THE COMPETITION EFFECTS ON COSTS IN TENDERING OF BUS CONTRACTS IN SWEDEN

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1 INTRODUCTION

In 1989 Sweden enacted a new law on local bus transport that abolished the former concessions for exclusive rights to particular bus routes and allowed Public Transport Authorities (PTAs) to tender for bus transport. After the deregulation the share of tendered transports increased steadily from eight percent of the total bus kilometres in 1988 to 70 % in 1995 (Alexandersson, Hulten and Fölster 1996, p. 5). During this period costs decreased by 10 % on average in counties where bus contracts were competitively tendered.

A similar law was enacted in 1984 for the London region. A recent study by Kennedy (1995) finds cost reductions from tendering of bus contracts in London of about 20 %.

This paper reports findings from the first cross-section study of the costs for scheduled bus transports procured by Swedish PTAs. The study based on a sample of 106 contracts for 1994. Due to partial non-response only 50-75 of these were usable for the estimation of cost functions.

The PTAs in Sweden decide upon which routes or sets of routes to put to tender. The offered contracts vary considerably in size. Many of the small contracts are for routes in sparsely populated regions and the largest contracts are mostly in the largest cities. In the majority of the contracts, the outline of the routes and the timetables are specified by the PTA. There are also, in most contracts, requirements on bus size and environmental standards. Virtually, all contracts are gross cost contracts where the operator remits all revenues to the PTA. There were no net cost contracts where revenue is kept by the operator.

The main concern in this paper is with how the degree of competition in the procurement process influences the PTAs costs per kilometre. In studying this influence we have sought to control for other factors effecting costs, such as: contract duration, area design, the number of buses required for a contract, the number of routes, if the routes are in densely populated areas etc. We can however not compare costs over time as we have no data on the corresponding costs for previous years. The previous study by Alexandersson, Hultén and Fölster (1996) examines aggregate time series data for PTAs.

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The main finding in the present study is that, contrary to what we expected, the number of bids for a contract is only weakly correlated with lower costs for the PTAs in our sample. In our best model (Model 1), we find a statistically significant correlation between more competition as measured by a competition index and lower costs. The effect is in the magnitude of 8 % when the number of bids goes from 3 to 4. This effect is statistically significantly above no effect. The magnitude and its statistical significance should however be treated with caution as it varies with different model specifications.

There are two possible explanations for this unexpectedly weak correlation. A first explanation is what in previous studies is sometimes referred to as a long-run equilibrium adjustment. This adjustment is appears when bus companies learn the cost level of contracts by studying the outcome of previous tenders for the same assignments, the profitability of previous contractors and adjust their bids accordingly. This explanation is consistent with Alexandersson, Hultén and Fölster's observation that most of the cost reductions occur either before or during the year a contract is tendered. It is not possible to examine this hypothesis in the present dataset.

A second possible explanation for this weak correlation may be is that there are few observations of non-competitively acquired contracts, as PTAs with high ratios of in-house, or non-competitively tendered, contracts have dropped out to a larger extent than PTAs with high ratios of competitively tendered contracts. Some PTAs with high ratios of in-house production refused to participate right at the start by not responding to the request for contract lists. In the following request for data on individual contracts, remaining PTAs with high ratios of in-house-production seem to have chosen not to respond to a higher degree than PTAs with lower ratios. The result is that our sample is biased in the sense that it contains fewer non-competitively acquired assignments than in the total population. The numbers of non-competitively acquired assignment was 15 % (11 out of 74) compared to between 30 percent (Alexandersson, Hulten and Fölster 1996) and 50 percent (SLTF 1994) observed found in other studies for the same year.

There are a number of factors known to have a strong influence on costs. The geographical situation of a route, the frequency of stops, boardings and alightings, the degrees of congestion all influence the possible average speed and therefore the time required to finish a route. These factors are however costly to observe. We therefore studied the effects the following characteristics of assignments.

We can not report any correlation's between bid variation and bid values. This is not possible as bid data are not considered public data.

Contracts in sparsely populated areas cost 16 percent less than contracts in densely populated areas. The magnitude of this factor appears to be more reliable as it varies little with model specification.

The presence of joint-utilisation of personnel and buses between assignments is correlated with lower costs although not statistically significant.

An unexpected effect in our sample is that more buses and more routes per kilometre are correlated with lower costs. This may be due to the fact that there are no good independent measures for economies of density and congestion and its consequences in terms of lower speeds.

For most contract requirements and assignment designs statistically significant effects on costs were not found. Examples of such requirements include degrees of freedom in the design of timetable, contract forms well as requirements on vehicle age, size and environmental standards etc. In theory stricter requirements on timetable, vehicle age, size and environmental standards should all increase costs.

In theory a contract form that does not transfer risk burden to the bus company should cost less. In the present study we did not find net cost contracts. We are therefore unable to compare results with a study of tendered bus contracts as in the study by White and Tough (1995) which compared tendering costs for gross contracts with net cost or minimum subsidy contracts. In gross contracts, the total cost is charged by the operator, and the revenue accrues to the tendering authority. In net cost contracts, the operator bids for difference between gross costs and estimated revenue which is kept by the operator. White and Tough found that gross cost contracts yielded statistically significantly lower costs (between 7 and 27 percent lower) for tendering authorities than did net contracts (p. 281).

The paper is organised as follows. Section 2 gives a theoretical background for the present empirical study. This is concluded with a summary of theoretical hypotheses. The section also summarises some previous empirical studies. Section 3 presents our data and estimation results. Finally, in section 4, the paper is concluded and some suggestions for future research are given.

2 THEORETICAL BACKGROUND AND PREVIOUS RESEARCH

Theoretical research on auctions focus on issues like consequences of auction form, the distribution of information among bidders and the extent to which the value of the auctioned object is private or common to bidders. Likewise research on contracts has focused on the pay-form and the distribution of information between buyer and seller.

In this paper we assume that data was generated from sealed bid first price auctions. This is an approximation as only the open procurement procedure corresponds to this auction form. It is however the most common procedure. No theoretical model has been explicitly specified for the contract or contract forms a basis for the cost function. Neither have we specified an explicit model for the form of competition underlying the bids.

The purpose was to study looser issues like the following. Do more bids induce lower costs? Does a more open procurement procedure give lower costs? Does contracts for longer periods give lower costs? What is an optimal contract size? Does stricter requirements on bus size and environmental standards induce higher costs?

Previous empirical studies of bidding for bus contracts (Glaister and Beesley 1991 and Kennedy 1995) take auction theory as a point of departure for the formulation of hypotheses. Auction theory provides a formulation of strategic aspects inherent in bidding processes. Previous studies assume that data are generated from a common value model, and proceed to examine the strength of the implied relationships between number of bids, uncertainty and bids. There are now different approaches to analyse if a set of bid data are consistent with a common value model or a independent private values model, e.g. Paarsch (1992) and Laffont et.al (1995). Such models require data from all bids. Due to lack of requirements in the procurement law Swedish PTAs are not required to make losing bids public. Therefore data on losing bids are not readily available. A collection of bid data is therefore hindered.

In a common value auction the value of the object (cost of the assignment) is assumed to the same to all bidders but it is assumed to be uncertain draw from an commonly known probability distribution. Assuming symmetric and risk-neutral bidders an optimal bid function and equilibrium may be derived (Wilson 1977). In this model the optimal bid varies inversely with the degree of uncertainty (for a presentation of these results see e.g. Kagel and Levin 1986). Usually the winning bid decreases with the number of bidders. There is however in general no predictable relationship between the number of bidders and the winning bid McAfee and McMillan (1987, p. 722). On the one hand competition drives down the optimal bid for a contract. On the other hand the phenomenon of the winners curse may arise. As each bidder makes his own estimate of the common value in a sealed bid auction, the bidder who wins is thus the bidder who made the lowest estimate. This implies that he has made the most unfavourable guess. Thus outbidding large numbers of bidders suggests greater errors in prior expectations regarding the value of the object (greater risk for winners curse) and a greater need for upward revisions of a tender bid. Compensation for the winners curse effect will therefore have a positive effect on the optimal bid.

In the independent-private-values model, a bidder knows his own valuation but not the others. He views the other bidder's valuations as drawn from independent probability distributions. In this case there is no common uncertainty. In this model the winning bid for a contract always decreases as the number of bidders increase.

Previous studies have observed that when the same assignment has been tendered several times, bidders will have more information of likely costs for an assignment by observing previous wining bids and profitability of winners. This is likely to influence the contractors perception of common costs. It is also likely to influence the assessment of whether the markets may be said to be in a long run industry equilibrium.

Following Glaister and Beesley 1991 and Kennedy 1995 we assume that the bids are constructed by taking account of the following factors. In this formulation a number of distinctions are suppressed. Firstly, the bidders are assumed to calculate the prospective costs of delivering the required services. These costs are assumed to be accounted for by some cost function approach. Secondly, the bidders are assumed to take account of a number of uncertain factors involved in the bidding process. These are uncertainties involved in the cost calculation process, the number of bidders, the degree of similarities in the competitors underlying cost relationships etc. Finally, the actual expenses may not be completely determined by the bids if the payment is related to variable costs. We disregard these possible differences between the expected costs of the bus company, the bid, and the final expenses of the PTA.

Summarising these factors we formulate a bid function based on the variables influencing underlying costs.

$$B = b\,(\,c\,(x))$$

We assume that the bids are calculated based on a costs per kilometre function.

ckm (x) = x number of buses per kilometre used for the contract
x number of routes per kilometre
x duration of the contract
x D (presence of joint production advantages with other contracts)
x D (area situated in densely populated region)
.
.
x D (

We did not examine the cost function for increasing returns to scale as previous studies suggest constant returns to scale (Glaister and Beesley 1991 and Kennedy 1995) or small returns to scale (Jörgensen, Pedersen and Solvoll 1994).

Let us now turn to the hypothesis underlying or choice of variables used in the questionnaire used for the individual contracts. These are loosely tied to conventional production theory as described below.

The competitive intensity of the bidding process will typically depend on the number of bids. But the competitiveness will also depend on the degree of competition in the underlying local operator market. In a prototype for the questionnaire used we asked for the number of operators in the local market and their market shares in order to construct a Herfindahl index to measure a degree of competition in the underlying local operator market. This attempt was rejected by the PTAs national committee on tendering on the grounds that such data were not readily available to the PTAs.

A previous study of cleaning services (Pyddoke and Ek 1994) used the procedure for procurement as a proxy for competition and found that *competitively tendered cleaning contracts costed less.* We therefore hypothesised that the procurement procedure could be used a proxy for competition in the underlying operator market.

If there are significant fixed costs with establishing new routes we should expect *more routes to cost more for a given number of kilometres in an assignment. The more buses that are required for a given route the larger the costs* we expect for that route.

The more the use of vehicles and personnel for a particular route may be integrated with complementary routes the lower the costs we should expect.

In addition to costs that correlate closely with the distance of a route, time is an important production factor. We may expect *routes in sparsely populated regions to require less* time for a certain distance, as higher average speeds are possible in such regions. This should reduce costs.

Requirements on vehicles may have opposing effects. On the one hand, strict requirements on age, size and environmental standards applied to a few contractors may increase costs. On the other hand, if such requirements are applied uniformly to most operators we should expect an indirect effect through standardisation and returns to scale to reduce these costs. The reason being that many operators posing the same requirements should increase demand for vehicles meeting this requirements and therefore reducing production costs for such vehicles. The opposite case of absence of requirements should be expected to reduce the capital costs of individual producers.

We formulate the following hypotheses about contract form or pay schedules. *Frequent repetition of tendering for a contract may have two opposing effects* (Tirole 1988 pp. 21-29). On the one hand, *frequent tendering may discipline the producer by comparison to outside competition.* On the other hand, frequent tendering induces switching costs. If a contract requires investment that is sunk as a result of the investment being specific to the relationship, then the incentives to invest to a socially optimal level will be weak. This will require a compensation for the duration of this investment beyond the expiration of the contract. Therefore shorter contract periods may require higher bids than periods that coincide with the durability of the investment. The implication would be that shorter contract periods will increase costs, and conversely that *the longer the contract period the lower the bids.*

Input cost indexation gives lower bids. The main reason being that if the input price risks are shifted to operators this requires a risk premium. Therefore a cost indexation may be expected to give lower bids.

Tenders for gross cost contracts receive more and lower bids than corresponding net cost contracts. The main reason being that net cost contracts requires a risk premium.

Penalties for both delays and for cancelled trips increases the bids, as this also requires a risk premium.

Previous empirical studies

Let us first turn to a recent Swedish empirical study by Alexandersson, Hultén and Fölster (1996). The data were collected from County Public Transport Authorities from 24 counties for the eight years 1987 to 1993 giving 192 observations. They found that costs per bus kilometre decreased from 1987 to 1993 by 7 percent measured in 1987 prices and calculated as an average for all Swedish counties. If an average is calculated for only those regions for which bus transport was competitively tendered the authors find an average cost reduction of 9,5 percent.

A comprehensive cost function was estimated using cost change ratio as dependent variable. Among the dependent variables were the number of bus kilometres, a ratio of tendered traffic over total traffic and a change in the tendered traffic ratio. In addition to these variables Alexandersson, Hultén and Fölster used year and county dummies. The year dummies allow for control of such external factors as changes in fuel prices or national regulations whereas the county dummies allow for control of county specific differences. The design does not however allow for estimation of threat effects spreading over the county borders.

Alexandersson, Hultén and Fölster find that when the tender-ratio increases from 0 to 100 percent in one year, then aggregate transport costs in a county are reduced by 6,6 percent. Adding a threat effect (cost reductions the year prior to a change in tender-ratio) and a improvement-lag (cost reductions the year following the change in tender-ratio) the authors find a total effect of 13,4 percent decrease in costs. The statistically significant effects are the threat effect the year before a change in tender-ratio and the effect during the year a the tender ratio changes. The lagged effect is not statistically significant.

A further important observation is that the level of tendered transports does seem to influence cost changes. This observation is attributed to the fact that the design of areas of tender, timetables etc. are not subject to change.

Let us now turn to three studies of competitively tendered bus services in the UK. The first, by Glaister and Beesley 1991, reported effects on costs at contract level from competitive tendering in London during the four first years following the reform in 1984 of the rules governing the management of public transport in London. The second, by Kennedy 1995, follows up on the Glaister and Beesley study, with data up to 1993. The third paper, by White and Tough 1995, examines data from four English public transport authorities in 1991.

A law similar to the Swedish law was enacted for London in 1985. This Act constituted London Transport as a nationalised industry. An early study was conducted for 135 London Transport route tenders from 1985 to 1988 by Glaister and Beesley (1991). These routes comprised about 25 % London bus route mileage. The database contained approximately 520 bids.

The primary purpose of this paper was to find out if bus traffic at the same or better standard as before deregulation could be administered at lower cost by a competitively tendered system.
The authors also examined the influence of uncertainty on bids, the presence of a winners curse effect and potential consequences when bidders learn from experience and also questions on optimal route combinations for bidding

The contracts studied were gross cost contracts for three years, with input cost indexation. The frequency, regularity, day of week and exact route are specified by London Transport. London Transport provided ticketing equipment to control revenues and the contracted services were subjected to London Transport revenue inspection. There were no age nor size limits for buses. Cancellations and other failures to meet specifications are formally warned and may lead to contract termination.

Two extreme hypotheses concerning competition and dispersion of information were examined. At one extreme a disequilibrium with few or unknown competitors and unknown cost structures was considered. This could lead to dispersion in bids and therefore less intense competition. At the other extreme an equilibrium with a number of known competitors and known costs was considered. This could lead to convergence in bids and therefore more intense competition. In this case Glaister and Beesley assume a common values model to be appropriate, as competitors would have roughly the same cost conditions. In this situation the winners curse phenomenon may arise. The winners curse phenomenon will induce rational bidders to shade their bids.

As we have seen above, such shading will also be greater the greater the uncertainty in the individual operators estimates of the common cost element. Glaister and Beesley ague that there considerable uncertainties for the involved operators in calculating road speeds, need for reserve capacity, labour costs etc.

The fact that the number of bids is not known in advance is poses an econometric problem as this is not consistent with standard auction models.

Glaister and Beesley estimated bid functions using maximum likelihood method for lognormally distributed error terms. They found no "strong relationship between bid and number of bidders" (p. 358). Neither did they find a evidence that bids increased "as the number of bids increased so as to avoid the winners curse".

As a measure of uncertainty ascribed by bidders to a route Glaister and Beesley used the coefficient of variation of the bids offered for a route. They also found increasing uncertainty to increase bids, but also that this response decreased with the lapse of time.

Some notable features of cost savings were the following:
- small vehicles showed considerable savings
- new double deckers cost their owners less than old

They also found an upward trend in bids which they interpreted as possibly being due to a crude response to low returns on early contracts.

Glaister and Beesley found that tendering "had been a key element in reducing costs of operations" (p. 365). Concerning the state of the market they found statistically significant differences between bids from operators using different kinds of vehicles.

There is therefore no possibility of a straightforward application of the common value model. The authors do however offer some interesting observations on the kind of bidding behaviour that would be necessary in a common values model with uncertainty which would be a reasonable model for an industry in long run equilibrium. They find that "bids do not appear to be more conservative when there are many bidders - as they ought to avoid the "winners curse"." (p. 365). Bidders do however, seem to respond to uncertainty even though this sensitivity appears to have fallen over time. Glaister and Beesley regard bids as being reasonably closely related to avoidable costs.

The authors also conclude with a caution that route combinations should not be too big.

In a later paper by Kennedy (1995) examines London bus tendering data from 1569 bids for 350 contracts up to 1993. Kennedy also looks for evidence for strategic behaviour, evidence for equilibrium in the bus market and estimates cost savings attributable to tendering.

London Transport continued to offer gross cost contracts. The bidders submitted sealed bids which remained confidential (p 306). By 1993 around 50 % of bus miles were competitively tendered.

Kennedy formulates the following bid function:

$B = f(N) + g(\text{var } B) + C$

Where B is bid value, N the number of bidders, var B the variance in bid value and C cost of contract.

Kennedy reports the following main results. Bidders were found to respond to uncertainty but not to the number of bidders. Bids tendered to be higher when bid variance increased. This effect is statistically significant.

Kennedy finds "no evidence of a systematic cost difference between public and private sector and the hypothesis of industry equilibrium is accepted". This concurs with Savas (1977) who found that public private cost differences eroded a short time after competition was introduced.

An estimated cost reduction of 20 % from the introduction of tendering is found. This is the same as the non statistical estimate of the managers.

In White and Tough (1995) the main contribution is a systematic examination of the relative costs for PTAs of tendering bus contracts with gross cost and net cost contracts.

Data involved all contracts in four local authorities (Oxfordshire, Essex, Wiltshire and East Sussex) since deregulation (enacted from ca 86/87). The final database contained more than 400 contracts. Services are tendered to fill gaps in commercially operated schedules. These may be evenings, weekends, schoolhouses etc. Contracts were divided in five categories Peak operations, All-day services, Evening and Sundays, School transport and Occasional services.

The contracts were compared with respect to **cost per mile** for different categories and tender methods. All revenues were subtracted to provide comparability.

The authors found the following results. Statistically significant lower costs were found for the overall means for gross cost contracts than for net cost contracts (p. 281)

In the UK, authorities are obliged, by Transport Act, to publish winning bid and number of bidders. This allowed White and Tough to examine some hypotheses on the relations between tender method and costs. These hypotheses are that gross cost contracts involve less revenue risk. This could therefore encourage more bids, which in turn, in theory, should entail lower costs.

The findings were that tenders using gross contracts were found to attract statistically significant more bids, and that in most counties and for almost all categories, increasing numbers of bids were found to be correlated with lower costs.

White and Tough also examined the competition patterns of these tenders. It was found that on average there was always two large firms bidding in each tender. When the number of bids increased the additional bids typically came from small and medium-sized firms.

3 DATA AND ESTIMATION RESULTS

In a first round a list of the active contracts for scheduled bus transports in 1994 was collected from Swedish PTAs. In these lists the authorities were asked to present their contracts in three categories. Contracts involving 5 or less scheduled buses per day, 6 -19 buses and 20 or more buses. Data were collected as a stratified random sample of 150 contracts (out of a total of more than 640) containing 50 contracts of each category from 21 PTAs. The stratification was designed to take account of the fact that large contracts are relatively few and that we wanted a sufficient number of observations in the final sample of large contracts. We obtained data on 106 contracts from 14 PTAs. Due to internal non response in many of these observations, not more than about 50 of these are actually usable in the statistical analysis.

Each PTA was asked to give the following data for all its contracts that were included in the sample:

The total cost for the contract in 1994

Total number of kilometres driven 1994

The number of bids given for a tender
From the number of bids we calculated a competition index, CI as,

$$CI = \sum_{i=1}^{b} \frac{1}{i}$$

where b is the number of bids. This index is designed to give a decreasing addition in competition as the number of competitors increase. The competition index takes the values 1 for one bid, 1,5 for two bids, 1,83 for three bids, 2,08 for four bids etc.

In addition to this index we used three different competition dummies. We used dummies for contracts for which there had been 3 or more bids (D3ormore), 4 or more and 5 or more.

The PTAs best guess of the potential number of bidders for a tender
The bidding bus companies can hardly know in advance exactly how many bids there will be for a certain contract. They can however guess how many potential bidders there are. We assume that the PTAs perception is roughly the same as that of the bus companies. As a proxy for perceived competition we therefore asked the PTAs for a best guess of how many potential competitors there were for a particular contract. The answer ratio for this question was 60 %. The correlation between the guessed numbers of potential bidders and actual number is 0.75.

The procurement procedure
The Swedish Public Procurement Act is modelled on the European Community procurement rules. The two most demanding procedure forms are the open and the negotiated forms. These imply fairly similar competitive circumstances. Most of the bus contracts in the sample were either procured by the open or the negotiated procedure according to the Swedish Public Procurement Act. Surprisingly few were not procured competitively (2 %).

Number of routes in a given contract

Number of buses used for the production of the service

Densely/Sparsely populated areas
Of the contracts in the usable sample 47 % were from sparsely populated areas.

Contract duration
Most contract lengths were distributed between 1.5 and 3 years.

Joint-production advantages
This question did not prove to be sufficiently distinguishing as the PTAs claimed that almost all (88%) of the contracts in the usable sample allowed for joint-production advantages with other contracts.

The correlation between the PTAs perception of a presence of joint-production advantages and the dummy variable for situation of the contract in densely/sparsely populated regions is 0.02. Joint-production advantages are perceived for 90 percent of the contracts in sparsely populated areas in the usable sample and 91 percent of the contracts in densely populated areas.

Contract form
All contracts in the sample were of gross cost form or of a cost plus form for driven kilometres or both! We interpret this as a fixed assignment with additional remuneration's for temporary or extraordinary services required by the PTA. We found no contracts in the sample of the net cost form. Practically all of the contracts in the usable sample are indexed (87%) for cost components. We find two kinds of penalties in the usable sample 70 % for cancellations and 4 % for delays.

Assignment and vehicle requirements
Contracts with given fixed timetables and routenets were 70 % of the usable sample. Practically all contracts in the usable sample had age (82 %), size (70 %) and environmental (74 %) requirements.

PTA specifics
We also used dummies to control for PTA specific properties like geographical outlay etc. Unfortunately the number of contracts in the sample were so unevenly distributed that only 3 PTAs had more than 10 contracts in the final sample.

Estimation results

In searching for the most robust model for presenting results we have used the following strategy. We first dropped some variables which are perfectly collinear. Then a gross model was estimated using the remaining available variables. Next a procedure was adopted that stepwise calculates the F-value for each variable currently in the model and selects the variable with the smallest calculated statistic. If the value is smaller than a preselected value the variable is dropped. This is repeated until there is no variable with a sufficiently low F-value to be dropped.

In addition to this procedure four exclusive categories of competition variables have been identified. These were the competition index using actual numbers of bids, three dummies for different numbers of bidders and finally a dummy for the procurement procedure. These specifications were used exclusively together with the remaining explanatory variables.

Ordinary least-squares regressions of effects on costs per kilometre in different specification

	Gross	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
logbuskm	-0.10	-0.12**	- 0.11**	-0.07	-0.16**		
logroutekm	-0.17	-0.13**	- 0.13*	-0.16***	-0.12***	-0.28***	-0.24***
logcondur	-0.36						
logCI	-0.32	-0.31**			-0.30**		-0.16
D3ormore	1.32 (2)					0.58***	
D4ormore	1.09		0.94				
D5ormore	1.05			0.92			
Dcomproc	(1)						
Dsparse	1.18	0.84**	0.85*	0.89	0.82**	0.86	0.91
Djoint	0.92						
Der1	1.12				0.82**		
Der3	1.34	1.18	1.12	1.13			
Der5	1.55	1.32	1.22	1.26			
Der6	0.95						
Ds1	1.12						
Dsize	1.21						
Denvi	0.82						
Used obs.	36	48	47	46	48	74	76
F-value	183.7	1001	881	893	1185	1094	960
R-square	0.99	0.99	0.99	0.99	0.99	0.98	0.98
Adj. R-sq	0.99	0.99	0.99	0.99	0.99	0.98	0.97

All these models are estimated without constant.
*** is significantly different from 0 at 1 % level ** at 5 % * at 10 %
(1) has only one observation with non competitively procured contract
(2) has only 3 observations with fewer than 3 bids

Note that the variables with names commencing with log are estimated in logarithmic form. The coefficients should therefore be interpreted as elasticities. A one percent increase in the required number of buses per kilometre will decrease costs per kilometre with 0.12 % in Model 1. All dummy variables (commencing with D) should be interpreted in multiplicative form. This implies that the dummy D3ormore (contracts which received 3 or more bids) with coefficient 1.32 should be interpreted so that such contracts cost 32 % more than other contracts.

We used the data to estimate a function for the costs per kilometre, assuming that the costs arose according to bids given in the procurement. This cost function is estimated in a logarithmic form for all continuous variables with dummy variables for the qualitative variables.

We give the results of these estimations in the table above. Let me now comment on the results.

Competition reduces cost
Competition does not have a strong and statistically significant influence. The way the competition variable is specified matters. In Model 1 using the competition index we find a statistically significant cost reducing effect. This effect is however not large in magnitude. Going from say two to three bids would correspond to 7 % cost decrease. In the models using the dummies for 4 or more bids and 5 or more bids the effects are respectively 6 % and 8 % lower costs than with fewer bids. Those effects are however not statistically significant. The procedure variable cannot be used as there is only one contract in the usable sample that was not competitively procured.

Contracts in sparsely populated regions cost less
In the Model 1 contracts in sparsely populated regions (Dsparse) cost 16 % less than in densely populated regions. This effect is statistically significant.

Contracts which allow for joint-production advantages cost less
This effect does not survive to the final models and it is not statistically significant. The dummy variable is denoted Djoint.

Number of routes and buses used for the production of the service
Both a larger number of routes per kilometre (logroutekm) and more buses per kilometre (logbuskm) decrease costs. This effect contradicts what we intuitively expect, but it is statistically significant. This result may be due to lack of good control variables.

Longer contract periods cost less
The estimated effect of the contract duration variable (logcondur) that such contracts cost less is not statistically significant.

A penalty for delay increases costs for the operator
In addition to the dummies for contract specification, six variables for contract form were specified. None of these variables survive to the final model. Let me comment on these variables in turn.

Der1 denotes fixed price for a given routenet and a fixed timetable. In model 4 these contracts cost less than other contracts though the effect is not significant. Der3 denotes contracts where a price is paid per additional bus kilometre. In the usable sample the PTAs claim that 56 % of the contracts were of the gross cost fixed price type. At the same time 48 % of the contracts were of the price per bus kilometre type. Our interpretation of this pattern is that some PTAs offer fixed price contracts for a given net and timetable. In addition to that operators are offered a fixed price per kilometre for any additional trips on account of temporary congestion etc. This implies that there is no clear alternative to this contract. Of these forms the pure fixed price form appears to yield the lowest bids. This effect is not statistically significant.

A penalty for delay increases costs for the operator
Der5 denotes a penalty for delay. Such penalties are present in 4 % of the contracts. The effect of the penalty is that costs increase. This variable is neither statistically reliable nor significant.

Der6 denotes a penalty for cancelled trips. Such penalties are included in 70 % of the contracts in the sample. The cancellation penalty decreases costs.

None of the requirements on vehicles, age, size and environmental standards have give statistically significant effects on costs. We find no statistically significant effects for the PTA specific dummies.

5 SUMMARY AND CONCLUSION

The aim of this paper was to examine a number of hypothesis concerning factors influencing bids for Swedish bus contracts. Our central concerns are how a PTA may influence competition and what aspects of competition matter for costs. We find no strong effects of procedure on costs. Neither does a variable defined as a measure the degree of competition based on the number of bids have a strong influence on costs. We do, however, find that when there are more than four bids costs are on average 6 % lower than when there are fewer bids. This contradicts findings from London reported by Kennedy (1995) who finds.

In order to control for a number of factors having a more direct and obvious influence on costs we included the number of kilometres, buses and routes required for the operation of the contract. The only variable having a consistently statistically significant influence on costs is the number of bus kilometres. The number of buses and routes have statistically significant increasing effects on costs in some model specifications. In a final model only the variable bus kilometres remains statistically significant.

The geographical location of a contract also influences cost. We find that contracts for transport in sparsely populated regions cost statistically significantly less than contracts in densely populated areas. Furthermore the possibility of joint utilisation of personnel, vehicles, depots etc. could be expected to reduce costs. We fail to find a statistically significant estimation of such an effect.

There are a number of questions concerning how an ideal contract should be specified. We found no instances of net cost contracts and hence we can not contribute to an assessment of the relative merits of gross and net cost contracts. A limited experiment with net cost contracts may shed additional light on the question of incentives and risk sharing.

In the observed interval of contract durations longer durations appear to cost more. This effect is not statistically significant. Penalties for delays and cancellation seem to increase costs. Neither do we find any statistically significant effects of the three versions of requirements vehicles, age, size and environmental standards.

Finally let me point to some further suggestions for empirical research in this field. More sophisticated bid data would be useful for examining hypotheses concerning the influence of uncertainty on bids. Another interesting approach would be to capture manifestations of underlying competition in local markets, such as a Herfindahl index for the local market, sunk costs in terminals depots etc. A third strategy would be to do a closer study of factors conductive to joint production advantages e.g. number of common terminal bus stops, common utilisation of depots, common utilisation of vehicles etc.

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