

## **Auction Rules and Property Rights in Competitive Tendering of Public Transit**

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### **Abstract**

This paper considers alternative methods and mechanisms for competitive tendering of public transit services. In particular, the benefits and costs of awarding transit service contracts in a first-price, sealed-bid auction (where the low-cost responsive and responsible supplier's compensation equals its actual bid price) are compared and contrasted with a second-price auction (in which the contract is also awarded to the low-cost bidder, but the winning contractor's compensation equals the second lowest bid). The objective of the analysis is to identify market institutions that alleviate bidders' incentives to misrepresent their costs while at the same time ensuring positive expected profits for the successful contractor. Because of the fundamental differences between public and private ownership arrangements, providing incentives for truthful revelation of relevant information to the contracting authority is especially critical in cases where the local public transit agency competes with private firms for the right to supply public transit services.

### **I. Introduction**

The financial condition of urban mass transit systems in the United States has deteriorated markedly during the past three decades. While ridership totals remained stagnant, operating costs per vehicle mile exploded by 418 percent from 1970 to 1990, an increase double that of the economy-wide rate of inflation in consumer prices and two-and-a-half times the increased cost of the transit service supplied by the private bus industry over the same period. The escalation in public transit operating costs has exceeded every component of the consumer price index, including fuel and health care costs.<sup>2</sup>

Because revenue from passenger fares has not kept pace with this rapid cost inflation — farebox collections now cover only about one-third of public transit operating costs nationwide — public subsidies to public transit have grown substantially. In 1970, total public operating subsidies to public transit amounted to \$318 million, none of which was financed by the federal government. By 1980, this figure was nearly \$4.4 billion, representing a 13-fold increase (a six-fold increase calculated in constant 1982 dollars) in just ten years. During the same period, annual operating subsidies from federal sources rose to over \$1.3 billion.

Moreover, because passenger fares do not come anywhere close to covering the typical public transit system's operating costs, they do not contribute at all toward financing transit capital projects. Just as obviously, public transit systems are denied access to private lenders because of their chronic operating losses. Government's role in financing the purchase of transit capital has expanded accordingly. Total public capital subsidies were \$200 million in 1970; they were \$3.4 billion (\$2.8 billion from federal sources) in 1980. All told, public transit systems in the US received more than \$7.8 billion in public operating and capital assistance in 1980, a 640 percent inflation-adjusted increase over the comparable figure a decade earlier.<sup>3</sup>

As a result of the increasing budgetary burden of public transit subsidies, private alternatives to public ownership of public transit have begun to reemerge.<sup>4</sup> Experiments with competitive tendering arrangements are on the rise.<sup>5</sup> Public transit agencies have begun contracting with private operators to

supply "demand responsive" and other auxiliary passenger transport services such as buses operating between central city locations and suburban airport terminals. While contemporary experience with such alternatives has been limited, the experiments conducted thus far have been sufficiently successful that competitive tendering is now seen as a potentially fruitful solution to the fiscal crisis in urban mass transit.

This paper evaluates the methods and mechanisms of private contracting for public transit. Our main objective is to consider the positive and normative implications of current competitive tendering arrangements which typically award transit service contracts to the low-cost supplier in a sealed-bid auction. The public benefits and costs of such a contract award mechanism are compared and contrasted with an alternative "second-price" auction in which the low-cost supplier who wins the contract receives in compensation the price tendered by the next lowest bidder. This second-price auction generally provides superior incentives for bidders to truthfully reveal relevant information to the contracting authority.

Providing incentives for truthful revelation of relevant information is especially important in cases where the local public transit agency competes with private firms for the right to supply specified public transit services. While it is true that competition forces public enterprises to more closely mimic the cost-efficiencies of their private sector counterparts, competition *per se* does nothing to change the fundamental differences in property rights between public and privately owned firms. We address the "competition versus ownership" debate to show that compared with private firms, public organizations have shorter time horizons, correspondingly weaker incentives to invest in and to maintain capital, and stronger motives to understate their costs.

Put differently, the observed cost inefficiencies of public transit are generally attributed to the lack of competition for service provision rights. The fact that the transit agency is publicly owned is typically not considered to be a separate source of inefficiency. We suggest that the ownership structure of public enterprises will yield inefficiencies even when the transit agency faces competition from private firms. The institutional structure of the competitive tendering process is consequently vital in promoting the submission of bids that are both responsive and responsible.

The paper is organized as follows. Section II summarizes the key elements of the competitive tendering mechanism now used to award public transit contracts. The alternative, second-price auction is also described there. Theory and evidence on the competition versus ownership debate are presented in Section III. Section IV contains some concluding remarks.

## II. Competitive Auctions for Public Contracts

A common market mechanism used for awarding public contracts is the sealed-bid auction. Here, we consider two alternative market institutions for determining the compensation paid to the winning bidder — the first-price auction and the second-price auction. Both types of auctions are relatively simple to understand and to operate, and the sealed-bidding requirement helps assure the participants' privacy.<sup>6</sup> A key difference between the two institutions is the pricing rule that determines the winning bidder's compensation and, hence, the participants' incentives for engaging in strategic behavior. These incentives for behaving strategically are important insofar as they influence the bids which the potential suppliers submit and, thus, ultimately determine the cost of providing service to the public.

In both types of auctions, potential suppliers submit private, sealed bids to the local contracting authority. The bids represent suppliers' minimum-willingness-to-provide, that is, the minimum amount of compensation each supplier requires to provide the specified service. The authority then awards the contract to the supplier who submitted the lowest bid and provides that supplier with compensation for providing service. The winning bidder's profit is the amount of the compensation received minus the true

cost of providing service.

Because bids are typically submitted on the basis of "gross cost," the contracting authority assumes all of the revenue risk associated with transit service provision. (Indeed, in most cases the winning bidder will be required to blindly hand over all farebox receipts to the contracting authority which then uses them to offset the compensation paid to the winner, thereby reducing the contract's net cost to the public.) Gross cost contracts are employed widely in the competitive tendering of public transit because an element of risk in estimating the contract's value is eliminated. Other things being the same, this reduction in risk tends to increase the number of bidders who are willing to compete for service provision rights and therefore tends to reduce the expected winning bid. It should be obvious, however, that gross cost contracts do not provide the winning bidder with incentives to increase revenue or ridership.<sup>7</sup>

In any case, in the first-price auction the winning (or lowest) bidder receives the amount of its "first place" bid as compensation for providing service, hence the name "first-price."<sup>8</sup> In the second-price auction, the winning (lowest) bidder receives the amount of the *second lowest* bid as compensation for providing service (and thus the name "second-price").<sup>9</sup> In both auctions, losing bidders receive nothing.

An extensive literature has identified a number of factors that affect the bidding strategies of auction participants and the resulting market prices.<sup>10</sup> A partial list of the key variables includes the auction's rules, potential suppliers' costs, the number of bidders, their attitudes toward risk, and whether or not the auction will be repeated. The discussion here focuses on suppliers' costs and their degree of risk aversion in the context of first-price and second-price auctions.

#### A. Independent, Private Values

Assume there are  $n$  potential suppliers, denoted by  $S_i$  ( $i = 1, \dots, n$ ), with associated valuations (or costs of supplying service) given by  $c_i$ . For simplicity, let  $S_1$  be the low-cost supplier (*i.e.*,  $c_1 < c_2 < \dots < c_n$ ). Each seller,  $S_i$ , knows her own private valuation,  $c_i$ , with certainty, but does not know the valuation of any of her competitors. However, all sellers, and the contracting authority, know the common probability distribution,  $F$ , from which all values are independently drawn.<sup>11</sup>

Auction theory provides several important results regarding the relative merits of alternative auction rules when bidders have independent, private values. In the first-price auction, bidders have an incentive to misrepresent their true cost of providing service by "overbidding" (*i.e.*, bidding such that  $b_i > c_i$ ). If a bidder bids at cost (so that  $b_i = c_i$ ), then profit is zero whether that bidder wins the auction or not. Bidding above cost reduces the chance that the bid will be the winning bid, but yields positive expected profit to the winner.

In the second-price auction, by contrast, truthful revelation (*i.e.*,  $b_i = c_i$ ) is a dominant strategy.<sup>12</sup> Because the winning bidder is awarded the *second lowest* bid as compensation, a bidder's bid affects *only* the probability of winning, and not profit. Consequently, a bidder can do no better by bidding anything other than  $b_i = c_i$ , regardless of what one's rivals bid.

When bidders are risk-neutral, the Revenue Equivalence Theorem states (in part) that the first-price and second-price auctions yield the same price *on average*. That is, the contracting authority can expect to award the same compensation to the winning bidder under either set of auction rules.<sup>13</sup> If the bidders are risk-averse, though, the first-price auction yields a lower expected price than the second-price auction. The first-price auction consequently leads to a lower cost of service provision, relative to the second-price auction, when bidders are risk-averse.<sup>14</sup>

The contracting authority's choice of auction rules depends partly on its policy goals and partly on the characteristics of the market participants. If bidders have private, independent values that are generated from the same probability distribution and if they are risk-neutral, then the second-price auction is preferred. The expected compensation to the winner is the same as would be paid under the first-price auction, but the bid submitted in the second-price auction is a more reliable indicator of the supplier's true cost of providing service. The contracting authority may find such information particularly useful if it wishes to monitor profit.

But if bidders are risk-averse, the first-price auction yields a lower expected compensation, and thus a lower cost to society for the service. However, the bids tendered are not necessarily reliable indicators of the true cost of service provision. The contracting authority must therefore decide which is more important, truthful revelation or low cost.

## B. Correlated Values

Alternatively, assume that all potential suppliers have access to a common technology,  $C$ , for providing service, but there is some uncertainty about the exact cost of that technology. Then service provision has the same objective cost, or *common value*, for all potential suppliers. However, different suppliers may have different estimates or information regarding that common, objective value. The bidders (potential suppliers) can be distinguished according to their private estimates,  $c_i$ . Each  $c_i$  is an independent draw from the probability distribution  $G(c|C)$ . As before, the form of the distribution is common knowledge.

The assumption of common values, rather than private values, generates a phenomenon called the *winner's curse*. According to the rules of either the first-price or second-price auction, the low bidder wins. However, if *on average* bidders correctly estimate the true cost,  $C$ , then the bidder with the lowest estimate has underestimated the cost of providing service. Hence, it is possible for a bidder to win the auction and end up with negative profit. While this is less likely in the second-price auction, the possibility still exists because the second-lowest bidder can also underestimate the true cost.

The winner's curse poses two potential problems for the contracting authority. First, if the winning supplier sustains economic losses, it may be forced to withdraw service before the expiration of the contract. Or, to prevent service deterioration, the contracting authority may be forced to provide additional compensation to the contractor, thereby increasing society's cost of service provision. Second, to avoid the winner's curse, bidders will bid more conservatively under either set of auction rules (*i.e.*, bid higher than they would if values were private).<sup>15</sup> Thus, the winning bid will tend to be higher, and the cost of service to society greater, relative to the private value case.

If suppliers' values have aspects of both private values and common values, then they are said to be *affiliated*. For example, potential suppliers may have different managerial structures (or private, independent values) and access to the same production technology that has some uncertainty regarding its true value (or common value). In that case, the second-price auction yields a lower expected price than the first-price auction. The second-price auction is consequently preferred on grounds that it provides service at the lower expected cost and bidders have stronger incentives to truthfully reveal their costs. Furthermore, if the contracting authority has any information regarding the true cost of providing service, it can lower the expected price by establishing a policy of reporting any such information.<sup>16</sup>

## C. Other Considerations

Increased competition in the form of additional bidders typically lowers the average compensation received by the winning bidder.<sup>17</sup> Thus, a contracting authority seeking to minimize the cost of service provision

has an interest in attracting as many participants as possible.<sup>18</sup> The foregoing analysis assumes that the number of bidders is given; allowing the number of bidders to be determined *endogenously* has important effects which are only now beginning to be explored.<sup>19</sup> If the potential suppliers of transit service can switch relatively quickly among various investment opportunities, then endogeneity in the number of bidders must be taken into account. Also, in a repeated game framework, subsequent auctions might have aspects of incumbent-rival games, which can also affect the relative merits of the first- and second-price auctions.<sup>20</sup> Finally, the contracting authority may want consider a two-part compensation scheme consisting of a flat payment to the winner plus a royalty tied to ridership, or, in the case of common-value auctions, specify a reserve price that is equal to its own cost of providing service.<sup>21</sup>

Another important consideration relates to how the contracting authority will actually use the information revealed to it in the bidding process. Knowledge of bidders' true costs of service provision is obviously valuable. But what the contracting authority does with this information may affect subsequent bidding behavior. For example, if the contracting authority systematically uses information about costs to reduce the winning bidder's profits, then bidding strategies will adjust to take this factor into account. Incentives for truthful revelation may then be compromised even in a second-price auction. Strategic behavior is less likely if the contracting authority uses cost information for more limited purposes like gauging industry trends (by computing historical rates of return to winning bidders, for instance), helping determine whether the bids submitted by private nonprofit organizations and public firms are based on generally accepted accounting practices, or detecting collusion. The key point is that the contracting authority must exercise care in using the information submitted by the bidders.

### III. Competition versus Ownership

Evidence that competitive tendering arrangements have restrained the escalation in public transit costs has led many observers to conclude that *competition* is a more important determinant of efficiency in the supply of public services than *ownership*. An extreme version of this argument holds that when forced to compete for the right to provide a specified good or service there are no significant differences in the performances of private for-profit firms, private not-for-profit organizations, and public enterprises.<sup>22</sup>

Important policy implications obviously follow from the acceptance of this conclusion. If there are in fact no important differences between public and private firms (or between not-for-profit and for-profit enterprises), then the introduction of competition in the supply of urban mass transit services largely eliminates the need for more formal privatization initiatives. The public sector can retain ownership of transit capital, while the operating cost inefficiencies associated with the transit agency's local monopoly can be alleviated by forcing it to compete with other public and private firms for service provision rights.

In this section we argue that the conclusion of no difference in efficiency between public and private firms is neither theoretically nor empirically sound. Because the ownership rights of public firms are ill-defined, managers in the public sector have much weaker incentives to use scarce resources efficiently than their counterparts in the private sector. Hence, while the introduction of competition in the provision of public services will, if designed properly, force publicly owned firms to improve their performance, public enterprises institutionally cannot fully replicate the cost-effectiveness of the private sector.

#### A. Property Rights and Economic Incentives

Urban mass transit systems in the US were added to the public ownership rolls during the 1960s and 1970s as local public transit authorities bought out private bus operators, often with the assistance of grants provided for this purpose by the federal government. This change in ownership arrangements had important consequences for the subsequent economic performance and financial well-being of public

transit systems nationwide. Prior to the shift to public ownership, transit operating expenses were wholly covered by passenger fares and capital projects were financed privately through the issue of general obligation bonds. Government played little or no role in financing the provision of public mass transit services.

The explosion in transit operating costs and the expansion of government subsidies to public transit that followed the shift from private to public ownership was predictable on theoretical grounds.<sup>23</sup> The modern theory of property rights suggests that publicly owned firms will tend to have higher costs, will tend to be less attuned to their customers' wants, will tend to be less able to adapt to changing market conditions, in short, will tend to be less efficient than private firms.

The reason for this inferior performance is that publicly owned enterprises, by definition, lack well-defined and saleable ownership rights. There is no *residual claimant* in place — no individual (or group of individuals) with a right to personally share in the profits of the firm. In consequence, no one directly bears the costs of error or garners the profits of success, and no one is able to capture (through sale of the residual claim) the market value of any efficiency-enhancing improvements made. Moreover, the "owners" of public enterprises (the taxpayers) are numerous and dispersed — no one of them has sufficient wealth at stake to make it worth taking an interest in the day-to-day operations of the firm.<sup>24</sup> The managers and employees of public enterprises accordingly have a great deal of discretion that they may use to further their own private interests rather than those of the public at large.

For example, because the salaries and other pecuniary rewards of government employees are typically subject to statutory ceilings and because it is more difficult (costlier) for owner-taxpayers to monitor consumption of the nonpecuniary benefits of public office, the managers of publicly owned firms will have increased incentives to take advantage of job-related rewards derived from nonmonetary sources.<sup>25</sup> Such behavior includes allocating resources to enhance job security, and adopting policies that ease workloads and make jobs more pleasant.<sup>26</sup> Among other things, the managers of public enterprises are therefore expected to consume more on-the-job amenities, to discriminate more in hiring so that their subordinates have more of the personal characteristics they prefer, and to work to reduce job-related frictions by appeasing vocal employees and customers. Publicly owned firms will tend to have higher production costs and will be less efficient by market standards as a result of these activities.

There is a substantial amount of empirical evidence supporting this conclusion. Publicly owned enterprises have been found to compare unfavorably on efficiency grounds in supplying a variety of goods and services, including electricity, water, banking, air transportation, fire fighting, garbage collection, and hospital care.<sup>27</sup> Similar findings have been reported in a recent study comparing the performances of private, "mixed" (public-private), and state-owned enterprises outside the US.<sup>28</sup>

Most importantly for our purposes here, publicly owned firms seem to be less efficient by market standards than comparable privately owned firms even where they face competition from rival suppliers.<sup>29</sup> Competition *per se* does nothing to change the fundamental differences between public and private firms. Hence, even when subject to regulation of fares and routes, with well-defined property rights in place, the owners of private bus companies have an incentive to see that the managers and employees of the firm allocate resources efficiently. Among other things, efficient resource use implies holding employee compensation rates to a level just above the amount they would earn in their next best alternative place of employment, and setting passenger fares at the level that maximizes profits, subject to price and output constraints imposed by public regulatory authorities.

By contrast, the managers and employees of public enterprises have weaker incentives to use the firm's resources efficiently because the absence of alienable ownership rights weakens owners' incentives to

monitor resource use. In addition, maximum profit is not a goal of public enterprise because profit is typically not a basis for judging the performance of public organizations. Instead, public enterprises are normally evaluated on the basis of other, more "visible" criteria.<sup>30</sup> In the case of public transit systems, ridership statistics are often a key performance measure. To the extent that increasing ridership thereby becomes a fundamental organizational goal, transit agency decision makers have a clear incentive to adopt low-fare policies to achieve that objective. The absence of a profit motive also means that the managers of publicly owned transit systems will be more likely to succumb to the wage demands of organized employee coalitions than the managers of private transit enterprises. The cost of doing so is lower because the increase in operating expenses resulting from wage hikes not justified by productivity increases is simply absorbed by the public treasury rather than borne by a cohesive group of private owners having a direct financial stake in the profits of the firm.

This is not to say that managerial decision making in public enterprises is entirely unconstrained. The managers of public enterprises are subject to the discipline of the managerial labor market. "Better" managers of publicly owned firms will in the long run be promoted more rapidly, have more employment opportunities, and command higher salaries. Such margins of external control limit managers' use of the discretion available to them to direct the resources of the firm in ways that consistently work against the interests of the public at large. The point is not that the managers and employees of public organizations have *no* incentives to use resources efficiently, but rather that these incentives are *weaker* than they would be with private ownership.<sup>31</sup>

In sum, the behavior of public enterprises differs systematically and predictably from that of private enterprises as a result of fundamental differences in ownership rights. Among other things, this observation suggests that care must be exercised when the local public transit agency is allowed to compete head-to-head with private bus operators for the right to supply specified transit services. Because the managers of public sector enterprises do not face the same profit constraint as the managers of privately owned firms, they may be motivated to understate their costs when bidding for transit service contracts.

## B. Cost Accounting and Pricing by Public Enterprises

The modern theory of property rights suggests that because the managers of public enterprises are unable to capture the full benefits — and do not bear the full costs — of their own production decisions, they have weaker incentives to use resources efficiently than their counterparts in the private sector. While the introduction of competitive tendering arrangements can in principle alleviate these well-documented cost-inefficiencies, the fundamental differences between public and private firms raise two practical problems for the competitive contracting process. One of these problems relates to the measurement of costs. The other concerns the higher payoff to public enterprises of engaging in "predatory pricing" to underbid their private sector rivals.

**Accounting for public sector costs.** The selection of the least-cost responsible and responsive bidder in any competitive tendering process requires a proper accounting of capital and overhead costs. When private and public firms compete head-to-head for the right to supply a good or service, the evaluation of bids is complicated by the fact that public enterprises typically do not use standard capital budgeting techniques that take account of the costs of purchasing, maintaining, and replacing long-lived, durable assets. Indeed, insofar as they are financed by special bond issues or by special tax initiatives, the capital expenditures of public enterprises are often carried entirely off-budget. In situations where such organizations are granted the opportunity to compete for service provision rights, their bids must therefore be evaluated carefully to assure compliance with standard capital accounting practices lest their costs be artificially low compared to those of private sector firms whose bids necessarily take account of fully allocated costs.

The failure to adopt standard capital budgeting practices also means that the managers of publicly owned firms have much shorter time horizons and, hence, much weaker incentives to undertake any capital investments that may be required to enhance the quality or quantity of service than their private sector counterparts. Weaker incentives to undertake capital improvements exist, because public enterprises have no ownership rights that can be sold. Because no one can personally profit from the sale of the capital assets of these organizations, there is less of an incentive to maintain, expand, or improve them.

The allocation of overhead expenses raises a second complication. When competing for service provision rights, private bus companies include in their bids a portion of their total central office expenses and other overhead costs. Such allocations are necessary to determine the overall profitability of the contract because the private sector firm's long-run survival depends on total expected revenue being at least as great as total expected cost. But public sector firms face no such profit constraint and, moreover, many of the overhead costs of operating the public transit agency may in fact be carried off-budget. Personnel, payroll, and data processing services, for example, may be supplied to the transit authority by other local government agencies. Properly allocated expenses of these types must be included in the bids submitted by the transit agency to fully account for the public sector's costs.<sup>32</sup>

**Predation by Public Enterprises.** One point often raised in objection to the competitive tendering of public transit services is that private bus companies have incentives to understate their costs to increase the probability that the contract will be won (so-called low-balling). Once the contract is awarded, the winning bidder then opportunistically threatens to declare bankruptcy unless the contract authority relieves it of the obligation of serving selected high-cost routes, pays a larger subsidy, or grants other concessions that increase the contract's expected profitability.

Such a strategy is a variant of a business practice known in the economics literature as *predatory pricing*.<sup>33</sup> Predation involves setting a price below marginal cost with the intent of bankrupting a rival. While predatory pricing behavior has some superficial appeal, the logical consistency of a strategy of below-cost pricing is open to question. Predatory pricing is compatible with the objective of long-run profit maximization only if the predator expects to successfully recoup its losses after rivals have been bankrupted and exited the industry. But charging a price greater than cost at some later date to recoup the losses sustained during the price war invites the entry of new rivals who, in the absence of significant barriers to entry, seek to share in the predator's profits. The predatory pricing episode must then be repeated and the whole sequence of events becomes unprofitable.

Predatory pricing further fails as a rational strategy in private markets because of the discipline imposed by the repeat purchase mechanism. Firms that take advantage of their customers in this way suffer losses of reputational capital that impair their ability to compete for subsequent contracts. The threat of loss of future business provides powerful incentives for profit-seeking firms to bid on contracts responsibly.

Publicly owned firms have much weaker incentives to avoid engaging in predatory pricing behavior.<sup>34</sup> There are three reasons for this conclusion. First, because public enterprises are not bound by a profit constraint, they face no requirement of recouping the economic losses sustained during a predatory price war. The publicly owned firm can in principle finance below-cost prices in perpetuity by offsetting its operating losses with subsidies from the public treasury. Second, to the extent that public enterprises are evaluated on the basis of service delivery rather than profit, they may have strong incentives to reduce their prices below cost to expand production beyond the cost-effective level.<sup>35</sup> Increasing service delivery provides indirect benefits to the managers of the public firm in the form of larger budgets and greater prestige from being associated with a larger agency. Lastly, below-cost pricing by public enterprises may be due to a desire by politicians to transfer wealth from the general taxpayer to selected special-interest groups (the riders and employees of public transit, for example).



In short, public enterprises may have much stronger motives for understating their costs than their counterparts in the private sector.<sup>36</sup> This observation highlights the importance of designing a competitive tendering arrangement that supplies incentives for truthful revelation of relevant information to the contracting authority.

#### IV. Concluding Remarks

Public subsidies to urban mass transit systems in the United States have grown substantially over the past 30 years, while ridership has remained stagnant. The increasing financial burden of public transit on public treasuries has led to consideration of private alternatives for the provision of transit service. While experience is limited, competitive tendering arrangements appear to be a possible solution to public transit's chronic fiscal crisis.

We consider two such competitive tendering arrangements. The first-price auction is a commonly used mechanism for awarding public contracts based on private, competitive bidding. The auction is simple insofar as the lowest bidder is awarded the contract and receives the amount of its bid as compensation for providing service. However, suppliers have a strong incentive to overstate their costs under this set of rules. In the second-price auction, where the low (or winning) bidder receives the second lowest bid as compensation, truthful revelation of costs is a dominant strategy. Which auction provides service at the lowest cost depends in part on the nature of the suppliers' valuations. When some aspects of cost are private, and some common, the second-price auction yields a lower cost of service provision, on average, relative to the first-price auction.

Finally, we argue that competitive tendering alone will not stem the tide of escalating transit costs. Publicly owned enterprises tend to be less efficient than privately owned firms, even when they must compete for service provision rights. The inefficiencies of public enterprises are due to a number of factors, including ill-defined property rights, the use of nonstandard cost accounting and capital budgeting techniques, and increased incentives to engage in predatory pricing.

In our view, there are two key elements in any policy that seeks to reduce the cost of public transit. First, private firms should be allowed to compete with public agencies for service provision rights. The competitive tendering arrangement should be designed to (a) reduce overall costs and (b) provide incentives for truthful revelation of costs by potential suppliers. Second, it must be recognized that while competition forces public transit authorities to more closely mimic the cost-efficiencies of their private sector counterparts, these improvements will not materialize unless the agency is required to adopt standard capital budgeting and accounting techniques. Failure to do so is likely to offset any gains achieved from competitive tendering. Moreover, while the problem of predatory pricing by public enterprises may be alleviated by a competitive tendering arrangement that provides incentives for truthful revelation of costs, the danger remains as long as the agency is not subject to a profit constraint. While taking these factors into account may not produce a complete solution to the urban mass transit problem, we believe they are an important part of the solution.

#### End Notes

1. We benefitted from comments by Jean Love, Wendell Cox, Peter White, and other workshop participants at the Third International Conference on Competition and Ownership in Surface Passenger Transport. Our colleagues, John Conlon, Bob Dorsey, Steven Graham, and Paul Pecorino, provided a number of useful suggestions for improving the paper. Any remaining errors are our own.
2. Jean Love and Wendell Cox, *Competitive Contracting for Transit Services* (Los Angeles, CA: Reason Foundation Privatization Center, March 1993).

3. William F. Shughart II, "A Property Rights Perspective on the Emergence of Publicly Owned Transit Systems in the United States," in Michael Beesley, David Hensher, and Antti Talvitie, eds., *Proceedings of the 2nd International Conference on Privatization and Deregulation in Passenger Transportation* (Espoo, Finland: Organizing Committee of the 2nd International Conference on Privatization and Deregulation in Passenger Transportation, 1993), pp. 183-90.
4. Virtually all public transit systems in the United States were privately owned before 1960. But by the early 1980s, only 15 of the 159 U.S. transit systems operating 50 or more vehicles in maximum service--and only one of the 45 largest systems (those operating 250 or more vehicles)— remained under private ownership. See B. Peter Pashigian, "Consequences and Causes of Public Ownership of Urban Transit Systems," *Journal of Political Economy*, Vol. 84, 1976.
5. See Rick D. Halvorsen and Nigel H. M. Wilson, "Economic Efficiency in Transit Service Contracts: The Role of Contract Structure," this volume, for recent data showing the extent of private contracting in U.S. public transit.
6. Sealed bidding may also facilitate collusion among the bidders. According to George Stigler, "the system of sealed bids, publicly opened with full identification of each bidder's price and specifications, is the ideal instrument for the detection of [secret] price cutting" that would otherwise cause a price-fixing agreement to unravel. Hence, with sealed bidding, the contracting authority knows that the contract was awarded to the low bidder, but does not know whether the low bid is the competitive bid or the monopoly bid. See George J. Stigler, "The Theory of Oligopoly," in George J. Stigler, *The Organization of Industry* (Homewood, Ill.: Richard D. Irwin, 1968), pp. 39-62.
7. In addition to the distinction between gross cost and net cost, contracts can be classified as either "fixed cost" or "cost-plus." In the first case, the compensation paid by the contracting authority is based on the contractor providing an agreed amount of service for a set fee. The fee cannot be raised except as determined by formulas specified in the contract allowing for increases in the prices of fuel or other major inputs. In the second case, the contractor is reimbursed for all costs of service provision plus a percentage that guarantees a margin of profit over and above those costs. See Halvorsen and Wilson, "Economic Efficiency in Transit Service Contracting," for data showing that fixed-cost contracts are currently the most common in transit service provision. This should not be surprising given the obvious lack of incentives for the contractor to minimize costs under a cost-plus contract. We assume throughout the following discussion that all contracts provide for a fixed fee per unit of service supplied.
8. The first-price auction is actually a discriminative auction where only one contract is awarded. In a "multi-unit" discriminative auction where  $Q > 1$  contracts are awarded, the  $Q$  lowest bids are accepted and each of these sellers receive the amount of their respective bid. United States Treasury bond auctions are examples of multi-unit discriminative auctions (except that bidders are bidding to buy, not sell).
9. Also called a Vickery auction because it was first proposed by William S. Vickery, "Counterspeculation, Auctions, and Competitive Sealed Tenders," *Journal of Finance*, Vol. 16, 1961.
10. For a survey of this literature, see R. Preston McAfee and John McMillian, "Auctions and Bidding," *Journal of Economic Literature*, Vol. 25, 1987.
11. That is, the distribution  $F$  is common knowledge: Each supplier knows  $F$ , knows that all rivals and the contracting authority know  $F$ , knows that everyone knows that everyone knows  $F$ , and so on.
12. Vickery, "Counterspeculation, Auctions, and Competitive Sealed Tenders."
13. Here is an intuitive explanation (see McAfee and McMillian, "Auctions and Bidding," for a formal discussion). In the first-price auction, the low-cost supplier  $S_1$ 's ideal bid would be slightly above the next-to-lowest cost seller's value  $c_2$  (i.e.,  $S_1$  would want to bid  $b_1 = c_2 - \varepsilon > c_1$ , where  $\varepsilon > 0$  is some small

- increment like \$0.01). Then  $S_1$  would win the auction and realize  $c_2 - \varepsilon - c_1 > 0$  as profit. In the second-price auction, truthful revelation is a dominant strategy for all bidders, so that each bidder bids  $b_i = c_i$ . Thus  $S_1$  wins the auction, receives  $b_2$  as compensation, and realizes  $b_2 - c_1 = c_2 - c_1 > 0$  as profit.
14. Bids in the second-price auction would be the same whether bidders were risk-averse or not because truthful revelation is a dominant strategy. In the first-price auction, however, a bidder increases the chance of winning with a lower bid. While this may lower realized profits, it increases expected profit (up to a point). Thus, risk-averse bidders will still bid above cost, but by a smaller amount than a risk-neutral bidder with the same cost.
  15. Paul R. Milgrom and Robert J. Weber, "A Theory of Auctions and Competitive Bidding," *Econometrica*, Vol. 50, 1982.
  16. If values are affiliated, then they will be positively correlated. See Milgrom and Weber, "A Theory of Auctions and Competitive Bidding," for a formal statement of affiliated values, the ranking of auctions, and the dissemination of information on the auctioned item's true value.
  17. Charles A. Holt, Jr., "Uncertainty and the Bidding for Incentive Contracts," *American Economic Review*, Vol. 69, 1979.
  18. Pre-certification acts like a fixed cost of bidding and, hence, reduces the number of bidders. The benefits of pre-screening to eliminate potentially unqualified suppliers must therefore be traded off against the expected increase in the winning bid.
  19. Ronald M. Harstad, "Auctions with Endogenous Bidder Participation," unpublished ms., Rutgers University (1993).
  20. Jean-Jacques Laffont and Jean Tirole, *A Theory of Incentives in Procurement and Regulation* (Cambridge, Mass: MIT Press, 1993). In fact, Halvorsen and Wilson, "Economic Efficiency in Transit Service Contracting," report that some contracting authorities use the implicit promise of contract extension or renewal as a performance incentive. However, the development of a long-term relationship between the contracting agency and the incumbent contractor is a two-edged sword.
  21. See McAfee and McMillian, "Auctions and Bidding," for references to the specific cases. As discussed below, incentives must also be provided to the contracting authority to truthfully reveal its own costs of service provision. Halvorsen and Wilson, "Economic Efficiency in Transit Service Contracting," discuss the penalties and incentives actually included in transit service contracts.
  22. For a recent collection of anecdotes supporting this extreme point of view, see David Osborne and Ted Gaebler, *Reinventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector* (Reading, MA: Addison-Wesley, 1992).
  23. See, for example, Armen A. Alchian and Harold Demsetz, "Production, Information Costs, and Economic Organization," *American Economic Review*, Vol. 62, 1972; and Louis De Alessi, "On the Nature and Consequences of Public and Private Enterprises," *Minnesota Law Review*, Vol. 67, 1982.
  24. Mancur Olson, *The Logic of Collective Action: Public Goods and the Theory of Groups* (Cambridge, MA: Harvard University Press, 1971).
  25. Armen A. Alchian and Reuben A. Kessel, "Competition, Monopoly and the Pursuit of Pecuniary Gain." In *Aspects of Labor Economics*, Universities-National Bureau of Economic Research Conference Series No. 14 (New York: Arno Press, 1962), pp. 157-75.

26. De Alessi, "Nature and Consequences of Public and Private Enterprises." Also see William A. Niskanen, *Bureaucracy and Representative Government* (Chicago: Aldine, 1971).
27. The relevant literature is summarized in William F. Shughart II, *The Organization of Industry* (Homewood, IL: Richard D. Irwin, 1990), pp. 183-87.
28. Anthony E. Boardman and Aidan R. Vining, "The Behavior of Mixed Enterprises." In R. O. Zerbe, Jr. and V. P. Goldberg, ed. *Research in Law and Economics*, vol. 14 (Greenwich, CT: JAI Press, 1991), pp. 223-250; and Anthony E. Boardman and Aidan R. Vining, "Ownership and Performance in Competitive Environments: A Comparison of the Performance of Private, Mixed, and State-Owned Enterprises," *Journal of Law and Economics*, Vol. 32, 1989.
29. Aidan R. Vining and Anthony E. Boardman, "Ownership versus Competition: Efficiency in Public Enterprise," *Public Choice*, Vol. 73, 1992.
30. Cotton M. Lindsay, "A Theory of Government Enterprise," *Journal of Political Economy*, Vol. 84, 1976.
31. Nor does it imply that the managers and employees of public organizations are less competent or more corrupt than their private sector counterparts. The outcomes produced by public and private firms differ simply because decision makers operate under different property rights regimes.
32. Generally speaking, the expenses incurred by external agencies for goods and services provided to the transit authority should be allocated on the basis of the supplying agency's marginal costs. For a discussion of transfer pricing, see William F. Shughart II, William F. Chappell, and Rex L. Cottle, *Modern Managerial Economics: Economic Theory for Business Decisions* (Cincinnati, OH: South-Western Publishing Co., 1994), forthcoming.
33. For a summary and critique of the predatory pricing literature, see Shughart, *Organization of Industry*, pp. 295-301.
34. John R. Lott, Jr., "Predation by Public Enterprises," *Journal of Public Economics*, Vol. 43 , 1990.
35. For evidence that service expansion is an important factor explaining the cost-inflation associated with public transit operating subsidies, see K. Obeng, W. K. Talley, and C. Colburn, "The Effects of Subsidies on Public Transit Long-Run Costs," unpublished ms., North Carolina A&T State University, 1991.
36. Some evidence in support of this conclusion is provided in Andrew R. Dick and John R. Lott, Jr., "Are Government Enterprises More Likely to Engage in Predation?: Some International Evidence," unpublished ms., University of California at Los Angeles, 1991. The pricing of Express Mail delivery by the U.S. Postal Service and recent allegations of European government subsidies to Airbus Industrie are cases in point.