

Privatization of solid waste and water services:

What happened to costs savings?

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Working paper Cornell University, Ithaca NY

July 2007

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Acknowledgments

Germà Bel is thankful for support provided to this research from the Spanish Commission of Science and Technology (SEJ 2006-04985) and from the Fundación Rafael del Pino. Mildred Warner's privatization research is supported by funding from the US Dept of Agriculture National Research Initiative (NYC-121524).

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Abstract

Cost reduction was the key benefit claimed by privatization. We conduct a meta analysis of all published econometric studies of water and waste production in cities since 1965. 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 solid waste collection. Theoretical expectations for cost savings arise from the benefits of competition and the incentives of private ownership. However, empirical results show the importance of market structure, industrial organization of the service sector, and government management, oversight and regulation.

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1. Introduction

Water distribution and treatment and solid waste collection are two of the most commonly provided local government services in the U.S. There has been substantial experimentation with privatization in solid waste collection, but privatization has been much less common in water services. The International City County Management Association tracks alternative service delivery for basic local government services by US cities. 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). As cities across the U.S. face the challenge of depreciating water infrastructure and rising technical requirements for water quality, many are looking to the private sector as a possible source of finance and management for their aging systems. The EPA (2003) estimates renewal costs of community water systems to range from \$250 to \$500 billion in the next 20 years. Is privatization an effective approach to finance system delivery in the 21st century? What does the empirical research show on privatization and costs?

Early surveys of the literature (Domberger and Rimmer 1994, Domberger and Jensen 1997) concluded that, according to expectations, privatization of city services was linked to cost savings. However, meta-analyses published later, such as Hirsch (1995), Boyne (1998a, 1998b) and Hodge (2000) found mixed evidence on cost savings and began to raise both methodological and theoretical concerns about such expectations. In this paper we review all econometric

multivariate 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. These large scale empirical analyses include both studies from the U.S., as well as several recent studies published on water and waste for European Union (E.U.) countries and other regions in the world. Hence, our review has a wider geographical scope than the previous reviews. European experience with privatization in water and waste is actually higher than in the U.S. (OECD, 2000, 2003). 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 twenty years. So in neither service area is competition expected to be maintained over time.

Costs are a driving factor in the decision of service delivery form (Walls, Macauley and Anderson 2005). However, local governments are interested in more than just costs (Carver 1989). Communities may prefer private delivery even if it is more costly, if that reflects their view of 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. As the

aftermath of Hurricane Katrina showed, citizens expect government to be there to provide basic services critical to public health. 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 distribution at the metropolitan scale. In discussing the results of our meta-analysis 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, Shleifer and Vishny, 1997), and thus reducing costs. Transactions costs and industrial organization theories both have embedded the principal-agent dichotomy (the basis of agency theory), and look more at the nature of the service and structure of the organization as well as 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).

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 can not 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 the more comprehensive theoretical approach of industrial organization theory, which focuses both

on actors and incentives as well as market and regulatory structure, is most useful in understanding 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, 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 provision 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 production 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 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 production would be the most costly due to market failures that prevent taking advantage of economies of density.¹ Competition under pure private production increases overlap and denies

the opportunity to realize the advantages of economies of density. A recent study by OECD (2000) confirms that pure private production 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 this second production choice and whether, under municipal provision, public or private production is less costly.

Waste Collection

The first econometric study of waste collection was conducted by Werner Hirsch in 1965. Using data from 24 municipalities in St Louis Co, 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 which 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, transactions 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, Vernon and Weicks, 1974) and Missouri (Collins and Downes 1977) found no difference between public and private production under municipal provision. A Connecticut study, (Kempler and Quigley 1976), found private production had lower costs, but they did not control for heavier public provision in larger 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 which enabled them to use smaller crews. Dubin and Navarro (1988) found economies of density in waste collection but not economies of scale.

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. Compulsory competitive tendering (CCT) was introduced in 1988 requiring municipalities to allow private competition for waste collection. Domberger, Meadowcroft and Thompson (1986) looked at 305 municipalities in England and Wales prior to CCT (from 1983-85) and 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 (Gomez-Lobo and Szymanski 2001). Competition encouraged public managers to keep costs down. Similar results were found by Szymanski and Wilkins (1993) in the 1984-88 period. Although they found a 20 percent savings in the first year, these savings disappeared in four years suggesting underbidding by contractors. Although 71 percent of municipalities won their competitions and retained public service provision, 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 studies 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 Irish study only included seven cases of contracting out and cost savings did not hold when they estimated the data as a panel.

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 more cost savings. Cost savings from privatization appear to erode over time as there were no cost differences between cities that had privatized earlier and those that retained public production.

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 calls, and public production without competition. 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 provision would continue to be necessary due to economies of scale. Thus benefits from privatization would be expected to erode over time. Indeed only six of the 18 studies found 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. Economies of scale seem to be exhausted at a relatively low population level (below 50,000 population) (Stevens 1978). 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.

Table 1 presents information on the empirical studies on waste collection.

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 decreased 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. More recently, empirical studies 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 water distribution firms 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 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 Teeple (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. studies already reviewed, Teeple 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. Teeple and Glyer's (1987) own findings showed no significant difference between private and public production. Subsequent studies of water service in the U.S., using models similar to those already reviewed, show no differences between private and public production (Byrne, 1991), lower costs with private production (Raffie, Narayanan, Harris, Lambert and Collins, 1993), and lower costs with public production (Bhattacharyya, Parker and Raffie, 1994). Finally, Bhattacharyya, Harris, Narayanan and Raffie (1995) used a different methodology, a stochastic frontier costs function, and concluded there are not significant differences between private and public production. However, when analyzing according to firm size, they found 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.²

In the U.K. the first analysis of privatization, efficiency and costs (Lynk 1993) studied all ten regional agencies in England and Wales in the periods 1979-80 (after 1973 reorganization)

and 1987-88 (prior to privatization), and 22 out of the 28 private firms in the periods 1984-85 and 1987-88. 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.³

The next econometric work for water privatization in the U.K. is Ashton (2000a, 2000b), who analyzed potential 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 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 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.

Several studies of countries in different regions of the world have been published more recently. Jones and Mygind (2000) is the first work on the Baltic countries that makes efficiency comparisons between private and public delivery of water services.⁴ 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. Similar results are found by Estache and Rossi (2002) 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, Parker and Zhang (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.

Water distribution is characterized by asset specificity and long term contracts (except for England and Wales where ownership was transferred to the private sector). Monopolistic characteristics make competition for the contract unlikely. Government quality regulations are strict. These factors reduce the likelihood of cost savings (Wallsten and Kosec 2007). Indeed, only three of the sixteen 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 economies of scale and government regulation demonstrate the salience of a broader industrial organization approach.

Table 2 presents information on the empirical studies on water distribution.

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.

Managers should be wary of over reliance on the importance of competition in markets for waste collection where the only potential competition is *for* the market – for the initial contract. 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.

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 (Fisher 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 provision even in the face of contracting so that they can sustain competition at least between public and private crews (Ballard and Warner 2000). But 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.

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. The need for such a strong market management role, and to understand how private managers respond to regulatory incentives, raises transactions costs for local governments.

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 transactions costs of contracting. It is crucial to focus on incentives that critically depend on the structure of the market, but incentives are less powerful in the water sector, because contract terms are longer (Johnson, McCormally and Moore 2002). And even when a concession is reopened for bidding, the position of the incumbent is extremely strong given the asset specificity of the 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 percent were renewed by renegotiation (without competition), 18 percent were renewed by competition (10 percent retained by the incumbent and six percent won by another company), and eight percent were deprivatized (returned to public production) (Moore, 2004).

Although there have been some anecdotal reports of quality reduction under private production, close public regulation of water quality limits the potential for private firms to reduce quality. Hence private managers have little incentive for cost minimization and this helps explain why no cost savings are found when comparing public and private ownership (Hart, Shleifer and Vishny 1997). In addition, monopoly production is the norm in water, so ownership does not affect costs. However, Joassart-Marcelli and Musso (2005) found municipalities that decide to contract out water and emergency services are more prone to contract with public agencies than with private firms due to concerns about service disruption.

The industrial organization approach helps explain the complex relationship between private production, public production and costs because it puts the emphasis on how incentives work. Incentives are related to the competitive conditions of the market and different outcomes

can be expected from different sectors. This helps us explain different empirical experience in water and waste collection.

Privatization is a tool that may or may not permit a better alignment of objective functions to ensure the manager chooses in favor of public objectives. Managers need to understand how incentives and market structure interact to affect the alignment of principal-agent (or public-private) objectives in public service delivery. 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. Most of the contracts were won by public teams (Stocker 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 market context (Wolf and Hallstein 2005). Managers should be cautious about choosing private production when there is uncertainty in the contracting process, high asset specificity, non standardized processes and difficulty in measurement. All these factors are highly related to contract failure. These factors are not unusual 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 (Kodryski 1994).

The importance of a sector's market structure and the incentives that arise therefrom 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 (Miranda and Lerner 1995). We also see inter-municipal cooperation to gain economies of scale (Parks and Oakerson 1993). 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 (Bel and Warner forthcoming).

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). 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, Hickey 2006, Miralles 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 privatization 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 which leads to monopolistic production and incumbent dominance in the event of a concession re-bidding.

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 vs 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. These results raise critical implications for cities as they grapple with decisions of how to address finance and delivery challenges in water and waste services.

Urban scholars 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 more careful attention must be given to these tools.

Government service delivery reform 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 and sustained cost savings in these two important sectors (which have wide experience with privatization) offers a useful insight to public managers. 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. City managers should proceed with caution.

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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 <i>et al</i> (1974)	USA-MT	Early 70s	22	No difference
Kitchen (1976)	Canada	Early 70s	48	Costs are higher with public production
Kemper & Quigley (1976)	USA-CT	1972-74	128	Private provision more expensive. Within municipal provision private production is less costly than public production
Collins & Downes (1977)	USA-MO	Early 70s	53	Private provision more expensive. Within municipal provision, no differences between public and private production
Pommerehne & Frey (1977)	Switzerl.	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 & McDavid (1986)	Canada	1981	132	Costs are higher with public production
Domberger <i>et al</i> (1986)	England & Wales	1983-85	305	Competitive tendering is less costly than public production without tendering. Public and private costs do not differ with competitive tendering
Dubin & Navarro (1988)	USA	1974	261	Private provision more expensive. With municipal provision, private monopoly is more costly than contracting out and public production
Szymanski & Wilkins (1993)	England & Wales	1984-88	185- 335	Public production more costly without tendering. Public and private costs do not differ with competitive tendering
Szymanski (1996)	England & Wales	1984-94	>300	Public production without tendering is more costly. Private costs are lower than public with competitive tendering
Reeves & Barrow (2000)	Ireland	1993-95	48	Costs are higher with public production
Callan & Thomas (2001)	USA-MA	1997	110	Production form does not influence costs
Dijkgraaf & Gradus (2003)	Holland	1996-97	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 & Costas (2006)	Spain	2000	186	Production form does not influence costs
Dijkgraaf & 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.

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

Work	Area	Year	Sample	Costs, efficiency & 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 & Zardkoohi (1978)	USA-38 state	1970	112	Private production is less costly
Bruggink (1982)	USA	1960	86	Public production is less costly
Feigenbaum & Teeple (1983)	USA	1970	319	No significant differences between public & private production
Fox & Hofler (1986)	USA-rural areas	1981	176	No significant differences between public and private production
Teeple & 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, <i>et al</i> (1993)	USA	1989	238	Private production is less costly
Bhattacharyya, <i>et al</i> (1994)	USA	1992	257	Public production is less costly
Bhattacharyya, <i>et al</i> (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 & Wales	1979-1988	32	Average levels of inefficiency higher in private firms than in public firms
Ashton (2000a,2000b)	England & Wales	1987-1997	10	Neither technical change nor productivity growth with privatization
Saal & Parker (2000)	England & Wales	1985-1999	10	Privatization does not induce costs reduction. Strict regulation does.
Jones & Mygind (2000)	Estonia, Latvia & Lithuania	1993-1996	566-655 138-144 325-452	Mixed results in Estonia & Latvia No relation between costs and production form in Lithuania
Estache & Rossi (2002)	Asia & Pacific	1995	50	No systematic relation between costs and production form
Kirkpatrick <i>et al</i> (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.

Endnotes

¹ Economies of density can be defined as a reduction in costs because of increasing concentration of the output (whereas economies of scale is 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 is a more recent concept than economies of scale. A seminal paper on the differences between these two concepts is Caves, Christensen and Tretheway (1984).

² 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, Grosskopf and Hayes (1986) do not find differences in efficiency between public and private production. Lambert, Dichev and Raffie (1993) find that public firms have greater efficiency than private firms.

³ In a later study, Hunt and Lynk (1995) found privatization suppressed the possibility of realizing economies of scope. Economies of scope refer to the 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 would have to yield big improvements in dynamic efficiency. However, their work does not compare public and private production.

⁴ 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.