
Published paper

Preston, J. (1988) *Regulation, Competition and Market Structure: A Literature Review of the Stage Bus Industry*. Institute of Transport Studies, University of Leeds. Working Paper 267

Working Paper 267

April 1988
(Updated October 1988)

REGULATION, COMPETITION AND MARKET STRUCTURE: A LITERATURE REVIEW OF THE STAGE BUS INDUSTRY

J. Preston

This work was sponsored by the Economic and Social Research Council.

1. INTRODUCTION

1.1 Aims

The 1985 Transport Act changed the regulatory constraints imposed on the British stage bus industry and has had important impacts on competition and market structure. In the discussion that preceded and immediately followed the Act a wide range of micro-economic theories and models were developed to explain possible impacts. The general aim of this paper is to review the literature in this field. More specifically, it will be attempted to develop a suitable taxonomy of the different models and theories of market structure that have been developed, common strands throughout the literature will be highlighted and models (and theories) reviewed in light of recent empirical evidence. This paper will act as a background document to subsequent work including an examination of contestability in Hereford (Preston, 1988) and Preston (Mackie and Preston, 1988), the use of games theory to explain competitive outcomes, predatory behaviour, collusion and mergers/acquisitions (Preston, 1989) and an assessment of the role of the minibus (Martinez, 1988, Preston, 1989).

1.2 Outline

Hence, in section 2 regulation theory will briefly be examined. Our starting point will be to examine the history of regulatory constraint of the British stage bus industry. This history will then be re-examined in the light of regulation theory. It will be stressed that the 1985 Transport Act modifies the regulatory constraints rather than removes them all together. The Act also acts as a focus for a number of other changes including the privatisation of the National Bus Company, the commercialisation of PTE and Municipal bus operations, the introduction of competitive tendering and the strengthening of some aspects of regulation (e.g. quality regulation, competition law). Furthermore, the Act was accompanied by the 1985 Local Goverment Act (which abolished the Metropolitan County Councils) and the accompanying reductions in subsidy levels.

In section 3 we go on to review the models of competition that have been developed in order to assess the effect of the 1985 Act. A number of model types are reviewed, including classical oligopoly, horizontal product differentiation, vertical product differentiation and simulation models. It is noted that the welfare implications of all these model types are equivocal. In section 4, the models' implications are then compared with the intitial experience of bus deregulation in Britain. In particular, a number of ambient circumstances and competitive practices with regard to bus competition, so far, are detected.

In section 5 we go on to examine the market structure of the urban bus industry. It is shown that we are dealing, in most cases, with competition amongst the few i.e. imperfect competition. Given this, the theory of contestability is examined and its applicability to the urban bus industry studied. It is shown that, for a number of reasons, the urban bus industry may not be contestable.

In section 6 we attempt to draw some conclusions. Our main finding is that the compexities of the real world limit the usefulness of micro-economic models based on over simplifying assumptions. A possible way forward, using game theory and based on conventional oligopoly (or duopoly) models, is suggested.

1.3 Characteristics of the Stage Bus Industry

Before continuing it may be useful to consider some of the characteristics of the stage bus industry. The following should be noted:

1. Demand is derived i.e. utility, in most cases, is not derived from bus travel, per se, but from the opportunities that are achieved through travel.

2. Adopting terms from spatial analysis, production location may be thought of as offered departure time, consumer location as prefered departure time (with re-scheduling cost being a form of transport cost) and price as money fare.

3. Individual demand is for travel from place i to j for purpose p at time t, with the importance of the time constraint being dependent on the nature of p. Market demand is a summation of individual demands. Normally market demand is related to a geagraphic area based either on a network of routes (such as in a free standing town), a group of routes (a corridor) or a single route.

4. For any demand, Tijpt, there may be different routes, vehicles etc. offered. These different routes etc. may be thought of as differentiated products

5. Output can not be stored, it must be consumed at the time produced or wasted.

6. The cost of output includes not only producer costs but also user costs in terms of in-vehicle, walk and wait time. In particular, it is important that wait time is a negative function of output, leading to a scale economy that has been termed the 'Mohring effect'.

7. The bus industry has important external effects on road congestion, accidents, the environment etc.

2. REGULATION THEORY

2.1 Regulatory History of the British Bus Industry

The history of the British stage bus industry has been documented by Hibbs (1968). The pre-cursors of regulation were the Town Police Clauses Acts of 1847 and 1890 which controlled the taxi-cab and horse drawn bus industries respectively. The rapid growth of the motor bus industry in the 1920s resulted in problems of over supply, 'pirate' operators and 'curious old (driving) practices', such as racing to stops or hanging back and led to demands for a similar form of regulation. Thus, concern with wasteful competition (stressed by Gwilliam, 1964) and safety (stressed by Glaister and Mulley, 1983) led to the 1930 Road

Traffic Act and the resultant regulatory system of Road Service Licences (RSLs), administered by Traffic Commissioners. This system evolved over the years as emphasis became placed on protecting existing operators and maintaining a network of services through cross subsidy, whilst Traffic Commissioners began to make wide use of their powers to attach fare and timetable restrictions to RSLs. In addition, the increasing concentration of the industry lead to the creation of territorial monopolies, although train and, inreasingly, car were close substitutes.

The 1930 Act remained largely unchanged for 50 years, despite the important role played by the British Transport Commission between 1947 and 1953 and the 1968 Transport Act, which created the PTEs and deregulated the road haulage industry (although this had its basis in theories of 'pure' competition and we shall see this is in marked contrast to the stage bus industry). Indeed the 1978 Transport Act, if anything, strengthened the existing regulatory system.

The 1930 Act was partially repealed by the 1980 Transport Act which deregulated the express bus industry (and was subsequently studied by Kilvington and Cross, 1986, and Douglas, 1986) and the relaxation of some aspects of stage bus regulation (Savage, 1985) and set up trial areas in parts of Devon, Hereford and Norfolk (Fairhead and Balcombe, 1984, Evans and Hoyes, 1984). Following the 'Buses' White Paper (Cmnd 9300) and a subsequent round of academic debate (see Bannister et seq. 1985), 'full' deregulation of the stage bus industry was heralded by the 1985 Transport Act (in fact it will be shown in 2.3 that this was very much deregulation with rules).

Hibbs (1985) in an international study notes that bus and coach regulation is widespread, although quality regulation is slightly more common than quantity regulation. A trend towards liberalisation is detected, particularly in Chile, New Zealand, the U.K. and U.S. Two forms of regulation are identified: arbitration, which is predominant in Canada, the U.K. and U.S. and is related to Common Law, and franchise, which is predominant in continental Europe and has its root in Civil Law.

2.2 Regulation Theory and the British Bus Industry

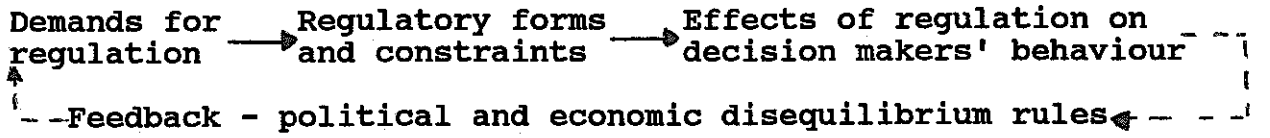
The main study of regulation theory is that of Posner (1974). Regulation is based on the assumption that economic markets operate inefficiently or inequitably (or both) and that regulation is relatively costless. Regulation mainly effects concentrated industries or industries that generate externalities (such as the bus industry). Thus, the 1930 Act might be seen as a product of public interest theory with the main consideration being safety. The fact that regulation has subsequently needed to be lifted might be explained by mismangement within the regulatory agencies (for example, it might be argued that the Traffic Commissioners over stepped their powers).

An alternative explanation for the 1930 Act might be provided by interest group (or capture) theory. In particular, it has been shown by Hibbs that the rail companies, tram companies and large bus operators (such as Thomas Tilling and British Electric

Traction) were all involved in pressing for bus regulation. Alternatively, regulation may be viewed as a product allocated in accordance with the laws of supply and demand, with demand being particularly great where cartelization is either infeasible (due to the large number of parties involved) or too costly (both of which may apply to the bus industry) (Stigler, 1971). Advantages of regulation include the ability to develop a system of cross-subsidy which, if there are limits on external finance, may be shown to increase net welfare (Gwilliam et al., 1985) and the ability to develop second best pricing in order to take into account external effects such as road congestion. The disadvantages of regulation have been outlined by Kahn (1971) and include slackness of management, exploitation of the monopoly power of organised labour, overinvestment and lack of innovation. The Buses White Paper saw most of these problems applying to the British bus industry.

An interesting synthesis of the above arguments has been provided by Needham (1983) who detected a regulation life cycle of the form shown by Figure 1.

Figure 1 Regulation Life Cycle Theory



2.3 The 1985 Transport Act

It has already been pointed out that to think of the 1985 Act as 'full' deregulation is a misnomer. Quality regulation remains and, in theory, has been tightened whilst PTEs and County Councils (or their equivalents) can put unprofitable services out to tender. Tendered services account for about 17% of local bus mileage (Department of Transport, 1988) and it is a weakness that much of the work discussed in later sections concentrates only on commercial services. The difficult interface between commercial and tendered services has been stressed (Buchanan, 1986), with it being particularly difficult to design sensible tendered services that do not, in some way, undermine the commercial network. Moreover, given most authorities policy of, wherever possible, buying back mileage, it is becoming apparent that judicious registration of services can enable the existing operator to exploit economies of scope when bidding for the resulting tenders. The literature on the contracting out of bus services is currently limited but is developing, both with respect to the tendering process in London (Higginson, 1987) and elsewhere (Tyson, 1987, and unpublished work by Hensher).

In addition, added regulation stems from the increased powers granted to the Traffic Commissioners and the application of Restrictive Practices legislation to bus services and stations, thus involving the Office of Fair Trading in the stage bus industry. British competition law has been criticised, particularly due to its ineffectiveness (see for example Hay, 1985). Recent experience in the bus industry, for example the OFT's ruling on access to Newport bus station in the Isle of Wight, tends to confirm this, whilst inconsistency has been

another problem, for example the differing Traffic Commissioner rulings on what constitutes a duplication. Moreover, the inapplicability of monopoly and merger legislation may, in time, be seen to be a major drawback.

Furthermore, the 1985 Act has had important effects on the ownership in the bus industry. The National Bus Company (NBC) was split into around 70 subsidiaries and all but one (the Victoria Coach Station was transferred to London Regional Transport) have been privatised, yielding around £300 million. There has, however, been a tendency for companies to reagglomerate as witnessed by the Caldaire, Drawlane and Stagecoach grups of bus companies. Similarly, the PTE and Municipal bus fleets have been re-structured as separate companies at 'arm's length' from their directly elected authorities/committees, with privatisation (and possibly fragmentation) likely options in the near future. A number of commentators, for example Farrington (1985), see privatisation and deregulation inextricably inter-related. However, Waterson (1986), in a study of publicly and privately owned natural monopolies, found that external constraint structures, internal organisation and management structure and emoluments varies significantly with ownership.

Lastly, it should noted that the 1983 Transport Act (which required PTEs to publish three year plans), the 1985 Local Government Act (which abolished the Metropolitan Counties) and the associated policy of reducing central government support to local authorities have had strong effects on the bus industry, particularly in Metropolitan areas. For example, between 1985 and 1987 there has been a real cut in public transport subsidy in the seven Metropolitan areas of around 26% (Gomez-Ibanez et al., 1987). This reduction in subsidy has overshadowed any effect caused by deregulation. However, Gomez-Ibanez argues that changes in fares (+29%) and reductions in services (-5%) in the Metropolitan areas were sufficient to cover only two-thirds to three-quarters of expenditure cuts, and this is evidence that competition has led to efficiency gains equivalent to 4% of total costs (the corresponding figure produced by the Department of Transport (1988) for Great Britain was 7%). Of course, whether reducing subsidy, either in the Metropolitan Areas or elsewhere, is socially efficient is a separate issue (see Glaister et al., 1987)

3. MODELS OF BUS COMPETITION

In this section four broad types of model will be identified: models based directly on classical oligopoly theory, models based on horizontal product differentiation, models based on vertical product differentiation and simulation models. These categories should not be thought of as mutually exclusive but merely reflect different degrees of emphasis and complexity. These models are important because either implicitly or explicitly they have been used to predict the effects of deregulation. As evidence about the post deregulation situation emerges, emphasis can be changed to finding models which best explain or are consistent with observed events (i.e. a normative assessment) and models which aid understanding of the economic characterisitics of the local bus industry (i.e. a positive assessment).

3.1 Classical Oligopoly Models

Most of the models we shall discuss have some foundation in oligopoly theory. An example is the model developed by Savage (1985) which is based on Stackelberg's duopoly model with simple assumptions regarding the firms' reaction functions and profit functions. Figure 2 shows that for any given profit level a locus of fare and frequency combinations are possible, with differing implications in terms of social welfare. It is argued that deregulation may lead to either social welfare gain or loss depending on the original position of E (i.e. whether over optimal or sub optimal regulated provision), costs and choice on timings. Given that headrunning is the most likely strategy, at least in the short run, it is argued that wasteful competition will result and hence social welfare loss is more likely than social welfare gains. Although this model helps explain likely outcomes, the approach is descriptive rather than predictive and, as it stands, lacks empirical basis.

Other oligopoly models that re-appear in the literature include the Cournot duopoly model, the kinked demand curve associated with Sweezy and the limit pricing theory models associated with Bain and the modifications of Sylos-Labini and Modigliani. (For a discussion of these and other classical oligopoly models see a standard textbook, for example Koutsoyiannis, 1979).

3.2 Horizontal Differentiation Models

Horizontal product differentiation models are based on the assumption that as fixed costs associated with entry decrease or the size of the economy increases then the market can result in a large number of closely located firms and hence, in a Chamberlinian configuration (i.e. perfect monopolistic competition), price competition would occur. Moreover, even if all goods were offered at the same price consumers would differ as to their most preferred choice. The micro-economic literature in this field has been based on models of spatial competition, derived from Hotelling's ice cream salesman problem (and reviewed by Graitson, 1982). These models may be easily extended to a temporal setting which is particularly relevant in transport (Greenhut et al., 1987, Ch 17) .

Evans (1987) has developed such a model for the bus industry, which is itself based on the theoretical work of Novshek (1980) and Salop (1979). This model is based on a large number of assumptions:

i. All operators have common costs
ii. Demand and costs are the same under all economic regimes
iii. All operators and passengers have complete information about services and fares
iv. Operators have information about demand and common costs
v. Each passenger has a preferred departure time but is indifferent between backwards and forward rescheduling
vi. The day is infinitely long
vii. The demand curve for travel is exponential
viii. All buses have spare capacity
ix. Traffic conditions are such that journey times are the same

throughout the day

x. It is assumed that departure times and fares of other operators are fixed (i.e. a form of Zero Conjectural Variation (ZCV)). Alternatively, it might be assumed that fares cuts (or frequency increases) will be matched but fare rises (or frequency decreases) (i.e. modified ZCV, as studied by Novshek, 1980) will not be matched.

Clearly, most of these ten assumptions are unrealistic but unlikely to dramatically influence results. However, other (possibly linear) demand functions might be worthy of consideration, whilst we shall see in later sections that both the infinite time and the ZCV assumptions are unrealistic.

Evans compares four economic regimes: competition, monopoly, unconstrained maximisation of net economic benefit and maximisation of net economic benefit subject to a break-even constraint. Space does not permit detailed restatement of the model but the key equations are:

$$q = 2\frac{L\,v}{c}\,e^{-f/v}\left(1 - e^{-(f' - f + ch)/2v}\right) \qquad (1)$$

where q = total passengers, L = potential passengers per hour, v = fare parameter (valuation of journey), c = rescheduling parameter, f = fare of representative bus, f' = fare of following bus, h = headway.

and

$$s = vq \qquad (2)$$
$$g = F + mq \qquad (3)$$
$$p = fq - g = (f - m)q - F \qquad (4)$$
$$b = s + p = (v + f - m)q - F \qquad (5)$$

where s = consumer surplus, g = total costs, F = fixed costs, m = marginal costs, p = profit, b = net economic benefit.

Analysis is performed with some assumed values for v, c, F and m (empirical evidence is required here) and results are modified to take into account discrete bus units and finite time cycles. Not surprisingly, it is found that competition is most likely where L is high and under a competitive regime potential demand below about one passenger per minute will be left unserved (did the commercial registrations conform to this ?). Moreover, it is found that, compared to other regimes, competition will lead to high frequency, high fare combinations (and it does appear that in most areas of competition frequency has increased whilst fare has remained stable or increased slightly). Compared to maximising net economic benefit subject to a break-even constraint, it is shown that competition leads to about a 10-12% decrease in net economic benefit. However, in order to determine the net welfare effects of deregulation the pre-deregulation economic regime need to be suitably defined and account needs to be taken of cost savings. If finite time cycles, and hence discrete headways, are considered, the results change in that, under competition, super normal profits may be made, natural monopolies may exist, instabilities increase and there is further loss of consumer surplus relative to the maximum.

Another example of the use of spatial competition models is the work of Foster and Golay (1986) (itself derivative of the earlier work of Hay, 1976) in showing that "curious old (driving) practices" may be consistent with equilibrium and in the public interest (for example missing stops when the bus is full or near full and turning short when the bus is empty and there is demand for a service in the opposite direction). Moreover, they argue that although practices such as predatory loss-leading and headrunning are not welfare optimal neither are they likely to exist under equilibrium conditions. (The fact that, for example, headrunning is particularly common place in a competitive environment suggests that in many areas these equilibrium conditions do not exist). Somewhat ironically, Foster and Golay also suggest legislation (= regulation) may assist in the process, for example if operators are forced to maintain to published schedules an equilibrium position will be rapidly achieved (the problem here is largely one of policing). It is also interesting to note that predictability of demand and road congestion (predictability of driving schedules) may be factors affecting on-the-road competition.

It should be noted that both the above analyses are weakened by the limiting assumptions concerning ZCV and functional specification. A generalised model of spatial competition has been developed by Capozza and Van Order (1978) based on a fundamental pricing equation:

$$c = p \left[1 + \frac{1}{e(R,p)} \right] \qquad (6)$$

where c = constant marginal cost, p = price and $e(R,p)$ = the aggregate demand elasticy of the market share R. This pricing equation applies irrespective of the nature of the competitive process. Further it can be shown that:

$$e(R,p) = \int_0^R \epsilon(r,p)\, w(r)\, dr + \alpha' p w(R) \qquad (7)$$

where ϵ is the elasticity of individual demand at location r, $\alpha' = dR/dp$ (the conjectural variation) and $w(r)$ is a weighting function such that

$$\int_0^R w(r)\, dr = 1 \qquad (8)$$

Thus, in the context of bus competition, for a given market share R, the elasticity of aggregate demand depends on a weighted average of the time specific demands and the conjectural variation from a fare change, α'.

3.3 Vertical Differentiation Models

These models are based on quality differentiation, so that were any two goods offered at the same price then all customers would choose the same one (i.e. the higher quality product). This phenomenon may lead to the creation of natural oligopolies. A model of this type for the stage bus industry has been developed by Dodgson and Katsoulacos (1987), which itself draws heavily on the work of Shaked and Sutton (1982,1983). It is shown that if quality is assumed to be a function of frequency and consumer preferences a function of income, market equilibrium may be

determined in three stages. In stage 3 a given number of firms have entered the market and they offer distinct qualities. Given this, the firms' Nash equilibrium prices are determined. In stage 2 the firm's optimal quality levels are determined given their Nash equilibrium prices, whilst in stage 1 the optimal entry decision can be determined. Given assumptions about income distribution, convexity of cost functions and size of the market it can be shown that there is a unique equilibrium involving only two firms. However, given this result it seems that the firms' failure to take into account the behaviour of their competitor is unrealistic. Moreover, given the assumption that frequencies are high anyway (and hence there are random arrivals) it is likely that consumers will have difficulties in perceiving quality differences whilst the assumption that consumers will remain loyal to the service that maximises their overall utility is only likely to occur given branded ticketing or different boarding points. For example, in Preston, excluding holders of branded tickets, around 90% of users boarded the first bus that arrived at their stop. Given these caveats it is not surprising that the model's predicted outcome of two firms, offering distinct qualities of service and charging different fares, does not appear to have occured in practice (although a lot depends on what is meant by distinct qualities). The model may be relevant in explaining inter-modal competition (e.g. bus v taxi and, possibly, bus v train) but does not seem too relevant in explaining competition within the bus market.

Although the Dodgson and Katsoulacos model does not appear to explain the most common competitive practices, it does provide an explanation for the most likely market configuration for competed routes with high demand (i.e. a mixture of large and small buses). However, we only know of two instances (Gravesend and Leicester) where the minibus charges a premium fare. In addition, the welfare implications are worth considering. In comparing deregulated market equilibrium with that of a regulated public monopolist, it is found that welfare effects depend on:

i. The weight given by the monopolist to retained profits as opposed to consumer surplus. The higher this is the more likely that all consumers benefit in the market equilibrium.

ii. The behaviour of total unit costs as bus-service quality increases relative to the behaviour of consumers' willingness to pay. When total unit costs increase rapidly relative to willingness to pay for quality improvements by high income consumers, it is likely that all consumers will find their welfare reduced after deregulation.

The resultant equivocal welfare implications are consistent with the earlier findings of Savage and Evans.

3.4 Simulation Models

One way of modelling the effects of deregulation is through the development of simulation models. Most work in this field has been based on studying the possible impact of minibuses. This work is described in more detail elsewhere (Martinez, 1988). Bly and Oldfield (1986) showed that minibuses would have a major impact, even if there was no variation in passengers' value of

time, due to the increased frequencies and reduced journey times that could be offered. This work seemed to confirm the earlier findings of Walters (1979, 1982). Glaister developed a model that forecast the likely split of traffic between minibus and traditional bus services on a hypothetical London route (1985) and using real data for services in Aberdeen (1986). He concluded that small vehicles would play an important part in a deregulated industry even if, as he assumed, they operated at premium fares. In areas of high demand he concluded that big bus services would remain, at lower fares, and that the availability of a range of different service qualities at different fares (i.e. the same outcome as that of Dodgson and Katsoulacos) would cater for people with different values of time to the public benefit. In low flow areas it was concluded that big bus services would be substantially reduced to the detriment of the lower income groups. Galvez (1986) showed that the results were sensitive to the assumptions regarding the simulation of passengers boarding and alighting. Nash (1985) criticised the method of pegging load factors to a pre-determined break-even figure (required for the model to converge) and concluded that the possibility of minibuses driving out big buses in circumstances where such an outcome was against the public interest was greater than suggested by Glaister.

The above simulation models appear to be justified in that the predicted increased role of minibuses has occured, with about 12 thousand such vehicles being deployed in Great Britain in 1986/7 (although the majority of these are not operated on stage services). However, the predicted quality/fare differentials, as already noted, have not emerged. In particular, if passengers board the first bus that arrives, there is little incentive for any operator to charge lower fares. Given this the high frequency, high fare outcome predicted by Evans seems most likely and social optimality is no longer guaranteed. A further criticism of the above models is that they fail to assess the effect of the qualitative differences between minibuses and big buses in terms of comfort, luggage space, staff courtesy etc. that surveys show many passengers believe important. There may be scope for stated preference and/or revealed preference experiments to quantify these effects. In addition, attention needs to be paid to the scope of minibuses for hail and ride operation and better penetration of residential areas which may lead to decreases in walk time.

Similar models have also been applied to study the effect of competition between big buses, for example by Oldfield and Emmerson (1986), although in this case results are at an aggregate level and hence optimisation methods rather than micro-simulation techniques are used. This model is developed for a single route and calculates the number of passengers using bus services as

$$P = Po \left(\frac{G}{Go} \right)^{e}$$

where G = generalised cost, e = generalised cost elasticity and o denotes the base situation. The proportion using bus i is then estimated as

$$Pi = \left(\frac{Gi}{Gi+1} \right)^{a}$$

where i+1 denotes next bus to arrive and a is a modal split parameter, which as the absolute value increases so does the proportion boarding the first bus.

Two objective functions were tested (maximise net profit and maximise passengers for a given (normal) profit). Equilibrium is achieved through iteration, beginning with one company and then introducing competitors. It was found that competition would lead to an increase in services and fares, particularly if companies can reduce costs (and hence the results are similar to those of Evans). If the objective was to maximise passengers, a competitor is unlikely to gain more than a small foothold unless unit costs are lower than the incumbent by 8%. Competition is more likely to be enduring if the incumbent can respond by cutting costs (e.g. the unit costs of the incumbent fall as a linear function of the competitor's share) or both companies reduce unit costs asymptotically to some minimum value. if the incumbent was able to fully match the lower costs of the entrant, entry would be forestalled when unit costs are 65% of original costs.

If an objective of maximising profits is considered different equilibria result. If an incumbent can match reductions in costs then equal shares result. Under a mixed system, where the incumbent maximises passengers and the entrant maximises profits (which may be a common occurence in urban areas where the incumbent is still publicly owned), similar results to those if the two companies were both maximising passengers are achieved. However, this assumes that both companies have similar unit costs. If the competitor has very low costs it can capture a large share of the market (capturing it completely at 60% cost level).

In terms of competition between three firms, it is found that assuming a maximising passengers objective, no equilibrium can be achieved with the problem always being reduced to two firm competition. If the objective is profit maximising, equal shares will result if companies have similar unit costs (although patronage will be lower than in the two firm situation). If two firms lower costs then the third will be forced out of business when costs are 80% of original value. If one company has lower costs than the other two, it would have a large share of the market and would force one of the high cost operators out of the market when costs are 77% of original value.

The importance of the above work is that it stresses the importance of managerial objectives (see Nash, 1978), illustrates the tendency towards duopoly and emphasises the role of competitive pressures in reducing incumbent's unit costs, as exemplified by the Scottish Bus Group, South Yorkshire Transport, Yorkshire Rider etc. etc. Clearly, such models can be readily extended to big bus/ small bus competition (for example the model developed by Frank Grimshaw for Yorkshire Rider), although the main problems are the limited evidence on generalised cost elasticities and the modal split parameter. Santoso (1988) has developed a similar simulation model for two routes in London considering capital reserves, fleet composition, fare system (flat or zonal) and manning arrangements (one or two person operated). Given an assumption that there are three groups of travellers with values of time of 144, 84 and 34 pence/hour (and

work by Bradley et al. 1986 suggest this may not be very realistic), it was shown that the competitor's best strategy was minibus operation at high fares (i.e. the same result as Glaister).

It should be evident that the above models are similar to the bus optimisation models that originate with the work of Mohring (1972) and Turvey and Mohring (1975) and epitomised by the work of Jansson (1984). Jansson developed a series of equations that gave the optimal pricing relevant cost, frequency, vehicle size and fare. It was found that the first best solutions for urban bus would typically result in higher frequencies (particularly off-peak), lower or even zero fares (again particularly off-peak) and smaller vehicles. This would, however, also lead to increases in subsidy (typically representing 50-90% of costs). It is interesting that although bus deregulation has led to smaller vehicles and generally higher frequencies (particularly in inter peak periods), fares have also tended to increase, largely as a result of reduced subsidy. In any case Jansson acknowledges that high levels of subsidy may have adverse implications in terms of X-efficiency and equity and hence a second best solution might be provided by Ramsey pricing (=optimal commodity tax). In cases where apoly threaten, this might be based on the inverse elasticity rule ('the relative excess of price over marginal cost is proportional to the absolute value of the own price elasticity').

Given that we are critical of the above models, how do we explain the minibus revolution? In a closed market operators can choose the cost minimising bus size. In an open market it is important to dominate frequency as passengers board the first bus that arrives except in the case of return tickets and travelcards (the purchase of which will also depend on frequency). Minibuses are the cheapest way of increasing frequency. As a result it may be that minibuses are not always deployed in a financially or socially efficient way (see Preston, 1989)

4. A REVIEW OF BUS COMPETITION SINCE THE 1985 TRANSPORT ACT

In this section we examine the extent of bus competition that has resulted from the 1985 Transport Act and in particular identify the extent of competition, the ambient circumstances that lead to competition, the competitive practices that have emerged and the likely market outcomes.

4.1. Occurence of Competition

For the purposes of this study we have defined urban areas as being free standing conurbations, cities or towns with at least a population of 40,000. Table 1 shows that, according to the 1981 Census, there were 140 such towns in England and Wales (excluding London) and a further 19 in Scotland. According to our monitoring study 44 of these urban areas experienced active on-the-road competition affecting at least two main routes during the first two years of deregulation, representing 28% of all urban areas. However, this percentage varied substantially from 42% in the North of England to only 18% in the South East of England.

Table 1 Urban Areas Affected by Major Competition

	No. of Urban areas	No. affected by major competition	% affected by major competition
North	43	18	41.9
Midlands	31	8	25.8
South East	45	8	17.8
South West & Wales	21	4	19.0
England & Wales	140	38	27.1
Scotland	19	6	31.5
Great Britain	159	44	27.6
Britain			

In fact, even in areas where major competition has occurred it has not taken place on all routes, whilst virtually every urban area has experienced some form of minor competition on at least one route. Hence TRRL estimate that competition only affects something like 10% of routes (see, for example Hopkins and Oliver, 1986 et seq.). It should also be noted that competition has occurred in towns of less than 40,000 population (Salisbury, the towns of South Wales, Whitehaven) and even in rural areas (e.g. Scottish Highlands).

4.2 Why Does Competition Occur?

Is competition just a random event or is there something systematic in the way that certain areas attract competition, whilst others do not? The key to answering this is to examine the nature of the two main participants; the incumbent and entrant firms.

Table 2
Analysis of Major Bus Competition in Great Britain

Entrant / Incumbent	PTC	Municipal	NBC/SBG	Independant	TOTAL
PTC	-	1	5	6	12
Municipal	1	2	16	7	26
NBC/SBG	1	3	4	8	14
TOTAL	2	6	25	21	52

N.B. The number of competitive cases exceeds 44 as in some instances there is more than one type of entrant.

Table 2 shows that the main entrants have been from Scottish Bus Group (SBG)/ex-National Bus Group (NBC) subsidiaries and independents. The scope for entry by the PTCs and Municipals is limited by the 1985 Transport Act and has only occurred in a handful of cases. The incumbent firms that have suffered entry are in the main, the PTCs and particularly the Municipals. In part this is because the territorial agreements of the regulated

regime gave these firms undue protection and once these agreements were removed competition from neighbouring NBC/SBG companies and local independants was likely to occur (e.g. Glasgow, Nottingham). It also reflects that the PTCs and Municipals were operating in the largest urban areas and hence commercially the most attractive bus markets. The concentration of the PTCs/Municipals in the northern half of Great Britain explains some of the regional variations in competition observed in Table 1. Another possible explanation is that labour market conditions are more favourable to competition in the northern part of the country (i.e. labour availability higher and wage rates lower).

At least initially, it was uncommon for operators within the same ownership group to compete with each other. This pattern has subsequently broken down with ex NBC companies competing with each other in Oxford, Poole and Salisbury and Municipals competing in Blackpool and Portsmouth.

Incumbents are identified as victims if they have high costs and/or poor product reputation (for example, because of industrial disputes e.g. London Country North East, Plymouth Citybus). The independents and NBC/SBG companies have generally believed that they have lower costs and better quality products than the PTCs/Municipals. The Municipals have attracted more examples of large scale competition because (apart from the fact that there are more Municipals than PTCs!), other things being equal, small bus companies (e.g. Taff-Ely, Barrow) are perceived as being more vulnerable than large companies, although some companies may be perceived as being too big (e.g. GM Buses). A firm only enters the market if it believes it can win. If entry is at a large scale a response will be anticipated. Some independents have attempted to enter at a small scale thereby hoping not to cause a response from the incumbent firm. By and large, such strategies have been unsuccessful (i.e. the incumbents have responded), except where the incumbent itself wishes to encourage some competition as a stimulus to wage reductions or productivity increases amongst the incumbent's own staff. An alternative strategy is for independents to act (either with or without collusion) collectively by each firm entering on a selection of routes in a belief that the incumbent will be unable to respond vigorously to all cases of entry. Such strategies have been particularly attractive where the incumbent operator has had intial operational difficulties (e.g. Liverpool, Manchester, Sheffield) and might be termed the 'vulture effect'.

Entry to the market is common from firms with spare capacity due to seasonal variations e.g Southern Vectis or from firms involved in what are believed to be declining markets (which is the view of some small coach firms). Entry will often occur on the periphery of the incumbent's main market area, particularly if the entrant has a local reputation (e.g. Black Prince in Morley). Entry may also take place in area which are on the boundary of a number of incumbent operator's market territory (e.g. Pudsey) or in areas which, due to recent growth, were previously unserved (e.g. Poole).

There are, however, personal factors that have led to competition. The management of the entrant firm often have

personal knowledge of the area being entered (e.g. Malcolm Robson in Preston, Harry Blundred in Oxford). This might also be seen as reducing the sunk costs that are related to the economies of experience that a skilled management team possesses (see 5.2). In addition, in many cases of competition the entrant will have former employees of the incumbent firm working for them. Hence firms that have recently shed labour (such as the PTCs) may be particularly vulnerable to attack. The most extreme examples are the workers co-operatives that have been established in, for example, Harrogate, Sheffied, Liverpool and Hertfordshire and consist almost entirely of ex-employees of the incumbent firm.

4.3. What Forms Does Competition Take?

Competition has tended to take the form of service wars with fares matching. The incumbent firm tends to take the role of price leader and the minibus is often used as the main competitive weapon. Fares are matched because of the industry's general adherence to area-wide fare scales (although this is beginning to break down in some areas of competition e.g. Harrogate, Liverpool), the belief that fares will be matched immediately and the perceived high risks of fare wars. Competition has concentrated on frequency because selective increases in service are easier to make and more difficult to match than changes in fare. In addition, wait time may be perceived as a larger and more sensitive component of generalised cost than fare and, due to imperfect knowledge and limited variation in values of time, passengers board the first bus that arrives hence making frequency the key to competition. Furthermore, firms may have managerial/behavioural reasons for expanding output rather cutting fares.

The emphasis on service wars has led to fierce on-the-road competition. Headrunning, racing to stops, holding back, turning round and other 'curious old driving practices' have been commonplace, although this competitive driving behaviour does tend to reduce with time. Particular trouble spots have proved to be bus stations and on-street bus stands in central areas. Following the experience of express coach deregulation where lack of access to coach stations acted as a barrier to entry, the 1985 Act attempted to ensure entry for all to bus stations. However, in some instances access could be denied, although this is now less likely following the Office of Fair Trading's decision with respect to Newport (Isle of Wight) bus station, which is owned by the Southern Vectis bus company. It is, however, common for entrant firms to be refused access to canteen/office facilities at bus stations, for information points to be manned solely by the incumbent firm's staff (who give either no information or mis-information about the entrant firm's services) and for entrant firms to be located in the least attractive stands in the bus station and at some distance from the incumbent firm's rival services. At both bus stations and on-street stands common practices have included the blocking in of a rival's bus, permanently occupying a stand or employing couriers to persuade customers to use one company's buses in preference to another. It seems clear that some of these practices, and particularly headrunning, are symptomatic of wasteful competition.

Fare wars have been less common. The Trial Area of Hereford

provides the best example of competition of this type (Evans, 1988). There have been instances of fare cuts on particular routes in a number of areas (e.g. Accrington (Lancs), Colwyn Bay (Clwyd), Harwich (Essex) and Fort William (Highland)) but these tend to be shortlived. Competition in fares has been mainly related to branded ticketing such as system passes, return ticketing, multi-rider tickets or discount vouchers of the Green Shield Stamp type. These might be seen as an attempt by operators to develop strategic barriers to entry. In some areas, there has also been competition for concessionary fare passengers, particularly where the local schemes have been based on some form of tokens (e.g Bournemouth, Darlington, Harrogate). A trend towards reducing the distance related taper on fare scales has been detected, particularly in the Metropolitan areas, whilst off-peak fare schemes have become more common. However, market based fare scales do not appear to have emerged as yet, although a trend towards them may be detected in some areas (e.g Harrogate, Liverpool). Where incumbent operators have exact fare schemes, entrants often introduce services on which change is given (e.g Cleveland, Preston).

The main innovation has been the minibus, with over 5000 vehicles deployed in 400 cities and towns. The main innovative features (aside from increased frequency) have been improved penetration of central and residential areas and the hail and ride facility. Services also tend to be faster than big bus services (and this reflected in brand names such as Zippy) and marketed as being more 'user-friendly'. Other innovations have involved crew-operated Routemasters in places as diverse as Glasgow, Carlisle, Northampton and Southampton, and limousines in Lincoln. One innovation that has failed to emerge is the shared-taxi, despite the scope for such develpments given by the 1985 Transport Act.

Successful innovations are usually copied, for example, the United Transport Buses' minibus services in South Manchester were quickly immitated by Greater Manchester Buses. A peculiar competitive practice has been for one operator to copy the livery of a competing operator (e.g. County Durham, Kingston upon Hull). This might be seen as a move to reduce the effect of a rival operator's goodwill/brand loyalty and can upset the incumbent. For example, Ribble were very sensitive over Lancaster City Transport's use of red buses.

Another peculiar practice has been that of operators attempting to raise a rival's costs. An early example was the behaviour of some PTCs during the intial stages of deregulation who witheld surplus buses from the second hand market. As a result it was hoped that the price of old buses would increase as their availability decreased, hence making entry to the local bus market more difficult. Another example, which is beginning to become more common as the labour market tightens, is the recruiting of a rival's staff by offering slightly better pay and conditions, (and advertising the fact on the back of buses). This practice contributed to the operational difficulties that United Transport Buses had in both Manchester and Preston. Of course, the success of such a policy is limited by the fact that it also affects the firm's own costs.

4.4 Market Outcomes

The competitive outcomes may be as follows (note this list is not intended to be exhaustive):

i. Two or more operators serve a route, either at similar fare/frequencies or at different fares and/or frequencies. This outcome will normally result in equal spacing but headrunning can continue over a long period (e.g the competition between Busways and Tyne and Wear Omnibus). What is important is whether this result is due to a non co-operative equilibrium, tacit collusion or temporary disequilibrium, with only the first likely to be a stable result.

ii. One operator serves a route, being either the incumbent or the entrant. Examples of where the entrant has withdrawn include South Wales and Walsall. This might be as the result of an independent company going into liquidation (e.g. Cream Line Services in West Glamorgan), redeployment of vehicles elsewhere or withdrawal from the stage bus industry. Alternatively, an incumbent may withdraw, for example Lincolnshire Road Car in Grimsby (depot closure) or Trent in Loughborough (joint company formed with Leicester Citybus)

iii. Two operators serve a market area but with routes operated by either one or the other. This might be done through registered joint operating agreements (although competitive pressures have led to a reduction in these types of agreements e.g. the break down of the joint operating agreement in Lancaster) or through tacit collusion (as believed, by some, to exist in most of the Metropolitan areas).

iv. Only one operator serves a market, thus holding a territorial monopoly. Merger/acquisition appears to be the method that many firms are using to acquire a territorial monopoly (e.g. Badgerline, PMT)

In the above, it should be noted that commercial and subsidised services might be thought of as different products leading to up to 16 outcomes (although outcome i. will only be relevant for subsidised services if a route tender is broken up into, for example, daytime, evening and Sunday work).

It should be noted that such outcomes will be achieved in what is a generally volatile market, particularly for small operators. Gomez-Ibanez et al. (1987) note that between November 1985 and April 1987 1356 firms remained in local bus services throughout the period, there were 662 'deaths' and 738 'births'. Of the 662 deaths, 121 ceased trading whilst 541 concentrated on other aspects of the bus and coach business (private hire and express). Of the 738 births, 161 were new operators (including 13 companies formed as the result of splitting NBC subsidiaries and 77 taxi companies), whilst 577 were previously private hire and/or express operators.

5. MARKET STRUCTURE

5.1 Market Configurations

In this section a number of theoretical market structures will be examined and their relevance to the urban stage bus industry assessed. This analysis will be at a basic level but should provide some interesting insights.

Perfect competition depends on a number of assumptions that rarely exist in reality. These include:

i. There is no government regulation. This was clearly not the case for stage bus between 1930 and 1986, whilst quality regulation and some quantity regulation remains.

ii. There are a large number of buyers and sellers. As a result of quantity regulation in the bus industry, there has traditionally been a small number of sellers, although a large number of buyers.

iii. Products are homogeneous. We have seen that the bus industry does have differentiated products.

iv. Both buyers and sellers have perfect knowledge. It is, however, evident that sellers only have limited knowledge about demand characteristics, whilst buyers have imperfact knowledge of the bus services available to them.

v. Sellers are profit maximisers and buyers act rationally (utility maximisers). It is evident that certain large bus companies may not be pure profit maximisers but may be sales maximisers, so that managerial models may be appropriate (Baumol, 1962, Dasgupta and Stiglitz, 1980). Such models might incorporate the effect of research and development (unlikely to be too important for the stage bus industry), advertising and marketing. In addition, given imperfect knowledge, behavioral models may be appropriate (Cyert and March, 1963).

Of the other assumptions, by and large, there is perfect mobility of factors of production (although the effects of unionised labour and concentrated second hand bus market should be noted), whilst there is now also relatively free entry and exit.

From the above, it is apparent that the stage bus industry, like most industries, is an example of imperfect competition. Clarke (1961) developed the concept of effective (or workable) competition in which, despite imperfections, competitive results still emerge. Requirements include that:

i. Short run marginal costs are less than average costs so that if volume shrinks costs will not reduce proportionally. This encourages defensive strategies.

ii. A single firm demand function is more elastic than the demand schedule for a group or industry (i.e. there are cross elasticites), but slopes in such a way as to limit tendencies to drive price below cost. Hence there is some

scope for aggressive strategies.

iii. There is a substantial number of firms small enough relative to the whole market to have strong competitive incentives and economically strong enough to make their competitive pressure count. There should be a diversity of firms, with the relationship between 'pace setting' firms and the 'bulk' being important (e.g. in terms of innovations).

iv. Uncertainties and delayed competive reactions may ensure that competition with limited numbers is possible without ending in an oligopoly stalemate.

v. There are certain standards of business attitudes/morals and a certain degree of customer competence.

All the above assumptions apply to the stage bus industry to some extent, although we might be concerned about the tendency to drive price below cost in aggressive competition, the lack of delayed reactions (see 5.2) and some aspects of producer/consumer competence.

A possible alternative market structure might be that of monopolistic competition, particulary as the bus industry's products, although differentiated, are close substitutes, whilst there is free entry and exit and prices of factors and technology are given (to some extent). However, due to regulation there is again only a small number of sellers, profit maximisation may be doubted, particularly in the short term where predatory behaviour may occur, firms do not know their demand curves with certainty and the long run can not be considered to consist of a number of short run periods which are assumed identical.

Alernatively, monopoly might be the most relevant market structure. This was obviously the case as regulation led to single sellers. However, with deregulation this should no longer be the case, particularly as bus does have some close substitutes (rail, car, walk), does not have major barriers to entry nor does it exhibit economies of scale (it is often argued that the bus industry exhibits constant returns to scale (e.g. Lee and Steadman, 1970)). However, monopoly might still exist where:

i. A market might not otherwise be served. A monopoly might be justified where the various sectors of a market have demand curves which, when added together, give a total market demand which when added together lies at all levels of output below the LAC of the firm (see Figure 3). However, if a monopoly exists, price discrimination may be practiced with high price (P1) charged to the inelastic sector of the market and low price (P2) set for the elastic sector. Thus total revenue is OXP'P and the monopolists excess profit is denoted by the shaded area. The 'rich' sector of the market subsidises the 'poor' sector in order to make production possible (and this argument may be used to justify cross subsidy). In practice, price discrimination in the bus industry is normally limited to concessionary fares and peak/off peak pricing, although cross - subsidy, although much reduced, is still likely to be widespread. The

above arguments only apply where demand is low i.e. they will be most applicable to rural areas, although they may also apply to some urban markets (e.g. circumferential routes).

ii. The incumbent bus company adopts limit pricing policy, heavy advertising or continuous product differentiation (or more likely all three at the same time) in order to forestall entry.

From the above it appears that market configurations relevant to the bus industry are those based on competition between the few and hence the emphasis on oligopoly models in section 3 seems justified. However, it may be argued that competition between the few is likely to lead to socially inefficient results. The counter-argument to this, used in the "Buses" White Paper, is provided by the theory of contestable markets, which itself might be thought of as an extension of the limit pricing theory oligopoly models developed in the 1940s and 1950s by Bain.

5.2 Contestability Theory

Expressed simply this theory states that provided certain conditions hold a socially efficient equilibrium may exist with only one (or a few) active firms in the market (Baumol, 1982). These assumptions include that:

i. Potential entrants have access to all production techniques available to incumbents. This is generally true for the bus industry.

ii. Potential entrants are not prevented from trying to attract the incumbents' customers i.e. there are no barriers to entry. It has been suggested by some that access to bus stations and the use of travelcards have acted as barriers to entry (Meadowcroft and Pickup, 1987).

iii. Entry decisions may be reversed without cost i.e. there are no barriers to exit (although in theory there is a 42 day delay) and no major sunk costs. In terms of sunk costs, it does appear (e.g. from Zippy's experience in Preston) that there are sunk costs in terms of training staff (managerial, administrative and platform). Such 'economies of experience' might enable incumbents to earn a degree of monopoly rent. Moreover, as bus industry activities are multiproduct by nature there may be 'economies of scope', where incumbents have lower unit costs from producing a range of outputs. Lastly, we have assumed that there are constant returns in the bus industry although major operators are now emphasisising the economies of scale of central functions such as engineering, computing, purchasing and marketing. It could be that under a regulated system the existence of slack payments in the largest (and hence most organisationally complex) firms outweighed any scale effects (see, for example, Button and O'Donnell, 1985). However, deregulation has led to changes in the goals of firms that have made such slack payments less acceptable.

iv. Incumbent firms can not respond sufficiently quickly to entry by reducing prices. This manifestly is not the case for the bus industry, as in theory an operator can respond within 24 hours, although if the entrant has manipulated the registration system it could take longer. The general inapplicability of this assumption is seen to be a major weakness of contestability theory (Schwartz and Reynolds, 1983), although Starkie and Starrs (1984) argue that if price adjustments are costly violation of this assumption will not be important. However, price adjustment for the stage bus industry is relatively costless. A more important consideration might be that excessive pricing will not only attract competition but might also lead to loss of goodwill (the 'chagrin effect' of Bhagwati (1970), which might exist in, for example, Merseyside).

Baumol, Panzer and Willig (1982) established a set of guidelines to establish whether contestability exists in practice:

i. Determination of the cost minimizing structure of the industry. In particular, it is needed to assess the profit region for different output vectors (for example, commercial and tendered services could be thought of as different outputs), the set of output vectors at which a firm's returns to scale are exhausted and the degree of trans ray convexity, which indicates the degree of complementarity (= economies of scope). In particular it is necessary to determine those outputs which can most economically be provided by a monopoly and those which are 'naturally competitive'. Our review so far has not resolved this question.

ii. Determination of degree of contestability, This is related to costs of entry, exit, sunk costs (role of resale markets and use in other activities ('fungibility')) and the affect of size of the potential entrant. There are some indications that the stage bus industry is not perfectly contestable. It is not clear, however, to what extent a limited degree of contestability will lead to deviations from optimal efficiency.

iii. Determination of obstacles to contestability and evaluation of the difficulty of their reduction or elimination. Legislation could limit the effects of bus station ownership, travelcard schemes, joint ventures and immediate price reaction (i.e. the 'strategic' barriers to entry). 'Innocent' barriers such as those stemming from product reputation, bankruptcy constraints and firms' objectives are more difficult to legislate for (although predatory behaviour can be limited), as are the effects of sunk costs (although start-up schemes may have some effect here).

iv. Determination of whether sustainable configurations for the industry exist (i.e. whether a socially efficient configuration can exist over all time periods). Unsustainability may result from:
a) public policies that impose special impediments on the incumbent (for example an obligation to serve quantities demanded at prevailing prices, as may be the position with

many PTC and Municipal operators).
b) existence of a natural oligopoly (which to some extent the stage bus industry may be (e.g. the Dodgson and Katsoulacos model)) with demand such as to rule out a market clearing configuration that minimises average ray costs.
c) economies of scope are insufficiently strong and economies of scale sufficiently strong so that specialized firms can take advantage of favourable demand conditions despite the cost advantages of a multiproduct supplier.

v. Qualitative and quantitative description of sustainable configurations. If no sustainable configuration exists then inhibition/prevention of entry (i.e. quantity regulation) or prevention of strategic entry may be needed.

vi. Identification of any substantial welfare problems associated with sustainable configurations. The continued existence of quality regulation and the creation of the tendering system is indicative of the importance of externalities in the stage bus industry.

vii. Description of institutional inhibitions to the adoption of efficient inter-temporal price patterns. All activities should pass the Areeda-Turner test of predatory behaviour in that prices must equal (or be greater than) both marginal and average incremental costs.

Empirical evidence on the degree of contestability of the transport industry has concentrated on the airline industry with the work of Bailey and Panzer (1981) and Starkie and Starrs (1984) broadly vindicating the theory, although the results of Graham et al. (1983) are more equivocal. In the U.K. the main work so far has been on the contestability of the express coach industry (Button and Pearman, 1984, Jaffer and Thompson, 1986). The work by the latter indicated that 'the effective competition hypothesis does not provide a good explanation' and that 'incumbents have been able to maintain a price premium over entrants and that in markets where entrants have been able to achieve a significant market share, prices are significantly lower'. Factors that limited the contestability of the express coach industry include National Express's control of the main terminals and the existence of an extensive network of agencies, the policy of fare matching (not copied by the Scottish Bus Group and, interestingly, the express market in Scotland was found to be more contestable than elsewhere) and the emergence of joint ventures with some of the main competitors.

Similar analysis of the stage bus industry based on data for Hereford between 1981 and 1987, provided by Evans (1988), shows that fare and frequency are related to market structure, hence suggesting that the industry is not perfectly contestable (Preston, 1988). However, these results are distorted by problems of transitional disequilibrium and short-run predatory pricing and output levels. The fact that in 1987 fares were generally lower and frequencies higher than in 1981 even though the dominant operator had maintained its market share does suggest that the effective competition hypothesis has some relevance. The key question has to be to what extent do deviations from perfect

contestability lead to social inefficiencies ? Another factor has to be to what extent is potential competition seen as a credible threat ? For example, following deregulation Yorkshire Rider saw, in the event wrongly, entry from UTB as very likely. As a results, frequencies were increased through minibus deployment, fares maintained at low levels and costs reduced, all responses that are consistent with contestability theory. However, potentially UTB could have entered the bus market anywhere in Great Britain (apart from London), so in theory all bus operators should have re-acted with the same vigour as Yorkshire Rider, which does not appear to have been the case.

6. CONCLUSIONS

It has beeen shown that the stage bus industry in the UK has been affected by a series of regulatory changes, the latest of which has been the policy of deregulation (in fact, limited regulation) implemented by the 1985 Transport Act. These regulatory changes can be interpreted within a theoretical framework, as shown by section 2.2. Section 2.3 went on to show how deregulation has been accompanied by other developments, in particular privatisation and reduced subsidy levels.

In section 3 a series of inter-related models of bus competition were examined and categorised. These were: classical oligopoly models, horizontal product differentiation (or spatial competition) models, vertical product differentiation models and optimisation/simulation models. The main results from these models was that depending on circumstances, in particular the degree of optimality of the regulated regime and the extent of cost reductions in the deregulated regime, a policy of deregulation could either lead to welfare gains or losses. However, in terms of fare/frequency combinations two outcomes appear possible:

i. Deregulation will lead to overall high fare and high frequency combinations in areas of heavy demand with areas of low demand possibly left unserved. This was broadly the findings of Evans' spatial competition model and Oldfield and Emmerson's optimisation model.

ii. Deregulation will lead to distinct qualities being offerred at different fares. In particular, high frequencies (based on minibuses) will be offered at high fares for those with high values of time, whilst low frequencies (based on big buses) with low fares will be offered for those with low values of time. This was the finding of the quality competition model of Dodgson and Katsoulacos and the simulation models of Glaister.

Section 4's review of competitive behaviour since deregulation came into force on October 26th, 1986 suggests that an outcome of type i. has been much more evident than that of type ii. However, the simulation models did successfully predict the increased deployment of minibuses. A range of additional outcomes were identified that were encompassed by neither of the outcomes given above, although many of these are likely to be associated with short run behaviour.

The main criticism of the models that were reviewed was that they were generally based on a number of restrictive assumptions. In particular:

i. Naive assumptions concerning the reaction of other firms to a change in frequency and/or fare by one firm in the market. Given an oligopolistic (or even duopolistic) configuration even on routes with high demand, it seems likely that a firm will modify its behaviour in the light of behaviour by other firms.

ii. The assumptions that preferences are based solely on income and that there is a wide range of values of time for bus travellers that underpins much of the work of Glaister might be questioned.

iii. The assumptions of perfect knowledge on behalf of both operators and users appear unrealistic. This may mean that operators act as satisficers (for example through adopting cost plus pricing) rather than optimisers. Moreover, uncertainty will affect customer behaviour. For example, the tendency to board the first bus that arrives, regardless of cost (assuming the cost difference is not too major), is related to uncertainty about when the next bus will arrive. It is this uncertainty, exhibited even with high frequency services, which are vulnerable to bunching, that has probably limited the outcomes predicted by Dodgson and Katsoulacos. A way of implicitly modelling this effect is to develop a probabilistic approach (Hey, 1981).

Another weakness of the models that have been reviewed is that they fail to take into account the interaction between the commercial and tendered bus markets. A framework that might be fruitfully applied to both of these markets is game theory. This would involve the development of a pay-off matrix (see Figure 4), which is based on the results of Firm 1 and 2's strategies. For a commercial route this strategy would be based on fare/frequency combinations, whilst for a tendered route it would be based on tender bids. In both cases the pay-off would be expected profit. The most likely behavioural rule would be that each firm expects the worst from its rival i.e. a maximin strategy. In addition, it is likely that the learning process will lead to different strategies being adopted round by round (a process that is already evident in the tendered market). It is likely that we are dealing with a non zero sum game, whilst again the assumption that each firm knows, with certainty, the exact value of the pay-off of each strategy is unrealistic. We may expect a range of results for each counter strategy of the rival, each with an associated probability. The applicability of gaming theory to oligopolistic behaviour has been well researched (see, for example, Friedman, 1986). It should be noted that the theory can be extended to n-firms, whilst third parties might be thought of as dealers rather than players (this is the role, for example, of PTEs/County Councils in the tendering process).

However, theory of games is essentially a descriptive tool, in order for it to become a predictive tool the relationship between pay-offs and strategies need to be modelled. This is where the oligopolistic models discussed in section 3 might be applied.

Other possible ways forward might be provided by the concepts of disequilibrium economics, and managerial and behavioural theories, although it is likely that this would rapidly lead to complex (and hence unusable) model forms. The emphasis on oligopolistic configurations, at least for routes with heavy demand, is vindicated by the analysis of market structure in section 5. This section concludes that the concept of perfect contestability does not appear to be applicable to the stage bus industry, although models of imperfect contestability might be worth exploring.

Finally, it should be noted that there is a tendency for the models that have been reviewed, in particular those of Savage, Evans and Nash's interpretation of Glaister's results, to indicate that a deregulated competitive regime will lead to non optimal welfare results. This seems likely to, eventually, lead to pressures for further regulatory reform. This pressure has been reinforced by the 1986/87 statistics that show that bus usage in London has gone up by 1.4%, whilst in the rest of Great Britain it has gone down by 7.3%, although clearly some of this is due to reduced levels of subsidy. This regulatory reform might be similar to the tendering out process that is being undertaken in London or, de-facto, that is being administered by National Express for most of the express coach market in England and Wales. Such a system would make the regulatory system in Britain more akin to the franchise systems common in continental Europe than the previous system of arbitration. However, it does seem, that in the short term at least, the pressures for deregulation will continue, with the 1985 Transport Act being extended to London in the near future.

REFERENCES

Bailey, E.E. and J.C. Panzer. 1981 "The Contestability of Airline Markets During the Transition to Deregulation". Law and Contemporary Problems. Vol. 44, pp 125-145.

Bannister, D. et seq. 1985. "Deregulating the Bus Industry in Britain (A) The Proposals (B) The Case Against (C) A Response". Transport Reviews. Vol. 5, No. 2, pp 99-142.

Baumol, W. J. 1962. "Business Behaviour Value and Growth". Harcourt and Brace.

Baumol, W.J. 1982. "Contestable Markets: An Uprising in the Theory of Industry". American Economic Review. Vol. 72, pp 1-15.

Baumol, W.J., J.C. Panzer and R.D. Willig. 1982. "Contestable Markets and the Theory of Industry Structure". Harcourt Brace Jovanovich. New York.

Bhagwati, J.N. 1970. "Oligopoly Theory, Entry Prevention and Growth". Oxford Economic Papers.

Bly, P.H. and R.H. Oldfield. 1986. "Competition between Minibuses and Regular Bus Services". Journal of Transport Economics and Policy. Vol. XX, No. 1, pp 47-68.

Bradley, M.A., P.A. Marks and M. Wardman. 1986. "A Summary into the Value of Travel Time Savings". PTRC Summer Meeting.

Buchanan, M. 1986. "Introduction: Public Transport in Perspective - Who Travels ? Who Pays ?". In Carr, J.D. (Ed.) "Passenger Tranport: Planning for Radical Change". Gower, Aldershot.

Button, K.J. and A.D. Pearman. 1984. "The Contestability of the U.K. Inter-Urban Bus Market". Paper presented at Transportation Research Board Annual Meeting. Washington D.C.

Button, K.J. and K.J. O'Donnell. 1985. "An Examination of the Cost Structures Associated with Providing Bus Services in Britain". Scottish Journal of Political Economy. Vol. 32, No. 1, pp 67-81.

Capozza, D.R. and R. Van Order. 1978. "A Generalized Model of Spatial Competition". American Economic Review. Vol. 68, No. 5, pp 896 - 908.

Clarke, J.M. 1961. "Competition as a Dynamic Process". The Brookings Institution, Washington D.C.

Cyert, R.M. and J.G March, 1963. "A Behavioural Theory of the Firm". Prentice-Hall.

Dasgupta, P. and J. Stiglitz. 1980. "Industrial Structure and the Nature of Innovative Activitiy". Economic Journal. Vol. 90, pp 266-293.

Department of Transport. 1988. "Bus and Coach Statistics. Great Britain. 1986/87" Statistics Bulletin (88) 29.

Dodgson, J.S. and Y. Katsoulacos. 1987. "Quality Competition in Bus Services: Some Welfare Implications of Bus Deregulation". Liverpool Studies on Bus Deregulation. Working Paper 1. University of Liverpool.

Douglas, N.J. 1986. "A Welfare Assessment of the Deregulation of the Express Coach Market in 1980". Gower, Aldershot.

Evans, A, and L. Hoyes. 1984. "The Hereford Trial Area". Working Paper. School of Advanced Urban Studies. University of Bristol.

Evans, A. 1987. "Competition and Other Economic Regimes for Bus Services". Journal of Transport Economics and Policy. Vol. XXI, No. 1, pp 7-36.

Evans, A. 1988 (forthcoming) "Hereford: A Case Study of Bus Competition". Journal of Transport Economics and Policy.

Fairhead, R,D. and R.J. Balcombe. 1984. "Deregulation of Bus Services in the Trial Areas. 1981-84". TRRL. Laboratory Report 1131.

Farrington, J. 1985. "Transport Policy and Transport Geography - Privatisation and Deregulation". In Knowles, R. (Ed)."Implications of the 1985 Transport Bill". Transport Geography Study Group. University of Salford.

Foster, C.A. and J. Golay. 1986. "Some Curious Old Practices and their Relevance to Equilibrium in Bus Competition". Journal of Transport Economics and Policy. Vol. XX, No. 2, pp 191-216.

Friedman, J.W. 1986. "Game Theory with Applications to Economics". Oxford University Press.

Galvez, T.E. 1986. "Competition on an Urban Bus Route: A Comment". Journal of Transport Economics and Policy. Vol. XX, No. 1.

Glaister, S. and C. Mulley. 1983. "Public Control of the British Bus Industry". Gower, Aldershot.

Glaister, S. 1985. "Competition on an Urban Bus Route". Journal of Transport Economics and Policy. Vol.XIX, No. 1.

Glaister, S. 1986. "Bus Deregulation, Competition and Vehicle Size". Journal of Transport Economics and Policy. Vol. XX, No. 2, pp 217-244.

Glaister, S. (Ed.) 1987. "Transport Subsidy". Policy Journals, Newbury.

Gomez-Ibanez, J.A. and J.R. Mayer with P. Kerin and L. Meyer. "Deregulating Urban Bus Services: Britain's Early Experience and the Lessons for the United States". Prepared for US Department of Transportation. Urban Mass Transportation Administration. November.

Graham, D., D.P. Kaplan and D.S. Sibley. 1983. "Efficiency and Competition in the Airline Industry". Bell Journal of Economics. Vol. 14, pp 118-138.

Graitson, D. 1982. "Spatial Competition a la Hotelling: A Selective Survey". The Journal of Industrial Economics. Vol. XXXI, Nos 1/2, pp 13-25.

Greenhut, M.L., G. Norman and C.S. Hung. 1987. "The Economics of Imperfect Competition: A Spatial Approach". Cambridge University Press.

Gwilliam, K. 1964. "Transport and Public Policy". Minerva Series. Allen and Unwin, London.

Gwilliam, K., P. Mackie and C. Nash. 1985. "Deregulating the Bus Industry in Britain (2) The Case Against". Transport Reviews. Vol. 5. No. 2.

Hay, D.A. 1976. "Sequential Entry and Entry Deterring Strategies in Spatial Competition". Oxford Economic Papers. Vol. 28, pp 240-257.

Hay, G.A. 1985. "Competition Policy". Oxford Review of Economic Policy. Vol. 1, No. 5, pp 63-79.

Hey, J.D. 1981."Economics in Disequilibrium". New York University Press.

Hibbs, J. 1968. "The History of British Bus Services". David and Charles. Newton Abbot.

Hibbs, J. 1985. "Regulation - An International Study of Bus and Coach Licensing". Transport Publishing Projects, Cardiff.

Higginson, M. 1987. "Competition and London's Bus Services". In Harrison, A. and J. Gretton (Eds). "Transport UK. 1987. An Economic, Social and Policy Audit". Policy Journals, Newbury.

Hopkins, J. and S. Oliver. "1986. Competition between Bus Services". TRRL, Transport Planning Division, Working Paper 23.

Jaffer, S.M. and D.J. Thompson. 1986. "Deregulating Express Coaches: A Reassessment". Fiscal Studies. Vol. 7, No. 4, pp 45-68.

Jansson, J.O. 1984. "Transport System Optimization and Pricing". John Wiley and Sons, Chichester.

Kahn, A.E. 1970. "The Economics of Regulation. Volume One: Economic Principles". John Wiley and Sons, New York.

Kilvington, R.P. and A.K. Cross. 1986. "Deregulation of Express Coach Services in Britain". Oxford Studies in Transport. Gower, Aldershot.

Koutsoyiannis, A. 1979. "Modern Micro-Economics". MacMillan. London.

Lee, N. and I. Steadman. 1970. "Economies of Scale in Bus Transport: Some Britisih Municipal Results". Journal of Transport Economics and Policy. Vol. IV, pp 15-28.

Mackie, P. and J. Preston. 1988. "Competition in the Urban Bus Market: A Case Study". PTRC Summer Annual Meeting.

Martinez, F. 1988. "Scope for Competition in the Urban Bus Industry: Mdels and Reality". MA Dissertation, School of Economic Studies, University of Leeds.

Mohring, H. 1972. "Optimization and Scale Economies in Urban Bus Transport". American Economic Review. September.

Meadowcroft, S. and L. Pickup. 1987. "The Initial Effects of the 1985 Transport Act in the Metropolitan Areas". Transport Studies Unit, Oxford University.

Nash, C.A. 1978. "Management Objectives in Bus Transport". Journal of Transport Economics and Policy. Vol. XII

Nash, C.A. 1985. "Competition on an Urban Bus Route: A Comment". Journal of Transport Economics and Policy. Vol. XIX, No. 3,

Needham, D. 1983. "The Economics and Politics of Regulation. A Behavioural Approach". Little, Brown and Company. Boston.

Novshek, W. 1980. "Equilibrium in Simple Spatial (or

Differentiated Product) Models". Journal of Economic Theory. Vol. 22, pp 313-323.

Oldfield, R.H. and P. Emmerson. 1986. "Competition between Bus Services: The Results of a Modelling Exercise". TRRL Research Report 72.

Preston, J. 1988. "Contestability and the Urban Bus Market". Technical Note 241. Institute for Transport Studies, University of Leeds.

Preston J. 1989. "Games People Play: Competitive Practices in the Urban Bus Market". UTSG Conference, Edinburgh.

Preston, J. 1989. "An Assessment of the Natural Role of the Minibus". (In preparation).

Posner, R.A. 1974. "Theories of Regulation". Bell Journal of Economics and Management Science. Vol. 5, No. 2, pp 335-358.

Salop, S.C. 1979. "Monpolisitic Competition with Outside Goods". The Bell Journal of Economics. pp 141-156.

Salop, S. and D. Scheffman. 1983. "Raising Rivals' Costs". American Economic Review. Papers and Proceedings. Vol. 73, pp 267-271.

Santoso, I. 1988. "An Interactive Computer Model for the Analysis of Bus Operation and Competition". Presented at the UTSG Conference, University College London. (Unpublished).

Savage, I.P. 1985. "The Deregulation of Bus Services". Gower, Aldershot.

Schwartz, M. and R. Reynolds. 1983. "Contestable Markets: An Uprising in the Theory of Industrial Structure: A Comment". American Economic Review. Vol. 73, pp 488-490.

Shaked, A, and J. Sutton. 1982. "Relaxing Price Competition through Product Differentiation". Review of Economic Studies, pp 3-13.

Shaked, A. and J. Sutton. 1983. "Natural Oligopolies". Econometrica. Vol. 51, No. 5, pp 1469-1483.

Starkie, D. and M. Starrs. 1984. "Contestability and Sustainability in Regional Airline Markets". The Economic Record, pp 274-283. September.

Stigler, G.J. 1971. "The Theory of Economic Regulation". The Bell Journal of Economics and Management Science". Vol. 2, No. 1, pp 3-21.

Turvey, R. and H. Mohring, 1975. "Optimal Bus Fares". Journal of Transport Economics and Policy. Vol. IX, No. 3, pp 280-286.

Tyson, W.J. 1987. "1986 Tendering in PTE Areas". A report to Association of Metropolitan Authorities and Passenger Transport Executive Group. (Unpublished).

Vickers, J. 1985. "Srategic Competition Between the Few". Oxford Review of Economic Policy. Vol. 1, No. 3, pp 39-62.

Walters, A.A. 1979. "The Benefits of Minibuses: The Case of Kuala Lumpur". Journal of Transport Economics and Policy. Vol. XIII, No. 3, pp 320-334.

Walters, A.A. 1982. "Externalities in Urban Buses". Journal of Urban Economics. Vol. 11, pp 60-72.

Waterson, M. 1986. "Privatisation: Why Might Ownership Matter ?". Newcastle Discussion Paper in Economics. No. 86-02. (Unpublished).

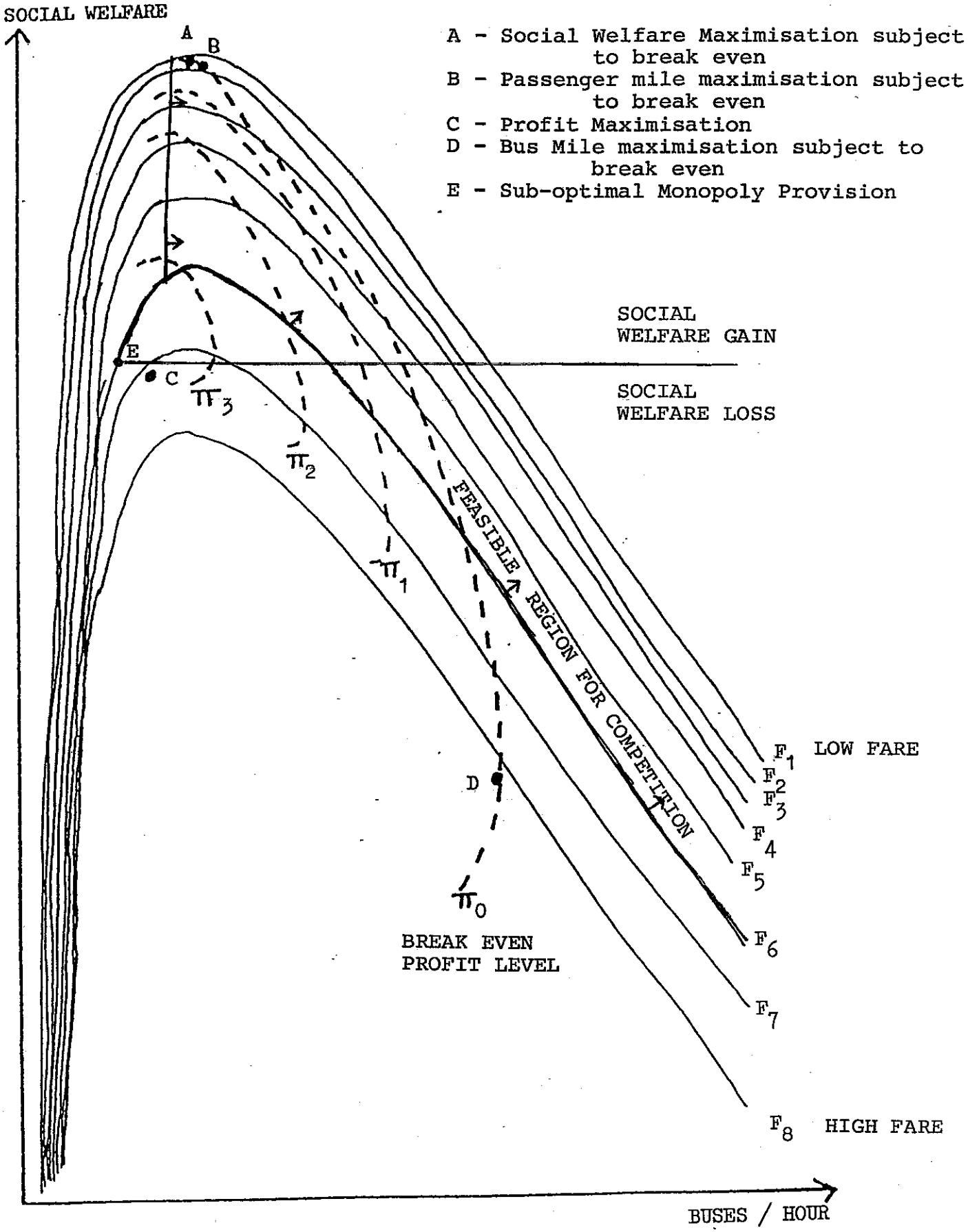


FIGURE 2 SOCIAL WELFARE / FREQUENCY / FARE MODEL

Source: Savage, 1985

FIGURE 3 PRICE DISCRIMINATING MONOPOLIST

Source: Koutsoyiannis, 1979, p.200

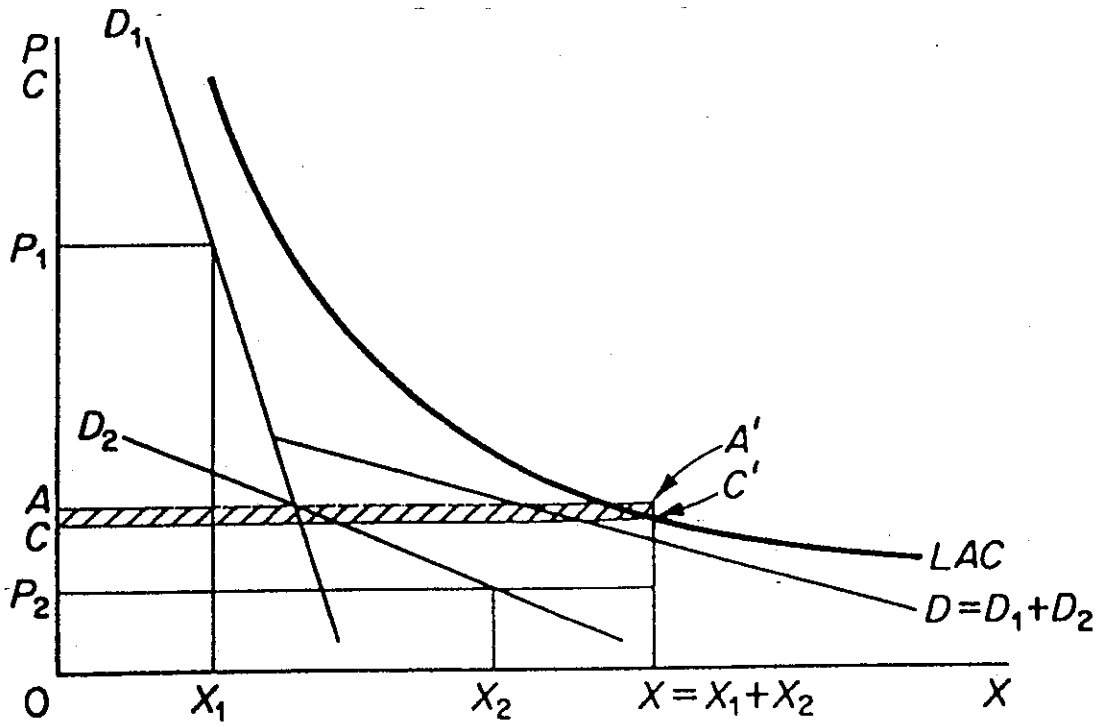


FIGURE 4 AN EXAMPLE OF GAMES THEORY (Based on Vickers, 1985).

		FIRM 2's STRATEGY	
		HIGH FREQUENCY	LOW FREQUENCY
FIRM 1's STRATEGY	HIGH FREQUENCY	1 / 1	0 / 3
	LOW FREQUENCY	3 / 0	2 / 2

Firm 1's pay-off is given in the bottom left hand corner. Firm 2's pay-off is given in the top right hand corner. In this example, Firm 2 might be considered the entrant and a policy of fares matching may be assumed . Assumimg a minimax strategy, the most likely outcome is that both firms will operate at high frequency, even though higher pay-offs would be achieved by both firms operating at high frequency even though higher pay-offs would be achieved by both firms operating at lower frequencies. This example, based on 'the prisoner's dilemma) illustrates the collusive pressures that exist in the bus industry.