMA survey. The various control variables—i.e., the city versus suburb and regional dummies—are also from the ICMA survey.

## Appendix B: Additional estimation results for multinomial model, dual choices

Table B.1 below shows the remaining results from the multinomial logit model of service delivery choices.  Shown in the table are the coefficient estimates for the dual choices of private/public, contract/public, and contract/private.

| | | Waste | | Recycling | |
|---|---|---|---|---|---|
| *Variable* | *Alternative* | *Coefficient* | *Z-statistic* | *Coefficient* | *Z-statistic* |
| **Technological costs** | | | | | |
| *Density* | Private & Contract/fran | 0.0821 | 0.85 | -0.0772 | -0.62 |
| | Private & Public | 0.0148 | 0.12 | -0.3319$^*$ | -1.83 |
| | Contract/franchise & Public | 0.2342$^{**}$ | 2.33 | 0.0633 | 1.11 |
| **Transaction costs** | | | | | |
| *Landwte* | Private & Contract/fran | 0.1190 | 0.14 | 0.7949 | 1.26 |
| | Private & Public | -0.8058 | -1.33 | 1.0142$^{**}$ | 2.21 |
| | Contract/franchise & Public | 0.4594 | 0.82 | 0.5729$^{**}$ | 1.69 |
| *MRF* | Private & Contract/fran | -29.363 | -0.00 | -29.377 | -0.00 |
| | Private & Public | 0.3631 | 0.31 | -0.0774 | -0.07 |
| | Contract/franchise & Public | -28.946 | -0.00 | -0.9597 | -1.17 |
| **Fiscal constraints** | | | | | |
| *Borrow* | Private & Contract/fran | 0.5805 | 0.60 | 0.4110 | 0.45 |
| | Private & Public | 0.2160 | 0.35 | 1.0559$^*$ | 1.76 |
| | Contract/franchise & Public | -0.1118 | -0.15 | -0.2192 | -0.56 |
| **Environmental regulations** | | | | | |
| *Yrdban* | Private & Contract/fran | -0.0370 | -0.04 | 0.3647 | 0.47 |
| | Private & Public | -0.2622 | -0.43 | -0.5430 | -0.93 |
| | Contract/franchise & Public | 0.0455 | 0.06 | 1.2784$^{***}$ | 3.08 |
| *Stateman* | Private & Contract/fran | 0.0983 | 0.78 | -0.4678 | -0.71 |
| | Private & Public | -0.5647 | -0.96 | 0.7000 | 1.26 |

| | | | | | |
|---|---|---|---|---|---|
| | Contract/franchise & Public | -0.1267 | -0.21 | 0.0034 | 0.01 |

*Table B.1 continued from previous page.*

| | | | | | |
|---|---|---|---|---|---|
| **Bureaucratic factors** | | | | | |
| *Polact* | Private & Contract/fran | 0.0016 | 0.00 | -0.4252 | -0.76 |
| | Private & Public | 0.0817 | 0.18 | -0.0873 | -0.19 |
| | Contract/franchise & Public | 0.2162 | 0.36 | -0.5186** | -1.77 |
| *Merit* | Private & Contract/fran | 0.8424 | 1.36 | 0.4328 | 0.80 |
| | Private & Public | 0.6175 | 1.15 | 1.2893** | 2.23 |
| | Contract/franchise & Public | -0.6754 | -0.88 | -0.0026 | -0.01 |
| *Purch* | Private & Contract/fran | 0.2126 | 0.29 | -0.1570 | -0.27 |
| | Private & Public | 0.2758 | 0.51 | 0.4886 | 0.91 |
| | Contract/franchise & Public | -0.3571 | -0.57 | -0.3357 | -1.14 |
| *Manager* | Private & Contract/fran | -0.0644 | -0.12 | 0.1490 | 0.30 |
| | Private & Public | 1.5086*** | 2.79 | 0.2579 | 0.56 |
| | Contract/franchise & Public | -0.1231 | -0.21 | -0.0546 | -0.19 |
| *Union* | Private & Contract/fran | -0.0129 | -1.54 | -0.0105 | -1.38 |
| | Private & Public | 0.0097 | 1.48 | 0.0054 | 0.81 |
| | Contract/franchise & Public | -0.0168* | -1.71 | 0.0020 | 0.50 |
| **Voter ideology** | | | | | |
| *Election* | Private & Contract/fran | -0.0252 | 0.03 | 0.0195 | 0.63 |
| | Private & Public | 0.0280 | 1.08 | -0.1797 | -0.68 |
| | Contract/franchise & Public | -0.0026 | -0.10 | 0.0091 | 0.61 |
| *Income* | Private & Contract/fran | 0.0181 | 0.03 | -0.0222 | -0.51 |
| | Private & Public | -0.1148* | -1.66 | 0.0099 | 0.24 |
| | Contract/franchise & Public | -0.0056 | -0.10 | 0.0463** | 2.39 |
| **Control variables** | | | | | |
| *City* | Private & Contract/fran | 1.0674 | 0.85 | 0.3179 | 0.33 |
| | Private & Public | 0.5626 | 1.07 | 0.2886 | 0.55 |
| | Contract/franchise & Public | 1.3772** | 2.15 | 0.3031 | 0.82 |
| *Suburb* | Private & Contract/fran | 2.4505** | 2.23 | 1.8829*** | 2.55 |
| | Private & Public | -0.4710 | -0.74 | -0.2335 | -0.41 |
| | Contract/franchise & Public | 0.2082 | 0.27 | 0.7143** | 2.04 |
| *Northeast* | Private & Contract/fran | 0.1617 | 0.18 | 0.4564 | 0.58 |
| | Private & Public | -0.0760 | -0.10 | -0.9649 | -1.35 |

| | | | | | |
|---|---|---|---|---|---|
| | Contract/franchise & Public | -0.6531 | -0.47 | -0.6276 | -1.30 |
| *Table B.1 continued from previous page.* | | | | | |
| *South* | Private & Contract/fran | -1.7041$^*$ | -1.61 | -2.3877$^{**}$ | -1.98 |
| | Private & Public | -1.2527$^*$ | -1.81 | -1.1244$^*$ | -1.61 |
| | Contract/franchise & Public | 1.3937 | 1.58 | 0.6667$^*$ | 1.68 |
| *West* | Private & Contract/fran | 0.0713 | 0.05 | 0.1021 | 0.08 |
| | Private & Public | 0.0103 | 0.01 | -0.7551 | -0.86 |
| | Contract/franchise & Public | 1.0093 | 0.81 | 1.2551$^*$ | 1.90 |
| **Constant** | Private & Contract/fran | -4.4184$^{**}$ | -2.16 | -4.0870$^{**}$ | -2.16 |
| | Private & Public | -3.6509$^{**}$ | -2.08 | -2.5405$^*$ | -1.55 |
| | Contract/franchise & Public | -3.7915$^*$ | -1.83 | -3.4061$^{***}$ | -3.43 |
| | | No. of obs = 980 | | No. of obs = 912 | |
| | | LR statistic = 469.1 | | LR statistic = 413.6 | |

Notes: ***, **, and * denote 99%, 95%, and 90% significance levels, respectively. Coefficient estimates are relative to the public provision alternative.

No. of observations in waste equation = 980; no. of observations in recycling equation = 912.

## References

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