The Economics of London Bus Tendering

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ABSTRACT

Following a period of rising costs, competitive tendering was introduced to the London bus industry in 1984. This thesis is an economic analysis of the impact of tendering on London bus services.

Chapter 1 states the aims and objectives of the thesis in the context of the economics literature. The chapter is divided into two sections. In section 1 the literature is drawn upon to provide an economic interpretation of the state of the London bus industry prior to the introduction of tendering, and to provide an economic context for the introduction of tendering. In section 2 literature relating to the design of a tendering process is summarised. The focus is on the auction aspect of the tendering process and some important dimensions of contract specification.

The impact of tendering on costs is analysed in chapter 2. Three questions are asked: What is the cost structure of the competitive London bus industry? Is there any evidence of strategic bidding behaviour as predicted by the auction theory literature? What level of cost saving can be attributed to tendering? The analysis is based on the full set of bid data from London bus tendering over the period 1985-1993 and is econometric in nature. The results are: there is no statistically significant difference in costs of operation between public and private sector operators under competition; bidding behaviour conforms to some features predicted by theoretical models; the estimated cost saving from tendering is 20%.

Chapter 3 evaluates the impact of tendering on the demand for bus travel in London. The relationship between demand and service quality is estimated, gains to tendering are attributed in accordance with the increased service quality due to tendering. A statistically significant relationship between demand and service quality is found. The lowest estimate of revenue gained due to tendering is £9.6 million over the period 1987-1992 in 1992 prices.

Chapter 4 estimates the welfare gain due to tendering, defined as the sum of changes in producer and consumer surplus due to tendering. The estimated welfare gain due to tendering is between £90 and £380 million over the period 1987-1992 in 1992 prices. An appendix to this chapter analyses the relationship between welfare and the type of contract upon which tendering is based.

It is argued that a cost contract is preferable to a bottom line contract.

Chapter 5 is based on an in depth series of interviews with key actors in the London bus industry. The aim here was to find out things that cannot be inferred from the data. Areas discussed include: the extent to which tendering as opposed to other factors led to change in the London bus industry; the source of cost savings; the impact of tendering on Labour; problems associated with tendering. Interviews suggested that: cost savings stemmed from wage reductions and productivity gains; there are some problems with the bidding process; there is a tension between bus planners and some bus company managers.

In certain cases the tendering authority offered contract for tender in bundles. Chapter 6 analyses this policy from theoretical and empirical perspectives and asks was it optimal for the tendering authority. It is concluded that the policy should not be used by London Transport.

Finally, in chapter 7, an overall assessment of the tendering process is presented. The focus is on results and policy implications for bus tendering in London and competitive tendering in general.

PREFACE

Some parts of this thesis are published by the Greater London Group at the London School of Economics in "London Bus Tendering" by D. Kennedy, S. Glaister and T. Travers. Parts of that publication appearing in this thesis are solely authored by me.

Part of Chapter 2 of this thesis is published in The International Review of Applied Economics, September 1995. Part of Chapter 4 is published in Transport Policy, December 1995. Part of Chapter 5 is published in Transport Reviews, June 1995. These papers were not written in collaboration with any other person. The remaining parts of these chapters, and chapters 3, 6, and 7 contain, to the best of my knowledge, original results and were not written in collaboration with any other person.

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CONTENTS

LIST OF TABLES

1. SURVEY OF THE LITERATURE

Introduction

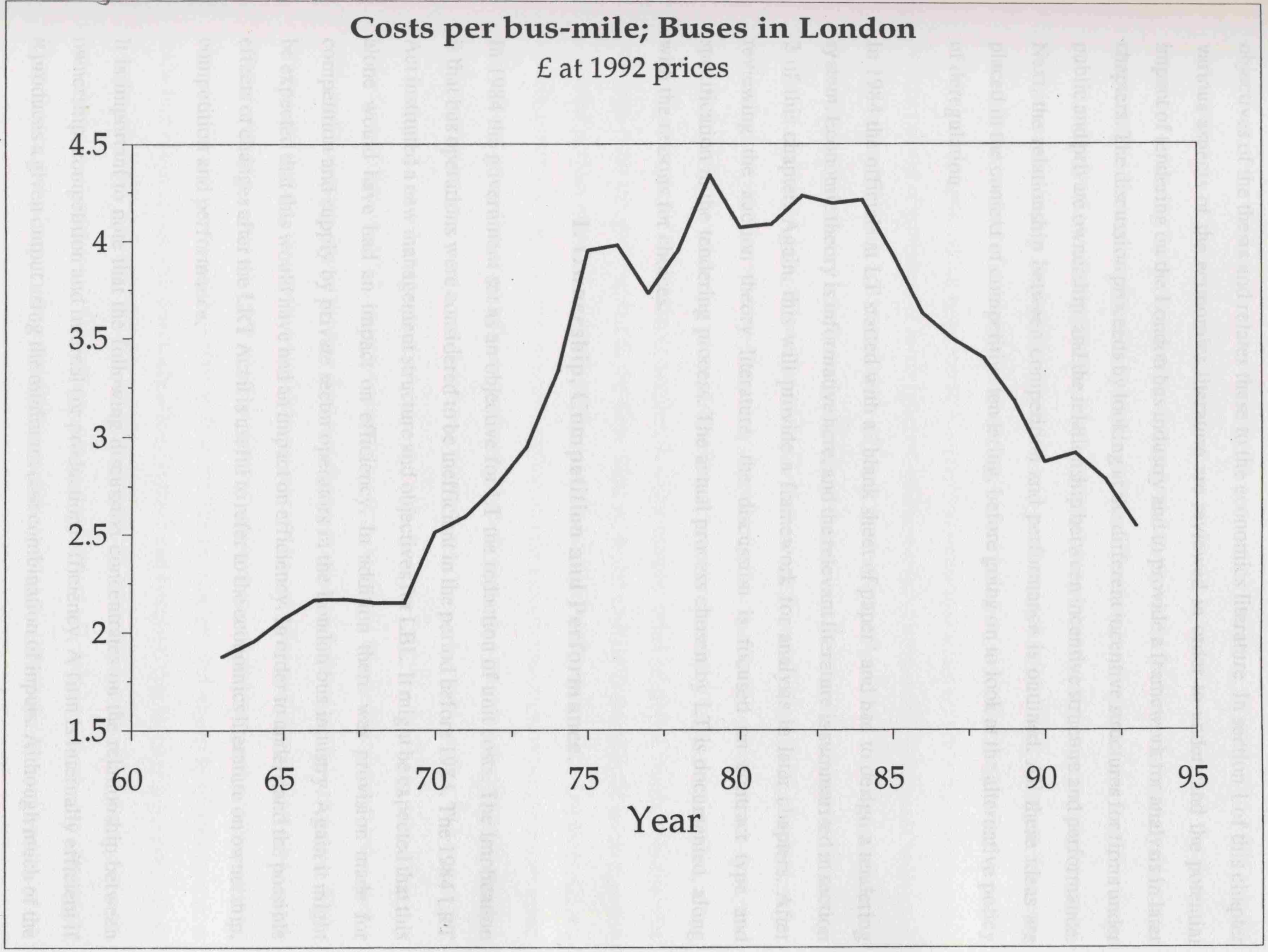
In the period before 1984 bus services in London were provided by London Transport (LT). This body was answerable to the Greater London Council (GLC) under legislation passed in 1969.

As figure 1.1 shows, between 1963 and 1979 costs per bus mile in the London Bus industry rose in real terms by a factor of 2.3. During the period 1970-1982 they rose by more than 68% and over the same period annual grant paid to London Transport rose from £6.5 million to nearly £85 million in constant prices, a thirteen fold increase. The Government presented these figures in the white paper *Public Transport in London* (Department of Transport, 1983) and stated that "new arrangements are needed to secure the cost effective delivery of services from both the public and the private sector".

In the White Paper *Buses* (Department of Transport, 1984) the Conservative Government stated its proposal to deregulate the bus industry outside London. This was implemented under the 1985 Transport Act. Deregulation in London was deferred "while the changes, so recently instituted, bear fruit" (*Buses*, para. 4.18). The changes referred to were consequence of the 1984 London Regional Transport Act. Under this Act, London Regional Transport (LRT, or LT) is constituted as a conventional nationalised industry but it has a statutory obligation "in the case of such activities carried on by them as they may determine to be appropriate invite other persons to submit tenders to carry on those activities for such period and on such basis as may be specified in the invitation to tender" (LRT Act, section 6(1)). London Transport responded to this obligation by putting many of its bus services out to competitive tender. Also under the LRT Act, London Buses Ltd and London Underground Ltd. were created as subsidiaries wholly-owned by London Transport.

Under tendering a new set of principal agent relationships between London Transport and operators was established. Opportunities for private sector firms to supply services were

Figure 1.1


Costs per bus-mile; Buses in London
£ at 1992 prices
4.5
4
3.5
3
2.5
2
1.5
60
65
70
75
80
85
90
95
Year

introduced. Monopoly provision was replaced by competition to supply services. This thesis is an economic analysis of the impact of these changes. The present chapter outlines the aims and objectives of the thesis and relates these to the economics literature. In section 1 of this chapter various aspects of the economics literature are reviewed in order to understand the potential impact of tendering on the London bus industry and to provide a framework for analysis in later chapters. The discussion proceeds by looking at the different incentive structures for firms under public and private ownership, and the relationship between incentive structure and performance. Next, the relationship between competition and performance is outlined. All these ideas are placed in the context of competitive tendering, before going on to look at the alternative policy of deregulation.

In 1984 the officials at LT started with a "blank sheet of paper" and had to design a tendering system. Economic theory is informative here, and the relevant literature is summarised in section 2 of this chapter. Again, this will provide a framework for analysis in later chapters. After reviewing the auction theory literature, the discussion is focused on contract type and specification in the tendering process. The actual process chosen by LT is documented, along with the reasons for choices.

1. Ownership, Competition and Performance.

In 1984 the government set as an objective for LT the reduction of unit costs. The implication is that bus operations were considered to be inefficient in the period before 1984. The 1984 LRT Act instituted a new management structure and objectives for LBL. It might be expected that this alone would have had an impact on efficiency. In addition there was provision made for competition and supply by private sector operators in the London bus industry. Again it might be expected that this would have had an impact on efficiency. In order to understand the possible effects of changes after the LRT Act it is useful to refer to the economics literature on ownership, competition and performance.

It is important to note that the following discussion concentrates on the relationship between ownership, competition and internal (or production) efficiency. A firm is internally efficient if it produces a given output using the minimum cost combination of inputs. Although much of the literature refers to allocative efficiency, this is not relevant to the present situation. Competitive tendering does not affect allocative efficiency, hence the focus on internal efficiency.

Objectives

Consider a firm in the public sector with objectives set by the government. Assume that the government is a social welfare maximiser and further that it seeks to maximise social welfare in a partial equilibrium context. We note that the partial equilibrium approach is limited: social welfare maximisation in a partial equilibrium context does not necessarily lead to a socially optimal outcome in the economy as a whole. However, the partial equilibrium approach provides a useful basis upon which to proceed. Assume that lump sum transfers are not possible, rather that the raising of government funds involves taxation which changes the decisions of individual agents in the economy. In this situation there are deadweight losses associated with the raising of public funds so that a £1 government transfer requires output losses elsewhere in the economy in excess of £1. We will refer to the difference between a £1 transfer and the associated output loss elsewhere in the economy as the shadow price of public funds. The government's objective for the firm can be said to be to maximise $W = CS + \Pi - \lambda T$ where W = social welfare, CS = consumer surplus, Π = producer surplus, λ = the shadow price of public funds, T = transfer payment from the government to the firm. That is, social welfare is the sum of consumer and producer surplus net of the deadweight loss associated with raising the transfer payment. Given a welfare maximising government and assuming that the government and the firm share the same objective function then a socially optimal outcome will ensue. In particular, the firm will achieve internal efficiency.

Vickers and Yarrow (1988) drop the assumption that the public firm will act to maximise social welfare. The reason for this is that the objectives for a public firm are set by politicians. They assume that a politician seeks to maximise chances of re-election and that this does not result from the maximisation of social welfare. Say that a politician considers a policy with potential benefits that are distributed unevenly amongst the population. An example of this is a cost reduction effort which will adversely affect workers and benefit either taxpayers or consumers. Assume that the benefits of the cost reduction effort exceed the costs *ie* engaging in cost reduction would increase social welfare. Assume also that the benefits will be highly dispersed. Then the impact of the policy will be more visible to workers than to taxpayers/consumers. In this situation a vote maximising politician might avoid reducing costs to socially optimal levels.

We may then rewrite the government's objective function for the firm as $W = CS + \Pi - \lambda T - \beta x$ where x is a measure of effort applied to cost reduction. Now maximisation does not lead to an internally efficient outcome; internal efficiency is sacrificed in order that political objectives may be fulfilled. Haskel and Szymanski (1993) analyse a case where the objective function for the public firm incorporates political factors. They show that if the government attaches positive weight to union utility, for a given level of employment wages will be higher in a public sector than a private sector firm. The implication here is that the public sector firm does not produce a given output at minimum cost *ie* it is not internally inefficient.

The principal and agent problem

There is another possible source of inefficiency if we drop the assumption that the government and the public firm share the same objectives. Say that the public firm is run by a utility maximising manager whose unfettered behaviour will not lead to maximisation of social welfare. Hay and Morris (1991) discuss the various factors which may influence a manager's utility. Amongst the variables that they suggest are income, status and power. Say that the utility of a public firm manager is a positive function of status. If status increases with the size of the workforce that the manager controls then he may expand it beyond the efficient level and as a result fail to maximise social welfare. Assume a manager of a public firm has utility that decreases as his effort increases. The utility maximising manager may choose a level of effort which is below that consistent with internal efficiency and hence maximisation of social welfare.

If manager utility maximisation is not consistent with social welfare maximisation then the government must attempt to create incentives for the manager to maximise social welfare. Whether this is possible can be analysed in a principal agent framework. See Rees (1985) for a discussion. In brief, the principal employs the agent to carry out a task. Standard neoclassical theory predicts that under profit maximisation the agent will be rewarded in accordance with his marginal product. Say that this is not possible because the principal does not observe the marginal product of the agent. An example of a situation where the principal does not observe the agent's marginal product is when the agent's output depends both on effort and random factors and the latter are observed only by the agent. There is scope here for the agent to pursue his own objectives as opposed to those of the principal. The principal recognises this and identifies the self interest of the agent. A contract between the prinçipal and agent is then designed so that the principal's objectives are pursued contingent upon utility maximisation by the agent.

Bös (1986) adopts a principal agent approach to analyse the public firm where government and management objectives diverge. Here the government is the principal and the manager of the firm is the agent. Bös assumes a government with the objective of maximising social welfare and a utility maximising manager. The manager's utility function is increasing in income and decreasing in effort. If the government can observe the input of effort by the manager then it is possible for the government to reward the manager so that the public firm achieves internal efficiency. However, this is not the case when the manager of the firm has private information. Assume that the manager has private information, that he is a utility maximiser and that utility is an increasing function of income and a decreasing function of effort. Bös shows that in these circumstances there does not exist a practically implementable incentive scheme such that internal efficiency will ensue.

The models analysed by Bös are based on idealised situations. The assumptions required for these models may not be practically tenable. Further deviations from internal efficiency than are predicted in the models might *actually* have occurred. Bös assumes that the government sets clear objectives for the firm. The manager then pursues these objectives subject to any discretion which he may have due to asymmetries of information. Kay and Thompson (1986) argue that public firms' objectives actually tended in the past to be ill-defined. Ill-defined objectives are hard to pursue, thus even a manager sharing government objectives might face difficulties in achieving good performance. Ill-defined objectives are also hard to monitor and less effective monitoring provides more scope for managers to pursue personal objectives. Foster (1992) puts a similar point of view. He suggests that it was often the case in the public sector that objectives were confused, complicated and varying and as a result effective management was difficult and precise monitoring was prevented. Foster explains poor performance in the public sector in these terms.

Relating the literature to the London bus industry, there are a number of possible sources of internal inefficiency in the period before 1984. Heseltine and Silcock (1992) suggest that labour costs are typically around 70% of total costs in the bus industry. Assume that the government was concerned with the utility of workers in the London bus industry before 1984. The result could have been that wages were allowed to rise above their market level in which case there would have been significant departures from internal efficiency. It was stated above that even in ideal scenarios monitoring problems are present and as a result internal efficiency cannot be achieved. Further departures from internal efficiency than are predicted in these ideal scenarios may actually have occurred in the London bus industry through failure to define objectives clearly or rigorously monitor performance. Whether this was actually the case is discussed in chapter 5.

The private firm

Consider now the private firm: both this and the following discussion of competition will be important later in discussing the potential outcome from the introduction of competitive tendering. Kay and Thompson (1986) argue that privatisation of a public firm will promote internal efficiency. Beesley and Littlechild (1986) put a similar view; they suggest that the substitution of market discipline for public influence which results from privatisation leads to a better use of resources. There are forces which may cause a tendency towards internal efficiency in a private firm. If a firm acts as a profit maximiser then it will be internally efficient. Whether or not a firm acts as a profit maximiser depends on the extent to which the firm's manager can be made to act as a profit maximiser. In the same way that the manager of a public sector firm may not act to fulfil government objectives in the absence of monitoring, the manager of a private firm may not act to pursue the profit maximising objectives of the firm's owners.

Vickers and Yarrow (1988) analyse the outcome for a private firm with a utility maximising manager and profit maximising owners. They assume a private firm with ownership in the form of dispersed shareholdings. In the absence of monitoring or if the level of monitoring is inadequate the manager of the firm may pursue personal non profit maximising objectives. The motivations for this type of behaviour are the same as in the case of the public firm *ie* the manager may gain disutility from increased effort and increased utility through status or power. If the level of monitoring is sub optimal then internal inefficiency will result.

Monitoring may be absent or at least inadequate for two reasons. The first of these is that when share ownership is dispersed individuals gain only a fraction of the benefit they create by undertaking monitoring, in other words there is a beneficial externality associated with monitoring. It is a standard result that in this situation sub optimal levels of activity will take place. The second reason is that there are economies of scale in monitoring which are not exploited when share ownership is dispersed. Dispersed share ownership will raise monitoring costs relative to the case of a monopoly monitor and hence the level of monitoring will be lower in the former situation.

There are however ways in which effective monitoring can be carried out when share ownership is dispersed, for example through a board of directors. Vickers and Yarrow (1988) conclude that it is not clear in a context of dispersed ownership whether the optimal level of monitoring will be undertaken. Assume that the optimal level of monitoring is undertaken. It was stated above that in the case of a public firm monitoring does not lead to an outcome which is internally efficient. Bös (1986) analyses the monitoring of a manager by a profit maximising owner and shows that the firm's outcome will tend towards, though not be synonymous with, internal efficiency.

An alternative pressure affecting managers in the private sector, again examined by Vickers and Yarrow (1988), is the threat of takeover. These authors consider the case of a non profit maximising manager who is vulnerable to takeover after which optimal monitoring would take place and internal efficiency would ensue. Incentives towards takeover increase as pre and post raid share prices diverge. Assuming that the manager tries to avoid a takeover, he will aim to achieve internal efficiency in order that the share price of the firm does not fall below its post raid level. However, internal efficiency via this mechanism is not guaranteed. Say for example that shareholders anticipate raids and hold on to shares until prices reach post raid levels. At this point a takeover will yield negative profit due to transactions costs; takeovers will not take place. Another example given by Vickers and Yarrow is the case where the raider is not a profit maximiser. In this case the achievement of internal efficiency does not prevent a takeover, thus incentives to internal efficiency are undermined.

Product market competition

Product market competition may act as a pressure towards internal efficiency. Consider the case of a monopoly firm owned privately by shareholders. Assume that the shareholders' objective is to maximise profits and that the manager of the firm is monitored in pursuit of this end. The shareholders cannot observe the effort input by the manager, there is a degree of managerial discretion, and inefficiency results. Hart (1983) shows that inefficiency is reduced when there is competition. He takes a situation where costs depend on managerial effort and an exogenous factor. If the exogenous factor is common to firms in the industry (or highly correlated) competition is information revealing. With better information about managerial effort shareholders can provide incentives for managers to input optimal effort, reducing costs relative to the case of inefficient monopoly. Kamecke (1993) demonstrates that competition may reduce inefficiency. He takes a situation where the manager of a monopoly has a degree of discretion due to monitoring failure and does not choose inputs consistent with internal efficiency. He shows that the introduction of competition is information revealing, thus reducing the potential for managerial rent, leading to an outcome which tends towards internal efficiency.

Summary

In a private sector firm monitoring can lead to a situation which is close to internal efficiency. When share ownership is dispersed it is not clear that the level of monitoring will be optimal. In the absence of monitoring takeover threats might lead to internal efficiency although this is not the only possible outcome. Competition provides information about relative managerial performance, allowing managerial reward to be linked with effort, hence eroding managerial discretion and pursuit of personal objectives.

We may apply some of the ideas above to the London bus industry. The provision for introduction of private firms under the 1984 LRT Act could be expected to lead to cost reductions. We have suggested already why the London bus industry might have been internally inefficient in the period before 1984. The substitution of private for public sector firms would result in the introduction of new objectives and monitoring systems more geared towards the achievement of internal efficiency. Although private firms do not fully achieve internal efficiency due to monitoring problems (monitoring is not fully effective in a context of asymmetric information, shareholders do not undertake optimal levels of monitoring, takeover threats are ineffective) in the present case of the London bus industry private firms were introduced simultaneously with competition. With the introduction of private firms and competition, the outcome can be expected to approach internal efficiency.

A major aim of this thesis is to analyse the impact of the introduction of private firms and competition on efficiency of the London bus industry. Analysis of the cost saving due to the introduction of tendering in London is presented in chapters two and five. It was argued above that public sector monopoly may be inefficient. Another aim of this thesis is to see if public firms can match the efficiency of private firms in a competitive environment, see chapter two.

The 1984 LRT Act also led to reform of the public sector bus company. The new public sector bus company was LBL. It was given objectives and monitoring systems geared towards internal efficiency and hence might also be expected to have led to cost reductions relative to the pre 1984 situation under conditions of both monopoly and competition.

Competitive Tendering

The discussion in this section will be general in nature rather than specific to London bus tendering. In our context competitive tendering is a process through which services formerly supplied by the public sector are made potentially open to supply by the private sector. Competition here is *for the market* as opposed to *in the market* so that, for example, there will be one piece of work which firms compete for the right to carry out. Competition typically takes place between firms from the public and private sectors.

The tendering process works in the following way. Consider a service formerly produced "in-house" (*ie* by the public sector) which is to be put out to competitive tender. The first step in the tendering process is to precisely specify the output and quality of the work to be tendered. Criteria for award of tenders must be devised. These must fulfil the objective of the tendering authority to achieve the desired level of output and quality at minimum cost. It is common to award tenders through some kind of auction process, usually a first price sealed bid auction. In this case a tender generally represents a fixed payment from the tendering authority to the tenderer agreed before work is undertaken and contingent upon carrying out the specified work. An in-house provider may compete with private sector firms for the tender. If so then this raises another issue. Rules must be set to govern bids from the former in-house provider to ensure that it has no advantage or disadvantage in comparison with private sector firms. After the tender is awarded the tenderer can increase profits by not carrying out the specified work. For this reason the tendering authority must monitor the tenderer to ensure that the specified work is carried out satisfactorily.

Hartley and Huby (1986) suggest that competitive tendering was introduced to the public sector as a solution to the problem of inefficiency. In the previous section sources of internal inefficiency in the public sector were discussed. It was suggested that lack of clearly defined objectives would lead to internal efficiency, as might clearly defined but non commercial objectives. Thomas (1987) presents competitive tendering as a process of work specification, performance management and cost allocation. This can be related to the literature on the relationship between firms' objectives and internal efficiency. It seems implicit in what Thomas says that competitive tendering involves the introduction of new objectives and monitoring systems. If these objectives are consistent with internal efficiency and can be monitored effectively then on this basis alone we might expect the introduction of competitive tendering to lead to efficiency gains. McMaster (1995) argues in a similar manner, suggesting that the establishment of cost centres inherent to tendering attenuates information assymetries between principal and agent, thus reducing inefficiency.

There are other motivations for possible efficiency gains in a tendering system. Domberger, Meadowcroft and Thompson (1986) argue that it is the competition inherent in a system of competitive tendering which drives efficiency gains. This can be related to the literature on competition and performance: it was suggested there that competition leads to internal efficiency.

Consider a service which is provided by a local authority and produced in-house. Assume that there exist asymmetries of information between voters and the local authority and that as a result political factors are allowed to influence supply of the service. Assume also that asymmetries of information exist between the local authority and the manager of the service. We have seen earlier that internal inefficiency in the supply of the service may result from either of these asymmetries. Now say that competitive tendering is introduced. The old objectives of the in-house provider are replaced and geared towards cost minimisation for a given level of quality. If managerial performance can be effectively monitored then we would expect to see a move towards internal efficiency.

It might be argued that the public sector firm has an advantage over the private sector firm as regards monitoring because of economies of scale in monitoring and dispersed share ownership in the private sector. In the absence of competition however it cannot be guaranteed that internal efficiency will be achieved. First of all it is not clear that monitoring will be effective in the absence of competition. Change within an organisation is likely to be subject to resistance and gradual in pace. It may also be the case that the expertise required to achieve internal efficiency may not be present in the public sector firm. It is the introduction of lower cost private firms that forces the in-house provider to adopt new objectives and monitoring systems and to search for new methods in production. Vining and Boardman (1992) argue that in a system of competitive tendering an in-house provider must act as if it were a private firm. This is intuitive: if the in-house provider does not act as a private firm then it will not survive in a system of competitive tendering.

We have said that the tendering process will be designed to select the lowest cost supplier for the specified work. Also that in the competitive tendering system private firms and public firms which act as though they were private compete with each other. The result will be the selection, through competitive tendering, of a firm which is internally efficient. In a situation where former in-house provision was not efficient, competitive tendering leads to efficiency gains. From a practical point of view this results in cost reductions.

Domberger, Meadowcroft and Thompson (1986) note the possibility that cost reductions may lead to failure in some other aspect of service provision; in a competitive tendering system there may be incentives for firms to reduce costs by reducing service standards. This can be avoided by designing contracts which prevent opportunistic behaviour. In order that this be achieved, contracts must be tightly specified, allowing effective monitoring of the service provided (Williamson 1976, Domberger 1987). Walsh (1991) argues that tendering leads to explicit contracts with clearly specified standards, allowing more effective monitoring of service quality relative to pre tender situations.

Competitive tendering has been used in Britain by local government since the early 1980's. The first major borough to use tendering was Wandsworth. Street cleansing services in Wandsworth were put out to tender due to overmanning, inflexible working practices and chronic absenteeism in the public sector monopoly provider (Beresford 1987); tendering was introduced to solve the problem of inefficiency. Wandsworth drew up specifications for the level of street cleaning service required, including a penalty scheme if the contractor failed to achieve the required standard. Tenders were invited, including from the council's own workforce. The result of tendering in Wandsworth was, according to the council's own estimates, a reduction in costs ranging from 26% to 30% (Beresford 1987).

By the mid 1980's competitive tendering was used widely in the procurement of refuse collection and ancillary hospital services. Compulsive Competitive Tendering was introduced under the 1980 Local Government Planning and Land Act, covering highway, building and maintenance work. Jackson (1994) quotes Nicholas Ridley from 1979, then Secretary of State for the environment and in charge of local government, who stated that Compulsive Competitive Tendering was introduced to reduce "the grip which local government unions have over services in many parts of the country." Under the Local Government Act of 1988 Compulsive Competitive Tendering was extended to refuse collection, building cleansing, other cleaning, schools and welfare catering, other catering, grounds maintenance, vehicle maintenance. Competitive tendering is widely used for procurement of services in Europe, America, Canada and Australia, see Parker (1990), Farago (1994), McAfee and McMillan (1988).

Two early studies of the impact of competitive tendering on costs suggested that cost reductions were achieved. Domberger, Meadowcroft and Thompson (1986, 1987) analysed refuse collection and ancillary hospital services and estimated that the introduction of competitive tendering had reduced costs by around 20%. These studies also found no evidence that cost reductions were gained at the expense of service quality. More recently, Domberger et al (1995) analysed firms contracted to carry out cleaning and found that competitive tendering does not reduce, and may increase, service quality.

In addition to estimating the cost saving due to tendering of London bus services, this thesis will attempt to quantify the impact of tendering on service quality from a financial and welfare perspective, see chapters three and four. Estimation of the overall impact of tendering on welfare is presented in chapter four. The relationship between service quality and monitoring is presented in chapter five.

Tendering versus deregulation in the bus industry

Bus tendering in London followed the 1984 LRT Act. Under the 1985 Transport Act all bus services outside London were deregulated. It was a possibility also to deregulate the London bus industry at this time. Similarly, competitive tendering might have been introduced to bus services outside London instead of deregulation. What follows is a summary of the debates which emerged concerning the alternatives of deregulation and competitive tendering in the bus industry.

The arguments in favour of deregulation are stated in the White Paper *Buses* and defended by Beesley and Glaister (1985a, b). They argued that deregulation of the bus industry would lead to the evolution of a contestable market. This was on the basis that a large part of the costs in bus operation are divisible and flexible (eg. labour) and that those costs which might regarded as sunk (eg. capital) would be made divisible and flexible through arrangements such as leasing. In a contestable market there would be significant savings in operating cost relative to the former situation of public sector monopoly. We can refer back to the discussion of ownership, competition and performance to understand why this might be the case. In a contestable market, as in a competitive market, there is no refuge for internal inefficiency.

Beesley and Glaister argued that the benefits of deregulation are not limited to the supply side. They suggested that under a deregulated system operators would cater with innovations for consumer demand. Innovations might be in fares, frequencies, routes and bus sizes. Innovations in bus size would be particularly important according to Glaister and Beesley, on the basis that the superior flexibility, speed and service frequency offered by minibuses would be better suited to demand characteristics in many situations.

Beesley and Glaister argued that cross subsidy between bus routes would be eroded under deregulation and that this would improve social welfare. They accepted that cross subsidy might be justified if there were no external subsidy. They questioned however whether actual patterns of cross subsidy conformed to the optimum. They regarded cross subsidy as a tax on the customers of profitable routes which was then redistributed by unaccountable planners and advocated instead external subsidy allocated through accountable bodies.

Beesley and Glaister were not in favour of the alternative system of competitive tendering for bus services. They suggested that the gains under competitive tendering would be limited to cost savings and furthermore that greater cost savings would be realised under deregulation than competitive tendering. They gave as the reason for this that whereas deregulation would lead to the immediate entry of new firms into the bus industry this would not be the case under competitive tendering. They predicted that competitive tendering would result in a small number of incumbent and collusive firms in the market. They pointed out that in a competitive tendering system operators would not be able to vary bus fare/frequency/route/size in accordance with consumer demand. Instead these variables would be dictated by planners and there would be no possibilities for increasing social welfare through the introduction of small buses. Finally the gains under competitive tendering would be realised only gradually because tendering authorities would by tendering only small parts of networks. They compared this to deregulation under which whole networks would be opened to competition and thus benefits would flow more quickly.

Gwilliam, Nash and Mackie (1985) posed the arguments against deregulation. They argued that a contestable market would not evolve in a deregulated bus industry because there would be barriers. They forecast the emergence of a small number of large companies able to practice predatory pricing, subsidising routes under competitive threat using resources from profitable parts of the business. In this situation there would not be maximum impetus towards internal efficiency.

Gwilliam, Nash and Mackie questioned whether innovations by operators in a deregulated market would lead to a socially optimal outcome. They were sceptical about the possibilities for increasing social welfare through the introduction of small buses. Although they agreed that patterns of cross subsidy might not conform to the second best optimal outcome they pointed out that this did not imply that removal of cross subsidy would increase social welfare.

Gwilliam, Nash and Mackie proposed competitive tendering of bus services as an alternative to deregulation. They argued that any potential cost savings from deregulation would be extracted under competitive tendering. Competitive tendering would allow planners to attempt to implement socially optimal bus fare/frequency/size combinations and facilitate continuing cross subsidy. A further advantage of competitive tendering was that it provide scope for planning an integrated transport system and that this would not come about under deregulation.

It was difficult to settle these debates at the theoretical level. So for example, Gwilliam, Nash and Mackie (1985) demonstrated that under certain circumstances optimal fare and service level combinations would not prevail under deregulation. It is possible however to demonstrate under alternative assumptions that an optimal outcome will occur under deregulation (Foster and Golay 1986). Regarding bus size, arguments were highly sensitive to assumptions about the level of suppressed demand for minibuses and the extent of potential cost savings from deregulation. Regarding cross subsidy it was not clear the extent to which this was sub optimal in real situations. Regarding contestability, it was not clear what extent of competition would emerge in either a deregulated or a competitively tendered system. In reference to the above arguments Glaister and Beesley (1985a p.133) conclude that "there can of course be no objective test as to which view is correct".

What actually happened was that under the 1985 Transport Act the bus industry outside London was deregulated. London was exempted so that "the changes, so recently instituted [under the 1984 London Regional Transport Act], bear fruit" (Buses, para 4.18).

The relative merits of tendering and deregulation as seen by bus company managers and bus industry planners are presented in chapter five of this thesis.

2.The Tendering Process

Economic arguments relevant to design of the tendering process are presented in the remainder of this chapter. The actual process implemented by LT is documented at the end of the section.

The Auction Mechanism

In the discussion of competitive tendering earlier it was suggested that the tendering authority must devise criteria for awards so that the objective to achieve the desired level of output and quality at minimum cost is fulfilled. Assume the optimal strategy for the tendering authority is the strategy which yields the desired level of output and quality at minimum cost. The optimal strategy can be illustrated with reference to the auction theory literature in economics.

Consider a tendering authority designing a tendering process. Assume that the authority has specified the quantity and quality of work to be tendered. Assume further that the tender will be based on a cost contract *ie* before work is undertaken the tendering authority agrees to pay the tenderer a fixed amount after the specified work has been completed in a satisfactory manner. Alternative contracts are discussed in this chapter and in more detail in chapter 4. Given that tendering is to be based on a cost contract, there are various possible strategies open to the tendering authority.

The auction theory literature

Stark and Rothkopf (1979) give a bibliography and Wilson (1992) give a survey of auction theory. Much of the literature assumes a monopolist selling a single indivisible object to one amongst a number of bidders. In the case of competitive tendering a monopsonist buys an object or objects from amongst a number of bidders. Although the majority of results in the literature are for the case of sale by a monopolist, from a theoretical point of view monopsony is essentially the same apart from the reversal of the signs of some variables (McAfee and McMillan 1987a, 1988). Derivations in the monopsony case are presented by Ortega Reichart (1968) and Holt (1980). For convenience the following discussion will be in terms of a monopoly seller.

Assume there is one object to be sold amongst n bidders, each observing only their own private value of the object. Each agent attempts to maximise the difference between their bid and the value of that they attach to the object (termed surplus) whilst taking care not to bid too low and forsake the chance of winning the auction.

This situation can be modelled as a game with incomplete information; agents maximise expected rather than actual utility because the context is one of uncertainty regarding payoffs (the payoff is the surplus contingent on a given outcome).

The game is regarded as non cooperative *ie* agents do not collude. This is justified on the following grounds: that collusion is illegal; there are difficulties in sharing out the gains from any collusive behaviour; the latter is self defeating in that high profits lead to entry of new firms outside any agreements (McAfee and McMillan 1988).

Types of auction

The English, Dutch, first price sealed bid and second price sealed bid auction mechanisms are widely used to sell goods. Assume an object is to be sold by auction. In the English auction the price of the object is successively raised until only one bidder remains. The object is sold to this bidder at the current price. In the Dutch auction the price of the object is lowered until one bidder accepts the current price. The object is sold to this bidder at the current price. In the first price sealed bid auction each bidder submits a bid, the object is awarded to the highest bidder at the bid price. In the second price sealed bid auction sealed bids are made. The object is sold to the highest bidder at a price equal to the second highest bid.

Private values

Assume a first price sealed bid auction. For a simple derivation of the optimal bid in a first price auction see McAfee and McMillan (1987a). Briefly, each (risk neutral) agent regards all values as drawn from a known distribution. The Nash bid (the optimal bid given the actions of other bidders) is chosen to maximise expected surplus (surplus given a win multiplied by the probability of a win). The optimal bid is derived under the assumption that all agents are rational and symmetric (the latter implies that the optimal bid for any bidder with a given value is equal). The optimal bid is an increasing function of the private estimate, therefore the outcome is the award of the object to the bidder with the highest value; the Pareto criterion is fulfilled.

Define the first order statistic as the highest bidder valuation, the next highest value the second order statistic etc. Then the magnitude of the winning bid is the highest valuation shaded by an amount equal to the expected difference between the first and second order statistics. Hence from an auctioneer perspective, expected revenue from a first price sealed bid auction is equal to the expected value of the object to the second highest evaluator. It is easily demonstrated that the expected value of the second order statistic rises with the number of bidders, in other words expected revenue increases with competition. Also the expected value of the second order statistic falls as bid dispersion increases *ie* there is an inverse relationship between bid variance and expected revenue.

Expected auctioneer revenue from the English, Dutch, first and second price sealed bid mechanisms is equivalent (Riley and Samuelson 1981). However, there are departures from this result if asymmetries are introduced. Maskin and Riley (1985) demonstrate that if private values are drawn from different distributions with identical supports then the first price sealed bid auction yields lower revenue than the English auction. If on the other hand values are drawn from distributions of similar shape but with different supports, the first price auction yields higher revenue than the open auction. In the case of the latter, Mcafee and McMillan (1987b) report that a mechanism which favours bidders drawing values from the distribution with the lower mean increases expected revenue. The reason for this is that the bidders with higher values are forced to bid more aggressively. In the case of procurement, a mechanism which favours higher cost suppliers reduces expected expenditure by the client.

The optimal auction mechanism is that one where the auctioneer maximises expected revenue. Myerson (1981) shows that the four formats above are optimal given that reservation prices are optimally chosen. Thus the auctioneer can increase expected revenue by introducing a reservation price. The reason for this is that the reservation price may be higher than the expected value of the second order statistic but lower than the first order statistic leading the bidder with the highest valuation to raise his bid. The optimal reservation price is higher than the value of the object to the auctioneer. This can result in a situation of no sale, an outcome which is Pareto suboptimal if any bidder places a higher valuation on the object for sale than the auctioneer.

Common values

An alternative situation arises when the object for sale has a common value to all bidders, this might be the case for an object that is to be resold after the auction, but that value is not known in advance. Assume that each bidder makes an estimate of the value based on private information, and that estimates are mutually independent and identically distributed. Then the bidder with the highest signal wins the sealed bid auction and is a victim of the winners curse.

This bidder fails to recognise that his signal is a biased estimate of the true value given that he is the highest signal holder and submits a bid which yields negative expected surplus. This fact is used to explain low returns from competitive bidding in the market for oil lease in America and book publishing rights (Capen, Clapp and Campbell 1971, Dessauer 1981).

Wilson (1977) derives the symmetric Nash bidding strategies for a common value auction and shows that as the number of bidders grows large the expected value of the winning bid converges to the true value of the object. Hence the Nash bid takes account of the fact that winning the auction is an informative event in itself and there is no winners curse. When agents behave optimally the outcome of the auction is Pareto optimal.

The optimal bid varies inversely with the degree of uncertainty (the relationship between expected revenue and bid variance is therefore the same as in the private values model) and the number of bidders. The latter suggests non aggressive bidding and runs in opposition to the result for the private values model. The optimal bid is bounded above by the posterior expectation of the value of the object for sale (*ie* the expected value given a win) and this declines as the number of bidders increases: outbidding larger numbers of bidders suggests greater errors in prior expectations regarding the value of the object and the need for greater downward revisions (Smith 1981). This is not the only relevant factor. As in the private values case strategic considerations suggest that the optimal bid should rise with the number of bidders. The relationship between the optimal bid and the number of bidders is thus ambiguous.

Auction revenues

Milgrom and Weber (1982) show that in a common values context revenue equivalence no longer holds: the English auction yields highest expected revenue, followed by the second price auction, and then the Dutch/first price auctions. The reason for this is that in an English auction some of the uncertainty regarding item valuation is removed because agents infer value estimates of competitors by observing the point at which they cease to bid. In a common value auction context the auctioneer can increase expected revenue by releasing any information about the true value of the item; this reduces the level of uncertainty leading agents to shade bids less cautiously. As in the private values model, the auctioneer may increase expected revenue by setting a reservation price (Milgrom and Weber 1982).

Hendricks and Porter (1988) report a common value model with asymmetric information in which all firms have access to public information and one firm has access to private information. In this case firms bid conservatively and avoid the winners curse, firms with only public information make zero expected profits, the firm with an information advantage makes positive expected profits, these are extracted from auctioneer revenue which must then be relatively lower than the situation where there is no privately held information.

Combination auctions

Drop the assumption that there is only one object for sale. A tendering authority may consider auctioning a number of contracts simultaneously. Bernheim and Whinston (1986) analyse outcomes in this situation. They present a model of a combination auction (bids are invited on components of a divisible object) and derive conditions that support Pareto optimal Nash equilibria in this context. The starting point for this model is an example in which an object is divided into two parts and auctioned between two bidders. Given that the ranking of valuations between bidders is reversed for each of the two components, there exists a set of Nash equilibria which are not Pareto optimal. In these situations there is a welfare loss and the auctioneer revenue is lower than would be the case if parts of the object were sold individually.

Anton and Yao (1993) analyse a procurement situation where there is one job which may be split into two parts. There are two bidders, each bidder may make bids for the two parts and for the job as a whole. Where there is asymmetric information between bidders regarding costs, optimal bidder behaviour leads to each part going to the lowest cost bidder for that part; the outcome is Pareto optimal.

Gale (1990) analyses the case where a number of franchises are to be auctioned. The franchises are complementary: the profits from two franchises owned by one agent are greater than double the profit from one franchise. Gale compares bidding for individual franchises with bidding for bundles of franchises. He shows that auctioneer revenue is maximised by selling franchises in bundles. The intuition here is that the auctioneer can extract some of the increased potential bidder profit from franchise complementarity by bundling.

Palfrey (1983) analyses a situation where one bidder values a whole object but not its contingent parts. This bidder refrains from bidding on the parts. The result can be that the bid for the whole object is more than the sum of bids for the parts, even if the sum of values placed on the parts exceeds the value placed on the whole object. The reason for this is the lower extent of bidding competition for parts of the object relative to bidding competition for the object as a whole. There is a free rider problem: bidders do not raise bids for parts sufficiently because they only gain some of the benefit of this action. The result is a Pareto sub optimal outcome. A Pareto improvement can be made by barring bids for the whole object.

Summary

To summarise, in a private values context revenue equivalence holds and revenue is maximised through the setting of a reservation price. In a common values context revenue equivalence does not hold. The optimal auction mechanism is the English auction. Revenue can be increased by the setting of a reservation price and the revelation of any information about the value of the object for sale. In a situation where the object for sale is divisible revenue may or may not be increased by sale of the object in parts.

Applications to bus tendering

There is scope for application of both common and private values to the case of bus tendering. The common values model may be applicable because firms are uncertain about costs. There are considerable uncertainties in bidding for bus routes. For example; achievable road speeds; the level of breakdowns; factor prices and productivity throughout the life of the contract. On the other hand, if firms know their own expected costs (that is, unlike the winner in a common value auction they do not on average overestimate costs) then the private values model is relevant. Some authors have modelled procurement in a common values framework (eg. Theil 1988) whilst others have adopted a private values framework (eg. McAfee and McMillan 1988 p.63). Given that either model may be applicable a bus tendering authority might best proceed both by setting a reservation price and releasing any information which it holds regarding operation costs. To the extent that there is a common values situation it is optimal for the tendering authority to choose an English auction mechanism.

Whether there is evidence of strategic behaviour by bidders as predicted by auction theory is investigated in chapter two of this thesis. Whether the tendering process could be improved, along with proposals, is discussed in chapters two and five. Whether the tendering authority might do better by auctioning routes individually as opposed to in groups is discussed in chapter six.

Contract type

Under a cost contract, the operator is paid a fixed amount by the tendering authority. The operator maximises profits by minimising costs. In the case of bus tendering, all revenue is returned by the operator to the tendering authority. Under a bottom line contract, the operator bears revenue risk: the operator pays an amount for the privilege to run a bus along the route and then collects all revenue from the route. The operator maximises profits by maximising the difference between revenue and cost. The choice between cost and bottom line contracts in a bus tendering process and the impact of this choice on economic welfare is discussed in chapter four of this thesis.

Cost and bottom line contracts are not the only possible types of contract upon which to base a tendering process. By adopting an alternative type of contract the tendering authority might do better. A more general form of the cost contract above is the linear incentive contract. Under a linear incentive contract the firm's revenue is given by the expression $\alpha p + \beta(p-c) + c$ where p is the firms bid, c is the cost of fulfilling the contract, α is the fixed profit parameter and β is the cost share parameter. The cost contract is a special case of the above where $\alpha = 0$ and $\beta = 1$ (firms revenue is then p). In the more general case the firm is paid the cost of fulfilling the contract (c) plus a fixed profit (αp) less an amount deducted for cost overruns $\beta(p-c)$. When the cost share parameter is equal to one this reduces to the special case of the cost plus contract; firm revenue is the cost of fulfilling the contract plus a fixed profit level.

Assume that there is a contract to carry out some specified work to be awarded. Assume that the costs of firms bidding for the contract are uncertain and that each firm has an estimate of its own expected cost. Assume that firms are risk averse; this may stem from shareholders who do not eliminate risk by portfolio asset diversification, or from managers who may be sacked for performing badly. Holt (1979) shows that under the assumption of profit maximising firms it is optimal for the procurer to bear all risk ie. to eliminate the cost of an overrun to the firm by offering a cost plus contract.

In this case the procurer can avoid paying the risk premium which would be incorporated in a bid for a fixed price contract by bearing the uncertainty in cost. However, this result does not take account of the fact that costs are directly related to actions taken by the firm and that moral hazard raises the expected procurement cost via a cost plus contract relative to alternatives.

McAfee and McMillan (1986) analyse a bidding process where firms are both uncertain regarding their costs and risk averse. They incorporate the possibility of moral hazard into their analysis. They demonstrate that there are three effects of varying the cost share parameter (β above): as this is increased risk averse firms lower their bids (the "risk sharing effect"); higher cost firms bid more aggressively because cost over runs are paid for by the procurer (the "bidding competition effect"); due to moral hazard firms engage in less cost reduction activity (the "moral hazard effect"). Through the first two of these effects expected procurement cost falls as the cost share parameter increases. Through the third effect expected procurement cost rises as the cost share parameter increases. In this situation a cost plus contract is never optimal because there is a high probability that the lowest cost firm will not be selected. The cost contract is only optimal if both the risk sharing and bidding competition effects are absent, this requires risk neutrality amongst firms and a large number of bidders/small variance in firms cost distribution. In any other case a cost share parameter in the interval [0,1] is optimal. Thus even when firms are risk neutral expected procurement cost is reduced by switching from a fixed price to a linear incentive contract because of the bidding competition effect. Laffont and Tirole (1993) derive the optimal auction mechanism for linear incentive contracts.

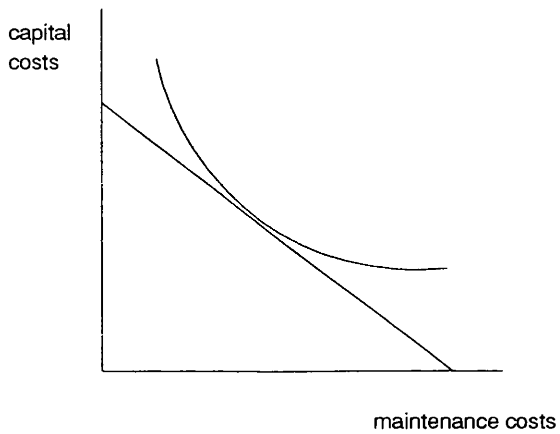
Contract Specification

We have stated above that all buses outside London began to be privatised and deregulated following the 1985 Transport Act. It was argued by Beesley and Glaister (1985a, b) that the resulting market would be either competitive or contestable. Any firm in this market would have to achieve productive efficiency in order to survive.

Vehicle age

Consider a firm deciding what age of bus to buy. Assume for now that the firm is risk neutral. A new bus has high capital and low maintenance costs relative to an old bus. Assume that the trade off between capital and maintenance costs is continuous. Then the situation can be represented as in figure 1.2. The curve represents combinations of capital and maintenance costs for a given level of output. The straight line is an isocost line with gradient equal to the negative of the input price ratio. The firm will choose the combination

Figure 1.2



of capital/maintenance costs at which the isocost line is tangent to the trade off curve. At this point the firm minimises costs. The result outside London is that firms have opted to buy older buses which have relatively high maintenance costs; this is illustrated by the figures in table 1. These figures show that since the deregulation of buses outside London in 1985 operators have opted for older buses. Say that the tendering authority is considering specifying a minimum age for vehicles to be used under tendering. We might conclude from the situation outside London that this would lead to a sub- optimal outcome in the sense that it would prevent firms from employing the minimum cost combination of inputs.

Table 1. Age distribution of buses and coaches with more than thirty three seats[1].

year	less than four years old (%)	four to seven years old (%)	8 to eleven years old (%)	12 years old or more (%)	Total (%)
1985	21	33	27	19	100
1986	19	31	29	21	100
1987	16	28	32	24	100
1988	14	25	34	28	100
1989	15	22	33	30	100
1990	16	20	31	34	100
1991	17	16	29	39	100
1992	15	15	26	44	100

There is another possibility. Drop the assumption above that firms are risk neutral. Say that there is uncertainty regarding the future of the bus industry and the second hand bus market. This implies that an investment in buses is risky. It might be the case that newer buses would minimise costs but that firms do not invest in them because of the associated risk (the risk associated with a new bus is greater than that for an old bus). In the face of uncertainty and risk aversity firms incorporate a risk premium in calculating the cost of capital. A firm which would have chosen newer buses in the absence of uncertainty may choose older buses when faced with risk even though this does not minimise costs. The outcome in deregulated markets may then represent cost minimisation in the face of uncertainty and risk aversity rather than certainty- cost minimisation.

Heseltine and Silcock (1990) argue that the aging profile of buses outside London is due to firms reluctance to invest in the face of uncertainty. If this is the case then a tendering authority

[1]Source: Dept of Transport (1994)

specifying a requirement for new buses could impose upon itself a risk premium (under tendering firms are faced with risk due to the relatively short life of contracts). Thus there are two possible ways in which procurement price in bus tendering may be raised through the specification of bus age: combined capital and maintenance costs may not be minimised by new buses; the high capital cost of new buses and uncertainty regarding the future may lead firms to add a risk premium into bids.

A major bus dealer provided the following prices as representative of the bus market in 1994: £100,000 for a new double decker bus, £65,000 for a seven year old double decker, £15,000 for a twelve year old double decker (all in good condition). Assume that depreciation is constant over the first seven years at £5,000 per annum. Assume also that buses have a life of twenty years and that after the twelfth year depreciation is constant at £2,500. Depreciation between the seventh and twelfth years must be at least £5,000 per annum on average. Consider an operator bidding for a three year tender. Consultation with engineers at London Buses suggests that it is reasonable to assume that a new bus will not require a new engine or gearbox during the three years but an old bus may. Assume that the old bus will definitely require a new engine and gearbox. This will cost (including fitting) £1,500 for the gearbox and £4,500 for the engine in 1994 prices. The cost of maintenance for an old bus over the three years is less than the differential in depreciation between old buses and new/seven year old buses. In addition to this rental costs of old buses are significantly lower: on the basis of a 2% real interest rate and the prices above, the rental cost for old buses is £1,700 and £1,000 lower than new and seven year old buses respectively per annum. On this basis costs are minimised using old buses and the age specification in tendering must therefore raise procurement price.

To the extent that the future is uncertain and firms are risk averse, age specification must further raise procurement price by a risk premium. It follows that withdrawing age specification would reduce procurement cost. It is noted that the tendering authority may prefer to continue specifying newer buses and paying a price premium in order to achieve a higher level of service quality: newer buses are more reliable than old buses and may be held in higher esteem by customers.

Contract Length

Grout (1984) presents an analysis of the benefits of long term contracts. He analyses a situation where there is a buyer and a seller. The buyer makes an investment specific to the seller of amount a. There are two periods: dates 0 and 1. The seller has a date 1 supply cost equal to c. The buyer has a date 1 benefit $b(a)$ where a is the date 0 investment. Assume that the buyer and seller are locked together but that there does not exist a long term (date 0) contract. Assume also that at date 1 surplus is divided between the buyer and seller according to the Nash bargaining solution *ie* $b(a) - p = - c$ where p is the price of the good exchanged between the buyer and the seller. The buyer chooses investment to maximise surplus $b(a) - p - a$. The result is under investment relative to the socially optimal level of investment which is chosen to maximise $b(a) - c - a$. The reason for this is that the buyer does not receive the full returns from the investment so incentives to invest are undermined. If a long term contract is signed p can be specified so that the buyer undertakes the socially optimal level of investment.

A long term contract in bus tendering could strengthen incentives for operators to make investments. Consider a bus operator who has the chance to make an investment which is specific to the tendering authority. This might be the purchase of new equipment which will reduce operating costs. Say that the operator will not be able to use the equipment outside of a relationship with the tendering authority and that the resale value of the equipment will be much less than its original purchase price. After the contract expires the tendering authority will be able to extract all benefits from the investment. In anticipation of this the operator may not find it profitable to undertake the investment. This is called the "hold up" problem (see Williamson 1985 for a discussion). The result is that cost reducing innovations are not incorporated into the tendering process. As contract length increases and operators enjoy more benefit from investment, incentives to invest increase: this is the advantage of long contracts. Longer contracts however do insulate tenderers from competition and may thus raise tendering authority procurement cost in the long run; as contract length increases incumbents become difficult to remove, new entrants are discouraged. In deciding contract length the tendering authority must recognise this trade off between investment incentives and competition.

The Tendering Process

Over the period to which this analysis relates (1985-93) the tendering process was organised by the Tendered Bus Division (TBD) of London Transport. The TBD decided which set of routes to put out to tender. A service specification for each tender was released. In order to avoid favouritism to the former in house provider, and to innovate around previous inefficiencies, the service specification was not the same as that prior to tendering. An alternative of offering no service specification was rejected on the grounds that new operators did not have service planning skills to devise a service from scratch (Newton and Rigby 1985 p.11). The service specification comprised a statement on vehicle capacity, the minimum number of departures per time period, and the streets and stands to be used on the service. It was designed by the Group Planning department of London Transport. Bidders were invited to submit bids, typically for three year contracts.

There were three types of bidder in London bus tendering. London Buses Limited (LBL) was a company wholly owned by London Transport comprising eleven operating units. LBL competed with private sector and ex-National Bus Company operators for contracts. Ex-National Bus Company operators comprised privatised subsidiaries from the former National Bus Company. LBL bids were constrained by rules to make it act as if it were a commercial firm. Firms submitted sealed bids based on the service specification. As long as the tenderer put in one bid that conformed with the specification he could also suggest variants, proposing for example alternative timetables, routes etc.

All bids remained fully confidential.They represented the payment required by the firm to carry out the specified service ie. the contract is a cost contract. All revenue was remitted by operators to London Transport. The payment associated with the cost contract was fixed: London Transport did not subsidise cost overruns. The alternative "linear incentive" contracts and "bottom line" contracts were not adopted over the period to which this study relates (bottom line contracts are however widely used in tendering for subsidised bus services outside London, see Meadowcroft 1988 or White and Tough 1993 and chapter 4 of this thesis for a discussion). The linear incentive contract was not considered as an option by London Transport. Regarding bottom line contracts LT saw four disadvantages: bottom line contractors have incentives to undermine the effectiveness of a network; there would be problems in allocating off bus revenue under a cost contract; fares adjustments, often necessary at short notice, are complicated under bottom line contracts; there was not scope for operator input to service planning, given lack of operator service planning skills, thus reducing the case for bottom line contracts. As a result of these factors, LT chose cost contracts as the basis for tendering (Newton and Rigby 1985 p.10).

The London Transport objective, to minimise expenditure whilst at least maintaining service quality, was normally achieved by awarding the tender to the lowest cost bidder at the bid price. This was not always the case. London Transport did not award contracts to bidders where there was doubt over the ability of that bidder to meet the service specification with the proposed resources. The winning contract price was not published. Firms did not learn from LT exactly how many bidders they bid against, either ex ante or ex post. However, a series of interviews with managers involved in London bus tendering strongly suggested that there is communication between managers prior to bidding such that they are well informed about the level of bidding competition (Kennedy, Glaister and Travers 1995).

In order that operators ran the required mileage after contract award the TBD monitored operators and deducted payments from the contract price for underperformance. For contracted miles not run payments were deducted at a rate of average cost per mile.

The first round of tenders was put out in 1985. This involved 13 small self contained routes in outer London, representing 1.2% of the LT bus operation. The routes were chosen following research by Higginson (1986). It was felt that a larger package would result in lack of competition for some routes; private sector interest in supplying bus services was perceived by LT to be limited. A larger package would also have been beyond the capabilities of the LT Group Planning Department. Outer London routes were chosen to match the location of companies most likely to be interested in tendering for bus services.

Since then the scale of tendering has steadily increased; between 1985 and 1993 around 5% of the total network has been newly tendered each year. By 1993 just under 50% of bus miles in London were secured by competitive tender. The remaining bus miles, called the "block grant network", were operated as a monopoly by LBL. Thus it is the presence of competition on the tendered network which distinguishes it from the block grant network.

It must be noted that since 1993 there have been significant changes in the organisation of the London Bus industry. In 1993 all routes operated on the block grant network were put onto negotiated contracts. In 1994 the TBD was replaced by a new body named London Transport Buses Procurement. Some of the LBL operating units were being privatised.

Conclusions

Tendering was introduced to the London bus industry as a response to rising costs. Under tendering the former public sector monopolist was exposed to competition from private firms. There is a large economics literature which suggests that the impact of this change would be to reduce costs. In fact, several early studies of the impact of competitive tendering have estimated a cost saving of around 20%. A major aim of this thesis is to estimate the cost reduction attributable to saving and also the source of this cost reduction. Key actors in the London bus industry are interviewed in order to divine the source of any cost reductions. It is of interest to learn how a public sector firm operates in a competitive environment. The impact of tendering on the performance of the public sector firm will be analysed in this thesis, in particular, the efficiency of the public sector firm relative to the private sector, under conditions of competition, will be estimated.

Other authors have argued that cost savings from tendering may be achieved at the expense of declining service quality. It has been suggested that in order to avoid this contracts must be well specified and effectively monitored. Although certain authors have addressed this question, there is little empirical evidence to complement theoretical propositions. This thesis discusses the monitoring system used by London Transport in bus tendering and quantifies the impact of tendering on service quality. Analysis of the impact of tendering on cost and service quality is combined to estimate the overall welfare impact.

In 1984 London Transport started with a "blank sheet of paper" and devised a bidding process. Did London Transport choose the optimal mechanism? Bid data is analysed to see if there is any evidence of behaviour as predicted by the auction theory literature. The results of this analysis could suggest improvements to the bidding process. Key actors in the London bus industry are interviewed with the aim of finding out any potential improvements to the bidding process.

In 1984 London Transport was faced with the choice of basing tendering either on bottom line or cost contracts. Whilst tendering authorities outside London opted for bottom line contracts, London Transport chose cost contracts. This thesis analyses the welfare impact of this choice from a theoretical perspective.

In certain cases, London Transport auctioned contracts in bundles. A number of papers analyse the auctioning of objects in bundles from a theoretical perspective. Whether bundling is optimal varies between theoretical models; for example, if there are cost diseconomies, bundling is not optimal, if there are cost economies, bundling is optimal. This thesis analyses London Transport's bundling of contracts from a theoretical and empirical perspective.

2 THE IMPACT ON COSTS

The primary aim in this chapter is to assess the impact that tendering has had on bus operating costs in the London area. Under tendering a new set of principal agent relationships between London Transport and operators has been established. Opportunities for private sector firms to supply services have been introduced. Monopoly provision has been replaced by competition to supply services. It was argued in chapter 1 that we might expect cost reductions to result in this situation. It appears that cost reductions have been achieved and at the same time the public sector operator has been successful in winning some contracts on the tendered network. Together these imply that the public sector must have made efficiency gains. Has the public sector firm reduced its costs to the levels of the private sector? This is one question which we attempt to answer in this paper.

Sutton (1993) argues that in contrast to many models in game theory, the extensive form of an auction game is such that it yields testable propositions. Authors such as Kagel, Levin and Harstad (1987) have tested auction theory using an idealised experimental approach. Is there any evidence that firms have acted strategically in this *real* bidding situation as predicted by the literature? We address this question before going on to estimate the level of cost savings which have accrued through tendering.

1. Relative Costs

Theoretical Background

A competitive industry may be regarded as being in disequilibrium if there are systematic cost differences across firms in that industry. Glaister and Beesley (1991) tested the hypothesis of industry disequilibrium in the context of London bus tendering. They found that, on the tendered network, public sector costs were systematically higher than private sector costs over the period 1985 to 1988. That is, the public sector firm had failed to achieve the efficiency level of the private sector firms. This can be explained at a theoretical level. Much of the privatisation literature has focused on the different incentive structures in private and public sector firms, see *inter alia* Beesley and Littlechild (1983), Vickers and Yarrow (1988), Foster (1992). So for example shareholder monitoring, takeover threats and bankruptcy threats which discipline private sector firms are absent in the public sector.

In the present case the public sector firm must compete with private sector firms to supply services. How effectively does this competition spur the public sector to achieve the level of efficiency in the private sector? Shughart and Van Boening (1994) argue that due to differences in incentive and monitoring structures private sector firms will be more efficient than public sector firms even in a competitive tendering system. Vining and Boardman (1992) argue that due to institutional factors, competitive tendering might facilitate public sector inefficiency. Glaister (1992, p.73) argues that public sector status may constrain a firm's ability to pursue commercial objectives, whilst being cushioned from the real threat of bankruptcy; this could lead to public sector inefficiency in a system of competitive tendering. Has the public sector been successful in adopting and implementing new objective functions and related incentive and monitoring systems? In other words, is there any evidence of industry disequilibrium as defined above? One aim of this chapter is to test the hypothesis of industry equilibrium.

A bid for a route by a firm represents the payment required by the firm contingent upon award of a contract. Bid data may be used to test the hypothesis of industry disequilibrium. To proceed, a bid function is specified which is based upon a cost function. To complete the specification possible strategic behaviour by bidders is modelled. This allows additional testing of hypotheses about strategic behaviour under conditions of competitive bidding.

There is a vast literature in the area of competitive bidding: see chapter 1 and also Stark and Rothkopf (1979) for a bibliography, Wilson (1992) for a survey. Two principal models - common and private values - are used here to interpret bidding behaviour in London Bus tendering. Although the literature covers alternative mechanisms (see chapter 1), London bus tendering was based on a first price sealed bid auction. It is on this mechanism which we focus in the following summary.

The independent private values model

In the independent private values model each agent has private information regarding his own value of the object for sale. Agents regard values as drawn from a known distribution and know how many bidders they are bidding against. They are assumed to be rational, symmetric and risk neutral. They act to maximise expected surplus (surplus multiplied by the probability of winning the auction, where surplus is defined as the difference between the bid and bidder valuation). McAfee and McMillan (1987a) derive the optimal bid. Define the first order statistic as the highest bidder valuation and the next highest valuation as the second order statistic. The Nash bidder regards his value as the first order statistic and shades his bid below his value by an amount equal to the expected difference between first and second order statistics. The expected value of the second order statistic falls with the number of bidders and the variance of the value distribution. Hence the optimal bid *falls* with the number of bidders and *falls* as the variance of the value distribution rises.

The common values model

In the common values model, agents bid for an object which has common but uncertain value. Assume that each agent makes an unbiased estimate of the object value. Then the naive bidder with the highest signal wins the sealed bid auction and is a victim of the winners curse. This bidder fails to recognise that his signal is a biased estimate of the true value given that he is the highest signal holder, and he submits a bid which yields negative expected surplus.

The Nash bid takes account of the fact that winning the auction is an informative event. Wilson (1977) derives the symmetric Nash bidding strategies for a common values auction. Assume that bidders are risk neutral. All bidders regard value estimates as being drawn from a common and known distribution and know how many bidders they are bidding against. Wilson shows that the optimal bid varies inversely with the degree of uncertainty (variance of the value distribution). This reflects the fact that the extent of overvaluation increases with the degree of uncertainty. The optimal bid is bounded above by the posterior expectation of the value of the object for sale (*ie* the expected value given a win) and this declines as the number of bidders increases: outbidding larger numbers of bidders suggests greater errors in prior expectations regarding the value of the object and the need for greater downward revisions (Smith 1981). On this basis the optimal bid *falls* with the number of bidders. This is not the only relevant factor. As in the private values case, strategic considerations suggest that the optimal bid should *rise* with the number of bidders. The relationship between the optimal bid and the number of bidders is thus ambiguous.

Empirical studies

There have been some empirical studies of common values situations: Mead, Moseidjord and Sorenson (1984) estimate returns from mineral rights auctions that are consistent with firms understanding and beating the winners curse; Kagel and Levin (1986) find that bidders learn to respond to the winners curse over time, Paarsch (1992) finds evidence to support behaviour as predicted by the common values model.

Procurement auctions and London bus tendering

The results above were for the case of a monopolist selling an object amongst a number of bidders. In a procurement auction, a monopsonist buys an object from amongst a number of bidders. From a theoretical point of view the situation is the same for monopoly and monopsony auctioneer, apart from the reversal of signs for some variables. In a private values procurement auction, agents realise cost rather than value signals. The optimal bid falls with the number of bidders and the variance of the cost distribution. In a common values procurement auction agents realise expected cost rather than expected value signals. The optimal bid increases with the variance of the cost distribution and the result of an increasing number of bidders is ambiguous.

The common values model may be applicable to bus tendering in London because firms are uncertain about costs. There are considerable uncertainties in bidding for bus routes. For example; achievable road speeds; the level of breakdowns; factor prices and productivity throughout the life of the contract. We do not need to assume that bidders know the variance of the underlying cost estimate distribution to apply the common values model, only that in bidding for a contract the bidder is aware of the uncertainty associated with that contract. For example, it is reasonable to assume that there is more uncertainty over costs for busy urban compared to unbusy suburban routes and that bidders are aware of this. To avoid the winner's curse in this situation, bidders should bid more cautiously for busy urban routes compared to unbusy suburban routes.

On the other hand, if firms know their own expected costs (that is, unlike the winner in a common value auction they do not, on average, overestimate costs) then the private values model is relevant. In order to shade bids in accordance with the private values model bidders would have to know the spread of expected costs across bidders.

Some authors have modelled procurement in a common values framework (eg. Theil 1988) whilst others have adopted a private values framework (eg. McAfee and McMillan 1988 p.63). Paarsch (1992) demonstrates the problems in testing between the common and private values models. In this analysis we do not attempt to test which of the common and private values models is applicable. Rather, we use both for interpretation of observed behaviour. It is likely that bidders are aware of uncertainty associated with particular routes - the information requirement for application of the common values model - but not the spread of expected costs among bidders, that is, the information requirement for application of the private values model. In light of this a cost plus (estimated cost plus a fixed margin) bid function may be more suitable than a private values bid function for modelling behaviour.

Industry disequilibrium

The private and common values models may be adapted for an industry in disequilibrium. Hendricks and Porter (1988) present a common values model with differential information and costs across firms. McAfee and McMillan (1987b) analyze a private values model with systematic cost differences across bidders. These may be used for interpretation if the hypothesis of industry disequilibrium is rejected.

Analysis of Bids

The model

The following bid function is hypothesised:

$$B = f(N) + g(Var\ B) + C$$

where B = bid, N = number of bidders, C = cost.

That is, bidders add two quantities to costs, one of which depends on the number of bidders and the other on variance of bids per bus mile. The cost, number of bidders and bid variance relate to the contract for which the bid is made. The interpretation of the bid variance varies according to which model is relevant. In the common values case the bid variance may be regarded as proxy for cost estimate variance (uncertainty). Uncertainty generates a spread of cost estimates, bidders mark up according to what they feel the level of uncertainty is, thus bid variance represents underlying cost estimate variance which in turn represents uncertainty. This is similar to the form of the bid function used by Kagel and Levin (1986). In the private values case, bid variance may be regarded as proxy for cost variance. Then the bid function is similar to that estimated by Gaver and Zimmerman (1977).

Following Glaister and Beesley (1991), the cost of operating a route is divided into two components: cost per bus hour operated (e.g. drivers) and cost per bus mile (e.g. fuel, tyres, capital, depreciation). Hence:

$$\text{Cost per bus year} = (\text{cost per bus hour})(\text{bus hours in year}) + (\text{cost per bus mile})(\text{bus miles in year}).$$

Let the cost per bus hour and cost per bus mile equal *a* and *b* respectively. Then dividing by bus miles per year gives:

$$\text{Cost per bus year/bus miles in year} = a\ (\text{bus hours per year/bus miles per year}) + b$$

Bus hours per year is the sum of bus hours on weekdays (Wd), evenings (Ev), Saturdays (Sa), and Sundays (Su) per year. Where

$$\text{bus hours on Wd} = (\text{hours of year on Wd})(\text{buses allocated to the route in the peak}) \times (\text{service frequency in Wd/peak service frequency}) \quad \text{etc.}$$

The cost function is based on a constant coefficients production technology. It contains an assumption of constant returns to scale. Research by Lee and Steedman (1970), Walters (1981), Tauchen, Fravel and Gilbert (1983), Glaister and Mulley (1983), and Windle (1988) supports this assumption. Although excess capacity and associated scale economies may occur on smaller routes, this is not relevant to the present analysis which is based on contracts for major routes. Viton (1981) finds evidence of short run disequilibrium (deviation from long run cost minimisation) in the bus industry. In London bus tendering contracts last for three years. Thus diseconomies of scale which might result from short run disequilibrium are not relevant here.

In these circumstances it is reasonable to assume constant returns to scale. In any event, all results that follow hold for a more flexible cost function; results for a more flexible cost function are presented in the appendix to this chapter.

The cost coefficients (a,b) are allowed to vary by type of operator. There are two types of operator: public and private sector (the public sector operator is LBL). A test of restrictions on cost coefficients by operator type is a test of industry equilibrium.The cost coefficient b is allowed to vary by type of bus upon which the bid was based. There are five bus types: new double deck (newdd), old double deck (olddd), new single deck (newsd), old single deck (oldsd), midi or mini (small). Setting up the cost function in this way, if there is evidence of industry disequilibrium, the source (labour or other costs) would be identifiable.

The data

Each time a tender was considered for award the officials of the TBD wrote a summary document of results for the members of the TBD board. This document would contain the name of each company which submitted a bid, the amount bid by each company, and the type of bus upon which the bid was based. The TBD choice of winning bidder was listed in the document as was a justification for the choice (see chapter 1 for a discussion of criteria for contract award). Within each summary document was an estimate of the saving due to tendering, based on the difference between LT's estimate of operating cost prior to tendering and the winning bid. For every tendered route the TBD recorded certain route characteristics: the annual route mileage, the number of buses required at varying times of the day.

The data used in the present analysis is compiled from TBD tender award summary documents and documents relating to route characteristics. The data are the value of 1569 bids for 350 contracts over the period 1985 to 1993 and:[2]

- bus miles per year on each route as estimated by LT;[3]
- some route characteristics: the number of buses required in the peak, bus frequency in the day, evening and at weekends;

[2]Bids are deflated by the index of average earnings for all industries.

[3]Note that this will differ from the (unobserved) figure used by bidders.

- the bidder type (public or private sector) and vehicle type (old or new, large or small etc.);

-the number of bidders for each contract.

Results

Regression results are presented in table 2.1. The dependent variable is the bid per mile in 1986 prices, with mean £1.62. The explanatory power of the model is low but is a typical result for regression based on cross section data. The null hypothesis that the model has no explanatory power is rejected at the 1% level of significance: $F(17,1547) = 40.9$; the 1% critical level for this statistic is 2.04.

Table 2.1: OLS regression explaining bids for tenders.

Variable	Coefficient	t-ratio
Constant	1.31	7.66
2,3 or 4 bids[4]	0.21	1.30
5 Bids	0.15	0.92
6 or 7 Bids	0.14	0.86
bid variance	0.34	6.27
LBL hours worked on route	2.68	7.66
Private hours worked on route	2.68	9.25
LBL newdd[5]	0.18	4.41
Private olddd	-0.07	-1.09
Private newdd	-0.10	-1.52
LBL oldsd	-0.13	-2.29
Private oldsd	-0.23	-3.17
LBL newsd	-0.0.4	-0.51
Private newsd	-0.04	-0.50
LBL small	-0.26	-8.29

[4]The number of bidders is an intercept dummy variable. The case where there was one bid is an omitted category.

[5]Old double decker is an omitted category.

Private small	-0.26	-4.50
time	-0.003	-6.47

$R^2 = 0.32$ $F(17,1547) = 40.9$

The estimated cost per bus hour coefficients are (with standard errors): London Buses Limited £2.68 (0.35); Private sector operators £2.68 (0.29). To the extent that costs per bus hour vary by bus type (*eg*. driver costs are lower on small buses compared to double deckers) this will be picked up by the vehicle specific coefficients. Turning to these, it must be noted that costs are estimated relative to the omitted category: an old LBL double decker bus. Thus, for example, the estimated cost per bus mile is £0.18 higher for a new LBL double decker bus compared to an old LBL double decker. One notable feature of the cost per mile coefficients is the considerable cost saving shown by small vehicles for both types of owner. This may be attributed partly to lower rates paid to their drivers and partly to lower ownership and running costs. The results also suggest that bids have fallen over time; this might be due either to falling wages or technological change or bidders learning about the winner's curse over time.

The hypothesis of industry equilibrium is tested through restriction of cost per mile and cost per hour coefficients by operator type. For example, the coefficients on variables *LBL olddd* and *Private olddd* are constrained to be equal, the coefficients on variables *LBL oldsd* and *Private oldsd* are constrained to be equal, the coefficients on variables *LBL hours worked on route* and *Private hours worked on route* are constrained to be equal. The Wald test statistic for this set of restrictions, Chi Squared (6) = 11.3. The 5% critical level for this statistic is 12.59. Hence there is no evidence of systematic cost difference between the public and private sector and the hypothesis of industry equilibrium is accepted. This concurs with Savas (1977) who found that public private cost differences in Canadian refuse collection were eroded a short time after competition was introduced, and Cubbin et al (1987) who found that public sector firms can match the efficiency of private sector firms.

Results from the restricted regression are presented in table 2.2.

The coefficient on the bid variance variable is statistically significant. It is estimated that as bid variance rises bids also rise. If we assume that changes in the bid variance represent changes in the level of uncertainty then the estimated coefficient shows that bidders behave optimally (more cautiously as the degree of uncertainty increases) as predicted by the common values model.[6] This seems to be the most reasonable interpretation: bidders are likely to be aware of levels of uncertainty. The alternative model, private values, requires that bidders know how expected costs vary across bidders, something which is less likely. The estimates in table 2.2 suggest that there is no strong relationship between bids and the number of bidders. The omitted class is the case where there was only a single bid (four routes). This result is in keeping with the common values model and violates behaviour predicted by the private values model.

Table 2.2: Restricted OLS regression explaining bids for tenders.

Variable	Coefficient	t-ratio
Constant	1.31	9.22
2,3 or 4 bids[7]	0.18	1.06
5 bids	-0.12	0.65
6 or 7 bids	-0.09	0.57
bid variance	0.34	6.37
hours	2.71	11.85
newdd[8]	0.15	6.46
oldsd	-0.16	-4.56
newsd	-0.005	-1.05
small	-0.23	-10.52
time	-0.003	-6.24

[6]It is possible that uncertainty may have declined over time as firms learned more about operating costs. This would lead to declining bid variance over time. A regression of bid variance on time yields the following

bid variance = 0.34 - 0.0003 time
(t statistic) (23.86) (-1.49)

Hence, there is no evidence of this effect.

[7]The number of bids is an intercept dummy variable. The case where there was one bid is an omitted category.

[8]Old double decker is an omitted category.

$R^2 = 0.32$ Number of observations = 1569

Results regarding the bid variance and the number of bidders conform with predictions from the common value model. If this is the case then we may apply a result from auction theory. In a common values auction a procuring authority can lower expected procurement cost by releasing any information it may have regarding expected operation costs, such as expected annual mileage and expected annual operating velocity, and hence reducing the level of uncertainty (Milgrom and Weber 1982).

2. Cost Savings

For each route we know LT's estimate of the cost of operation prior to tendering. In addition, we know the cost per mile to the tendering authority after tendering (this is equal to the winning bid per mile). Finally we know the corresponding independent variables in the cost function of the previous section (bus type, hours worked on route). The cost function is estimated based on this data. Cost savings can then be inferred from the estimated coefficients:

Cost per bus year/bus miles per year = a (bus hours per year/bus miles per year) + b

where the cost per mile is total operating cost per year divided by bus miles per year, and a, b are defined as before (a relates to labour cost, b relates to fuel, maintenance, capital costs).

Following Greene (1993 p.464) we pick up cost differences between pre and post tender bus operations through the intercept dummy variable. To make this operational, we allow the coefficient b to vary by three categories: these relate to double decker buses after tendering, either old or new, and old double decker buses before tendering. Estimated cost savings from tendering are then made, based on estimated differences in costs of operation before and after tendering.[9]

The results of the regression are presented in table 2.3. The dependent variable is cost per mile with mean £1.62 in 1986 prices. The estimated labour component of costs is £5.30 per hour.

[9] Ideally we would like to identify the source of cost differences (labour or capital costs). There is a problem of high multicollinearity which prevents us from doing this.

This is higher than in the previous section. The reason for this is that in the previous section the estimated coefficient represented an average of costs per hour for small and big buses, in the present section the estimated coefficient represents costs per hour for big buses only.

Table 2.3: OLS regression of pre and post tender costs.

Variable	Coefficient	t-ratio
Constant	1.05	11.69
new tendered double decker[10]	0.17	2.84
pretendered old double decker bus	0.39	6.66
hours worked on the route	5.30	8.22
time	-0.004	-3.59

$R^2 = 0.38$ Number of observations = 214

As in the previous section there is evidence of declining costs over time: the estimated time trend coefficient is -0.004 with t ratio -3.59. This is of the same order as that estimated in the previous section.

The dummy variables (new tendered double decker and pretendered bus) pick up differences in operating costs relative to the omitted category, which is old tendered double decker. Although in the theoretical specification of the cost function the coefficient on the intercept dummy represents fuel, maintenance and capital costs, in the regression it picks up all cost differences including differences in labour costs, thus it represents differences in total operating cost.

Operating costs for pretendered (*ie* block grant) buses are £0.39 per mile higher than for tendered old double decker buses. The difference between costs pre and post tender is statistically significant at the 5% level. New double deckers are, on average, about £0.17 per bus mile more expensive than old tendered double deckers.

[10]Old tendered double decker is an omitted category.

Cost savings are estimated as the ratio of the difference between pre and post tender operating costs for old double decker buses (£0.39 as estimated above) and the mean operating cost pre tender. The mean pre tender operating cost is £1.88. The cost saving based on a £0.39 cost differential is 20%. This is the same as London Transports own estimate (20%).[11] It is similar to cost savings estimated by Domberger, Meadowcroft and Thompson (1986, 1987) in the contexts of tendering for refuse collection and hospital domestic services.

Tendering in London has often resulted in the introduction of new buses. The reason for this is the service specification on the tendered network which required buses to be less than seven years old. Many of the independent companies operating tendered routes have chosen to use new vehicles even after the seven rule was dropped. This has been the major source of new bus investment, whilst the London Buses fleet has aged. We allow for this in estimating cost savings by taking a weighted average of cost differentials between block grant and old/new tendered double decker buses, weighting according to the ratio of old to new buses on the tendered network. The cost saving from tendering estimated this way is 18% (14% net of administration costs).

Conclusion

The aim of this chapter was to assess the impact of competitive tendering on costs in the London bus industry. Bid data from the tendering process was analyzed. A bid function was hypothesised. Cost coefficients relating to different kind of operators underlying the bid function were constrained to equal each other. A joint hypothesis test suggested that this restriction was valid. The conclusion was that the industry is in equilibrium. The result is of interest as an earlier study over a different time period suggested that the industry was in disequilibrium. Thus the public sector firm has made efficiency gains to the extent that there are now no discernible systematic cost differences relative to the private sector.

Regarding strategic bidding behaviour, there was no evidence that bidders adjust bids in the face of changing levels of bidding competition. Bidders did seem to respond to uncertainty. Given the response to uncertainty it was suggested that London Transport might reduce procurement

[11] London Transport estimates cost savings at 16% after administrative costs are taken into account.

cost by releasing any information it might have regarding expected operating costs. In the second section data on pre- and post- tender operating costs were analyzed in order to estimate cost savings. The estimated cost saving from tendering was 20%.

Appendix: a test of returns to scale

In this chapter implicit in the cost function was an assumption of constant returns to scale. We argued that this was justified based on previous evidence from the bus industry. Now we drop the assumption of constant returns to scale and repeat the regressions. The results remain unchanged. The new regressions confirm that the previous assumption of constant returns to scale was not unreasonable.

We adopt a simplified version of a translog cost function (see Christensen, Jorgensen and Lau 1973 or Christensen and Greene 1976 for more details). This specification allows flexibility regarding scale economies. In particular it facilitates estimation of a U shaped average cost curve. We estimate the following reduced form:

$$\ln B = b_0 + b_1 \ln X + b_2(\ln X)^2 + \Sigma_i b_i D_i + b_{12} \ln V + b_{13} T + b_{14}\, Var\, B + \Sigma_j\, b_j N_j$$

where B = bid per mile in 1986 prices (as defined above) , X = bus miles per year (as defined in above), D_i is a dummy variable relating to bus type (as defined above), V = average velocity (defined as bus hours per year divided by bus miles per year, equal to the inverse of the *hours* variable, in the first section), T = time, N_j is a dummy variable relating to the number of bidders (as defined above). We adopt this constrained form of the translog which does not have any terms containing factor prices because we do not have data about factor prices.

Regression results are presented in table 2.4. Estimated strategic behaviour is the same as before: there is no statistically significant relationship between the bid and the number of bidders; there is a statistically significant positive correlation between the bid and the bid variance. Testing industry equilibrium again yields a Wald test statistic, Chi-Squared (5), of 9.5. Hence the null hypothesis of industry equilibrium cannot be rejected.

Table 2.4: Respecified OLS regression explaining bids for tenders

Variable	Coefficient	t-ratio
Constant	0.72	2.88
Ln X	0.18	2.20
$(\ln X)^2$	-0.02	-2.40
2,3 or 4 bids[12]	0.12	1.16
5 bids	0.08	0.81
6 or 7 bids	0.08	0.77
bid variance	0.19	8.16
LBL newdd[13]	0.10	4.16
Private olddd	-0.04	-2.22
Private newdd	0.06	3.44
LBL oldsd	-0.11	-3.09
Private oldsd	-0.16	-5.81
LBL newsd	-0.04	-0.76
Private newsd	-0.05	-1.73
LBL small	-0.20	-9.40
Private small	-0.20	-10.20
ln V	-0.30	-15.05
time	-0.002	-7.27

R^2 = 0.36 Number of observations = 1569.

Table 2.5: Least Squares Random Coefficients regression explaining bids for tenders

Variable	Coefficient	t-ratio
Constant	187	3.10
Ln X	0.30	1.43
$(\ln X)^2$	-0.03	-1.46

[12]The number of bids is an intercept dummy variable. The case where there was one bid is an omitted category.

[13]LBL old double decker is an omitted category.

2,3 or 4 bids[14]	0.22	1.33
5 bids	0.16	0.99
6 or 7 bids	0.15	0.87
bid variance	0.33	5.64
LBL newdd[15]	0.21	6.41
Private olddd	-0.07	-2.74
Private newdd	0.09	3.91
LBL oldsd	-0.04	-0.82
Private oldsd	-0.13	-3.19
LBL newsd	-0.06	1.0
Private newsd	-0.02	-0.56
LBL small	-0.27	-7.48
Private small	-0.23	-6.81
ln V	-0.47	-8.6
time	-0.003	3.10

R^2 = 0.34 Number of observations = 1569.

Estimates of the coefficients b_1 and b_2 suggest slightly increasing returns to scale over a large output range. However, t-ratios for the estimated coefficients are close to the 5% critical value. The Durbin Watson statistic for the regression is low and examination of residuals shows that they are grouped by route. This suggests the presence of cross sectional autocorrelation and reduces reliability of the t-ratios. To allow for this bids were stratified by route and estimation assuming random coefficients was applied (see Greene 1993 for a discussion). The results are presented in table 2.5. The t ratios for the estimates of coefficients b_1 and b_2 (0.3 and -0.03) are not statistically significant at the 5% level. Hence there is no evidence against constant returns to scale.

[14]The number of bids is an intercept dummy variable. The case where there was one bid is an omitted category.

[15]LBL old double decker is an omitted category.

Cost savings from tendering were estimated from the following reduced form:

$$\ln B = c_0 + c_1 \ln X + c_2(\ln X)^2 + \Sigma_i c_i D_i + c_5 \ln V + c_6 T$$

where bus type dummy variables correspond to block grant old double decker, old tendered double decker and new tendered double decker. Regression results are presented in table 2.6. The cost saving from tendering is based on the difference between cost for tendered and block grant double decker buses. The estimated coefficient for the block grant old double decker dummy variable (with t ratio) is 0.22 (6.57). This implies that tendered old double decker costs are 80% of block grant old double decker cost; tendering led to a 20% cost saving. Results again suggest no evidence against constant returns to scale.

Table 2.6: Respecified OLS regression of pre and post tender costs

Variable	Coefficient	t-ratio
Constant	0.93	1.59
Ln X	0.16	0.75
$(\text{Ln X})^2$	-0.01	-0.64
Tendered newdd[16]	0.09	2.68
Block Grant olddd	0.23	6.57
Ln V	-0.42	-8.63
time	-0.002	-3.91

R^2 = 0.40 Number of observations = 214

[16] Tendered old double decker is an omitted category.

3 DEMAND

Introduction

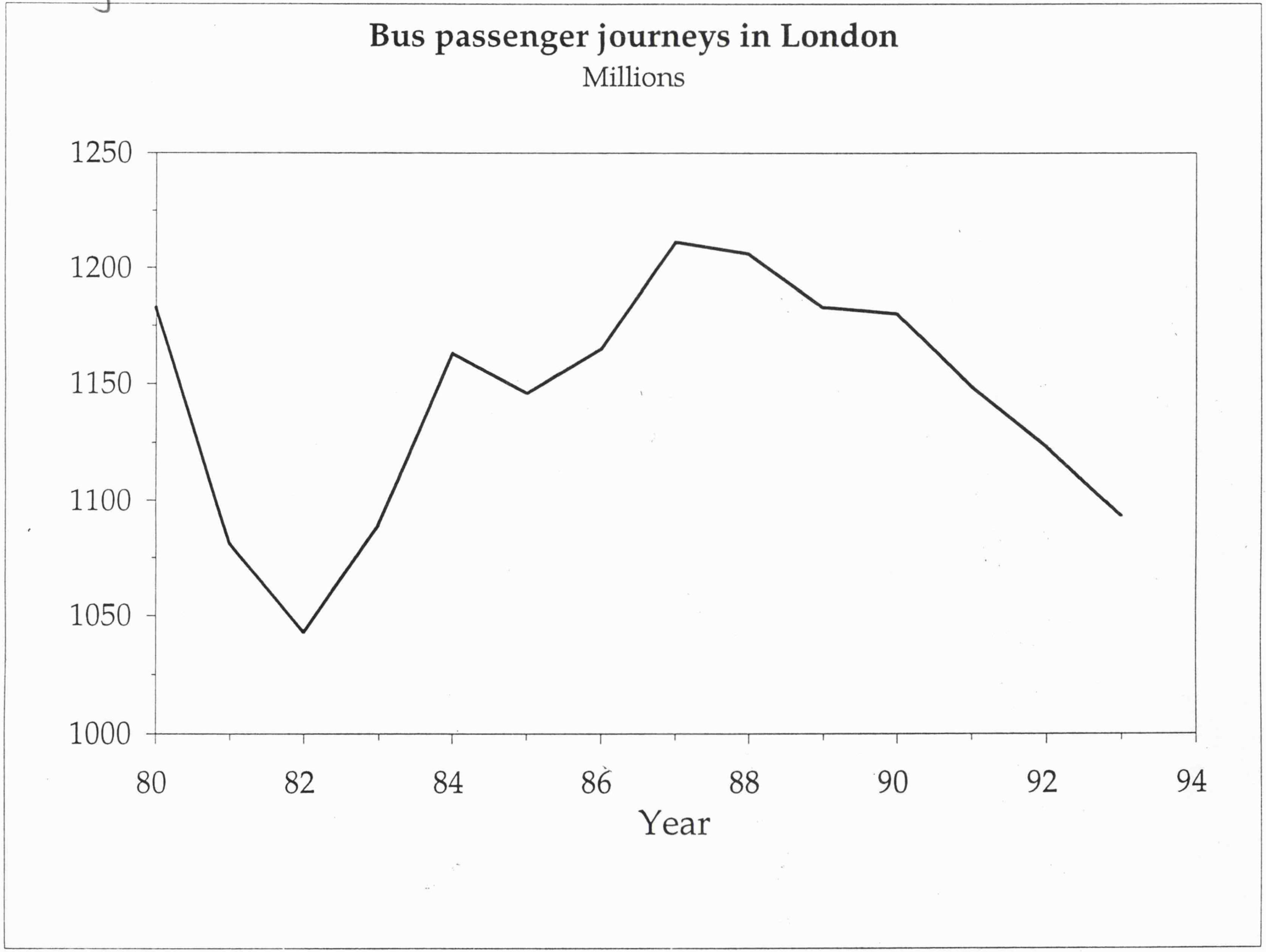
Tendering has had a dual effect on the London bus industry. Costs have been reduced, both by the securing of services from lower cost operators and by exposing the public sector supplier to competition. The impact of tendering on cost is analysed in chapter 2. In addition to cost reductions, tendering has led to an increase in the service quality of bus operation. Under standard assumptions we would expect this to have caused increased demand for bus travel. The aim of this chapter is to assess the impact that tendering has had on demand for bus travel in London.

For more detail about contracting between operators and the TBD see chapter 1. Briefly, when a tender is awarded, a contract between the TBD and the operator is signed. The contract specifies the timetable and total mileage to be operated. Subsequent to the commencement of a contract, the TBD monitors operator performance. Given the divorce between bus operators and revenue, the TBD must create incentives for the operator to run the required mileage. These are in the form of deductions from the contract price for under performance. Define schedule coverage as the percentage of scheduled bus miles actually run. The result of tendering has been increased schedule coverage. In this chapter the relationship between demand and schedule coverage will be estimated. In the first section the estimated relationship is based on aggregate data for the London network. A corresponding estimate of revenue generated by tendering is presented. The estimated revenue increase attributed to tendering will be based on tendered bus performance relative to block grant bus performance. In the second section we compare the estimated revenue gain with results based on route level data for the tendered network.

1. Analysis based on aggregate data

Ridership on the London bus network has varied as shown in figure 3. Factors that influence the level of ridership include service quality, real fares, employment and population. We attempt to isolate that part of change in ridership due to increased service quality associated with tendering.

Figure 3


Bus passenger journeys in London
Millions
1250
1200
1150
1100
1050
1000
80
82
84
86
88
90
92
94
Year

In estimating the revenue impact of tendering we follow White (1990). First we estimate the increased mileage attributable to tendering. Given the percentage increase in mileage we can estimate the percentage increase in demand by applying a mileage elasticity of demand. We proceed by estimating the demand for bus travel in London. Having estimated the percentage increase in demand we can derive the percentage increase in revenue and hence the revenue gain through tendering.

There are certain assumptions implicit in this approach. Domencich and McFadden (1975) provide the theoretical basis for a travel demand function which is dependent on travel time. Foster and Golay (1986) model two types of bus route: those where passengers arrive at random or alternatively where they arrive to meet a timetabled bus. In general the random arrivals assumption is valid either for high frequency or unreliable low frequency bus routes (MVA Consultancy 1994). For either random or non random arrivals increased schedule coverage reduces the time passengers wait at bus stops and hence reduces travel time.[17]

The Model

The demand for bus travel was estimated from the following model:

$$Y = \beta_0 e^{\beta_1 t} BMR^{\beta_2} EMP^{\beta_3} POP^{\beta_4} (\Pi_i p_i^{\beta_i}) (\Pi_j m_j^{\beta_j})$$

Here Y is the number of standard journeys (revenue deflated by the standard fare) made on the whole (block grant and tendered) network, BMR is bus miles run, EMP is employment in the South East of England, t is a time trend, POP is a population variable, p_i is price lagged i periods, m_j is an intercept dummy corresponding to season j, β_0, β_1, β_2 etc. are constants. This model is similar to that estimated by Gilbert and Jalilian (1991) for travel demand in London.

The data are 77 four-weekly observations from April 1986 to April 1993 on tendered bus revenue, tendered bus miles run, population and employment in the South East[18], and prices of bus/underground travel.

[17]Travel time comprises time waiting at the bus stop and time spent on the bus.

[18]Source: Regional Trends.

Results

There are certain econometric difficulties in estimating this model. Ideally the price vector would comprise bus and underground price variables. The price of travel on a given mode is taken to be the real standard fare on that mode. The relative prices of bus and underground travel have remained fairly constant over the period of the study. This prevents the inclusion of underground prices. Thus the price vector contains only bus price variables. After experimentation, it was found acceptable to follow Gilbert and Jalilian in constraining the price vector to observations on the real standard bus fare (p), the real standard bus fare lagged one period (p_{-1}), and the average of the real standard bus fare over the preceding year (p_{AV}).

The bus miles run and population variables are highly correlated with the time trend. To counter this, we assume a unitary elasticity of demand with respect to population and estimate the model in first differences. Hence the estimated equation is:

$$\Delta \mathrm{Log} Y = \beta_1 + \beta_2 \Delta \mathrm{Log}\ BMR + \beta_3\ \Delta \mathrm{Log}\ EMP + \Sigma_i\ \beta_i \Delta \mathrm{Log}\ p_i + \Sigma_j\ \beta_j\ m_j$$

where i = 5, 6, 7, (corresponding to the three price variables) j = 8, 9, ... 20 (thirteen season variables).

Estimation results are presented in table 3.1. The estimated impact price elasticity is -0.84. This is close to that found by Gilbert and Jalilian (1991), but higher than that which is typically found (see Goodwin 1992 for a survey). The null hypothesis that the coefficient on $\Delta Log\ p_{-1}$ is zero is accepted at the 5% level of significance under a two tailed test. The null hypothesis that the coefficient on ΔLog p_{AV} is zero is accepted at the 5% level of significance. The model suggests that there is no lagged price response. Hence, the long run price elasticity is equal to the impact price elasticity in this context. The estimated elasticity with respect to bus miles run is equal to 0.78.

The regression does not suggest any relationship between employment and the demand for tendered bus travel. This might be due to the fact that the employment statistic is for the South East (a London statistic is not available) and this does not reflect employment movements in areas served by the London bus network.

Table 3.1: Results from OLS regression explaining changes in ΔLog(journeys/population) on tendered buses in London from 1986-1993.

Variable	Coefficient	t-ratio
Constant	-0.01	-0.94
ΔLog BMR	0.78	12.53
ΔLog EMP	0.86	0.80
ΔLog p	-0.84	-6.32
ΔLog p_{-1}	0.17	1.91
m_5	-0.03	-2.03
m_7	0.04	2.93
m_{10}	-0.03	-1.94
m_{11}	0.04	1.87

R^2 = 0.9 number of observations = 77.

m_i $(i = 1 \; ..13)$ are counterparts to the 13 intercept dummy variables in the levels model. m_1 is an omitted category. Only dummy variables with coefficients statistically different from zero at the 5% level of significance are included in the table. Finally, there is no evidence that demand for tendered bus travel is changing over time; the t-ratio of the constant term is insignificant at the 5% level.

The Revenue Impact

Schedule coverage is defined as the ratio of bus miles actually run to scheduled bus miles. Table 3.2 shows the increased schedule coverage which can be attributed to tendering; this is taken to be the difference between coverage on the tendered and block grant networks. The implication is that, had services not been put out to tender, the level of bus miles run would have been less. In other words, ceteris paribus, the transfer of a service from the block grant to the tendered network leads to an increase in bus miles run. The relationship between bus miles run and demand for bus travel was estimated above. The estimated revenue impact of tendering may then be calculated based on the increased bus miles attributed to tendering and the estimated elasticity of demand for bus travel with respect to bus miles run.

Miles gained are estimated from columns 2,3 and 4 of table 3.2. The increase in demand, which as a percentage is equivalent to the increase in revenue, is calculated using the estimated elasticity of demand with respect to bus miles run (0.78).

In estimating revenue gains, two possible scenarios are considered:

- increased schedule coverage on the block grant network has been independent of tendering. For instance, in parallel with tendering there were network reviews designed, *inter alia* to increase the operability of routes. This meant there was an additional factor affecting the schedule coverage of block grant routes. Suppose it is reasonable to assume that block grant network schedule coverage is proxy for what coverage would have been on tendered routes had they not been tendered. This is taken into account when calculating the lower bound for gained tendered miles. The estimated lower bound for tendered revenue increase is based on this statistic.

- increased schedule coverage on the block grant network is a result of tendering. A route on the block grant network may be put out to tender if schedule coverage is low. Hence tendering creates incentives to perform well on the block grant network. In this case, when calculating gained tendered miles in a given year it is more appropriate to consider the difference between tendered schedule coverage in that year and block grant coverage in the initial year. The resulting statistic is the upper bound for gained tendered miles, upon which the upper bound for tendered revenue increase is based. Added to this is the revenue generated on the block grant network due to increased performance. The upper bound for gained block grant miles (and revenue) correspond to this.

The lower bound for gained block grant miles is zero: if increased schedule coverage was not due to tendering then no block grant miles were gained through tendering. Which scenario is empirically valid is debateable. There are strong views within the industry about why schedule coverage increased. These are presented in chapter 5.

The lower bound for tendered bus miles gained in a particular year is calculated based on the difference between scheduled tendered and block grant coverage in that year. The upper bound for tendered bus miles gained in a particular year is calculated based on the difference between tendered schedule coverage for that year and 1987 block grant coverage. The upper bound for block grant miles gained in a given year is based on the difference between block grant coverage in that year and in 1987.

tendered miles gained lower bound = (tendered miles run)(1 - block grant coverage/tendered coverage)

tendered miles gained upper bound = (tendered miles run)(1 - 91.8/tendered coverage)

block grant miles gained upper bound = (block grant miles run)(1 - 91.8/block grant coverage)

Estimated revenue gains are presented in table 3.2. The revenue figures are inflated by an index of London bus fares using 1992 as the base year. The lower bound for total revenue gain over the period 1987-1992 is the sum of tendered lower bounds for revenue gain, equal to £9.6 million. The upper bound for total revenue gain is the

Table 3.2: The estimated revenue impact of tendering

year	tendered miles run (mill)	grant network miles run (mill)	tendered schedule coverage (%)	block grant schedule coverage (%)	tendered miles gained lower bound (%)	tendered miles gained upper bound (%)	block grant miles gained upper bound (%)	tendered revenue increase lower bound (£ mill.)	tendered revenue increase upper bound (£ mill)	block grant revenue increase upper bound (£ mill)
1987	24.1	141.9	94.3	91.8	2.5	2.5	0	1.0	1.0	0
1988	33.4	134.1	96.3	93.9	2.5	5.4	2.2	1.5	3.2	5.7
1989	46.1	129.3	96.4	92.9	3.8	5.3	1.1	2.6	3.4	2.9
1990	54.6	134.1	97.6	95.7	2.1	6.4	4.3	1.7	5.1	8.5
1991	71.2	125.0	98.5	97.2	1.4	7.5	6.4	1.6	7.7	13.6
1992	81.1	116.0	98.8	98	0.9	7.5	6.4	1.2	9.0	12.1

sum of tendered upper bounds for revenue gain plus the sum of upper bounds for block grant revenue increase, equal to £71.6 million.

2. Analysis of route level data

We continue to assume that demand for bus travel is a function of generalised cost, where generalised cost is defined as the sum of the price of travel and value of travel time. We have argued that the impact of bus tendering on demand is through increased schedule coverage which leads to reduced travel time. On high frequency routes passengers arrive at random, whereas on low frequency routes they arrive to meet a timetabled bus. In either case, increased schedule coverage leads to reduced passenger waiting time. One might expect the sensitivity of demand to coverage to be different between high and low frequency routes.

We specify the following model:

$$D = \alpha\, e^{\beta_1 C + \beta_2 F + \beta_3 S + \Sigma_i \delta_i d_i + \Sigma_t \gamma_t t_t}$$

where D = demand, C = schedule coverage, F is bus frequency (low or high), S is bus size (small or large), d_i is a dummy variable for location i, t_t is a dummy variable for period t. We divide the London network into quadrants: North West, North East, South West, South East. To construct the location dummy variable we identify which quadrant or quadrants a route is operated in. The parameter β_1 is equal to the (constant) proportional change in demand following a one per cent increase in schedule coverage.

The data comprises thirteen four weekly observations on revenue, schedule coverage, bus frequency and bus type for each route in the tendered bus network starting in April 1992. The revenue and schedule coverage data was provided by the Tendered Bus Division of LT. The bus frequency was provided by London Transport's planning department. The bus type was taken from the Tendered Bus Division service index. The location of each route was determined using a map of the bus network provided by London Transport.

We used the data to estimate the following equation:

$$ln\ R_{it} = \alpha + \beta_1 C_{it} + \beta_2 F_i + \beta_3 S_i + \Sigma_i \delta_i d_i + \Sigma_t \gamma_t t_t$$

where R_{it} is the revenue on route i in period t ($i = 1...186$, $t = 1...13$), C_{it} is the coverage on route i in period, F_i is the frequency of buses on route i, S_i is the size of bus on route i, d_i is a location dummy variable for area i, t_t is a dummy variable for period t.

Regression results are presented in table 3.3. We started by using Ordinary Least Squares estimation. This yielded a low Durbin Watson statistic caused by cross sectional correlation of residuals.To allow for this observations were stratified by route and estimation assuming random coefficients was applied. This estimation method assumes random variation in the intercept term by route (see Greene 1993 for a discussion). The dependent variable is the natural log of revenue with mean 10.6. The estimated coefficient relating revenue with schedule coverage (with t ratio) is 0.015 (6.45). This suggests that a 1% increase in schedule coverage leads to a 1.5% increase in revenue. Other notable results are that revenue is estimated to be lower for small routes and low frequency routes. Regarding period effects, the results suggest that revenue is lowest in period 1 (this is the four week period starting at the beginning of April and is an omitted category). Area effects are relative to buses which operate in both North West and South East quadrants. Again, area effects are lowest for the omitted category.

We experimented with alternative specifications and variables. We used the natural log of revenue per mile as the dependent variable (rather than the natural log of revenue). We also included a variable linking bus routes with zones of the network. In either of these cases results were similar to those in table 3.3. In particular, the difference in the estimated relationship between demand and schedule coverage across alternative models was negligible.

Table 3.3: Random Coefficients estimation of route demand.

Variable	Estimated Coefficient	t-ratio
Constant	8.38	28.96
Schedule coverage	0.015	6.45
Frequency[19]	0.77	8.71
Size[20]	-0.96	-10.96
period 2[21]	0.04	3.49
period 3	0.06	5.11
period 4	0.07	6.10
period 5	0.05	4.77
period 6	0.004	0.34
period 7	0.09	8.69
period 8	0.13	11.75
period 9	0.12	11.32
period 10	0.01	1.06
period 11	0.10	9.7
period 12	0.14	13.19
period 13	0.26	22.57
North West[22]	0.91	4.78
North West and North East	0.77	3.07
North East	0.51	2.7
South West	0.79	4.01
South West and North West	0.53	1.91
South West and South East	1.05	3.74
South West, North West and South East	0.31	0.52
South East	0.41	2.09

[19]This is an intercept dummy variable. The omitted category is low frequency bus.

[20]This is an intercept dummy variable. Large bus is an omitted category.

[21]This is an intercept dummy variable. The omitted category is period 1.

[22]This is an intercept dummy variable. The omitted category is for buses which run in both North West and South East quadrants.

South East and North East	1.13	1.88

Number of observations = 2518

$R^2 = 0.59$

Next we apply an alternative estimation method to the data. Before doing this we respecify the model:

$$D = \alpha\, e^{\beta C}$$

where D = demand and C = coverage. The parameter α is a composite of exogenous influences. These include geographical factors and other aspects of generalised cost apart from schedule coverage.

We use the same data set as above to estimate the following equation:

$$\ln R_{it} = \alpha_i + \beta\, C_{it} + \gamma_t$$

where R_{it} is the demand for route i in period t (i = 1...186,t = 1..13), α_i is a route specific constant comprising all exogenous influences, C_{it} is the schedule coverage on route i in period t, γ_t is a period constant common to all i in period t.

We continue to stratify observations by route and apply (two way) Least Squares Dummy Variables estimation. This estimation method allows the intercept term to vary by route (see inter alia Greene 1993, Judge et al 1985). Results are presented in table 3.4. The dependent variable is the natural log of revenue with mean 10.6. The estimate of β from this regression is 0.016 with t ratio 9.50. The estimated relationship between demand and schedule coverage is statistically significant at the 1% level. This suggests that a 1% increase in schedule coverage leads to a 1.6% increase in demand. We note that this is close to the estimate from the random coefficients model. The estimated period effects are relative to period one which is an omitted category. So for example demand is proportionately 3% higher in period two than period one. The hypothesis of no period effect is rejected for most cases at the 5% level of significance.

We allowed for dynamic effects of changes in schedule coverage on demand by including lagged schedule coverage variables in the regression. Estimation of a regression with lagged independent variables absent prior imposition of a lag structure yields a well determined long run response (Stewart 1991); it is the long run response that we are interested in. The difference made by including lagged schedule coverage variables as regards the response of demand to schedule coverage is negligible.

We allowed for differing response to changes in service quality according to whether the route was high or low frequency. This was done by estimating a slope coefficient for a high frequency coverage dummy variable. The estimated coefficient for this variable was 0.003 with t-ratio 1.05. This represents the response of demand to schedule coverage on high frequency routes relative to the response on low frequency routes. Thus, surprisingly, there is no evidence of a differing response to schedule coverage by type of route. This may be due to London Transport's definition of a high frequency route as one with more than four scheduled buses per hour: we might ideally like to lower this critical value.

We will use the estimate of β to estimate the revenue of impact on tendering. Before doing this we investigate possible upward bias in the estimated coefficient. When coverage improves along a route passengers may be creamed from substitute routes. If this effect is present then revenue on the route in question would rise more than the total revenue. This would affect the estimate of the coefficient β at the aggregate level. Using the estimated β to estimate demand effects of tendering would lead to overstatement at the level of the whole network where revenue generated by substitution between routes cancels out.

Table 3.4: Least Squares Dummy Variables estimates for route demand

Variable	Estimated coefficient	t-ratio
Coverage	0.016	9.50
Period 2	0.03	3.74
Period 3	0.05	6.78
Period 4	0.07	8.24
period 5	0.05	6.06
period 6	0.02	0.21
period 7	0.09	11.53
period 8	0.12	15.57

period 9	0.12	15.16
period 10	0.01	1.85
period 11	0.10	13.23
period 12	0.14	17.74
period 13	0.27	30.8

Number of observations = 2418

R Squared = 0.99, $F(207, 2210)$ = 1,598

We do not know the magnitude of substitution effects between routes. We could argue that we would expect substitution to be higher on high than low frequency routes. The estimated negligible differential response to changing service quality for high and low frequency routes would then suggest that the substitution effect is small. An alternative argument is that schedule coverage for competing routes will be highly correlated; variations in schedule coverage may be due largely to traffic conditions which are common to competing routes. Similarly competing routes running from the same garage will have highly correlated schedule coverage. In either case the substitution effect would again be small.

We attempt to allow for substitution effects by aggregating data. We use London Transport's division of the London bus network into thirty six sub-networks and aggregate data for each sub-network. First we outline the procedure for aggregating data.

Assume that a sub network comprises two competing routes with demand given by the following relationships:

$$\ln R_1 = \alpha_1 + \beta C_1 + \beta_{21}(C_1/C_2) \quad (1)$$

$$\ln R_2 = \alpha_2 + \beta C_2 + \beta_{12}(C_1/C_2) \quad (2)$$

where R_i, α_i, and C_i are respectively revenue, exogenous revenue and schedule coverage on route i (i=1,2). β is the proportional increase in revenue net of substitution effects corresponding to a unit increase in schedule coverage. β_{ji} measures the magnitude of the substitution effect between routes i and $j(j=1,2, j$ not equal $i)$. It is the proportional increase in revenue following a unit increase in the ratio of schedule coverage on routes i and j.

Consider a change in schedule coverage on routes 1 and 2. The aggregate increase in revenue for the two routes is given by:

$$\Delta R = \Delta R_1 + \Delta R_2 \quad (3)$$

Dividing (3) by R gives:

$$\Delta R/R = (\Delta R_1 + \Delta R_2)/(R_1 + R_2) \quad (4)$$

From (1) and (2) we have that:

$$\Delta R_i = \beta R_i \Delta C_i + \textit{cross-substitution term}_i \quad (5)$$

Note that the second term on the right hand of (5) cancels when revenue change is aggregated across routes. Substitute (5) into (4):

$$\Delta R/R = (\beta R_1 \Delta C_1 + \beta R_2 \Delta C_2)/(R_1 + R_2) \quad (6)$$

Rearranging (6) gives:

$$\Delta R/R = \beta\{[R_1/(R_1 + R_2)]\ \Delta C_1 + [R_2/(R_1 + R_2)]\ \Delta C_2\} \quad (7)$$

Which would be a consequence of:

$$\ln R = a_3 + \beta\{[R_1/(R_1 + R_2)]C_1 + [R_2/(R_1 + R_2)]C_2\} \quad (8)$$

Data on revenue and schedule coverage is aggregated in accordance with (8).[23] Regression of (8) will yield an estimate of revenue response to schedule coverage which is net of substitution effects.

Least squares dummy variables was applied to estimate equation (8) on the basis of area level data. As a result of aggregation the estimated coefficient on schedule coverage rises to 0.03. This implies that a 1% increase in schedule coverage leads to a 2.7% increase in revenue. The standard error of the estimated coefficient increases to 0.005 . This result contradicts our *a priori* belief that estimated schedule coverage response would stay constant, or fall if substitution effects were present.

Area revenue per month varied from £17,000 to £1.2 million. We exclude from the sample areas with monthly revenue less than £100,000. These areas comprise low frequency results. The contribution of these areas to network revenue is approximately 8%. Re-estimation of (8) now yields a coefficient of 0.014 on schedule coverage with standard error 0.004. This is marginally lower than the route level estimate. It suggests that there is not a strong substitution effect between routes. If this were not the case, estimated schedule coverage coefficients would fall between route regressions and area regressions.

The route level estimate of the schedule coverage coefficient is 0.016. This is the estimated average network response along a route to changing service quality on that route. It supports our hypothesis that demand is related to service quality and conforms with work carried out by Bly (1976) and London Transport (1991).

Route revenue is the sum of on bus revenue and allocated off bus (travelcard) revenue. Off bus revenue is allocated to a route in proportion to the number of travelcard journeys made on that route. As coverage increases on a route the number of fare paid journeys and the number of travelcard journeys may increase. The service quality coefficient estimated in the cross section regressions relates service quality and total journeys (fare and travelcard). The estimated service quality coefficient may overstate the response of revenue to changes in

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[23] A more standard grouping of data as in Johnston (1972) would not aggregate out substitution effects.

service quality: the proportional change in revenue for a change in service quality may be less than the proportional change in journeys if some journeys are made by travelcard holders.

For this reason the 1.6 estimated service quality elasticity may be an overstatement. In fact, the work by Bly (1976) and by London Transport (1991) suggests that it is reasonable to apply an elasticity around unity. This approximates to the elasticity applied to estimate revenue gains in the first section of this chapter. In light of this we will use estimates of revenue gained in that section as a lower bound.

Conclusion

The aim of this chapter was to assess the impact of competitive tendering on demand in the London bus industry. Tendering has improved the quality of bus service and hence demand. We proceeded by estimating the mileage gain attributable to tendering and then applied an estimated mileage elasticity to yield estimates of revenue gained. This part of the analysis was based on data aggregated to the network level. We found a positive relationship between demand and service quality based on route level data. We used the estimates from the aggregate analysis as a lower bound for revenue gained. On this basis we estimate a revenue gain from tendering over the period 1987-92 in 1992 prices of between £9.6 and £71.6 million.

4 A WELFARE BALANCE

The aim of this chapter is to assess the welfare impact of these changes. Following White (1990), cost benefit techniques currently used to evaluate urban transport expenditure in Britain are applied to this end.

In 1994 London Transport began to organise tendering on the basis of bottom line rather than cost contracts. In the appendix to this chapter the choice between cost and bottom line contracts is discussed in terms of the impact of the choice on economic welfare.

The Impact of Tendering

The welfare impact of tendering is calculated as its net effect on producer and consumer surpluses. Tendering has been associated with cost reductions and service quality improvements (see chapters 2 and 3). Cost reductions and revenue generating service quality improvements both have a positive effect on producer surplus. Service quality improvements also increase consumer surpluses. These effects are considered in greater detail and quantified below.

1. Cost Savings

We will proceed in the present analysis by assuming that bus tendering resulted in a 14% net cost saving. This was the (weighted) cost saving due to tendering estimated in chapter 2.We apply this figure to the total annual cost of operating the tendered network each year over the period 1987-1992. Total annual operating cost data is taken from London Transport accounts. Total annual operating costs on the tendered network and associated cost savings calculated on the basis that tendering led to a 14% reduction in pre tender costs are listed in columns *a* and *b* of table 4.1.[24]

Total cost savings from tendering calculated on this basis over the period 1987-1992 are £123.5 million in 1992 prices. This figure relates only to savings on the tendered network.

[24]The cost benefit calculation relates to the period 1987-1992. All figures in this chapter are in 1992 prices.

Tendering may also have led to cost savings on the block grant network: managers may have tried to ensure good performance on the block grant network in order to avoid routes being put out to tender. There are other factors however which have contributed to cost savings on the block grant network; these are listed in chapter 5 . In that chapter we explain why we do not feel that it is possible to identify the effect that tendering as opposed to other factors has had on block grant network costs.

Table 4.1: Cost savings from tendering in 1992 prices.

year	a. Cost (£mill)	b. Cost saving (£mill)	c. Labour cost (£mill)	d. Reduced wages (£mill)	e. Net cost saving (£mill)
1987	56.5	9.2	47.1	7.5	1.7
1988	87.4	14.2	72.9	11.7	2.5
1989	117.8	19.2	98.2	15.7	3.5
1990	136.8	22.3	114.0	18.2	4.1
1991	170.6	27.8	142.1	22.7	5.1
1992	189.0	30.8	157.5	25.2	5.6

Areas where cost savings have been made are listed in greater detail in chapter 5. Tendering has led to reduced overhead costs: management slack allegedly present before tendering has been eroded and many jobs have been lost in this area; there have been efficiency gains in engineering; it is common for buses to be housed in yards located out of the city as opposed to the former covered inner city depots; expenditure on staff facilities has fallen under tendering.

The bus industry is labour intensive. Further cost savings have been achieved through reductions in labour costs. Some labour cost savings have stemmed from changed working practices leading to increased productivity. On the other hand a large part of labour cost savings has accrued through reductions in wages. In evidence presented to the House of

Commons Transport Committee one LBL manager stated that a typical wage fall due to tendering is 16% of the basic weekly rate (House of Commons 1993). At the same time the hours associated with the basic week have not fallen. This implies that the hourly rate has fallen by at least 16%. Overtime enhancements have been reduced so that hourly overtime rates must also have fallen by at least 16%. These figures were put to LBL managers during a series of interviews and there was general agreement that they are reasonable estimates (interviews are summarised in chapter 5).

White (1990) argues that wage reductions represent transfers and as such should be excluded from the cost benefit calculation. In order to allow for this two welfare balances - one based on total cost savings, one based on cost savings net of wage reductions - will be estimated. We proceed to estimate cost savings net of wage reductions by first estimating labour costs on the tendered network. We assume that labour costs make up 70% of total operation costs: this is consistent with the ratio of the LT wage bill to total operation cost as calculated from LT accounts. Tendered network labour costs calculated on this basis are listed in column c of table 1. Wage reductions are calculated on the basis that hourly wages have fallen by 16%. The value of reduced wages is listed in column *d* of table 4.1. Total estimated wage reductions are £101 million in 1992 prices over the period 1987-1992. The cost saving net of wage reductions is listed in column *e* of table 4.1. Over the period 1987-1992 the total cost saving net of wage reductions is £22.5 million in 1992 prices.

2. Revenue Gained[25]

We estimate the revenue impact of tendering based on the increased bus miles attributed to tendering and the elasticity of demand for bus travel with respect to bus miles run. We assume a 0.78 elasticity between bus miles run and demand for bus travel as estimated in chapter 3. The miles gained in any year is calculated in the following way:

miles gained = (miles run)(1 - block grant coverage/tendered coverage)

The increase in demand, which as a percentage is equivalent to the increase in revenue, is

[25] What follows summarises section 1 of chapter 3

calculated using the elasticity of demand with respect to bus miles run.

Estimated revenue gains are presented in table 4.2. The revenue figures are inflated by an index of London bus fares using 1992 as a base year. The total revenue gained between 1987 and 1992 estimated in this way is around £10 million.

Table 4.2: Revenue gains from tendering in 1992 prices.

year	a. tendered schedule coverage (%)	b. block grant schedule coverage (%)	c. revenue gain lower bound (£mill)	d. revenue gain upper bound (£mill)
1987	94.3	91.8	1.0	1.0
1988	96.3	93.9	1.5	8.9
1989	96.4	92.9	2.6	6.3
1990	97.6	95.7	1.7	13.6
1991	98.5	97.2	1.6	21.3
1992	98.8	98.0	1.2	21.1

Now consider an alternative scenario: increased schedule coverage on the block grant network is a result of tendering. A route on the block grant network may be put out to tender if schedule coverage is low. Hence tendering creates incentives to perform well on the block grant network. In this case, when calculating gained tendered miles in a given year it is more appropriate to consider the difference between tendered schedule coverage in that year and block grant coverage in the initial year. We can argue that in this case block grant miles have also increased as a result of tendering. Then we calculate the gained block grant miles in a given year based on the difference between block grant schedule coverage in that year and the initial year. We follow the same method as above for calculating revenue generated and we do this for both the block grant and tendered networks. The revenue generated by tendering, which is the sum of revenue generated on the tendered and block grant networks, is approximately £70 million over the period 1987-92 in 1992 prices.

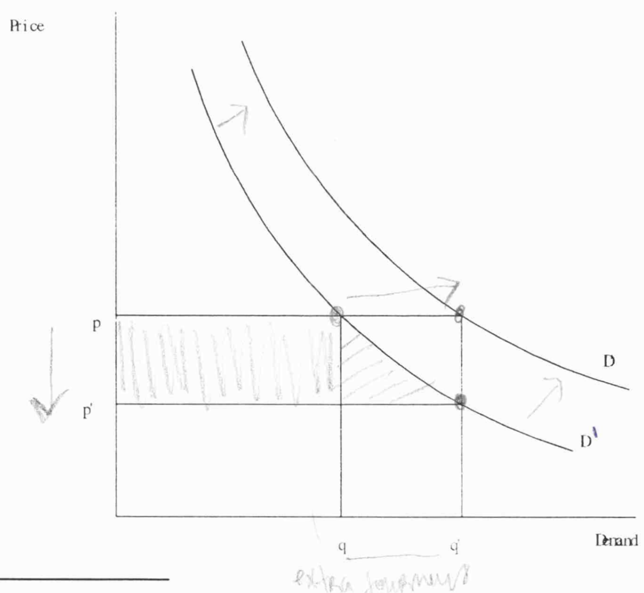
Revenue gains are estimated based on revenue and mileage data taken from LT accounts and are presented in columns *c* and *d* of table 4.2.[26]

3. Gains to consumers

It is a standard result that a fall in price leads to an increase in consumer surplus. There is an analogous result regarding changes in the service quality of transport; an increase in service quality raises the level of consumer surplus (see Jones 1977 p.95-98, Glaister 1981 p.31-32). For every service quality change there is an equivalent price change which yields the same increase in demand and the same increase in consumer surplus. Define generalised cost as the sum of price of travel and the cost to the consumer of journey time. Price and service quality changes which yield equivalent changes in demand yield equal changes in consumer surplus if generalised cost is a linear function of travel time. See MVA (1994) consultancy for derivation of a generalised cost function which is linear in travel time.

We have argued that bus tendering led to an increase in service quality. In this section we estimate the increased consumer surplus that has resulted from this. The methodology we

Figure 4.1



[26]Mileage gains estimated in this way are sensitive to the mileage elasticity. Based on data from the period 1971-1990 London Transport estimate that the upper bound for mileage elasticity of demand for bus travel is 0.3 (London Transport 1994) . Estimated revenue gains based on this elasticity are approximately 40% of those in table 2.

adopt is to first estimate the equivalent price change to the service quality increase and then use this to estimate the increase in consumer surplus. In the previous section we estimated the revenue generated by tendering. Estimated journeys generated by tendering are obtained through dividing revenue gains by the standard London bus fare. The journeys generated by tendering are represented by [q'-q] in figure 4.1.

Consider an initial situation with price p and demand q. The service quality improvement leads to a shift in the demand curve D to D' resulting in increased total demand given a constant price. The same increase in demand would be generated by a price change from p to p' along the original demand curve D. Given such a price change there would be generation of consumer surplus both to new and existing passengers. Under standard assumptions consumer surplus gains to existing users are equal to [p-p'] x q. and consumer surplus gains to new users are equal to 0.5 x [p-p'] x [q'-q].

We can obtain an estimate of q' in the figure by dividing the annual revenue by the standard bus fare. We can estimate q given q' and [q'-q]. We know the price of bus travel, this corresponds to p in the figure. We can use the constant price elasticity of demand estimated in chapter 3 together with estimates of q and [q'-q] and the price p to estimate the price p' in the figure. There is then sufficient information to estimate the consumer surplus generated by a price change from p to p' which is equivalent to the consumer surplus generated by tendering due to increased service quality.

Consumer surplus gains attributed to tendering are presented in table 4.3. The lower bound for consumer surplus gains corresponds to the scenario in the previous section where tendering led to increased service quality on the tendered network. Here we divide the lower bound for revenue gains to obtain [q'-q] and we divide revenue on the tendered network to obtain q'. The upper bound for consumer surplus gains corresponds to the scenario in the previous section where tendering led to increased service quality on both the tendered and block grant networks. Here we divide the upper bound for revenue gains to obtain [q'-q] and we divide the sum of revenue on the tendered and block grant networks to obtain q'.

Table 43: Consumer benefits of tendering in 1992 prices[27]

year	Gains to present users lower bound (£mill)	Gains to new users lower bound (£mill)	Total gains lower bound (£mill)	Gains to present users upper bound (£mill)	Gains to new users upper bound (£mill)	Total gains upper bound(£ mill)
1987	1.2	-	1.2	1.2	-	1.2
1988	2.1	-	2.1	12.2	-	12.1
1989	3.8	-	3.8	9.1	0.1	9.2
1990	2.2	-	2.2	17.8	0.3	18.1
1991	1.9	-	1.9	27.7	1.4	29.1
1992	1.4	-	1.4	26.0	1.3	27.3

The total gain in consumer surplus is the sum of the gains to existing and new users. The lower bound for total gain over the period 1987-1992 is £12.6 million in 1992 prices. The upper bound for total gain over the period 1987-1992 is approximately £95 million.

4. The welfare impact of tendering

The welfare impact of tendering is calculated as the sum of resulting changes in producer and consumer surpluses. This is presented in table 4.4. The change in producer surplus is equal to the sum of cost reductions and generated revenue. The lower and upper bounds for change in producer surplus in table 4.4 correspond to the lower and upper bounds for generated revenue. The lower bound for welfare change is the sum of the lower bounds for changes in producer and consumer surpluses (similarly for the upper bound).

Two upper and two lower bounds are presented: the lower/upper bound for producer surplus

[27]Where there is no entry in the table consumer surplus gain is negligible.

I and corresponding lower/upper bound for welfare change I regards wage reductions as transfers; the lower/upper bounds for producer surplus II and corresponding welfare change II regard wage reductions as efficiency gains.

Producer surplus changes are weighted by the shadow price of public funds: increased producer surplus has allowed a reduction in the level of subsidy to the London bus industry. A weight of 1.21 as suggested by Dodgson and Topham (1983) for use in the appraisal of transport projects is used.

Results

The lowest bound for total welfare gain through tendering over the period 1987-1992 is approximately £50 million in 1992 prices. We note that this figure understates the actual welfare gain. The lowest bound is based on the assumption that wage reductions represent transfers as opposed to changes in welfare. We proceeded by deducting wage reductions from cost savings to get a net cost saving. We did not at this stage take into account the fact that wage reductions allow the freeing of public funds and thus have an impact on welfare. Assuming a shadow price of public funds equal to 1.21 the deadweight losses avoided due to wage reductions total £21 million in 1992 prices over the period 1987-1992. This figure can be added to the lowest bound for welfare change which then becomes approximately £70 million. The highest bound for total welfare gain through tendering over the period 1987-1992 is approximately £330 million in 1992 prices.

This figure actually overstates the welfare gain. There have been severance payments made due to tendering. Although severance payments represent transfers they impact on welfare through deadweight losses associated with raising public money. Detailed data relating to severance payments through tendering is confidential and has not been made available to us. London Transport accounts show total severance payments (*ie* due to tendering and other factors) over the period 1987-1992 were approximately £60 million in 1992 prices. The deadweight loss associated with this figure is £10 million in 1992 prices. This represents an upper bound for the impact of severance payments on welfare.

Welfare gains can be adjusted so that they represent the estimated present value of tendering.

Assume the standard 8% discount rate for public sector projects. The lower bound for the present value of net benefits (taking into account deadweight losses avoided through wage reductions) from tendering over the period 1987-1992 is approximately £90 million. Over the same period the upper bound for the present value of net benefits is approximately £380 million.

Conclusion

The aim in this chapter was to estimate the impact upon welfare of London bus tendering. This has affected producers' surplus both through the reduction of costs and the generation of revenue. Consumer surplus has increased due to service quality improvements. Four scenarios were allowed for, two for alternative assumptions about the impact of tendering on revenue, and for each of these including and excluding transfers away from labour. The present value of the lowest bound for welfare change, corresponding to the lower bound for revenue generated and extracting wage reductions from cost savings, is around £90 million for the period 1987-1992. The highest estimate of present value which corresponds to the upper bound for revenue generated and regards wage reductions as efficiency gains is around £380 million.

Table 4.4: The welfare impact of tendering in 1992 prices.

Year	Change in producer surplus lower bound I (£mill)	Change in producer surplus upper bound I (£mill)	Change in producer surplus lower bound II (£ mill)	Change in producer surplus upper bound II (£ mill)	Change in consumer surplus lower bound (£mill)	Change in consumer surplus upper bound (£mill)	Change in welfare lower bound I (£mill)	Change in welfare upper bound I (£ mill)	Change in welfare lower bound II £mill)	Change in welfare upper bound II (£mill)
1987	3.3	3.3	12.3	12.3	1.2	1.2	4.5	4.5	13.5	13.5
1988	4.8	13.8	19.0	28.0	2.1	12.2	6.9	26.0	21.1	40.2
1989	7.4	11.9	26.4	30.9	3.8	9.2	11.2	21.1	30.2	40.1
1990	7.0	21.4	29.0	43.4	2.2	18.1	9.2	39.5	31.2	61.5
1991	8.1	29.1	35.6	59.4	1.9	29.1	10.0	61	37.5	88.5
1992	8.2	31.8	38.7	62.8	1.4	27.3	9.6	59.1	40.1	90.1

Appendix

When tendering was introduced to London, a decision was made over which type of contract would be offered to tender. The options considered were "cost" and "bottom line" contracts. Under a cost contract London Transport would release a service specification comprising a statement on vehicle age and capacity, the minimum number of departures per time period, and the streets and stands to be used on the service. Firms would be invited to submit bids. These would represent the payment required by the firm to carry out the specified service. All bus revenue would be remitted to London Transport. Under the alternative bottom line contract a service specification would be released. Firms would be invited to submit bids. These would represent the payment from the firm to London Transport in return for the right to operate the specified service and collect revenue from it.[28]

Both cost and bottom line contracts are used by bus tendering authorities outside London (White and Tough 1993). In London it was decided that cost contracts would be offered. This system has continued until 1994. From 1994 bottom line contracts have been offered. We do not have data to test the impact of switching from cost to bottom line contracts. This appendix analyses from a theoretical perspective the impact of the change in type of contract upon social welfare.

Monitoring costs and incentives

Given the divorce between operators and revenue under a cost contract, it was necessary for London Transport to create incentives to ensure good performance. Performance targets were introduced. For example, operators were obliged to achieve a specified level of schedule coverage. Performance was monitored by London Transport. Poor performance would result in financial penalty to operators and possible contract termination.

The structure of performance incentives is different between bottom line and cost contracts. There are a number of possible effects switching from cost to bottom line contracts, the first of these being that after switching the tendering authority might avoid the former requirement for performance monitoring and associated costs. However, it is not necessarily the case that monitoring costs will be reduced if

[28]Bids might be either positive or negative. A negative bid would represent the level of subsidy required by a firm to operate a route.

the tendering authority is a social welfare maximiser. In this case the tendering authority will have different objectives from profit maximising operators. The social welfare maximising tendering authority does not schedule the profit maximising level of bus miles. Hence there are incentives to deviate from service specifications in the absence of performance monitoring. If specified work is to be carried out monitoring is still necessary.

This can demonstrated in the following model. Consider the problem facing a planner attempting to maximise social welfare. Assume that the planner has perfect information regarding demand and supply.[29]

Demand is given by the function

$$Q = Q(p, M)$$

where Q = demand, p = price, M = bus miles. Then consumer surplus, V is given by

$$V = \int_p^{\infty} Q(a, M)\, da$$

Cost is a function of bus miles and passengers carried *ie*

$$C = C(M,Q)$$

Producer surplus is given by

$$\Pi = pQ - C + G$$

where G is government subsidy.

Define social welfare

$$W = V + \Pi - (1+\lambda)G$$

where λ is the shadow price of public funds. Maximising W with respect to p, M *and* G subject to a firm participation constraint (non negative profits) yields the first order conditions

$$(p - C_Q)/p = \{\lambda/(1+\lambda)\}(1/e_P) \quad (1)$$

[29]Results are qualitatively unchanged if the perfect information assumption is dropped. That is, the objectives of the planner and the operator still differ. See Pedersen (1994) for an analysis of transport regulation under asymmetric information.

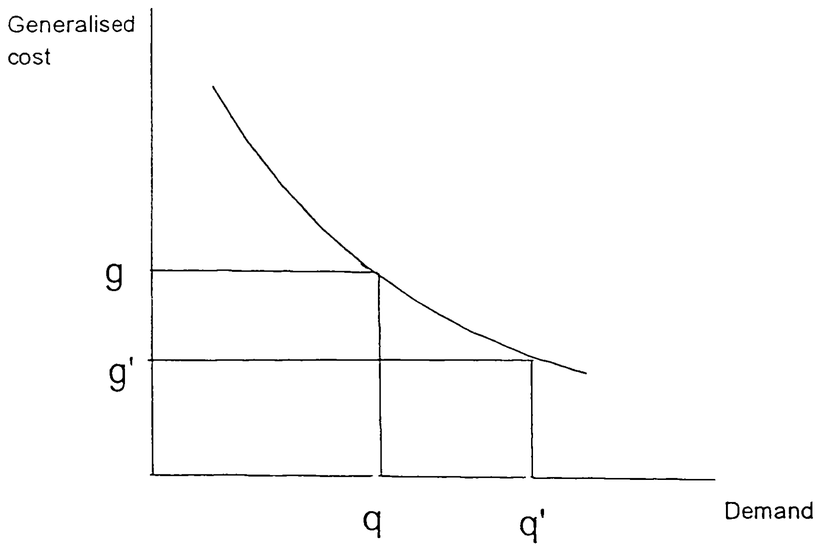
$$V_M + (1+\lambda)(p-C_Q)Q_M = (1+\lambda)C_M \quad (2)$$

$$G + pQ = C \quad (3)$$

Where subscripts refer to first partial derivatives except in the case of e_p which is the price elasticity of demand. (1) is the Ramsey price condition which says that the proportionate deviation of price from marginal cost should be inversely proportional to the price elasticity of demand. (2) says that the social value of an extra mile should equal the social cost. (3) says that the operators rent is zero.

Say that the planner sets an optimal price and output but does not monitor the operator. At the optimal price the operator will not run all scheduled miles. This can be seen by reference to figure 4.2.[30]

Figure 4.2



Say that generalised cost equals g. Hold price constant and increase miles so that generalised cost falls to g', demand rises from q to q'. In calculating the benefits of these additional miles the planner takes into account changes in consumer surplus - the rectangle $(g-g')q$ and the triangle with base $(q'-q)$ and height $(g-g')$ - and changes in producer surplus $((q'-q) \times price)$. This just restates condition (2) above.

[30]For simplicity the following abstracts from welfare losses associated with raising public funds. This abstraction does not affect the result.

On the other hand the firm is only interested in changes in producer surplus. Thus the marginal social benefit of increased miles exceeds the private benefit to the firm for any given price including the social welfare maximising price. At the social optimum where marginal social benefits and costs from extra miles are equal, marginal benefit to the firm is below marginal cost. This means that the planner will set miles in excess of what an unmonitored operator would run. If the optimal level of miles is to be run under a bottom line contract operators must be monitored.

Therefore, there are incentives on the operators to run less than the fully contracted bus mileage, though they may be stronger under cost contracting than bottom line contracting. This was confirmed in the interviews with bus managers, presented in chapter 5. We suspect that switching from a cost to a bottom line contract would not greatly reduce monitoring costs.

This argument assumes that monitoring is undertaken. In order that monitoring is undertaken, the social value of departure from the planned outcome must exceed monitoring costs. In the above example welfare losses occur under a bottom line contract through the failure of operators to run the socially optimal level of miles. There are other ways in which incentives under a bottom line contract are not consistent with a socially optimal outcome. It has been suggested that when operators have revenue incentives *cutting in* and *hanging back* may occur (Foster 1985, Foster and Golay 1986).

Cutting in takes place when two buses are competing for custom and one cuts in front of the other at a bus stop in order to pick up the passengers at that stop. This situation may ensue where there is congestion which results in buses becoming bunched together. Foster and Golay demonstrate that profit maximising firms will attempt to avoid bunching. To the extent that this is unavoidable due to congestion, cutting in may prevail in the absence of legislation or contractual specifications relating to this practice. This may be a case for monitoring: cutting in is dangerous and undesirable, hence the tendering authority may wish to prevent it through the contract which would in turn require monitoring.

A bus hangs back if it moves slowly along the route to the point where it is just ahead of the bus behind. Assume a route where bus traffic is dense and passenger arrivals are random. Say that there is a demand shock such that demand on a particular bus is lower than was expected. In order to make up revenue this bus may race on and compete for custom with the bus ahead. Foster and Golay suggest that greater profits can be made by hanging back in order to pick up passengers who would have caught the bus behind. The result of these kinds of incentives is that buses will deviate from their timetables. Possibly more importantly, passengers already on buses will suffer delays to journeys. From a welfare perspective, the disutility incurred through journey delays may be high. In the London bus industry of the 1830's, it was the disutility of delayed passengers which prompted legislation against hanging back (Barker and Robbins 1975 p.34-35).

There is a third area where incentives may change between the two types of contract. Under a cost contract there is a divorce between operators and passengers. The operators objective is to run bus miles. The operator is not concerned with the outcome in terms of passenger miles. Where operators have revenue incentives (as in the bottom line contract) they must try to attract customers. Glaister and Beesley (1985a, 1985b) argued that in a deregulated system this would lead to operator innovations in fare, frequency, route and bus size. A tendering system based on bottom line contracts would not facilitate these operator innovations.

There is, though, another way in which operators can attract custom. Hibbs (1993) argues that drivers are an important means of securing additional revenue: customers are drawn by a friendly or smartly attired driver. By training and through incentive schemes operators can encourage drivers to attract customers. In this way switching from cost to bottom line contracts could improve the quality of bus services. However, it is not clear that operators do not encourage drivers to act in the above ways under a cost contract. In a series of interviews with London bus company managers reported in chapter 5, it was claimed by the managers that great efforts are made to ensure that drivers are welcoming and smart. This to the extent that one company employs plain clothes inspectors to monitor drivers. Also what is not clear is the rationale for operators to act in this way. It could be that firms perceive an element of discretion in tender awards. Then the behaviour above may be an attempt by operators to enhance their reputation with London Transport in the hope of winning future tenders. Alternatively firms may be acting in anticipation of alternative systems - either bottom line contracts or deregulation - and attempting to build up links with customers or train staff in advance.

London Transport Finances

Revenue risk is borne by the tendering authority under a cost contract and by operators under a bottom line contract. In the case of a cost contract tendering authority surplus is the difference between revenue and the contract price. This is as opposed to the bottom line contract where tendering authority surplus is the contract price. Tendering authority surplus will be eroded under a bottom line contract if operators are risk averse (and hence bids incorporate risk premia). This worsens the position of the tendering authority if it is less averse to risk.

Bidding for a bottom line contract may be modelled as a common value auction. In a common values auction, agents bid for an object which has common but uncertain value. Assume that bidders are risk neutral and that each bidder makes an unbiased estimate of the object value. Then (in a first price sealed bid auction) if the bidder with the highest estimate is naive, he wins the object and is a victim of the winner's curse. This bidder fails to recognise that his signal is a biased estimate of the true value of the object for sale given that he holds the highest estimate, and he submits a bid which yields negative expected profit. A rational bidder will take into account the fact that winning the auction is an informative event. If all bidders are rational then the average sale price will tend towards the true value of the object for sale as the number of bidders becomes large (Wilson 1977). Now assume that bidders are risk averse; as the number of bidders grows large the average sale price will be less than the true value of the object for sale by an amount equal to bidders' risk premium.

This can be seen as follows. The proposition is that risk aversity amongst bidders will reduce expected selling price by an amount equal to a risk premium. This can be demonstrated using the following model which is taken from Smith (1981). Operators bid for a common but uncertain stream of revenue (R). Each operator ($i = 1, 2, ..., n$ where n is the number of bidders) makes an unbiased estimate z_i of R. Call the maximum of these estimates x; this has pdf $h(x / v, n)$. R has pdf $p(.)$. Hence x and R have joint pdf $f(v, x / n)$ where

$$f(v, x / n) = h(x / v, n)\, p(.)$$

Smith assumes that the marginal utility from revenue is constant. Assume here instead that operators have a utility function $U(.)$ and that $U'>0$, $U''<0$. Then an operator making a bid b gains expected surplus:

$$\int_0^{\infty} \int_0^{b} (U(R) - b) f(v,x|n)\, dx\, dR$$

Maximising this function with respect to b yields the optimal bid. This has the feature that it is bounded above by $E(U(R) \mid z=x)$, that is the expectation of revenue utility conditional upon a win. This is intuitive: a bid in excess of $E(U(R) \mid z=x)$ would yield negative expected surplus and hence could not be optimal. As the number of bidders grows large the expected selling price tends towards the upper bound (Wilson 1977). For risk averse bidders $E(U(R) \mid z=x) < E(R \mid z=x)$, the difference between the two represents the risk premium. Thus the presence of risk aversity reduces the expected selling price.

If the tendering authority is risk neutral it bears risk without a premium. Thus transfer of revenue risk to risk averse bidders reduces tendering authority surplus without reducing the cost of risk borne by the tendering authority.

The questions then arise: are firms risk averse and is the tendering authority risk neutral? McAfee and McMillan (1988 p.11-15) argue that firms are likely to be risk averse. There are a number of reasons for this. Although shareholders may reduce exposure to risk by holding a portfolio of assets it does not follow that they will be risk neutral. Stock prices tend to move together (with the business cycle) so that shareholders cannot avoid investment risk through diversification of share holdings. Investors are subject to *undiversifiable* or *market risk*.[31] Therefore risk averse shareholders require firms also to be risk averse.

Risk aversity may also occur where a firm has a small number of owners each with a large investment. In a situation of uncertainty these owners are subject to large potential losses contingent on adverse outcomes. Consider the case of a bus company with a small number of owners operating a number of routes under bottom line contracts. Assume that revenue is correlated across routes. Assume also that in the event of low revenue realisation the bus company will become bankrupt and that assets will be sold off quickly for less than their true value. In this situation risk averse owners will require the company to act in a way that is risk averse.

[31]See Brealey and Myers (1991 p.136-139) for a discussion of risk diversification.

McAfee and McMillan cite a third source of risk averse behaviour by firms. Consider the case of a firm controlled by a manager where the manager's utility depends upon the success of a particular project with uncertain returns. Assume that there is monitoring failure so that the manager has scope to pursue personal objectives. If the manager is risk averse then the firm will be risk averse.

Turning now to the tendering authority, assume first of all that it is financed by the government. Mcafee and McMillan argue that the government is a risk neutral body because it pools risk over a large number of projects. Alternatively government risk is borne by taxpayers who are many in number so that the risk borne by any individual is negligible. This latter idea is developed by Arrow and Lind (1994). They assume a situation where a taxpayer has a share in a (public) asset with uncertain returns. The value of this share to the tax payer is less than the certainty equivalent *ie* he is risk averse. Call the return to investment B which can be divided into $\underline{B}$ and X where $\underline{B}=E(B)$ and X is a random variable with zero mean. Say that the population comprises n agents who each bear a proportion of risk equal to $(1/n)X$. The total cost of bearing risk X is n times the cost associated with bearing risk $(1/n)X$. Arrow and Lind show that for large populations this cost tends to zero implying that the government is risk neutral.

In summary, there are arguments to support the assumptions of risk neutral government and risk averse firms. It seems reasonable to extend the risk neutrality assumption to a tendering authority which is funded by the government. Alternatively the tendering authority may be regarded as not subject to risk premiums because it pools revenue risk over all routes in the bus network. To the extent that route revenues in one period are positively correlated, revenue risk can be diversified over time.

In this situation the tendering authority can bear revenue risk or lose an amount equal to the private sector cost of bearing risk. The former corresponds to a cost contract, the latter to a bottom line contract.

Off bus revenue is derived from various bus passes and travelcards and concessionary fare subsidy. Under a cost contract off bus revenue accrues to London Transport. Under a bottom line contract off bus revenue is allocated amongst bus operators. There must be a criteria for allocation. London Transport proposes to allocate to an operator a proportion of the off bus revenue related to the ratio of passenger miles run by that operator to network passenger miles. London Transport estimates the administrative cost of operating this system will be around 4% of off bus revenue. This will be deducted from off bus revenue prior to allocation between operators.

Say that buses are procured through a cost contract and that expected bus revenue is equal to R. Now change the contract type to bottom line. Assume a common values model with risk neutral bidders. Also a method of allocating off bus revenue with administrative costs as above. It was stated above that in a common values model with a large number of risk neutral bidders the sale price of the item tends to its actual value. This must be less than R by an amount equal to the cost of administering the allocation system. Compare this to the outcome under a cost contract where London Transport receives all revenue; this has expected value R. Although London Transport receives a portion of off bus revenue under a bottom line contract this does not compensate the loss implied above because it only covers the cost of administering the allocation system. In relation to the case of the cost contract, London Transport surplus is eroded by an amount equal to the cost of administering the allocation system.

Alternative Contracts

Glaister and Travers (1993 p.48-49) note that in the context of rail franchises an alternative has been proposed to a bottom line contract: to award franchises based on a Chadwick-Demsetz contract. Demsetz (1968) considers the case of an increasing returns industry. He argues that there are potential gains from awarding a monopoly franchise via a competitive bidding process. If this process takes the form of a first price sealed bid auction for monopoly rights monopoly profits are transferred to the government. If on the other hand a level of subsidy is announced by the government and bidders submit a price at which they would be prepared to supply output, given that there is bidding competition productive efficiency is achieved and consumer surplus is maximised given the level of subsidy. This is the essence of the Chadwick-Demsetz contract.

However, under the London Bus cost contracting regime the policy has been to set consumer prices - for both buses and the Underground - centrally: the most efficient firm is selected through the bidding process. Thus the Chadwick Demsetz contract does not seem to offer any advantage over the cost contract in this context. Under the Chadwick Demsetz contract revenue risk is borne by operators. For risk averse bidders bids would incorporate risk premiums; the cost of bearing revenue risk would be passed on to the consumer in the form of higher prices. Given a risk neutral tendering authority the cost contract is superior to the Chadwick Demsetz contract in this respect. Whereas the cost contract facilitates an integrated fare system and associated travelcards and other benefits (see Gwilliam, Nash and Mackie 1985), this would not be possible under a system where bidders compete on the basis of price.

Summary

Switching from cost to bottom line contracts does not allow monitoring costs to be escaped: incentives under bottom line contracts are such that operators have to be monitored to make sure that all scheduled miles are run and that buses are run on time. There are limited ways that operators can generate revenue given that price and output are fixed. Drivers may be oriented towards customers under a bottom line contract but, to an extent,this was already the case in London under cost contracts and so there is limited gain in this respect by switching between the two. Switching from cost to bottom line contracts reduces social welfare by an amount equal to the cost of administering revenue allocation amongst operators. This amount was estimated by LT to be 4% of total revenue. The erosion of social welfare would be compounded if bidders were risk averse; bidders would incorporate a risk premium into bids, the result being lower contract prices.

5 AN ATTITUDE SURVEY

Introduction

This chapter relates a series of interviews with managers and other organisations involved in the London bus industry. Some questions cannot be answered using the data sets in the previous chapters. For example, though the data showed that costs have been reduced it did not show why or where cost reductions had taken place, though the data showed that service quality had increased it did not show the extent to which service quality might be further improved under alternative systems. The broad aim of this chapter is to focus on these types of areas and thus complement the data analysis in previous chapters.

One objective of the research was to find out how, in the view of managers, the 1984 London Regional Transport Act has affected the industry. Hibbs (1991) adopted this methodology in an analysis of bus deregulation outside London. In the present study a broad cross section of managers - from the London Bus subsidiaries, the ex National companies, private sector operations (in and outside London) - were interviewed. They were asked about: the state of the industry prior to tendering; if tendering led to change; where change occurred; how change has affected labour relations.

Another objective of the research was to investigate management perceptions of the tendering system. Managers were asked: does the TBD accept bids made on alternative specifications?; is the resource cost of making a bid high?; are LBL bids unfairly subsidised?; are awards fair?; is monitoring effective?; is the TBD responsive to suggested innovations after contracts have commenced?

Two outer London authorities, the Transport and General Workers Union, and the London Regional Passengers Committee were interviewed. In contrast to the structured approach taken with company managers, these interviews were more informal. Representatives of these organisations were asked for their general perceptions of tendering.

Data collected by interview were written up and sent to the interviewees for verification of accuracy and correction as necessary.

It is important to note that all views expressed here are reports of those of the interviewees, not necessarily those of the author.

Research

The Situation in 1985

It was suggested in the White Paper *Public Transport in London* (Department of Transport, 1983) that the London bus industry was inefficient before 1985. Managers of ex National and LBL companies were asked if they agreed with this.

One of the ex National managers came into the public sector from a background in industry. He described working in the public sector as "like [being on] a holiday". He stated that heavy subsidy supported a large degree of inefficiency.

An alternative view, expressed by another of the ex National company managers, was that pre- 1985 levels of subsidy reflected the non-commercial objectives of the National Bus Company rather than gross inefficiency. Local authorities paid the company to provide unremunerative but "socially desirable" services. Having said this, the same manager conceded that there was scope for raising efficiency above 1985 levels.

There was consensus that the National companies would have been in no position to compete on a commercial basis in 1985 without significant innovation.

There was agreement amongst the LBL managers that before tendering took place the London bus industry was highly inefficient. One manager stated that the operation was organised to benefit staff rather than passengers or taxpayers. The high level of inefficiency was generally attributed to poor management. This was compounded by the highly bureaucratic nature of the company. There was little scope for innovation given these factors. Furthermore there was little incentive for innovation. Monitoring was bad, accountability was poor, there was little in the way of incentive structures.

The Pressure For Change

Managers were asked to what extent cost savings - on both the tendered and block grant networks - resulted from tendering. The reason for this question was that other changes, apart from tendering, resulted from the 1984 London Regional Transport Act. So for example the formation of LBL led management to be devolved to smaller accountable units with clearly stated and measurable goals. This signified the introduction of a new set of principal agent relationships which may have contributed to cost reductions: much of the inefficiency in former nationalised industries may be attributed to unclear, shifting, multiple and contradictory objectives and associated poor monitoring systems. The present study was concerned to discover if in the eyes of managers the industry was inefficient before the 1984 Act, and which of the changes ensuing from this Act were important in bringing about cost reductions. Note that the distinction between the tendered and block grant networks is important here: new principal agent relationships were introduced on both networks whereas competition was only introduced on the tendered network.

All managers from the ex National companies stated that change occurred as a result of the need to achieve commercial viability. Companies were forced to become more cost efficient in order to compete in tendered and deregulated markets. One manager suggested that the changing nature of company objectives and related cuts in mileage were the catalyst for change. This led to massive restructuring. It was the combination of commercial requirements and the environment of change that led to efficiency gains.

It was generally agreed amongst LBL managers that tendering did lead to cost reduction. They argued however that this must not however be overstated and suggested that restructuring of LBL led to cost reduction. Many gains, they said, can be attributed to new management with increased powers brought in at this time. New salaries, perks and prestige had a strong effect on management motivation. More effective monitoring was introduced and there was a higher degree of accountability. Managers thus argued that it was *corporatisation* which led to increased efficiency. Corporatisation involves the introduction of new managers with new objectives and monitoring systems. The potential impact of corporatisation may be understood with reference to chapter 1. For a review of corporatisation in Europe see Bös (1993)

Managers stated that they were striving to innovate in preparation for privatisation and deregulation rather than as a result solely of tendering. One manager provided evidence of cost savings on the block grant network which suggested that unit costs will soon be lower here than on the tendered network. Another manager pointed out that these gains are an indirect result of tendering. Companies have aimed to improve efficiency in order that routes will not be put out to tender [32].

Cost Reduction

Heseltine and Silcock (1990) identify the following components of cost reduction following deregulation of buses outside London:increased labour productivity; reduced wages; lower maintenance costs, due to the introduction of small buses and the subcontracting of maintenance to the commercial vehicle trade; lower rental costs through the closing down of depots and replacement with less sophisticated out of town sites; lower capital costs due to the drastic fall in expenditure on new buses.

The managers of LBL and ex-National companies were asked to identify areas in which cost savings had been made.

Managers from both the LBL and ex National companies linked efficiency gains with increases in labour productivity. The latter came about through renegotiation of what had formerly been restrictive agreements. New rosters made better use of labour time.

Many managers drew attention to the reduction of slack in the overhead. This has been achieved largely through increased productivity in management. Many jobs have been lost in this area. In support of this point one LBL manager said that between 1986 and 1993 his company had undergone expansion whilst at the same time reducing the number of frontline managers by 50%. Further gains were attributed to increased efficiency in engineering. It was widely recognised by LBL and ex National managers that companies have reduced costs by shifting to out of town locations and rationalising depot facilities. An example of rationalisation was provided by an ex National manager. He described how his company had lowered costs by closing five of six worker canteens with an annual subsidy of £100,000, and by moving out from the garage to a yard in the countryside. The new operation resembled that typical of the private sector companies surveyed.

All LBL managers contended that wage reductions had contributed to cost reductions. One LBL manager stated that "tendering is an exercise to worsen pay". Other LBL managers agreed that wage

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[32]Although LBL managers did not draw attention to this, cost savings accrued through the introduction of one person operation buses, small buses, and route restructuring, according to London Transport studies.

cuts were a significant source of saving. In the National sector this was less the case, managers said that workers have not suffered unduly through changes in pay and conditions.

The impact of tendering on labour relations

In the ex National companies there have been very few difficulties. In one company there was a two week strike attributed by the manager to "luddites". He suggested that the lack of labour difficulties is related to generous earnings and good job security. All managers in this sector claimed that cost reductions have been achieved through increasing productivity rather than reducing wages.

LBL managers associate tendering with wage cutting. In evidence presented to the House of Commons Transport Committee a manager from LBL stated that a typical wage fall due to tendering is 16% of the basic weekly rate (House of Commons 1993). At the same time the hours associated with the basic week have not fallen. This implies that the hourly rate has fallen by at least 16%. Overtime enhancements have been reduced so that hourly overtime rates must also have fallen by at least 16%. These figures were put to LBL managers and there was general agreement that they are reasonable estimates. It was argued by them that the move away from the former relatively favourable position for the workers has involved skirmishes and hard negotiation. There have also been two major industrial disputes.

There is the further point that tendering creates an unstable environment. Workers now have little in the way of job security. The result is low worker morale. This has rubbed off on managers who also feel low morale. One manager spoke of his anguish at seeing workers with thirty years in the company leaving in tears in order to save a penny a mile on the contract. A number of managers suggested that low worker morale undermines attempts to improve service quality. Levels of absence through sickness are rising. There are difficulties in retaining staff, this is forecast by management to get worse as conditions in the job market change. Drivers represent companies on the road, they are the most important element of the company according to one manager. Low worker morale can be bad for relations between operators and passengers.

LBL managers pointed out that the negative impact on workers is dampened by generous severance payments from LBL. Workers accept voluntary redundancy and immediately start working with one of the private sector companies. Employees in LBL companies which win contracts do not benefit in this way; they are subject to new pay and conditions without compensating severance payments.

One manager argued that job losses through failure by an LBL company to win the contract for a route which it formerly operated provided an opportunity to rid the company of workers resistant to change.

Managers of the private sector companies say that morale in their companies is good. This is due to the fact that pay and conditions in the private sector are "generous". Also workers are often new to the industry and so have not experienced the changes of workers in the public sector. It is the legacy of past privilege rather than pay and conditions now which has caused labour difficulties.

At one company labour is recruited from the long term unemployed. Staff recruited from LBL companies are subsidised by severance payments. In both these cases workers are content and low morale is not present.

One manager attributed good labour relations in his company to management style. He said that he has a good personal relationship with each of his employees and that they regard themselves as working for him rather than for a faceless bureaucracy.

The Tendering Process

Tendering and specification

Companies must submit a compliant bid. In addition they are invited to submit alternative proposals. The purpose in asking managers about the response to their alternative proposals was to find out to what extent tendering embraces commercial judgement.

All managers bar one said that they have often submitted bids based on specifications alternative to the one put out by the tendered bus division. The TBD is often responsive to these innovations. However, one manager argued that there was no incentive to innovate in this way because the TBD would take alternative proposals and ask all operators to bid on them *ie* there is no edge to be gained by submitting alternative proposals. Another manager complained that sometimes perfectly good proposals were rejected. He argued that these are proposals which would have been implemented in a deregulated environment. The result is that cost saving or revenue increasing opportunities are foregone.

Resource cost of bidding

There was a variety of views here. Two managers said that the massive amount of work required in putting together a bid sometimes discourages them from competing for a tender. On the other hand, some managers stated that there is no difficulty in putting a bid together.

LBL bids

Managers where asked if they thought that LBL bids are made on a commercial basis. This question was to find out if managers perceive LBL as having any advantages or disadvantages in the bidding process. The perceptions of management are important: if it is felt that LBL does not bid on a level playing field with other operators then the tendering system may be undermined. For example, an operator may be dissuaded from bidding if he feels that LBL bids are made spuriously low by subsidy leaked from the block grant network. If this were to happen the number of bidders in the tendering process would fall and the contract price may then increase (see McAfee and McMillan, 1988, for a discussion). Whether or not LBL bids are actually (rather than perceived to be) made on a commercial basis is also important. If LBL bids are subsidised from the block grant network for example, then it may win contracts without being the lowest cost bidder. Award of contracts in this way would have a negative overall impact on London Transport finances relative to awarding contracts to the lowest cost bidder. We return to this point after first outlining management perceptions of the bidding process.

Managers from the private and ex-National companies unanimously believed that they are not fairly treated compared with LBL. There were repeated allegations that LBL bids are based on marginal costing: in effect, LBL cross-subsidises bids using resources paid for on the block grant network.

Until recently LBL was not penalised for poor performance on the block grant network. Non LBL managers[33] believed that LBL uses resources from the block grant network to improve coverage on

[33]Non LBL refers to private and ex-National.

the tendered network. Private sector companies must buy extra resources relative to LBL in order to ensure good coverage. This allows LBL bids to be artificially low they argued.

A common suspicion amongst the non LBL managers was that LBL bids have been based on historic cost property rents rather than the much higher current market values. This is facilitated because LT owns LBL properties. Low property rental rates represent a subsidy to LBL. In addition to this non LBL managers alleged that LBL bids have been based on uncommercially low profit margins. Non managers were aware of the rules designed to make LBL act as if it were a commercial company but suggested that the rules are not applied.

Non LBL managers agreed that the views above were based on suspicion rather than fact. We have suggested that the presence of such views is important because it may undermine the faith of bidders in the bidding process and hence the level of bidding competition. We suggested that it is also important to know if these suspicions have any basis in fact. To this end we refer to interviews with and documents provided by the audit department of London Transport. Bids from the LBL companies are vetted by the LBL Bus Management Meeting and passed on to the TBD if they conform to the bidding rules. The TBD refers bids which appear to be too low to LT audit. LT audit assesses bids on the basis that: (i) they must be based on fully allocated cost (as opposed to marginal cost); (ii) they must incorporate a 5% margin on turnover; they must be based on market value property rental rates. On the whole, according to the LT audit department, LBL bids have been found to conform to these rules. They say that there is little evidence of LBL shifting resources between networks in order to avoid contract failure on the tendered routes.

Fairness of awards

The same points as above apply here. If tender awards are perceived by managers to be unfair (in the sense that they are not to the lowest cost compliant bidder) then they may be dissuaded from bidding, the extent of bidding competition will then fall and contract prices may rise. If tender awards are not to the lowest cost compliant bidder then the tendering process is not efficient. We outline management perceptions of how tender awards are made before proceeding to the London Transport view of what really happens.

A number of managers questioned the service quality standards set by the TBD. The feeling here was that awards are based too much on cost at the expense of service quality. "Cowboy operators"[34] have been awarded routes. Better quality operators feel that they cannot compete on these terms and are discouraged from entering the tendering process.

Many managers suggested that the trade off between price and quality constantly shifts. This makes bidding difficult. Managers make attempts to reduce costs to the minimum but fail to win a contract because the TBD opts for a price premium and higher service quality.

This is not to say that service quality should be discounted in awarding a contract. One manager with experience of operating both in tendered and deregulated markets stated that tendering provides a mechanism for regulating service quality and hence avoiding problems witnessed outside London.

Interviews revealed a belief amongst managers from all company backgrounds that the TBD objective is not simply to select the lowest cost compliant bid. Some managers believed that the TBD takes into account political factors and favours certain operators. This is facilitated by the non transparency of awards. It was commonly suggested by managers that what passes as a compliant bid is at the discretion of the TBD, and this is - in their view - another way in which bids can be engineered. It was alleged that the TBD may reject a bid as non compliant in order that a favoured operator be awarded a tender. Finally, several managers expressed the view that routes to be tendered may be chosen where the public sector clearly has an advantage or disadvantage, thus tending to determine the tender outcome in advance. There was, rightly or wrongly, clearly suspicion of the TBD among managers.

LT memoranda document the way that bids are appraised and awards made. Bids are checked for compliance with service specification. Compliant bids are evaluated on grounds of workability. This involves analysis of proposed running times, number of vehicles, hours worked, wages. Past performance of companies on tendered routes, the degree of experience, and the level of commitment are important factors at this stage. The several lowest cost compliant and workable bids are compared on grounds of service quality. The bid with the desired price service quality mix is chosen. LT memoranda relating to actual awards that were made show that: (i) low bids have been rejected on

[34]This is the terminology of one of the managers.

grounds of non compliance; (ii) the lowest cost compliant bid is in general selected. LT dismisses as unfounded managers allegations that tender awards are unfair.

One LBL manager alleged that private sector managers are in contact with each other. All private sector managers agreed that this is the case. One manager said that a small amount of information on relative costs is exchanged. Another manager went so far as to say that private sector managers do each other "favours". Managers get together and decide who will bid for each route. We cannot however substantiate claims private sector managers have acted collusively.

Monitoring

All but one of the managers interviewed criticised the system of monitoring performance after commencement of a contract. Monitoring leads to "rough justice". It is "appalling", "terrifically bad", "silly and pedantic".

It was suggested that there are too many monitoring criteria and that the system of monitoring imposes a massive cost on the operator (this is because the operator must carry out self monitoring in order to avoid contract failure). One manager did point out that new technology will soon revolutionise the monitoring process.

Monitoring criteria are not consistent with the provision of the best quality service. One example of this that came up repeatedly is the case when a bus leaves the last stop on time and arrives early at the next stop. Where this stop is a monitoring point the bus waits on the road until it should have arrived and then lets off passengers. This is very inconvenient for the passenger.

Post Award Innovation

There was a general feeling amongst managers that the TBD was unresponsive to innovations proposed after the commencement of a contract. Innovations were either rejected or took a long time before they were given the go ahead. Numerous examples were given. A request to add one extra duty per week at a cost of £10,000 to £20,000 per annum was approved one year after it was submitted. It took four months for TBD approval of a timetable change that was clearly in the interest of passengers. There was general agreement that the rewards for innovation are insufficient.

Broad Attitudes

Bureaucracy

Two managers talked about the myth of bureaucracy and suggested that the TBD was actually a very commercial unit. However, all the other managers suggested that the tendering has become increasingly bureaucratic. There are now many people involved. The TBD is not autonomous; it is interlinked with many other LT departments. Although some leading members of the division are well liked by managers, relationships have become increasingly impersonal. There is very little contact between the TBD and the operator after the start of a contract.

Delay in approving contract innovations cited above may be attributed to bureaucracy.

The monitoring process is highly bureaucratic. Lack of flexibility in the system, which may be seen as a result of bureaucracy, has been described above. Another case is where an operator consistently under performs due to circumstances outside its control, for example if road works on a route are causing congestion. Operators inform the TBD of the problem. Every four weeks a letter is sent from the TBD to the operator stating that quality service indicators show contract failure and action must be taken. This kind of correspondence wastes time and undermines operator managers perceptions of the TBD.

Group Planning

We asked bus company managers about TBD responses to operator proposals to find out how responsive the TBD has been to market judgement. When an operator suggests a service innovation it is referred through the TBD to the Group Planning department at London Transport. On the whole managers tended to express strong negative opinions about this department. They argued that: Group Planning has significant power and little accountability: it is not proactive in the way that operators would be in a deregulated environment; that Group Planning has "very little feel for the industry"; that "rather than work in the real world they rely on computer models"; they are "driven by a socialist[35] agenda to provide a network of services at any cost". In addition it was argued that decisions are subject to the sanction of political forces within LT and that small errors made on every route by Group Planning comprise a massive aggregate error. Such errors are not corrected. Innovations are

[35]Socialist in the sense that social rather than commercial goals are pursued.

often rejected for no apparent reason in the view of bus company managers. The result is that bus services do not meet passenger demands.

The ensuing situation is one of tension between operators and LT. Managers said that they want to make innovations but these are barred by Group Planning. London Transport was referred to as "The Golden Palace" and Group Planning as "the enemy" by one LBL manager. He suggested that after all the restructuring that has taken place in order to devolve responsibility it is ironic that tendering has increased the power at the centre.

The Nature of Tendering

One manager from the private sector believed that the tendering system has worked well in London and is the best form of future organisation. This view was not typical however. Managers generally tended to see tendering as labour contracting. As such they argued all gains from tendering have been realised. There is no scope for further raising labour productivity. Wages cannot be reduced any more. In fact tendering has benefited from conditions in the labour market. A number of managers pointed out that the success of tendering might be undermined when the labour market picks up and subsequently contract prices rise. The difficulties that companies are having recruiting labour at current wage rates was cited by managers as evidence to back up this assertion.

Tendering is a planned bus system. One private sector manager argued that in a planned bus system, passengers are made to fit in with services which are centrally dictated. He went on to say that the emphasis in a planned system is on keeping costs down rather than providing a good service. There is an ethos amongst planners that passengers do not matter; this results because there is no market pressure on planners to provide a good service. Tendering was called "old hat" by one LBL manager. Other managers from LBL reported that gains on the block grant network (where managers have scope to innovate) now run far ahead of those on the tendered network. As a result costs will soon be relatively lower on the former in some LBL companies. LBL managers warned that the tendering system does not encourage the innovation necessary if these gains are to spread to presently tendered routes. A planned system is not directed towards growth. A private sector manager with experience of bus operations both in and outside London argued there is little scope for pursuit of growth within a planned bus system: a service which fulfils passenger demand comes about as the result of frequent and often expensive innovation. Such innovation is, it was argued, not possible in a planned system because of the constraints of public sector finance and bureaucracy. In the case of London, where managers allege that LT objectives and operator incentives are geared to cost reduction, the result is that there is much unexploited potential. There was agreement amongst managers that the only beneficiaries of this system are small and non innovative. There was a call for a new system of providing bus services from the great majority of managers interviewed.

Other Organisations

Local Authorities

Representatives from two outer London authorities were interviewed.

At one authority there was the belief that buses can never meet public transport needs because the transport system is over congested. To the extent that buses might play a role, potential is not fulfilled. This is because bus services are controlled by LT, an organisation which is seen by this authority as regimented, conservative, and unresponsive to local needs.

The other authority expressed contrasting views. Here it was believed that local needs are well catered for. The authority enjoys good relationships with both LT and local bus companies. It was pointed out that it is important to know the right people in these organisations.

It was agreed by both authorities that there has been a perceptible increase in bus service quality since tendering commenced. In one authority this statement is borne out by evidence from a recent Mori poll in the area. This showed that in 1993 two thirds of people felt that the quality of service is good, 13% described it as poor. This is compared to 1990 , when 31% rated services as poor, and 41% felt they were good. One LBL manager pointed out that the services in this area were predominantly on the block grant network during the period in question.

Both authorities favour a system of tendered rather than deregulated bus services. It was argued that deregulation would lead to declining vehicle quality and road congestion. The negative aspects of the situation outside London were highlighted.

An additional interview, with the Association of London Authorities (ALA) was conducted. This body agreed that tendering has led to better bus services: bus reliability and frequency has improved. The introduction of non-red buses in London, which came as a result of tendering, has reduced bus patronage. There is concern over the age profile of buses, which is regarded as too old. LT could do more to cater for the disabled and women with children, and also to get buses into local shopping/office centres. LT is centralised and impractical. These problems can be worked out within the tendering process. The ALA view is that deregulation will have a negative impact (this is based on the experience outside London). They advocate instead the extension of tendering to the whole London network.

The Transport and General Workers Union[36]

Tendering has affected the London bus industry in the following ways:

- employees wages have been reduced.

- employees are required to work long hours. This has resulted in increasing breaches of Driver's Hours Regulations.

- the infrastructure has been damaged. 24 bus garages have been closed down and replaced by depots with "third world" facilities.

- as a consequence of the factors above, worker morale is at a low.

- this is compounded by the perceived unfairness of tendering which stems from the confidentiality of the bidding process. Confidentiality also means that workers do not find out if wage cuts were fully justified (a contract might have been won with lower wage cuts).

- driver training standards have declined.

- medical requirements for drivers have been relaxed.

Although wages and conditions have declined for bus workers, there have been few industrial disputes.

[36]Views were given by a union officer.

The reasons for this are:

- workers were not aware of the impact that tendering would have on pay and conditions. Hence there was little support for industrial action.

- formation of the LBL subsidiaries narrowed the extent of any potential industrial action.

- strike action would simply result in contract award to the private sector and loss of members' jobs.

Tendering is described by the union as "a periodic auction of jobs, wages and conditions".[37] As such, it has benefitted from the recession. At present dissatisfied workers have little in the way of alternative job opportunities. When the job market picks up there will be a mass exodus of workers, and London's bus services will be in disarray. The union is motivated by responsibility to its members, and a "social conscience". The union strategy is to lobby politicians and try to mobilise the general public. It is hoped that this will bring about a public enquiry and subsequently a revised transport policy based on an alternative to both tendering and deregulation.

The London Regional Passengers Committee

The London Regional Passengers Committee was set up under the 1984 LRT Act to represent the interests of passengers on services operated by or on behalf of LT and British Rail in the London area.

The representative for this organisation stated that there have been significant increases in service quality and that these are attributable to tendering. He argued that service quality increases have resulted from stringent service specification and effective monitoring/enforcement of contractual obligations. The tendered network has kept step with passenger demands due to its innovative nature.

In addition to service quality increases, tendering has allowed the continuation of: an integrated network; the support of loss making services by cross subsidy; travelcard (the implication was that travelcard would not survive in an environment of deregulated bus services).

[37]This argument is laid out in more detail in Fuller (1992).

It was suggested that deregulation would lead to a lack of integration and information, and harmful competition with no compensating benefits.

Evidence presented to the Transport Select Committee

Representatives from various parties involved in the London Bus Industry presented evidence to the Transport Select Committee on the subject of bus deregulation (House of Commons, 1993). The evidence is summarised in this section.

The Independents

This group of managers came either from the ex National or private sector companies (one ex National, two private sector). They set out by describing the virtues of the tendered system in London: it has led to increased service reliability (operator incentives are geared towards providing a quality service); it has allowed LT to control the age profile of buses; consequently patronage has increased; it has yielded costs savings; tendering combines the benefits of planning and competition.

Some of the independent operators talked of the unyielding nature of the London tendering process. It was described as a "regime". Managers feel frustrated that any changes must go through bureaucracy. There is little commercial freedom in a tendered system. It was suggested that contract length should be extended to provide a greater degree of certainty surrounding investment decisions. Also that LT should act to increase the availability of mid life buses. It was argued that LBL should be privatised in order to put this company on an equal footing with the independent operators.

Negative aspects of deregulation were highlighted: that it will lead to reductions in mileage on socially necessary but commercially unviable services; bus mileage will increase on profitable routes, although this will do little to benefit the passenger (these routes are already well served) it will lead to increased road congestion; that there will be a loss of networking and coordination, this will lead to a breakdown in the provision of information and as a result reduce bus patronage; the travelcard will not survive; fares will increase on services which are presently subsidised; companies would suffer due to the declining bus market. To counter this, deregulation would lead to increased commercial freedom. This could result in service innovation which would be beneficial to the passenger. One company stated that "[subject to high industry entry standards and the presence of an adequately funded tendering authority] deregulation is best for passengers".

LBL Subsidiaries

Evidence presented by managers of the LBL subsidiaries reflected the views expressed in the interviews summarised above. It was stated that: tendering led to cost savings (through changes in pay, productivity and overheads) and service quality increases; there are no further cost savings to be gained through tendering; the gap in service quality between the tendered and block grant networks has been closed; restructuring of LBL and preparation for privatisation have contributed to increased performance by the LBL companies.

The tendering system was referred to as "planning led". It was agreed that the Group Planning department at LT is out of touch with customers and bus company staff. Planners impose schemes upon operators which take no account of commercial judgement. The result is a system of bus services which are costly and/or detrimental to the bus passenger. It was argued that the planning and operation of bus services should be linked rather than divorced by increasing layers of bureaucracy. Deregulation would tie bus services to the market, resulting in the provision of a better service (through increased passenger choice, service quality, quick response to changing passenger needs). Deregulation would remove the uncertainty inherent in tendering, unit costs would fall. There are means by which all the problems associated with deregulation can be overcome: the "socially necessary" network can be supported by external funding; vehicle quality standards can be regulated; congestion is not seen as a potential problem because buses make up a small proportion of total traffic (on roads which are heavily trafficked by buses some kind of quantity restriction may be required); the technology required for the continuation of travelcard has been developed; information and marketing can be provided by a central authority.

The LT response

Representatives of London Transport were invited to comment on the research findings presented in this chapter.

London Transport strongly contested the argument that gains on the block grant network are independent of tendering. They argued that such gains would not have occurred in the absence of tendering. Again it was argued that the threat of tendering spurred managers to good performance.

It was suggested to us by London Transport that we might try to find a relationship between block grant network performance and proportion of business tendered for each LBL operating unit in order to test the hypothesis that managers have responded to the threat of tendering. We do not feel however that this would allow us to say anything meaningful. We would not be able to distinguish whether managers responded to the threat of tendering or, the reverse, that the TBD avoided tendering routes from companies which were well managed. What we can say is that tendering has led to an average 16% cost reduction. The implication is that there are gains which can solely be attributed to tendering. The cost savings presented in section III may understate the full cost reduction attributable to tendering depending on the extent to which tendering indirectly reduced costs on the block grant network.

The allegation that the TBD selects "cowboy operators" cannot be justified according to LT: the objective is to gain value for money, with a significant emphasis being placed upon service quality. Evidence of this is that performance standards have been higher on tendered than block grant routes. As regards the claim that the trade off between price and service quality constantly shifts, this is fallacious: there has been no significant policy change in this matter.

Allegations that contracts are awarded to "favoured" operators are wrong.

Although monitoring can be irksome for operators, this is necessary if contractual obligations are to be checked. It is a requirement imposed upon LT by the Secretary of State for Transport. The constraints placed upon operators by monitoring will be eased as new technology is introduced.

The activities of Group Planning were defended by London Transport. LT argued that Group Planning is a responsive body. Operator proposals are considered and when deemed worthwhile they are implemented. LT argued that many proposals do not pass simple value for money tests. In a deregulated environment where operators would have to bear revenue risk, proposals would also not be implemented. LT suggested the tension between operators and planners is natural because planners reduce management discretion and that the adverse comments by managers should be seen in this context.

London Transport did not agree that the tendered system has failed to be demand orientated. They argued that there have been progressive reviews of tendering, leading to increased scheduled mileage, increased road coverage, extensive use of mini buses, more "workable" routes. The bus network has in fact been almost completely revised over the period of tendering. The result, claimed London Transport, is that supply and demand are better matched.

A Department of Transport view

A senior official from the Department of Transport was asked about his perceptions of tendering.

In the early 1980's the Government adopted a policy of market testing provision of services by the public sector. The 1984 LRT Act may be seen in this context. It was suggested that the state of the London bus industry was bad in the early 1980's. There existed "producer domination" and as a result costs were above market levels. The 1984 Act provided scope for market testing of transport provision in London. It was to result in competitive tendering for bus services, a "half way house" to the alternative of full bus deregulation.

Under section 6(1) of the 1984 Act LRT was obliged "in the case of such activities carried on by them as they may determine to be appropriate invite other persons to submit tenders to carry on those activities for such period and on such basis as may be specified in the invitation to tender". Thus LT was given discretion. It chose to tender for bus services because this was feasible; there existed potential competition for bus service provision in London.

The objective of tendering was to reduce costs - both on tendered routes and in the LBL subsidiaries - whilst maintaining the level of service quality. This was both an end in itself and preparation for the privatisation of LBL in a deregulated bus market.

Cost reductions were to be achieved through productivity gains.

It would not have been sufficient solely to restructure LBL. Competitive tendering and the associated threat of job loss was required in order for the union to make concessions over restrictive practices and wage cuts. It was envisaged that this would involve some industrial relations difficulties.

The Department of Transport was consulted by LT about tendering after the 1984 Act. Since then it has audited the tendering process. For example, it has checked LBL costing of bids (although some LBL bids were lowered by block grant resource leakage this was allowed on the basis that severance payments would be reduced). Around 1986/87 the Department put pressure on LT to speed up the rate of tendering. Tendering proceeded at a slower pace than the Department suggested in order not to decimate the LBL subsidiaries.

LT severance payments due to tendering were generous but not out of character with the public sector. Severance payments ease industrial relations problems and may be seen as a short term cost in the face of long term benefits.

The Tendered Bus Decision has continued to run unprofitable routes. This may seem "puzzling" in the face of financial pressure and pressure from operators, but the routes may yield social benefits, and ministers have instructed LT to run a comprehensive service.

Whereas buses outside London where deregulated under the 1985 Transport Act, deregulation in London was deferred. This can be attributed to the monolithic nature of LBL at the time of the 1985 Act and the size of London. Deregulation was politically sensitive, particularly because its effects were uncertain. More recently deregulation has been postponed because of its politically sensitive nature. New legislation would be required in order to deregulate the London bus market.

Bus tendering in London has been a success. Cost savings have been achieved with surprisingly few industrial relations difficulties. At the same time as costs have been reduced, service quality has been increased.

Conclusion

Managers agreed that the London bus industry operated inefficiently in the period before tendering was introduced. They suggested that tendering did lead to cost savings. Cost savings stemmed from increased productivity and reduced overhead costs. Wages also fell as a result of tendering. This is one reason for TGWU opposition to tendering. Wage reductions did not on the whole lead to major industrial disputes. Rather, argue LBL managers and the TGWU, the impact of lower wages was on worker morale. Some managers argue that cost savings would have been achieved in the absence of tendering on the basis that block grant network costs fell after the 1984 LRT Act. LT dispute this and argue that gains on the block grant network are a result of tendering.

There are perceptions amongst managers of bus companies involved in London bus tendering that the system is unfair, either because LBL bids are subsidised or because tenders are not awarded to the lowest cost bidder. The system does actually operate efficiently. Such perceptions are important because operators may be discouraged from bidding for tenders. If they do not bid contract prices are likely to rise. This problem could be partly solved by privatisation of the LBL companies which should dispel suspicion about the relationship between LBL and LT. Managers complain that monitoring is bureaucratic and not consistent with the best quality of service although LT reject these allegations.

Finally, we may refer back to the debates over bus deregulation where Beesley and Glaister (1985a p.133) concluded "there can of course be no objective test as to which view [in favour of deregulation or competitive tendering] is correct". Debates about the relative merits of tendering and deregulation have surfaced in London in the form of a tension between operators and planners stemming from disputes over service innovation. London Transport defends tendering as a system which is responsive to consumer demand and are supported in this view by local authorities and the London Regional Passengers Committee. Many bus company managers argued that this is not the case, rather that a lack of service innovation is inherent to tendering and that a new system of providing bus services is required.

6 BUNDLING OF CONTRACTS

Introduction

It has often been the case that geographically inter related sets of routes have been tendered together. Firms are invited to submit bids on all individual routes in the bundle and to submit a bid on all routes together (a "combination bid"). LRT minimises procurement cost across the bundle. This may involve an award based either on individual or combination bids. In the latter case a firm may make the lowest bid for a particular route but not win that route.

This chapter will compare two auction mechanisms: procuring routes individually; procuring routes as a bundle. The aim is to use bidding data to find the optimal mechanism from these two in the case of London bus tendering.

A bid for an individual route is termed a "stand alone" bid. Glaister and Beesley (1991) suggest that in some instances LBL did not make serious stand alone bids; their strategy was to bid high for individual routes - sufficiently high so that bids had no chance of succeeding - and low for bundles. Given that LBL had lowest costs on some, but not necessarily all, routes in a bundle, and the presence of some scale economies, non serious bidding by LBL may have vetoed an award made on the basis of stand alone bids. The result could have been a failure to allocate individual routes to the lowest cost bidder. In this situation, the tendering authority might have done better by withdrawing the combination bid option.

To illustrate this, consider an example with two bidders (A,B) and two routes (1,2). Costs are as presented in the table, so for example the cost to bidder A of operating route 1 is 50.

	route 1	route 2	routes 1 & 2
bidder A	50	70	119
bidder B	70	50	119

Note that there is a very small scale economy for both bidders. Allow bidders to bid for route 1 and route 2 and routes 1 and 2 together. Say that bidder A bids non seriously for the individual routes.

Then in any standard auction model (eg private values, common values) the auctioneer will minimise procurement cost by awarding both routes to one bidder, even though this is inefficient. The auctioneer would do better by withdrawing the option to make a combination bid, auctioning the routes as single objects and allocating route 1 to bidder A, route 2 to bidder B.

In section 1 of this chapter, a model of bidding in a simultaneous auction is presented. The problem is presented as one of mechanism design. Two mechanisms - routes are auctioned either as a bundle or individually - are compared. It is demonstrated that bundling allows the tendering authority to gain if scale economies are present. This must be offset against the loss from bundling, which is the failure to award individual routes to the lowest cost bidder. In actuality, both of the mechanisms analysed were implemented simultaneously. By bidding non seriously, LBL chose which one of these mechanisms would be operative. The operative mechanism was bundling, due to the LBL bidding strategy. Bundling may not have been the optimal mechanism.

Why did LBL bid non seriously? This question is discussed in section 2. It is argued that the motivation for non serious bidding stemmed from the LBL status as incumbent bidder with short term capacity constraints. The present analysis may therefore be widely applicable, for example to competitive tendering in general, where there is typically a public sector incumbent bidder. In section 3 a numerical example is provided to show how, in the context of the preceding discussion, the LBL strategy could affect the outcome of the bidding process. Did LBL choose the optimal mechanism as far as the procurement authority was concerned? This question is considered in section 4. In contrast to theoretical examples presented by Bernheim and Whinston (1986) and Anton and Yao (1993), in the present *real* situation optimal bidding behaviour led to a Pareto sub optimal outcome.

1. Bundling and Procurement Cost

This model is adapted from Gale (1990). Gale shows that in a simultaneous sale of franchise contracts it is optimal for the seller to bundle, given that values are superadditive.[38] Superadditivity means that the profits earned by a firm for a number of contracts are greater than the sum of profits if the same

[38]Bundling is defined as constraining the outcome of the simultaneous auction such that all contracts are awarded to one bidder.

contracts were held by a number of firms. It will be demonstrated here that in a simultaneous procurement setting bundling is also optimal, although the new result is, motivated by assumptions about cost technologies rather than monopoly power.

Assume two risk neutral bidders bidding for N bus routes to be allocated according to *(n, N- n)* ie. n routes to bidder 1, N-n routes to bidder 2. Each firm holds a cost signal which may be regarded as a random variable drawn from a distribution with supports $[\underline{c}, \bar{c}]$ and pdf = $f(c)$. This can be taken as representing the cost to that firm of operating one route. For routes of unequal size, the cost signal represents the cost per bus mile. An alternative interpretation is that the cost signal represents the estimated cost to the firm of operating one route. In the former case cost differences between firms are differences in actual operating costs, the model is one of independent private values. In the latter case all firms share a common but unknown operating cost and cost signal differences represent differences in estimated operating cost.[39]

Both the private and common value models may be relevant in bus tendering. The common values model may be applicable because there are uncertainties about costs. There are considerable uncertainties in bidding for bus routes. For example: achievable road speeds; the level of breakdowns; factor prices and productivity throughout the life of the contract. On the other hand if firms know their own expected costs (that is, unlike the winner in a common value auction they do not on average underestimate costs) then the private values model is relevant. Some authors have modelled procurement in a common value framework (eg. Theil 1988) whilst others have adopted a private values framework (eg. McAfee and McMillan 1988 p.63).

Assume for now that costs are linear i.e. $c_i^n = nc_i$ where c_i is firm i's cost signal, c_i^n is the cost to firm i of operating n routes (i=1,2, n ε[0,N]). This simply means that firms are price takers in factor markets, and that marginal/average cost are constant and equal (ie. there are no scale economies or diseconomies).

[39]See McAfee and McMillan (1987a) for a discussion of independent private values and common value models. In the common value case of the present model, it would be possible to allow updating of cost estimates based on information as in, for example, Myerson (1981). This does not add anything to the analysis, which is restricted to the first price sealed bid auction mechanism.

Optimality of bundling can be demonstrated in an incentive compatible direct revelation mechanism. In a direct revelation mechanism each agent reveals a cost estimate, is subsequently paid by the auctioneer and allocated a number of routes. In an incentive compatible direct revelation mechanism each agent truthfully reveals their cost estimate. The revelation principle states that for any auction mechanism there is an incentive compatible direct revelation mechanism with the same outcome. Thus the incentive compatible revelation mechanism can be used to mimic the optimal mechanism (for more details see McAfee and McMillan (1987a) and Myerson (1979)).

Define

$$V_1 = \int_{\underline{c}}^{\bar{c}} x(c_1, c_2) f(c_2)\, dc_2 - \int_{\underline{c}}^{\bar{c}} \Sigma c_1^n\, p^n(c_1, c_2) f(c_2)\, dc_2 \tag{1}$$

$x(\cdot)$ = payment function to bidder 1
$p^n = p$ (bidder 1 gets n contracts)
V_1 = expected surplus to bidder 1.

The first term on the right hand side of (1) is the expected payment to the operator, the second term is the operator's expected cost.

Expected surplus must be maximised under truthful revelation (the incentive compatibility constraint) and be non negative (the participation constraint) in a feasible mechanism.

In addition the function p must satisfy the following probability constraints:

$$p^n(c_1, c_2) \geq 0, \sum_{n=0}^{N} p^n(c_1, c_2) = 1; \text{ for } n = 0,1,..,N; (c_1, c_2) \in C^2$$

Say bidder 1 has signal $c*_1$ but reveals $c_1 < c*_1$.

$$V_1(c_1) = \int_{\underline{c}}^{\bar{c}} x(c_1, c_2) f(c_2)\, dc_2 - \int_{\underline{c}}^{\bar{c}} \Sigma\, c*_1^n\, p^n(c_1, c_2) f(c_2)\, dc_2$$

$V_1\ (c_1\ )$ is surplus to 1 given untruthful revelation.

Let $c*_1 = c_1 + dc_1$. Incentive compatibility requires

$$V(c*_1)\ - V(c_1) \geq dc_1 \frac{dV_1}{dc*_1}(c*_1;c_1,p,x)$$

$$V(c*_1)\ -\ V(c_1) \geq dc_1 \int_{\underline{c}}^{\bar{c}} \Sigma\ \frac{dc*_1^n}{dc*_1}(c*_1;c_1,p,x)\ p^n$$

Dividing by dc_1 and taking the limit as dc_1 approaches zero gives

$$V'(c_1;p,x) \geq \int_{\underline{c}}^{\bar{c}} \Sigma\ \frac{dc_1^n}{dc_1}\ p^n(c_1,\ c_2) f(c_2)\, dc_2 \tag{2}$$

Now say that c_1 is reported when the signal is $c_1\text{-}dc_1$. Repeating the exercise above reverses the inequality and implies (2) holds with equality. Hence we have a differential equation in V which can be solved

$$V_1(c_1\ ;\ p,x)\ =\ V(\bar{c}\ ;\ P,x)\ +\ \int_{c_1}^{\bar{c}} \int_{\underline{c}}^{\bar{c}} \Sigma\ \frac{dc_1^n}{dc_1}\ p^n(c_1,c_2) f(c_2) dc_2 dc \tag{3}$$

In an optimal mechanism $\quad V(\bar{c}\ ;\ p,x)\ =\ 0 \quad ,\quad$ this term may be dropped from (3). Expected expenditure by the auctioneer is given by the first term on the right hand side of (1). Call this X. Substitute for V_1 from (3) into (1) to give

$$X\ =\ \int_{\underline{c}}^{\bar{c}} \Sigma\ c_1^n\, p^n\ (c_1,c_2) f(c_2) dc_2 + \int_{c_1}^{\bar{c}} \int_{\underline{c}}^{\bar{c}} \Sigma\ \frac{dc_1^n}{dc_1}\ p^n(c_1,c_2) f(c_2) dc_2 dc \tag{4}$$

The auctioneer must minimise $2X$ in an optimal mechanism.

Sale As A Bundle

Impose a bundling constraint so that all outcomes except the award of all or no routes are barred ie.

$$\hat{p}^0(c_1, c_2) = \sum_{n=0}^{N} \frac{c_2^n}{c_2^N} p^n(c_1, c_2) \quad (5)$$

$$\hat{p}^N(c_1, c_2) = \sum_{n=0}^{N} \frac{c_1^n}{c_1^N} p^n(c_1, c_2) \quad (6)$$

where the left hand side of (5) is the probability of winning no routes, the left hand side of (6) is the probability of winning all routes.

These are valid because they sum to one:

$$c_1^n = nc_1 \rightarrow \frac{c_1^n}{c_1^N} = \frac{n}{N}$$

$$\hat{p}^0 + \hat{p}^N = \sum_{n=0}^{N} \left(\frac{c_1^n}{c_1^N} + \frac{c_2^n}{c_2^N} \right) p^n(c_1, c_2) = \sum_{n=0}^{N} \left(\frac{n}{N} + \frac{N-n}{N} \right) p^n(c_1, c_2) = 1$$

Substituting these constraints into (4) gives

$$X = \int_{\underline{c}}^{\bar{c}} c_1^N \hat{p}^N f(c_2)\, dc_2 + \int_{c_1}^{\bar{c}} \int_{\underline{c}}^{\bar{c}} \frac{dc_1^N}{dc} \hat{p}^N f(c_2)\, dc_2 dc \quad (7)$$

Substituting (6) to the first term on the right hand side of (7) gives

$$\sum \frac{c_1^n}{c_1^N} c_1^N p^n(c_1 , c_2) = \sum c_1^n p^n(c_1 , c_2)$$

Substituting (6) to the second term on the right hand side of (7) gives

$$\frac{dc_1^N}{dc_1} \sum \frac{c_1^n}{c_1^N} p^n(c_1, c_2) = N \sum \frac{c_1^n}{Nc_1} p^n(c_1, c_2) = \sum \frac{c_1^n}{c_1} p^n(c_1, c_2)$$

Hence (7) is equivalent term by term to (4). Call the bundling case a "bundling auction", and the non bundling case an "non bundling auction". Revenue is equivalent between the bundling and non bundling auctions: the auctioneer does not raise procurement costs by offering tenders in a bundle given that costs are linear.

The model above does not yield to an analysis of the case where there are economies of scale. Assume instead that[40]:

$$c_i^N \leq c_i^n + c_{-i}^n \quad (8)$$

$$\frac{dc_1^n}{dc_1} \geq \frac{dc_1^N}{dc_1} \frac{c_1^n}{c_1^n + c_2^n} \quad (9)$$

[40] $-i$ in (8) reads *not i*. Assumptions (8)-(11) are taken from Gale.

$$\hat{p}^N = \sum \frac{c_1^n}{c_1^n + c_2^n} . p^n \quad (10)$$

$$\hat{p}^0 = \sum \frac{c_2^n}{c_1^n + c_2^n} . p^n \quad (11)$$

(8) models scale economies. It states that production costs over n routes are lower for one than two producers. (9) states that a producer with less capacity is affected proportionately more by an increase in c_I. (10) and (11) sum to one ie. they are the bundling constraints.[41] Repeat the steps from the linear cost case. (7) now dominates (4) term by term; a bundling auction is the optimal mechanism if there are scale economies.

Say that the auctioneer procures routes in a first price sealed bid bundling auction. For the private value case above this is optimal given that reservation prices are optimally set (Myerson, 1981).[42] Let b_i^j denote the bid by bidder i on route j and b_i^N the combination bid by i $(i=1,2, j=1...n)$. From the results above, we have that

$$\min\,(b_1^N, b_2^N) \leq \sum_{j=1}^{N} \min\,(b_1^j, b_2^j) \qquad (12)$$

There is a simple intuition for this result. The optimal mechanism awards each route to the lowest cost bidder. This is achieved under bundling in the above model where it was assumed that one bidder has

[41]Compare (10) and (11) with (5) and (6). It might seem that the first model is the edge case of the second. This is not true; the cases are equivalent only when cost signals are equal. However, the result in the linear cost model does not require this assumption.

[42]Note that for the common value case the procurement authority can do better tendering via an alternative mechanism, eg. the English auction (Milgrom and Weber 1982).

lowest costs on all routes. Where costs are linear there is no gain or loss to the procurement authority due to bundling. Where there are scale economies these are reflected in a combination bid and hence bundling reduces procurement cost.

The choice of a bundling auction by LBL in the above model would not adversely affect London Transport. With linear costs London Transport is indifferent between bundling and non bundling auctions. With scale economies London Transport prefers a bundling auction.

Drop the assumption that one bidder has lower costs on all routes. Now allow i's cost signal to vary by route in order to model the possibility of route specific shocks. The cost signal is still a random variable with pdf and supports as before. Assume that there are no scale economies. Using the reasoning in Palfrey (1983)[43], since the sum of minimum costs is always less than or equal to the minimum of the sum of same costs we have that

$$\min\,(c_1^N, c_2^N) \geq \sum_{j=1}^{N} \min\,(c_1^j, c_2^j) \qquad (13)$$

Assume still that routes are to be allocated through a first price sealed bid auction. If costs are linear, it follows from (12) that bidders will adopt the bidding strategy for a single object auction in forming stand alone bids.[44] It then follows from (13) that

$$\min\,(b_1^N, b_2^N) \geq \sum_{j=1}^{N} \min\,(b_1^j, b_2^j) \qquad (14)$$

Bundling prevents selection of the lowest cost supplier for every route except in the case where one supplier has the lowest cost on every route. Hence procurement cost under bundling is at least as great

[43] Actually, inverting the reasoning, because the present case is a procurement auction.

[44] This is not the case if there are diseconomies of scale: bidders can do better by adopting randomised strategies (Engelbrecht Wiggans and Weber 1979, Lang and Rosenthal 1991).

as that under not bundling and bundling is no longer the optimal auction mechanism.[45]

With scale economies and route specific shocks, which of inequalities (12) and (14) holds depends on which of the scale economies and route specific effects dominates. In cases where LBL forced a bundling auction through non serious bidding, this would only have been optimal for the auctioneer if the impact of route specific shocks on costs was small relative to the impact of scale economies. McMillan (1994 p.151) states "theory sometimes shows that there are effects that work in opposite directions from each other, and data are needed to establish which effect is likely to be dominant." The path we follow now is not to derive theoretical conditions (which do not yield testable propositions), rather, we test which of inequalities (12) and (14) holds in the present bidding situation.

2. Motivation for Non Serious Bidding

Consider an incumbent firm bidding for the opportunity to carry on operating in the market. Say that the market can be divided into parts. It can then be auctioned off either in parts or as a bundle. In the case of London bus tendering the market would be a network of routes and the incumbent firm would be LBL. Assume that a network of routes is to be tendered, that LBL is the incumbent firm, and that LBL capacity is adjusted to the network of routes. Assume further that LBL faces costs in adjusting capacity. Given a choice, LBL would prefer a bundling over a non bundling auction in order to avoid these adjustment costs.

Costs of adjustment here fall into two categories: real costs of adjustment, due to sunk costs; managerial disutility associated with changing capacity. Taking the first of these, if factor markets work imperfectly, loss of routes could leave LBL with excess capacity. For example, LBL could be left with excess garage space after loss of routes. Alternatively, LBL costs may be sunk due to its public sector status. An example of this might be a garage which cannot be quickly sold because sale

[45] Although we have assumed that route specific shocks are independent draws from a distribution, it is clear that the (13) holds for both positively and negatively correlated firm specific shocks.

would involve a long bureaucratic process. Again, loss of routes would leave LBL with excess garage capacity.

Turning now to adjustment costs associated with managerial disutility, if a manager has a strong preference for maintaining capacity, he or she maximises expected utility by competing in a bundling - as opposed to a non bundling - auction. Managerial resistance to changing capacity can stem from a variety of sources. Management utility may be decreasing in effort; an input of management effort is required to change capacity. Management utility may be a function of prestige; prestige is eroded as firm size is reduced. Another possibility is that managers aim to maintain the size of their workforce. Failure to win a contract results in job loss which can be bad for worker morale and company performance. Managers may also try to avoid workers' job loss because they have personal relationships with workers (Kennedy et al 1995 p.128).

3. Non Serious Bidding Leads to Bundling

In order to show how LBL would have been able to veto stand alone bids, a simple numerical example is presented. Assume that ten routes are to be tendered and that these are to be allocated between LBL and one other operator. Assume that each firm has a route specific cost and that LBL has a cost advantage on five routes. There are various sources of route specific cost advantage, we will assume that the LBL advantage stems from the geographical relationship between the routes and its garages. Say that this advantage is such that the LBL *dead time* (time driving between the garage and the end of the route) is half an hour per bus less than the other operator. Assume that the cost per bus hour of operation is £10 and that twenty buses are required to operate each route. The LBL advantage in setting down costs is then £200 per day for each route, approximately £70,000 per year or £350,000 per year over the five routes where it holds the advantage. A non serious LBL bid would not reflect these route specific advantages. Assume that the non LBL bidder has a £350,000 advantage on the remaining five routes in the bundle. The tendering authority can either make an award based on stand alone bids or combination bids.

Assume the following bidding strategies, which are consistent with the analysis of section 1 and this section: when routes are auctioned individually, bidders regard each route as a single object and bid accordingly making serious stand alone bids, that is, they adopt the Nash bid for a first price sealed bid auction (see, for example, McAfee and McMillan 1987a); in a bundling auction, bidders regard the set of routes as a single object and bid accordingly, as above, they adopt the Nash bid for a first price sealed bid auction; where bidders may make stand alone and combination bids, LBL makes non serious stand alone bids, other bidders make serious stand alone bids, when making a combination bid all bidders regard the bundle as a single object and adopt the Nash bid for a first price sealed bid auction.

In the linear cost case without route specific shocks the combination bid of LBL is equal to the combination bid from the non LBL company which is equal to the sum of stand alone bids of the non LBL company. With non serious bidding, the sum of LBL stand alone bids exceeds the LBL combination bid. The procurement authority will award the bundle to LBL - based on the LBL combination bid - or the non LBL company. Non serious bidding does not adversely affect the tendering authority.

Now take the case with linear costs and route specific cost shocks. Non serious bidding by LBL gives London Transport the option of awarding all routes to the non LBL firm based on stand alone bids or all routes to either firm based on combination bids. London Transport will be indifferent between these options because the sum of stand alone bids by the non LBL firm will be equal to its combination bid which will be equal to the LBL combination bid. If there are scale economies then combination bids will be lower than the sum of the non LBL firms' stand alone bids and London Transport will make an award based on combination bids. In both these cases the outcome is sub optimal: the procurer would ideally award five routes to each operator. The second case is the important one for the present analysis: the non serious bidding by LBL means that awards are based on combination bids only. Thus there is an LBL bidding strategy which allows it to compete only in a bundling auction.

4. Case Study

This section is based on data from bus tendering in London. It relates to the Harrow network of bus routes. There were eleven contracts for tender and five operators bidding. LBL made stand alone bids for all eleven contracts and also a combination bid. LBL won all eleven contracts based on its combination bid, the value of which was over £5 million per annum.

In addition to stand alone bids and a bid for the bundle, LBL made a bid for the bundle but with one route dropped, and this for each route in turn. The difference made to the total bid by dropping a route must represent the difference made to operating cost by dropping that route. Call this the avoidable cost of the route. The relationship between bid and avoidable cost for each route is presented in table 1. Row A shows the mark up of the stand alone bid over avoidable cost as a %. Row B shows the avoidable cost as a proportion of the stand alone bid. Row C shows the size of the route as indicated by the vehicle requirement.

The mark up of the stand alone bid over avoidable cost varies greatly in percentage terms (from 39 to 339%). In absolute terms (not shown) the mark up shows very little variation: it appears that in constructing stand alone bids LBL adds a fixed amount on to avoidable cost, an amount sufficiently large to make LBL stand alone bids uncompetitive. It is reasonable to regard this fixed amount as garage, administration and engineering costs at network capacity. Then the avoidable cost of a route relates to wages, capital rental cost, fuel, maintenance and mark up associated with the route.

Table 5 London Buses Limited's bids for routes in the Harrow network.

Routes	1	2	3	4	5	6	7	8	9	10	11
A Mark up of bid over avoidable cost (%)	59	339	39	80	138	66	55	134	78	176	128
B Avoidable cost as a proportion of bid (%)	63	22	72	56	42	60	63	43	56	36	44
C Vehicle requirements for route (number)	12	3	17	11	4	8	10	6	10	5	6

We can use avoidable costs to gain an idea of what the outcome would have been if London Transport had restricted auctioning to a non bundling mechanism. Assume for now that LBL is not capacity constrained. Find the garage/engineering/administration costs for the operation at network capacity by deducting the sum of avoidable costs over all routes from the combination bid. Assume that these costs are divisible; this is a reasonable approximation based on evidence from the bus industry which generally shows that the extent of scale economies is very small (see for example Walters 1981, Tauchen, Fravel and Gilbert 1983, Viton 1981). In particular, evidence from London bus tendering further supports the assumption that these costs are divisible (House of Commons 1993, chapter 5 of this thesis). Allocate the garage/engineering/administration costs across routes in proportion to route size as indicated by the vehicle requirement and add this to the avoidable cost.

Assume (12) in section 1 holds with equality, so the combination bid is equal to the sum of stand alone bids. We know the LBL combination bid and can estimate serious stand alone bids from LBL using avoidable cost data. To disaggregate the combination bid, we add to the avoidable cost for each route garage/engineering/administration costs. This gives a proxy for the set of LBL bids in our hypothetical situation of a non bundling auction where there is no option to make combination bids.

Summing across routes the lowest stand alone bid (including the proxy LBL bids) gives the following results; London Transport procurement cost would have been approximately £370,000 per annum less than the amount it actually paid LBL to operate the routes; contracts would have been awarded to five operators. The potential cost saving through withdrawal of the bundling auction option can be understood in terms of the discussion in section 1 of this chapter; the lowest cost firm varies by route due to route specific cost shocks, there is a failure to select the lowest cost operator for each route when routes are bundled. In terms of section 2 of this chapter it is the presence of route specific cost shocks that facilitates vetoing of stand alone bids.

The potential cost saving through withdrawal of the bundling auction option can be understood in terms of the above discussion; the lowest cost firm varies by route due to route specific cost shocks, there is a failure to select the lowest cost operator for each route when routes are bundled. It is the presence of route specific cost features that facilitates vetoing of stand alone bids.

A reasonable shadow price of public funds to apply in transport project appraisal is 1.21 (Dodgson and Topham 1987). If we apply this shadow price to the potential cost saving from focusing exclusively on a non bundling auction and assume a 5% discount rate then the net present vale of potential cost saving at the time of contract award over the three year contract life is approximately £1,300,000.

We calculated hypothetical stand alone bids on an assumption of constant returns to scale. Now we allow for increasing returns to scale in the following way: regard an $x\%$ scale economy as increasing the previously calculated hypothetical stand alone bid by $x\%$. Then at least a 10% scale economy is required in order that gains from bundling are non negative. To reiterate, we have no evidence for a scale effect of this magnitude.

Return to the assumption above that LBL is not capacity constrained. Recap that in section 2 it was argued that capacity constraints stem either from sunk costs or some aspect of managerial utility. If non serious bidding results because a manager has a preference for a network, withdrawal of the option to make a combination bid would remove the motivation for non serious bidding; a company making non serious bids would not win any routes. Evidence from London bus tendering suggests that it is managerial preference rather than *real* sunk costs which motivate non serious bidding: in an analysis of bid data, Glaister and Beesley (1991) find that LBL stand alone bids for the Harrow network were substantially higher than those predicted on the basis of econometric analysis of all LBL stand alone bids; LBL has made numerous adjustments in the areas of garage, engineering and administration (House of Commons 1992). In this scenario, the £1, 300 000 saving from the withdrawal of the combination bid is a valid estimate.

If LBL capacity is constrained due to sunk costs, this does not mean that combination bids should be allowed. The sunk costs in the case study are the difference between the sum of avoidable costs and the combination bid, approximately £200 000. This does not offset the cost saving from withdrawing the combination bid. A possible solution in this case would be to allow LBL to exclude costs of excess capacity from stand alone bids. Allowing LBL to bid on this basis and withdrawing the option to make a combination bid would lead to the outcome above, namely award of contracts to five operators, a cost saving of £370 000 per annum, this time less any costs of excess capacity at LBL. Further advantages here result from the involvement of more operators: this encourages competition and hence efficiency (Domberger, Meadowcroft and Thompson 1986, Kamecke 1993); information about operating costs by route is revealed, information which is necessary in order to set optimal prices (Pedersen 1994).

Finally, we have considered the alternatives of bundling and non bundling. Cramton (1995) and Chakravorti et al (1995) analyse situations where bidders may bid for portions of bundles. A third option when auctioning off a set of contracts would be to invite stand alone bids and combination bids for a small number of routes in the set. This would reduce the motivation for non serious bidding; non serious bidding would no longer maximise the probability of maintaining market share. It would permit the auctioneer to enjoy the benefit of operator route specific cost advantages and scale economies (although we have argued that the latter will be small).

Conclusion

The starting point for this chapter was the observation that LBL had made non serious bids for individual routes which were part of a bundle. It was suggested that the objective of this strategy was to avoid costs of adjusting operation size, these due to management disutility or sunk costs. The aim of this paper was to determine the impact of this strategy on procurement cost. A model was presented in section 1. It was demonstrated that if costs are linear then auctioning of routes individually or in bundles yields the same expected procurement cost. If there are scale economies the bundling auction is optimal. If there are route specific shocks then auction of individual routes is optimal given linear costs, with scale economies either mechanism might be optimal. A case study was presented and on this basis it was argued that the LBL bidding strategy adversely affected London Transport. In other words LBL chose for London Transport the sub optimal auction mechanism; London Transport would have done better by allowing stand alone bids only.

7 CONCLUSION

London Regional Transport was formed in 1984 at a time when competitive tendering was being promoted as an efficient means of procurement for all publicly provided services. It was believed by the Government of the day that London's bus services were being provided at a considerably higher cost than would be the case if forces of competition could be brought to bear to bring costs down to private sector, competitive market levels. Outside London the Government chose to remove price, quantity and most quality regulation. Inside London the centrally-planned, price-regulated, monopoly service licensing system was preserved, but competitive tendering was progressively introduced through the agency of London Transport. This thesis analyses the outcome of this policy.

Analysis of bid data for London Transport bus service tenders provided no evidence that there are now systematic cost differences between public and private sector bidders. We identified a small fall in real bids over time which may be attributed either to falling real wages, improving labour productivity or technological innovation. The conclusion was that the industry is now in equilibrium. The result is of interest as an earlier study suggested that the industry was, at that time, still in disequilibrium. Thus the public sector firm has made efficiency gains to the extent that there are now no discernible systematic cost differences relative to the private sector.

The estimated cost saving from putting a given route out to tender was confirmed to be 20% on average. It is the same as London Transport's own (non-statistical) estimate and is of the same order as those previously estimated in the contexts of refuse collection and ancillary hospital services. After allowing for costs of administration the estimated cost saving was 16%. This is on a like-for-like basis. But as part of tendering it was often the case that old buses were replaced by more expensive new buses. The estimated cost saving net of administration costs after taking this factor into account is 14%, against which one should set any passenger benefits associated with new vehicles.

In interviews managers from bus companies agreed that the London bus industry operated inefficiently in the period before tendering was introduced. They agreed that tendering did lead to cost savings.

Managers suggested where costs had been saved; these were similar to areas of cost saving in the bus industry outside London after deregulation. Tendering has led to reduced overhead costs: management slack allegedly present before tendering has been eroded and many jobs have been lost in this area; there have been efficiency gains in engineering; it is common for buses to be housed in yards located out of the city as opposed to the former covered inner city depots; expenditure on staff facilities has fallen under tendering. A part of cost reduction has stemmed from wage reductions: a typical wage fall due to tendering is 16% of the basic weekly rate. The Transport and General Worker's Union felt that they have been powerless to act because in a competitive environment industrial dispute results in members' job loss. Fragmentation of LBL through the formation of subsidiaries and lack of awareness over the potential impact of tendering further contributed to the lack of industrial action. The union and managers of bus companies suggest that worker morale is low and that this may make bus service quality poorer than it would otherwise have been.

Our estimate of the financial impact of tendering is based on the analysis of cost and revenue data. The total cost saving from tendering assuming that tendering has led to a 14% net cost reduction *on tendered routes*, is approximately £125 million in 1992 prices over the period 1987-1992.

Estimated revenue gains attributed to tendering are approximately £10 million in 1992 prices over the period 1987-1992. Service quality increased on the block grant network after the introduction of tendering. If service quality increases on the block grant network are attributed to tendering then estimated revenue gains rise to approximately £70 million.

The service quality increases generate consumer welfare gains. We estimated increased consumers' surplus corresponding to the two scenarios for revenue generated by tendering. The estimated increase in consumers' surplus in 1992 prices over the period 1987-1992 total around £12 million on the tendered network and £90 million in the case where tendering is credited with service quality increases on the block grant network.

Finally we estimated an overall welfare balance for tendering. Producer surplus gains are the sum of cost savings and revenue gains. We estimated two welfare balances corresponding to the two scenarios for revenue generated by tendering as above. The welfare gains corresponding to the worst-case scenario, in which we take the cost saving net of estimated wage rate reduction together with the lower bound for revenue generated, is £90 million. For the best-case scenario the gain is £380 million. Both of these figures relate to the period 1987-1992 in 1992 prices and assume compounding at a rate of 8% pa.

If a 14% cost saving had been realised across the *whole* network, then, *ceteris paribus* costs would have been reduced (in 1992 prices) by £84 million per year since 1986, yielding a cumulated cost reduction of £588 million by the end of 1992. The present value of this cost reduction, based on an 8% compounding rate, is approximately £744 million. as opposed to the £125 million (or £170 million when compounded at 8%) we have attributed to cost saving on the tendered network alone.

Some managers argue that cost savings on the block grant network would have been achieved in the absence of tendering. Others dispute this and argue that gains on the block grant network could not have been achieved in the absence of tendering. The estimates of welfare gains just given did not include any credit for cost savings on the block grant network which might be attributable to tendering. Assume equal operating efficiency throughout the period on the tendered and block grant networks and assume that improvements in efficiency on the block grant network are fully attributable to tendering. Then the figure of £84 million per year gives an approximate upper bound for the annual cost saving due to tendering. In this scenario the actual welfare gain would be substantially higher than the estimates we have given. In reality it took a period of years for efficiency on the block grant network to match that on the tendered network so one could only claim the whole of the £84m for the most recent years.

A source of possible over-estimation of welfare gains is severance payments made due to tendering. Although severance payments represent transfers they affect on welfare through deadweight losses associated with raising public money. Detailed data relating to severance payments through tendering have not been made available to us. London Transport accounts show total severance payments (*ie* due to tendering and other factors) over the period 1987-1992 were approximately £60 million in 1992 prices. The deadweight loss associated with this figure is £10 million in 1992 prices. This represents an upper bound for the detriment to the welfare balance due to severance payments associated with tendering.

It was often the case that geographically inter-related sets of routes have been tendered together. Firms are invited to submit bids on all individual routes in the bundle and to submit a bid on all routes together (a "combination bid"). LRT minimises procurement cost across the bundle. This may involve an award based either on individual or combination bids. In the latter case a firm may make the lowest bid for a particular route but not win that route. We argued that the gain from bundling to LT might stem from scale economies whilst the loss stemmed from the failure to select the lowest cost firm for a particular route. Contrary to theoretical predictions by others our conclusion was that bundling of tenders adversely affected LT and that it should not be pursued further.

The analysis of bid data suggested that bidders respond with caution to uncertainty regarding operating costs. We were able to find a statistically significant positive association between the bid per unit output and the level of uncertainty. This conforms to a prediction from the common value model of auctions. On the basis of the estimated relationship between bids and uncertainty we suggest that truthful information about operating costs should be released by LT prior to bidding in order to reduce the level of uncertainty and hence reduce bids.

London bus tendering was, until recently, based on minimum cost as opposed to bottom line contracts. We developed a framework to assess LT's selection of the cost contract in preference to the bottom line contract. We argued that in terms of monitoring costs neither contract type offered an obvious advantage over the other. On the basis that bidders behave cautiously in the face of uncertainty we argued that a cost contract was preferable for London Transport because uncertainty is greater under a bottom line contract. Further, the costs of administering bottom line contracts exceed those for cost contracts because of the additional need to allocate travel card revenue amongst operators. One has to set against this the advantage that bus operators would gain a direct interest in generating new revenues. In the absence of any evidence that this factor would be important enough to be dominant we concluded that the minimum cost contract probably had a more favourable impact on LT finances than a bottom line contract would have done.

In interviews managers from non LBL companies expressed suspicions that LBL bids are subsidised and as such are unfair. Managers from companies of all backgrounds argued that tenders were not always awarded to the lowest cost compliant bidder. Documentation and interviews with LT officials suggested that the system does actually operate reasonably well. There was no convincing evidence that LBL bids were normally subsidised. In a few cases LT Audit had detected invalid bids and the contracts had been withdrawn and renegotiated.

The *perceptions* amongst managers concerning the fairness of the bidding process are important: perceived unfairness may discourage operators from bidding for tenders. If they do not bid contract prices may rise. This problem could be solved by the recent privatisation of the LBL companies which should dispel suspicion about the relationship between LBL and LT.

Managers of bus companies said that they find contract monitoring irksome. They also argued that LT is highly bureaucratic and unresponsive to market judgement. Many managers advocated deregulation of London bus services as a solution to these problems. LT rejected claims that it is unnecessarily bureaucratic and unresponsive to commercial judgement. Thus debates about the relative merits of tendering and deregulation before the 1985 Transport Act have surfaced in London in the form of a tension between operators and planners stemming from disputes over service innovation.

As the impacts of the first rounds of tendering became clear, sceptics within LT and elsewhere must have been surprised. Tendering produced net savings, produced larger revenues and improved service quality. LT expanded the level of service following tendering as a result of the lower costs and the change to the use of a greater number of smaller vehicles. This means that whilst London Buses' market share fell their total volume was little affected. By any standards, the early impacts of competitive tendering were sufficiently encouraging to allow more routes to be tendered. LT appears to have taken seriously the importance of nurturing potential new operators. Over the years from 1984 to 1995, a significant number of private sector operators have tendered successfully for London bus routes. Some of these operators now run several services.

In terms of the bus tendering versus deregulation debate, Beesley and Glaister (1985a, b) suggested that gains from tendering would be less than those from deregulation, also that they would be achieved more slowly. This prediction has been borne out, tendering was introduced gradually and led to an 18% cost reduction, costs have fallen by approximatley 40% under deregulation (Mackie, Preston and Nash 1995). However, greater cost savings achieved outside London do not imply that there are further efficiency gains to be made in London; cost reductions depend on initial positions which may have varied between London and the rest of the country.

There was debate between Beesley and Glaister (1985a, b) and Gwilliam, Nash and Mackie (1985) over which system of providing local bus services - tendering or deregulation - would be of greater benefit to passengers. Under deregulation there has been a rise in real fares since deregulation, this has been accompanied by a 20 per cent increase in bus miles run. Standard theory suggests that this would result in increased ridership due to reductions in passenger waiting times. This has not occurred, possibly due to what White (1990) calls "instabillity effects" - reliability of bus services has fallen, there is a lack of passenegr information, timetabling has been such that extra miles have been wasted in the sense that they do not minimise passenger waiting time. Instabillity effects have led to a decline in ridership of over 20% (Mackie, Preston and Nash 1995). This may be compared to London, where tendering provided consumer benefits due to improved reliabillity of services and allowed continued integration of public transport services.

On the basis that tendering has been welfare improving whereas deregulation has been welfare reducing, tendering may be preferred as the basis for provision of local bus services. By 1993, the Government was confident enough of the tendering process to announce that all London Buses subsidiaries would be privatised. However, the decision to sell off the LBL companies was made in parallel with another decision to abandon - for the foreseeable future - plans for deregulation in the capital.

The Government's reasons for effectively abandoning the move to deregulation have never been explained. No action to deregulate in London had been taken in the years following deregulation in the rest of the country. Then, in November 1993, John MacGregor, Secretary of State for Transport, announced that all of the London Buses subsidiaries were to be privatised. Privatisation would be accompanied by a move to extend tendering. But, crucially, Mr MacGregor concluded that the Government "should continue for the moment to secure further improvements to the delivery of London's bus services through privatisation and by building on the policies which have already achieved major improvements in those services......This means that, although bus deregulation remains our long-term aim for London, we shall not be proposing legislation in this Parliament" (Department of Transport, 1993).

By any standards, the November 1993 announcement looked like the effective abandonment of deregulation in London. This is certainly how the announcement was interpreted at the time. After almost a decade of deregulation in the rest of the country, ministers were clearly unconvinced they could withstand the political consequences of the move to deregulation. Whether or not a future government might return to deregulation. only time will tell.

The process of tendering bus services in London was not introduced entirely without problems. However, they were managed successfully by staff at LT, LBL and in the private companies. Given the politically-charged nature of some of the early debates about the future of bus provision in London, it is a tribute to the professionalism of those involved that the system worked as well as it did. The notion of a publicly-organised and accountable bus system in the capital has remained intact, yet savings were achieved and services improved. What London now has is a system that embraces all the benefits of an organised route network with most of the benefits of private sector management. It is an arrangement that is likely to survive.

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