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Review

Does privatization of solid waste and water services reduce costs? A review of empirical studies

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ABSTRACT

Cost reduction was the key benefit claimed by privatization. We conduct a review of all published econometric studies of water and waste production since 1970. Little support is found for a link between privatization and cost savings. Cost savings are not found in water delivery and are not systematic in waste. Reviewed studies build from public choice, property rights, transaction costs and industrial organization theories. We conclude public choice theory is too focused on competition, which is typically not present in quasi-markets. Property rights theory gives attention to ownership and service quality, but absent competition, ownership makes little difference on costs borne by municipalities. Transaction costs argue privatization is best when contracts are complete—a rare situation in public service markets. We find the industrial organization approach most useful in explaining results because it directly addresses incentives, sector structure and regulatory framework. Overall, the empirical results show the importance of market structure, industrial organization of the service sector, and government management, oversight and regulation. Because there is no systematic optimal choice between public and private delivery, managers should approach the issue in a pragmatic way.

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1. Introduction

Water distribution and solid waste collection are two of the most commonly provided local government services. There has been substantial experimentation with privatization in solid waste collection, but privatization has been much less common in water services.[1] In this paper, we review all econometric studies of privatization and costs in water and solid waste. Thirty-five papers in total (18 studies in waste beginning in 1965, and 17 papers in water beginning in 1976) from more than 10 countries are reviewed.

[1] The International City County Management Association tracks alternative service delivery for basic local government services. Private, for profit contracting for solid waste peaked at 49% of responding governments in 1997 and was reported by 39% of responding governments in 2002. Private, for profit contracting for water distribution and treatment is only reported by 7% of responding governments (Warner and Hefetz, 2004). This is much lower than in European countries (Bel, 2006).

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Previous reviews of privatization experience (e.g. Hirsch, 1995; Boyne, 1998a,b; Hodge, 2000) have smaller samples of studies and a narrower geographical scope. Regarding solid waste collection, the reviews published until the late 1990s focused on the US and the UK (Switzerland being the unique exception). Since 2000, the sample of multivariate works has increased by 50%, and five out of the six newer works study European Union countries other than the UK. On water distribution, reviews until the late 1990s used samples with studies on the US (with the exception of one study on the UK). Since 2000, five new works have been published, thus increasing the sample by more than 40%. The new works deal with the UK, the Baltic countries, Asia and the Pacific, and Africa.

Hence, our large-scale empirical analysis includes both studies from the U.S. and experience in Europe and elsewhere in the world. The more recent works usually employ larger databases and more sophisticated econometric methods, thus achieving more robust results. European experience with privatization in water and waste is actually higher than in the U.S. (Bel, 2006). However, empirical studies from across these countries show that privatization does not necessarily provide least cost service delivery.

The reasons for this are several. First, most of the expectations of cost savings come from the notion that competition increases pressures for efficiency and reduced costs. Water distribution is a service with high asset specificity and as such tends toward natural monopoly. Thus, competition is not expected. This may also explain why we have seen so little privatization in water in the U.S. In solid waste collection, competition is more likely and privatization has become much more common in the U.S. However, we have seen considerable concentration in the waste sector over the last 20 years. So in neither service area is competition expected to be maintained over time.

Local governments are interested in more than just costs (Carver, 1989; Bel and Fageda, 2007; Hefetz and Warner, 2007). Communities may prefer private delivery even if it is more costly, if that reflects their view on the role of government in service delivery (e.g. pure market provision of solid waste) (Dubin and Navarro, 1988). In Britain where the national government made competitive tendering compulsory in the late 1980s and the 1990s, recognition that competition is not enough led to a shift to a "best value" framework that includes service quality, stability, innovation and citizen engagement. U.S. local government leaders share this broader set of concerns. Water distribution and waste collection are two critical services where an efficient, cost-effective, high quality and failsafe system is expected by the citizenry.

Notwithstanding the relevance of all these considerations, the objective of this review is to analyze whether privatization is an effective service delivery alternative to save costs in solid waste and water services. In discussing the results of our review, we look at four theoretical perspectives that suggest a basis for cost savings under privatization. Public choice and property rights theories look at incentives to managers and the role competition can play in reducing excessive public supply of public services (Niskanen, 1971), or providing stronger incentives for cost reduction under private property (Hart et al., 1997), and thus reducing costs. Public choice is a theory of non-market failure (Lowery, 1998). But in reality government services are at best quasi-markets with a limited number of alternative private suppliers (Sclar, 2000). Competitive markets rarely exist for public services and this undermines the basis for cost savings under public choice. Transaction costs and industrial organization give more attention to the nature of the service, the contracting process and the market. The principal–agent dichotomy (the basis of agency theory) is embedded in transaction costs and industrial organization theories, in their understanding of the nature of the service, the structure of the organization and of the market. They give special importance to the costs of contracting and monitoring (Williamson, 1999), the structure of the market (Vickers and Yarrow, 1988) and the importance of economies of scale (Donahue, 1989). We argue that transaction costs and industrial organization theories offer a more robust theoretical basis for assessing privatization. Public choice and property rights theory give too much attention to competition and ownership when government intervention through regulation or market structuring behavior is more important to ensure cost savings occur and are sustained over time.

All these theories identify competition as an important causal factor in reducing costs. However, they also identify the importance of government management—in contract specification, monitoring and engagement in the market. One of the challenges in both water and waste is that competition is more often *for* the market (for the initial contract) and then erodes over time. Thus, managers cannot rely on a continuing process of competition *in* the market to secure cost savings.

We use these theoretical lenses to assess the empirical evidence. We conclude that a comprehensive theoretical approach that focuses both on actors and on incentives, as well as market and regulatory structure is needed in order to understand why privatization has not delivered sustained cost savings in these service areas. In conclusion, we suggest that if privatization is chosen as a tool for reform, a singular focus on competition is not enough. Governmental regulation and market structuring is necessary to ensure that cost savings occur and are sustained over time.

2. Empirical review

Water and waste services can be provided in three ways. Pure private provision occurs when consumers contract with private vendors on an individual basis for water and waste collection services. Pure public production is where government owns and operates a service. New hybrid forms of public private partnerships are emerging in both water and waste where public ownership may be mixed with private operation. The empirical studies in our review compare public with private production and look across countries and over time to assess the impacts of contracting on cost savings. Most studies do not measure costs before and after privatization; instead they compare costs of public production with costs of private production across cities.

Most of the studies in our sample are concerned with publicly provided services that are produced either by municipalities (public production) or by private firms (private production). Dubin and Navarro (1988) emphasized this distinction by modeling a two-stage process – the decision by a municipality to intervene in the market and publicly provide a service, and the decision of how to deliver the service – either through public or private production. They argued that pure private provision would be the most costly due to market failures that prevent taking advantage of economies of density.[2] Competition under pure private provision increases overlap and denies the opportunity to realize the advantages of economies of density. A recent study by OECD (2000) confirms that pure private provision is more expensive than municipal provision. Under public provision, these economies can be realized through monopoly production, be it private or public. What we analyze is

[2] Economies of density can be defined as a reduction in costs because of increasing concentration of the output (whereas scale economies are concerned with the quantity of output). This is a concept widely used in transport economics, and has been used in studies of waste collection because of the large influence of transportation costs in overall collection costs. Economies of density are a more recent concept than economies of scale. A seminal paper on the differences between these two concepts is Caves et al. (1984).

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this second production choice and whether, under municipal provision, public or private production is less costly.

2.1. Waste collection

Hirsch (1965) conducted the first econometric study of waste collection. Using data from 24 municipalities in St. Louis County, Missouri, he found no difference in cost due to public or private contract arrangement. His production cost model provided an example that has been followed by many studies since. His cost model controlled for amount, quality, service conditions that affect input requirements, factor prices, technology, density, and form of finance (user fee or general budget). These variables took into account important features of property rights, transaction costs and industrial organization theories. Hirsch found no significant difference in costs by municipal or private production. Similar results have been found in other studies of U.S. municipalities. Statewide samples in Montana (Pier et al., 1974) and Missouri (Collins and Downes, 1977) found no difference between public and private production under municipal provision. A Connecticut study (Kemper and Quigley, 1976), found private production had lower costs, but they did not control for heavier public production in cities. In a national sample (Stevens, 1978) found no difference in costs in municipalities under 50,000 population, but private monopolies were less costly in cities over 50,000. She attributed this to better technology (and larger trucks) among private providers in large cities, which enabled them to use smaller crews. These differences increased in magnitude with city size. Dubin and Navarro (1988) found economies of density in waste collection but not scale economies.

Competition is a key feature underlying theoretical claims for costs savings, but turns out to be problematic even in waste collection. Great Britain provides an interesting case. Domberger et al. (1986) looked at 305 municipalities in England and Wales from 1983 to 1985 (before compulsory competitive tendering, CCT; was introduced in 1988, requiring municipalities to allow private competition for waste collection). They found that under competitive contracting there was no difference in public and private costs; but in places where there was no competitive contracting, public costs were higher. Where there are larger numbers of bidders, there are more cost savings (Gómez-Lobo and Szymanski, 2001). Competition encouraged public managers to keep costs down. Szymanski and Wilkins (1993) found similar results in the 1984–1988 period. They found a 20% savings in the first year, but these savings disappeared in 2 years, suggesting underbidding by contractors. Although 71% of municipalities won their competitions and retained public service production, their costs were not significantly different from the private providers. A follow up study by Szymanski (1996) on 365 English municipalities from 1983–1994 found that although savings eroded over time, private production costs were lower than public production.

Only three other studies have found lower costs with private production. These include two works from Canada in the 1970s (Kitchen, 1976) and 1980s (Tickner and McDavid, 1986) and one more recent study in Ireland in the mid-1990s (Reeves and Barrow, 2000).

The most recent studies on waste collection have found no differences in costs. In the US, Callan and Thomas (2001) using a multi-product framework found that the form of production does not influence costs in a study of municipalities in Massachusetts. Ohlsson's (2003) study of 115 Swedish cities found private production was more costly than public because of higher input and capital costs for private firms. Dijkgraaf and Gradus (2003) show no difference between public and private production under competitive contracting among cities in Holland. Bel and Costas (2006) in a study of 186 Spanish cities and towns find the form of production does not influence costs overall, and market concentration creates problems for competition. Only cities that recently privatized show cost savings. Cost savings from privatization appear to erode over time, since there were no cost differences between cities that had privatized earlier and those that retained public production. The erosion over time of cost savings from privatization is a result also found in Dijkgraaf and Gradus (2007).

Table 1 presents information on the reviewed empirical studies on waste collection. Table A1 in the appendix displays characteristics of the models estimated in each study.

Regulatory structure matters. In a recent paper, Dijkgraaf and Gradus (2008) find that private production is initially associated with cost savings, but this effect disappears over time, even with government regulatory interventions. These results suggest the importance of regulatory environment from an industrial organization approach.

In most countries, there is a strong association between private production and competition for the market through competitive tendering, and public production without competition for the market. Typically, public production is outside a competitive framework. The benefits of competitive contracting (increased efficiency) would come primarily with competition *for* the market as monopoly production would continue to be necessary due to economies of scale. Thus, benefits from privatization would be expected to erode over time. Indeed only five of the 18 studies found systematic cost savings with privatization, and most of these were using data from the 1970s.

Theoretically, we expected more competition in waste markets and more benefits from technological innovation than these empirical studies show. Scale economies seem to be exhausted at a relatively low population level (20,000–50,000). Failure of cost savings, especially in the more recent studies, derives from incentives, regulatory structure and industrial organization of the sector itself. The sources of cost savings under private production tend to be due to technology and productivity arising from more flexible work practices—which speaks to an industrial organization perspective.

2.2. Water distribution

Empirical literature on the relationship between urban water distribution and costs goes back to the mid-1970s. Between the mid-1970s and the mid-1990s, the econometric works on the issue are limited to the U.S. Since the mid-1990s, interest in this kind of analysis has declined in the U.S., but the first econometric works appeared for the U.K., right after the privatization of water systems in England and Wales began in the late 1980s. Finally, in recent years empirical works for regions and countries beyond the U.S. and the U.K. have appeared.

The first econometric study (Mann and Mikesell, 1976) used a sample of 188 government-owned and 26 privately owned water firms in the U.S. and addressed both ownership and regulatory aspects. They found private investor-owned utilities had higher costs than government-owned utilities. The model included operating environmental variables (water supply sources, per capita income and population density of market area), as well as institutional variables (ownership, regulation jurisdiction (state or local) and rate base valuation method. The next study by Morgan (1977) found costs with private production were lower than with public production. Morgan used a sample of 143 firms of water distribution in six U.S. states. His model gave more attention to operational costs (total output, length of the water network, number of connections served, percentage of surface water, percentage of water bought from other agencies, and storage capacity), but less

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Table 1
Basic characteristics of the relevant works on privatization and costs in waste collection

Work	Area	Year	Sample	Costs and form of production
Hirsch (1965)	USA, MO	1960	24	No difference
Pier et al. (1974)	USA, MT	Early 1970s	22	No difference
Kitchen (1976)	Canada	Early 1970s	48	Costs are higher with public production
Kemper and Quigley (1976)	USA, CT	1972–1974	128	Private provision more expensive. Within municipal provision private production is less costly than public production
Collins and Downes (1977)	USA, MO	Early 70s	53	Private provision more expensive. Within municipal provision, no differences between public and private production
Pommerehne and Frey (1977)	Switzerland	1970	103	Costs are higher with public production
Stevens (1978)	USA	1974	340	Private provision more expensive. Within municipal provision, private monopoly is less costly than public in cities >50,000. No difference in cities <50,000
Tickner and McDavid (1986)	Canada	1981	132	Costs are higher with public production
Domberger et al. (1986)	England and Wales	1983–1985	305	Competitive tendering is less costly than public production without tendering. Public and private costs do not differ with competitive tendering
Dubin and Navarro (1988)	USA	1974	261	Private provision more expensive. With municipal provision, private monopoly is more costly than contracting out and public production
Szymanski and Wilkins (1993)	England and Wales	1984–1988	185–335	Public production more costly without tendering. Public and private costs do not differ with competitive tendering
Szymanski (1996)	England and Wales	1984–1994	>300	Public production without tendering is more costly. Private costs are lower than public with competitive tendering
Reeves and Barrow (2000)	Ireland	1993–1995	48	Costs are higher with public production
Callan and Thomas (2001)	USA, MA	1997	110	Production form does not influence costs
Dijkgraaf and Gradus (2003)	Holland	1996–1997	85	Public production more costly without tendering. Public and private costs do not differ with competitive tendering
Ohlsson (2003)	Sweden	1989	115	Costs are higher with private production
Bel and Costas (2006)	Spain	2000	186	Production form does not influence costs
Dijkgraaf and Gradus (2007)	Holland	1998–2005	491	Initially privatization reduces costs. This effect disappears over time

Note: All works in the table are multivariate econometric studies. Only Pier et al. is bi-variate. *Source*: Author's.

attention to institutional and regulatory variables (only a dummy variable reflecting public or private ownership of the firm). The next empirical analysis, by Crain and Zardkoohi (1978), used data from firms in 38 U.S. states, and like Morgan, found that private firms have lower costs. They attributed this difference to lower employee productivity in public firms. Using a similar approach, Bruggink (1982) studied a sample of 86 firms and found private firms have higher costs than public production, like the first study by Mann and Mikesell.

Feigenbaum and Teeples (1983) used a hedonic costs model and did not find significant cost differences between private firms and public production. Fox and Hofler (1986) introduced the multi-product characteristic of water firms: they produce potable water and they distribute it. They did not find significant differences for technical efficiency or aggregate costs.

Given the different results obtained in the U.S. empirical works already reviewed, Teeples and Glyer (1987) analyzed reasons that could explain these differences. They found models with more restrictions and more omitted variables were more prone to find larger differences between private and public production. However, these results disappeared when the models had fewer restrictions and more operational and environmental variables included. Teeples and Glyer (1987) own findings showed no significant difference between private and public production. Subsequent works for water service in the U.S., using models similar to those already reviewed, show no differences between private and public production (Byrnes, 1991), lower costs with private production (Raffie et al., 1993), and lower costs with public production (Bhattacharyya et al., 1994). Finally, Bhattacharyya et al. (1995) used a different methodology, a stochastic frontier costs function, and concluded there are not significant differences between private and public production. Nonetheless, when analyzing according to firm size, Bhattacharyya et al. (1995) obtained that private production is more efficient when small scales of production and small firms are involved, whereas public production is more efficient when analyzing large-scale operations.[3]

In the U.K. the first analysis of privatization, efficiency and costs (Lynk, 1993) studied all 10 regional agencies in England and Wales in the periods 1979–1980 (after 1973 reorganization) and 1987–1988 (prior to privatization), and 22 out of the 28 private firms in the periods 1984–1985 and 1987–1988. Lynk used the cost-frontier methodology and econometric estimations of total operational cost. The study does not permit a direct comparison of efficiency between public and private units, but offers information on the average levels of efficiency in each type of ownership in the years before privatization. He found inefficiency was higher in private firms, and public agencies had improved their efficiency throughout the 1980s.[4]

The next econometric work for water privatization in the U.K. is Ashton (2000a,b), who analyzed improvement in efficiency in the former public agencies that were privatized in 1989. His findings show that technical change and total factor productivity improvement after privatization are very small, and the unique relevant

[3] There are other evaluations for the U.S. using data envelope analysis (DEA). DEA is a standard tool used in economics to estimate production frontiers. This approach constructs a 'best practice frontier' (the maximum possible outputs for given quantities of inputs) and this frontier is used to assess firms' technical efficiency. Byrnes et al. (1986) do not find differences in efficiency between public and private production. Lambert et al. (1993) find that public firms have greater efficiency than private firms do. We have not included these studies in our review because they are not econometric analyses.

[4] In a later study, Hunt and Lynk (1995) found privatization suppressed the possibility of realizing economies of scope, which refer to potential cost savings from joint production (Changes in average costs occur because of changes in the combination of output between two or more products. The products do not need to be directly related to each other.) To compensate for loss of economies of scope, privatization should yield big improvements in dynamic efficiency. However, their work does not compare public and private production.

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change seems to be improvement in the quality of the inputs used in the industry. Finally, Saal and Parker (2000) analyze whether privatization caused a reduction in production costs. They find that the trend toward increasing costs did not change after privatization. Moreover, they find that it is regulation (price caps) that induced efficiency improvements in the mid-1990s.

In recent years, several studies of countries in different regions of the world have been published. Jones and Mygind (2000) is the first work on the Baltic countries that makes efficiency comparisons between private and public delivery of water services.[5] In Estonia and Latvia, they find a private efficiency advantage in some periods, and no significant difference between private and public delivery and efficiency in other periods. Foreign ownership in Estonia and employee ownership in Latvia could explain the relatively higher frequency of cost savings than in Lithuania, where no significant relationship between efficiency and production form is found. Estache and Rossi (2002) find similar results in their analysis comparing the efficiency of 50 public and private firms in 29 countries in Asia and the Pacific region. Estache and Rossi adopt a cost-frontier function approach and find that franchising and private sector participation have no significant link with production costs (Estache and Rossi, 2002: 145). Finally, Kirkpatrick et al. (2006) study the relationship between form of production and costs in a sample of 76 firms in African countries. They, too, find no significant influence of production form on costs.

Table 2 presents information on the reviewed empirical studies on waste collection. Table A2 in appendix displays characteristics of the models estimated in each study.

Water distribution is characterized by asset specificity and long-term contracts (except for England and Wales where ownership was transferred to the private sector). Asset specificity implies asymmetric information between the incumbent and the potential competitors. For instance, when the contract is subject to a new bid process, potential competitors have much less knowledge of the true state of the distribution network and of the required investments to be undertaken during the life of the new contract. In addition, the longer the term of the current contract, the stronger the dominant position of the incumbent in the new bidding process. These factors explain why the rate of contract renewal in water distribution – either by renegotiation or by competition – is extremely high (in the next section we provide more detailed information on this).

Government quality regulations are strict. These factors reduce the likelihood of cost savings as well (Wallsten and Kosec, 2008). Indeed, only three of the 16 studies found private production less costly than public production. All three were done for the U.S., two in the early 1970s. While some studies found public production more efficient, most found no significant differences in costs or efficiency between public and private production. The importance of density economies and government regulation demonstrate the salience of a broader industrial organization approach.

3. Discussion

Comparing across water and waste provides the opportunity to assess not only the empirical results on privatization and costs savings but also the relative importance of competition, industrial organization and public management. Empirical results for waste show the majority of studies find no difference between public production and private production. While a few studies from the 1970s find cost savings with privatization, these results do not persist over time. For water, only three studies found cost savings with privatization (Morgan, 1977; Crain and Zardkoohi, 1978; Raffie et al., 1993). The more dynamic results in waste collection are best explained by an industrial organization approach, which allows us to look at changes in public management, changes in competition, and the way in which incentives affect governments and private managers. We find public choice and property rights theories too static to capture the dynamics of changing incentives due to changes in market and industrial structure.

Public choice theory emphasizes the importance of competition but we see that even in markets for waste collection the only potential competition is *for* the market—for the initial contract. Managers should be wary of over reliance on the importance of competition in markets for waste collection where empirical results suggest that competition *for* the market is not sufficient to ensure cost savings sustain over time. We see economies of scale tend toward monopoly production, at least at the neighborhood or municipal scale, and most municipalities do not face a competitive market of alternative suppliers. Thus, the only competition can be *for* the market and even then competition is often quite limited.

Private production is not systematically cheaper in waste or water services. Early reviews suggested the costs of taxes, billing and a non-exclusive market help explain these differences (Fischer, 1962; Stevens, 1978). But more recent evidence addresses changes in the structure of the solid waste management sector, where significant consolidation during the 1990s has led to erosion in cost savings over time (Bel and Costas, 2006; Dijkgraaf and Gradus, 2007, 2008). Several cities in the U.S. have split their service markets and maintained a level of public production even in the face of contracting so that they can sustain competition at least between public and private crews (Warner and Hefetz, 2008). However, this denies the benefits of economies of scale. Competition *for* the market also eroded due to incumbency—contracts are typically renewed as other providers exit the market. In the U.S., Hefetz and Warner (2004, 2007) have shown the importance of reverse privatization as a means to maintain competition over time. Reductions in quality and lack of cost savings were the primary reasons for this reverse privatization (Warner and Hefetz, 2004).

Despite government regulation to ensure competition and price policies to ensure cost efficiencies, recent research has shown private managers collude and price differences erode. Dijkgraaf and Gradus (2007) found that private providers increased their prices after the Dutch government implemented the VAT compensation fund to place higher tariffs on public competitors. In the Netherlands, private firms usually compete with public firms for contracts. Therefore, when the VAT compensation scheme raised the costs of public firms, private firms were able to ask for higher prices in their bid proposals and still retain their ability to win (some) of the contracts. The need for such a strong market management role, and to understand how managers respond to regulatory incentives, raises transaction costs for local governments. More attention must be given to regulatory policies (Massarutto, 2007; Warner and Bel, 2008) and the design of regulatory institutions (Cunha Marques and Simões, 2008).

In the case of water, due to the nature of a fixed infrastructure of sunk costs, long-term concessions are the norm. This creates incomplete contracts and raises concerns about the cost-effectiveness of privatization given the high transaction costs of contracting. The industrial organization approach encourages us to focus on incentives that critically depend on the structure of the market. Incentives are less powerful in the water sector, because contract terms are longer (Johnson et al., 2002; Bel, 2006). Even when a concession is reopened for bidding, the position of the incumbent is extremely strong given the asset specificity of the

[5] The Ménard and Saussier (2000) study for France is the first econometric work on water distribution outside the Anglo Saxon countries. However, they do not study the relationship between production form and costs, productivity or efficiency.

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Table 2
Basic characteristics of relevant works on privatization and costs in water distribution

Work	Area	Year	Sample	Costs, efficiency and production form
Mann and Mikesell (1976)	USA	1976	214	Public production is less costly
Morgan (1977)	USA-6 states	1970	143	Private production is less costly
Crain and Zardkoohi (1978)	USA-38 state	1970	112	Private production is less costly
Bruggink (1982)	USA	1960	86	Public production is less costly
Feigenbaum and Teeples (1983)	USA	1970	319	No significant differences between public and private production
Fox and Hofler (1986)	USA-rural areas	1981	176	No significant differences between public and private production
Teeples and Glyer (1987)	USA-Southern CA	1980	119	No significant differences between public and private production
Byrnes (1991)	USA	1976	154	No significant differences between public and private production
Raffie et al. (1993)	USA	1989	238	Private production is less costly
Bhattacharyya et al. (1994)	USA	1992	257	Public production is less costly
Bhattacharyya et al. (1995)	USA	1992	221	No significant differences between public and private production. Private more efficient at small scales of operation, whereas public is more efficient at large-scales
Lynk (1993)	England and Wales	1979–1988	32	Average levels of inefficiency higher in private firms than in public firms
Ashton (2000a,b)	England and Wales	1987–1997	10	Neither technical change nor productivity growth with privatization
Saal and Parker (2000)	England and Wales	1985–1999	10	Privatization does not induce costs reduction. Strict regulation does
Jones and Mygind (2000)	Estonia, Latvia and Lithuania	1993–1996	566–655,138–144,325–452	Mixed results in Estonia and Latvia. No relation between costs and production form in Lithuania
Estache and Rossi (2002)	Asia and Pacific	1995	50	No systematic relation between costs and production form
Kirkpatrick et al. (2006)	Africa	2000	76	Production form does not impact costs

Note: All works in the table are multivariate econometric studies. Studies for the UK have a small number of producing units. Nonetheless, by using panel data the total number of observations is much larger. *Source*: Author's.

service. Competition here is not even a metaphor. According to data from Public Works Financing, of all privatization contract renewals of water/wastewater in the U.S. between 1998 and 2001, 75% were renewed by renegotiation (without competition), 16% were renewed by competition (10% retained by the incumbent and 6% won by another company) and 8% were deprivatized (returned to public production) (Moore, 2004). The popular literature typically confuses privatization and competition, but you can have privatization without competition and that is the case in water privatization.

Both public choice and property rights theory give too much emphasis to competition, which rarely exists in public service markets for waste or water. Private ownership may be less costly when competition is present. However, without competition property rights theory predicts excess profits or corruption in private production and over-employment and patronage in public production (Hart et al., 1997). We have shown that competition is limited in both of these sectors. From property rights theory we can derive the important insight that regulation of quality must be the counterpart to ensure that cost savings are due to efficiency and not quality erosion. Indeed, we believe that it could be that regulation of quality is so tight in water that there is no room for reducing quality and this might explain the failure to see cost savings. In the U.S., vertical integration among waste haulers and landfill operators as well as the expansion of recycling can help explain cost savings even if quality is not eroded. Thus while property rights is helpful, it is not broad enough to address market structure differences.

Generally, industrial organization is a more powerful approach to explain the complex relationship between private production, public production and costs. This is because it puts the emphasis on how incentives work, rather than why objectives are established. Because the function of incentives is related to the structure of the market, different outcomes can be expected from different sectors. This helps us explain the different empirical experience from water and waste collection.

From an industrial organization perspective, privatization is a tool that might or might not permit a better alignment of objective functions to ensure the manager chooses in favor of public objectives. In contrast to the narrow view of public managers as budget maximizers and over suppliers found in public choice theory (Niskanen, 1971), industrial organization theory allows us to see how incentives and market structure interact to affect the alignment of principal–agent (or public–private) objectives in public service delivery. Careful management of contracts and of the local or regional market of alternative suppliers is needed to ensure efficiency and avoid conflicts of interests. However, this does not mean that competition exogenously imposed on local government will yield efficient results. Indeed, under CCT in the U.K. the central government took the role of principal in defining objectives for local government agents and forced them to use a tool many did not want to use. Public teams won most of the contracts (Stoker, 1997; Reimer, 1999). Thus, we should not expect the same results as when conditions of potential competition and alignment of principal agent objectives are fulfilled.

The issue is not so much public or private ownership as management quality and context (Wolf and Hallstein, 2005). Managers should be cautious about choosing private production when there is

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uncertainty in the contracting process, high asset specificity, non-standardized processes and difficulty in measurement. All these factors are highly related to contract failure (Hefetz and Warner, 2007). These factors are usual in waste and are highly common in water distribution. Managers should also pay careful attention to the nature of their local service market. U.S. research finds suburbs face more favorable markets for privatization than rural towns or core metro areas (Warner and Hefetz, 2003; Warner, 2006).

The importance of a sector's market structure and the incentives that arise there from are key factors to explain differences between sectors and dynamics within a sector. By focusing on incentives we see how contracting creates pressure on managers to benchmark costs and production practices with private actors. It also encourages managers to consider other innovations that could increase efficiency. These include mixed public and private production (which is growing in the U.S.) that benchmarks public versus private production in the same jurisdiction (Warner and Hefetz, 2008). We also see inter-municipal cooperation to gain economies of scale (Bel and Costas, 2006; Warner and Hefetz, 2002).[6]

These public sector innovations also may explain the failure to find cost savings under privatization. New forms of performance based public management have achieved important efficiency gains within the public sector itself (Osborne and Gaebler, 1992; Osborne and Plastrick, 1997; Boyne, 2002). As governments seek to save costs and improve practices, they pay careful attention to their own role as players in the market. We find considerable instability in private contracting for both water and waste services in the U.S. In fact, between 1997 and 2002 twice as many governments brought previously privatized work back in house, as pursued new contracts in water and waste (Warner and Bel, 2008). Understanding the *dynamics* of market contracting, and why governments contract out or contract back in is now recognized as an important area of study, especially given the rise in reverse privatization (Hefetz and Warner, 2004, 2007; Warner and Hebdon, 2001).

As government managers explore new partnerships with the private sector, we need to shift from conceptualizing the problem as a simple principal–agent relationship to recognizing the multiple objectives and challenges that come from managing a network of diverse actors where there is dispersed control (Goldsmith and Eggers, 2004). Network governance theory recognizes the challenges when government is just one node in a network of actors. The loss of hierarchical control, the rise in interdependencies and the need to maintain partners in the network can make monitoring more difficult, costly and less desirable for government managers (Salamon, 2002; Rhodes, 1996; Brown et al., 2007). This network governance view is part of a new industrial organization approach that gives attention both to market structure, regulatory frameworks and the motivations of agents (Sclar, 2000; Miralles, 2008; Hebdon and Jalette, 2008).

4. Conclusion

Differences in costs under public and private production have been attributed primarily to competition. However, we point to the importance of management, service characteristics and the industrial organization of the sector itself. By reviewing empirical studies on costs in water distribution and waste collection where the most extensive experience with private production is found, we can move beyond the inconsistent results of case studies and identify theoretically based reasons why cost savings are not systematically found.

Waste collection is characterized by weak competition or collusion, because of the trend to concentration in the market. Water distribution is characterized by asset specificity that leads to monopolistic production and incumbent dominance in the event of a concession re-biding. Our analysis shows that competition *in* the market is not expected for water or waste, and competition *for* the market is expected but not typically found. The public versus private debate places too much emphasis on ownership when primary attention should be given to market structure, regulations and incentives, and the level of contract completeness. For water distribution, we see a natural monopoly where efficiency gains are best achieved with monopoly regulation—not competition. For waste collection, weak competition between firms erodes potential cost savings. This analysis suggests regulation may be more effective than simple privatization. Regulation is central to ensure quality and efficiency gains, either with regulation of monopoly or with antitrust policy.

Most studies reviewed use a cross-sectional framework. However, time-series design would be more effective to analyze the relationship between privatization and costs. Future research should explore time-series design but the challenge will be to ensure comparative cost data over time.

Future research should look more broadly at the variety of alternatives government has for service delivery reform. Ownership, regulation and competition policy are partial substitutes for government intervention in service markets. We need a more comprehensive analysis that looks at mixed use of these tools and hybrid forms of organization. Government service delivery is not a simple choice between public and private. New managerial approaches blur the public/private dichotomy. As we move into a network governance system, these tools of government deserve careful attention.

The debate on privatization needs to move beyond a debate on competition and ownership and instead look more closely at the costs of contracting and the organization of the service sector itself. These are the primary features, which will determine cost savings under public or private production.

That private production has failed to deliver consistent cost savings in these two important sectors (which have wide experience with privatization) attests to the inadequacy of theoretical frameworks based primarily on assumptions about competition and ownership. A more elaborate understanding of the nature of public service markets, by service, location and industrial organization, is needed in order to determine when to expect cost savings from privatization. Cost savings crucially depend on the nature of public service markets, the characteristics of the service itself, the geographical dimension of the market in which the city is located, and the industrial structure of the sector. There is no systematic optimal choice between public and private production, therefore managers should approach the issue in a pragmatic way.

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Appendix A

See Tables A1 and A2.

[6] Another way to escape the dichotomy between pure public and pure private production is that of the community waste sector (Sharp and Luckin, 2006).

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Table A1
Characteristics of the econometric estimations in studies for solid waste collection

Work	Dependent variable	Explanatory variables	Sign[a]	Function	Regression method[b]
Hirsch (1965)	Average Cost	Output (and output^2) Frequency Density Private production	0 (0) + 0 0$^-$	Cost function	Linear regression
Pier et al. (1974)	Output	Input labor Input capital	+ +	Production function	Linear regression
Kitchen (1976)	Average costs	Output (and output^2) Frequency Density Input prices labor Distance to landfill Private production	+ (−) 0 + + 0 −	Cost function	Linear regression
Kemper and Quigley (1976)	Average costs	Frequency Density Private provision (market) Private production	0 0 + −	Cost function	Linear regression
Collins and Downes (1977)	Average costs	Output Frequency Private provision (market) Private production	0 0 + 0$^+$	Cost function	Linear regression; step-wise estimation
Pommerehne and Frey (1977)	Average costs	Output Frequency Density Private production	+ + − −	Cost function	Linear regression and log-linear regression
Stevens (1978)	Total costs	Output Frequency Density Input prices labor Private provision (market) Private production	+ + 0 + + 0$^-$	Cost function	Log-linear regression
Tickner and McDavid (1986)	Total costs	Output Frequency Density Input prices labor Distance to landfill Private production	+ + 0 + 0 −	Cost function	Log-linear regression
Domberger et al. (1986)	Total costs	Output Frequency Density Input prices labor Private production Tendering and public prod.	+ + 0 + − −	Cost function	Log-linear regression
Dubin and Navarro (1988)	Average costs	Output Frequency Density Private provision (market) Public production	− + − + 0$^+$	Cost function	Linear regression (controlling for selectivity bias)
Szymanski and Wilkins (1993)	Average costs	Output Frequency Density Input prices labor Private production Tendering and public production	0 0 0 0 − −	Cost function	Log-linear regression Two stage estimation
Szymanski (1996)	Average costs	Same as in Szymanski and Wilkins (1993)	Same signs[c]	Cost function	Log-linear regression; pooled estimation
Reeves and Barrow (2000)	Total costs	Output Recycling Frequency	+ 0 0	Cost function	Log-linear regression; panel estimation

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Table A1 (*Continued*)

Work	Dependent variable	Explanatory variables	Sign[a]	Function	Regression method[b]
		Density	–		
		Private Production	–		
Callan and Thomas (2001), I	Total costs disposal	Output disposal	+	Cost function	Linear regression
		Output recycling	+		
		Out. disposal[a], out. recycling	–		
		Frequency	+		
		Density	+		
		Distance landfill	+		
		Public production	0^{-}		
Callan and Thomas (2001), II	Total costs recycling	Output disposal	+	Cost function	Linear regression
		Output recycling	+		
		Out. disposal[a]; out. recycling	–		
		Frequency	+		
		Density	0		
		Public production	0^{-}		
Dijkgraaf and Gradus (2003)	Total costs	Output	+	Cost function	Log-linear regression
		Recycling	0		
		Frequency	+		
		Density	0		
		Public without tendering	+		
		Public with tendering	–		
Ohlsson (2003)	Average costs	Output	–	Cost function	Log-linear regression
		Frequency	+		
		Density	0		
		Distance landfill	+		
		Private production	+		
Bel and Costas (2006)	Total costs	Output	+	Cost function	Log-linear regression
		Recycling	+		
		Frequency	+		
		Density	0		
		Input price labor	+		
		Tourism	+		
		Distance to landfill	+		
		Inter-municipal cooperation	–		
		Private production	0^{-}		
Dijkgraaf and Gradus (2007)	Total costs	Output	+	Cost function	Log-linear regression
		Recycling	0		
		Density	–		
		Private production	–		
		Tendering and public production	–		
		Concentration rates	+		

Source: Authors'.

[a] In this column (+), positive and statistically significant coefficient; (–), negative and statistically significant coefficient; (0), coefficient not statistically different from zero. When (0) is the sign for variables related to public versus private production, sign in superscript indicates the direct coefficient from regression.

[b] Estimation method is OLS, unless otherwise specified.

[c] Szymanski (1996) introduces dynamics on the data and variables from Szymanski and Wilkins (1993). The main change is that cost reduction with private production is sustained overtime, whereas cost reduction with tendering and public production is not sustained overtime.

Table A2
Characteristics of the econometric estimations in studies for water distribution

Work	Dependent variable	Explanatory variables	Sign[a]	Function	Regression method[b]
Mann and Mikesell (1976)	Average operating cost	Output (and output^2)	– (+)	Cost function	Linear regression
		% Water purchased	+		
		% Water surface sources	+		
		Regulatory jurisdiction (local)	+		
		Private production	+		
Morgan (1977)	Total operating costs	Output (and output^2) [and output^3]	+ (–) [+]	Cost function	Linear regression
		% Water purchased	+		
		% Water surface sources	+		
		Private production	–		
Crain and Zardkoohi (1978)	Total operating costs	Output	+	Cost function	Log-linear regression
		Input prices labor	+		
		Private production	–		

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Table A2 (*Continued*)

Work	Dependent variable	Explanatory variables	Sign[a]	Function	Regression method[b]
Bruggink (1982)	Total operating costs and Average operating costs	Output (and output^2) % Water purchased % Water underground sources Regulatory jurisdiction (local) Public production	– (0) + – 0 –	Cost function	Log-linear regression
Feigenbaum and Teeples (1983)	Cost index	Output (and output^2) Service quality attributes Input prices labor Input prices energy Input prices capital	+ (0) + 0 0 0	Hedonic cost function	Non-linear; maximum likelihood
Fox and Hofler (1986)	Output	Service quality attributes Input prices labor Input prices capital	+ + +	Production function	Log-linear regression, maximum likelihood
Teeples and Glyer (1987)	Total costs	Output Water purchased Input prices labor Public production	+ + + 0^-	Translog cost function	Log-linear regression
Byrnes (1991)	Total costs	Output Input prices labor Input prices energy Input prices capital Public production	+ 0 + + 0^-	Cost function	Log-linear regression two stages (correcting for selectivity bias)
Raffie et al. (1993)	Total costs	Input prices labor Input prices energy Input prices capital Input prices materials Public production.	+ + + + +	Cost function	Log-linear regression
Bhattacharyya et al. (1994)	Average costs	Output Input prices labor Input prices energy Input prices capital Public production	0 + + + –	Translog cost function	Non-linear seemingly unrelated regression
Bhattacharyya et al. (1995)	Cost-frontier index	Output Surface water Input prices labor Input prices energy Input prices capital Public production	0 0 + + + 0^-	Translog cost function	Log-linear regression; two stages estimation
Lynk (1993)	Total operating costs	Output Quality Input prices labor	+ + +	Translog cost function	Log-linear regression
Ashton (2000a,b)	Total operating costs, average operating costs	Output Input prices	– 0	Translog cost function	Log-linear regression; panel estimation
Saal and Parker (2000)	Total operating disposal	Output Quality Input price labor Input price capital Regulation enforcement Private production	+ + + + – 0^+	Translog cost function	Non-linear iterative seemingly unrelated regression
Jones and Mygind (2000)	Output	Input labor Input capital Private production	+ 0 0^-	Production function	Log-linear regression
Estache and Rossi (2002)	Total operating costs	Output Quality % Surface water Density Input prices labor Private production	+ 0 0 – + 0^+	Cost function	Log-linear regression OLS, OLS corrected and maximum likelihood
Kirkpatrick et al. (2006)	Total operating costs	Output Quality Density Input prices labor Private production	+ 0 – + 0^+	Cost function	Log-linear regression, maximum likelihood

Source: Authors'.

[a] In this column (+), positive and statistically significant coefficient; (–), negative and statistically significant coefficient; (0), coefficient not statistically different from zero. When (0) is the sign for variables related to public versus private production, sign in superscript indicates the direct coefficient from regression.

[b] Estimation method is OLS, unless otherwise specified.

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