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Evaluation of Competition in the British Local Bus Industry

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ABSTRACT

The British local bus industry has been organized as a system of strictly regulated route monopolies for more than 50 years. Suggestions that this monopoly is undesirable have prompted a critical appraisal to determine the economically optimal market structure. Contained in this paper is an analysis that concurs with the common view that competitive stimulus can result in lower-cost operation. The analysis concludes that a reduction in cross-subsidy, caused by competition on the more profitable routes and timings, will be beneficial. This result arises because cross-subsidy currently disguises some loss-making services that are provided needlessly, and is also an economically inefficient way, vis-à-vis direct subsidy, of funding unremunerative bus services. However, the analysis concludes that the current United Kingdom government's solution to this, of permitting competition between bus companies "on the road," is also undesirable. This is because direct competition is liable to result in short-term waste and will not a priori lead to optimum provision in the long run. In addition, it can cause problems by severing demand- and supply-side linkages and increasing the chance of unacceptable driving and maintenance standards. Therefore, the institutional problem addressed in this analysis is how to obtain the long-run benefits without the costs of unfettered competition on the road. This would indicate that, in the bus industry, competition for the market, rather than in it, is required. The analysis concludes that for an effective potential competition in the bus industry to exist, a regulated system with low entry barriers such as franchising or contracting of services should result.

Internationally, there has been a general reduction in transport regulation in the last 10 years. For example, controls have been removed from the airlines in the United States and from long-distance coaching in Britain. However, the proposed total deregulation of local "stage-carriage" services in Britain is highly significant as, with the exception of Chile, no comparable change has occurred elsewhere. This paper, which is based on a Ph.D. thesis undertaken from 1981 to 1984, attempts to determine the optimal market structure for this industry. Its conclusions are somewhat at variance with current United Kingdom government policy.

HISTORICAL BACKGROUND

Following intense competition on local bus services in the 1920s, regulation was introduced in the form of the 1930 Road Traffic Act. In addition to quality controls on operators and vehicles, the act set up a protected monopoly on each route, using a licensing system administered by regional traffic commissioners.

The basis for the granting of the licenses had two profound effects on the structure of the bus industry. First, the protected monopoly was granted partially in return for an undertaking by the bus companies to provide unremunerative services out of the profits generated on other activities (known as cross-subsidy).

Second, if an operator was already operating a route, he would have priority if the license was challenged by a potential entrant. Amalgamations and takeovers of neighboring companies in the 1930s coupled with the priority for licenses resulted in a small number of large bus companies, each of which had a secure territorial monopoly. In recent years, it was suspected that these large companies, now all publicly owned, and together providing 92 percent of local bus miles, had been cosseted by the priority principle from effective competition; thus, inefficiencies had arisen and innovation had been stifled.

A Conservative government was returned in 1979 with a policy of encouraging a competitive atmosphere throughout the public sector, and the bus industry was no exception to this. The 1980 Transport Act, in addition to removing all quantity controls over long-distance (express) services, removed fare control and encouraged some competition of the direct on-the-road kind on local services. This was not a major relaxation of licensing, however, and widespread competition did not emerge.

However, the Conservatives were reelected in 1983 and, in October 1985, an act was passed that will eventually deregulate the industry. It was considered that only a complete deregulation would (a) allow free-testing of innovation, and (b) secure and sustain cost savings. The Conservatives thus proposed to remove the licensing system. However, the monitoring of the quality of operators and vehicles is to be retained and strengthened, to protect the public from any "foolish" behavior by operators. In addition, because of concern about the amount of money devoted to subsidy, the government proposes that

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public money only be used to sustain services on routes or at times of day that would not be provided in the free market. Competitive tender will be introduced for the allocation of such support. Finally, the large publicly owned bus companies are to be reorganized into smaller free-standing parts and transferred to the private sector.

The purpose of this paper is to determine the most optimal (in the economic sense) market structure appropriate to the stage-carriage bus industry. It is thus concerned with the form of regulation rather than with the issues of optimum subsidy levels or ownership. It will answer the following questions:

1. Is there a need for a competitive environment?
2. If so, should there be "unfettered" competition (similar to that proposed), and
3. If unfettered competition is not desirable, what requirements are there for an optimal market structure?

THE NEED FOR A COMPETITIVE ENVIRONMENT

Four arguments can be advanced for wishing to introduce competitive stimuli into the bus industry. They are

- Operating costs can be reduced,
- Demand and supply will be better matched,
- Innovation will be encouraged, and
- The industry is not a natural monopoly and competition is likely to be sustainable.

Lower-Cost Operation

By the 1970s, it was believed that the regulatory system had protected inefficient or high-cost operators. The introduction of a competitive stimulus can be expected to lead to cost reduction either by lower-cost entrants to the industry forcing out higher-cost ones, or by commercial pressures making existing operators become more efficient. The author undertook investigations to see if either of these was likely to occur following deregulation.

Existing Firms Becoming More Efficient

Some economic writers, such as Leibenstein, suggested that economic welfare losses attributed to inefficiency (or "X-efficiency" as it is known) in monopoly situations are greater than the resultant allocative efficiency, deadweight loss (1). He argued that when profits are high, or when there is no competitive pressure, slack working practices result.

The author attempted to observe the most likely source for X-efficiency gains within existing bus operators. Following studies of both a labor market (bus drivers) and a capital factor market (the market for buses), it was concluded that the former market had the most scope for an X-efficiency gain.

In the labor market, the author's investigations indicate that the competitive effect will be manifested in the productivity rather than the wage dimension. This is not surprising as wages are generally determined nationally, although work content is broadly under the control of local management. To test for this, the author undertook econometric analysis on data [for subsidiaries of the state-owned National Bus Company (NBC)] before and after the limited relaxing of licensing in 1980.

Analysis of the wage data did not identify any perceptible change following the new legislation. However, econometric results of investigations of productivity data gave indications, albeit not statistically significant, that there was room for improvement. This supports a wealth of descriptive analysis that indicates that productivity can be increased. In particular, there is a plethora of restrictions on the scheduling of driving staff to particular runs. As far back as 1967, the National Board for Prices and Incomes (2) had noted on the subject of scheduling constraints that "There is evidence . . . that the scope for negotiable change may well be considerable."

The author concurs with this and believes that statistically insignificant changes in productivity following the 1980 legislation were due to the general paucity of entrants to the market rather than the existence of limited potential to increase productivity. This suggests that greater X-efficiency reductions may only result from a market regime in which the threat of potential competition is more real and effective.

Lower-Cost Operators

In traditional economic theory, a benefit of competition occurs when a genuine lower-cost firm replaces a higher-cost one. In Britain, there are numerous independent operators (nearly 6,000) of which a proportion would wish to provide scheduled local bus services. The author investigated whether these operators were genuinely lower cost compared with the large, local bus companies.

A direct comparison of costs is problematic. For example, the comparison of operating costs for different operators on similar routes or timings is not meaningful. The interworking of routes or timings, or both, by bus companies means the level of cost on individual routes or timings depends on how they fit into a governed set of other operations.

Because of these economies of scope, route costs do not necessarily reflect the underlying differences in unit costs between operators. Thus, the cost of operation by two operators need not be ranked the same on all routes. However, it is argued that if sizable parts of networks were passed to independent operators, there would be a saving in resource cost.

Accepting this, the evidence that independent operators have cost advantages when they are small is considerable [for example, Tunbridge and Jackson (3)]. However, it should not be inferred that this advantage would persist if these operators gained a large local bus operating commitment. This involves additional costs of bus stations, inquiry offices, and bus stops as well as operating at times that are traditionally relatively expensive (e.g., evenings and Sundays, and the provision of high- and off-peak vehicle ratios). In addition, the increased company size may result in increased unionization or a change in labor union attitudes, or both. Nevertheless, a licensing system, based on longevity of operation and not level of costs, can preclude genuine lower-cost operators if they emerge. Recent evidence (4) has suggested that small private operators could be up to 20 percent cheaper than existing operators.

In summary, opportunities for reduced operating costs following deregulation do appear to exist. However, it will be noted that much of this reduction is due to a reduction in staff wages and conditions. Therefore, only part of the cost reduction will actually be a welfare gain to society, as much of the cost reduction will merely be a transfer from workers' to producers' or consumers' surplus. The actual split between transfer and social welfare gain will depend on the amount of passenger traffic generated as a result of the lower-cost operation being passed on to the consumer.

Better Matching of Demand and Supply

The 1930 legislation inherently encouraged cross-subsidy between services and times of day. Indeed, since the Second World War, the traffic commissions have, in the face of declining demand, explicitly tried to maintain the largest possible network by the use of cross-subsidy. However, it has been argued in recent years that cross-subsidy was both distorting individual bus markets and disguising services that were being provided needlessly.

It may be presumed that entrants to the stage bus industry, being primarily private companies, will seek to make a profit. They may thus be expected to attack the routes and timings of the existing network operators where they can make the most money. The abstraction of revenues from the profitable segments will lessen the amount of finance available for cross-subsidy. Thus, competition can be expected to reduce cross-subsidy. In the following section it is argued that this reduction in cross-subsidy will result in a more efficient allocation of resources.

The Definition of Cross-Subsidy

The definition of internal cross-subsidy is problematic. It exists because profits on some activities are used to support loss-making activities. It is therefore particularly important to define "profits" and "loss-making." This will depend crucially on the assumptions made concerning costs. For management purposes, the true definition of a cross-subsidized service must be when avoidable costs exceed avoidable revenues. Thus, the Ponsonby/Hibbs (5,6) test of "Would we be better off if we did not run service X?" would be the most appropriate. The problem of data has meant that, traditionally, a system of fully allocated costs and revenues has been used to identify cross-subsidy.

On this basis, certain characteristics of cross-subsidy have been identified by recent studies by the Institute for Transport Studies (ITS) (7), the MVA Consultancy (8), and Booz-Allen and Hamilton (9). The cross-subsidy between routes is widely recognized. The ITS work indicates that, generally, the interurban routes support rural and, to a lesser extent, urban routes. Cross-subsidy between times of day on individual routes is less well known and depends crucially on the allocation of costs adopted. The recent works have shown that the extent of cross-subsidy varies by location. However, the weekday interpeak and Saturday daytime periods have generally been identified as the main surplus generators, and the evening and Sunday periods are unremunerative. The financial position of the peak periods depends largely on the number of vehicles solely reserved for use at that time. A third type of crosssubsidy is between individual parts of a route. However, the data complexities have meant that none of the recent studies have tackled this.

The overall implication is that not only is there a transfer of surplus between passengers on different routes at different times of day, but there will also be a transfer between different person types and journey purposes. The recent studies have shown that cross-subsidy is not only widespread, but also, as the ITS and MVA work illustrates, can be more important than external subsidy in maintaining unremunerative activities.

A Critique of Cross-Subsidy

Internal cross-subsidy has been subject to a large amount of criticism. A particular criticism is that it can cause a misallocation of resources. This is because (a) passengers on remunerative activities are paying higher prices or receiving lower frequencies than they would if capacity were expanded to remove abnormal profit and (b) on some unremunerative activities, cross-subsidy is presently supporting a level of provision that does not reap sufficient consumer benefits to outweigh the resource costs. [Note that the distortion to efficient allocation of resources caused by cross-subsidy has been analyzed by Gwilliam (10).]

The implication, therefore, is that if competition on remunerative activities reduces the level of cross-subsidy, then, in these circumstances, there will be a better matching of demand and supply in all bus markets and, therefore, a more efficient allocation of resources. However, not all unremunerative activities reap insufficient consumer benefits to justify their existence. In these cases, the crucial issue becomes whether it is more efficient to financially support these services by raising abnormal profits on inherently profitable activities, or by direct payment from public funds.

The cost of raising public funds is not clear-cut, however, as any increased local authority support might come from a variety of sources. Browning (11) reviewed the shadow price of taxation and found it to lie in the region of 1.1, depending on the form of taxation used. This can be compared, on a purely allocative basis, with the welfare cost of raising abnormal profits on inherently profitable operations.

The distributional consequences are arguably the more important. Obviously, as a result of the relative numbers of people involved in the two scenarios, the burden of losses per person on the passengers in the subsector where finance for cross-subsidy is drawn is probably larger than the welfare losses of whatever taxation system provides the alternative. Therefore, if unremunerative activities are now provided by a general taxation system, then there would be a shift from raising money from (primarily) women on shopping trips to the community in general. It can be argued that this is certainly more equitable and may be better in terms of distribution.

The author concludes that on an allocative basis, it is not clear which (direct subsidy or cross-subsidy) is welfare-superior. However, the effects on cross-subsidized services cannot generally be used as an argument against competition, as activities that have higher consumer benefit than resource cost can potentially be funded by direct subsidy, which is liable to be preferable to cross-subsidy on a distributional basis.

In summary, the reduction in cross-subsidy as a result of competition can be seen as beneficial because (a) cross-subsidy is an opaque form of subsidy and can disguise loss-making services provided needlessly, and (b) on the balance of allocative and distributive arguments, direct subsidy is preferred to cross-subsidy.

The implication, therefore, is that competition will a priori increase the amount of direct subsidy required to maintain the current network. In Britain, deregulation is occurring at a time of great pressure on government expenditure. Therefore, some service loss might be expected unless subsidy is sufficiently increased. The United Kingdom government, however, has argued that the increased subsidy requirement, resulting from the loss of cross-subsidy, will be counteracted by a reduction in expenditure as operators' costs fall in the competitive environment. Whether this will be true or not will depend crucially on the amount of cross-subsidy in a particular local network and the magnitude and timing of cost reductions. A recent Booz-Allen and Hamilton study (9) graphically illustrated this trade-off. In the

County of Surrey, cross-subsidy was found to be relatively low (£1 of cross-subsidy to every £3 of external subsidy), yet cost reductions of from 10 to 15 percent were needed to counterbalance the effect on direct subsidy of the loss of cross-subsidy.

Undoubtedly, the high probability of withdrawal of loss-making services after deregulation can be seen as a negative argument for competition. However, the author does not concur with this because (a) the reduction in cross-subsidy is a desirable long-term objective of transport policy and (b) if there is a loss of service because external subsidy has not increased, then the tax-paying public have inherently shown their preference (via their elected representatives) on the extent of loss-making services to be provided. This contrasts with the present situation where the cross-subsidy is raised from some transport users who are often not identified, let alone consulted on their preferences on the size of the network.

Innovation

Academic researchers have not proved conclusively whether a monopolistic or competitive market structure produces more innovation (12,13). However, it is contended that, in this industry, it has been the form of monopoly (i.e., the issue of route licenses) which has meant that there has been inflexibility to experiment and innovate.

An objective of the 1980 legislation was the hope that innovation could be encouraged in rural areas where informal public transport would replace the fast-disappearing traditional service. However, experience in the 1980s suggests that these deeply rural (and deeply unprofitable) services would only be encouraged by local authority subsidy and not relaxation of licensing. Therefore, the author concludes that, if strict route licensing were relaxed, then innovation would be expected in urban rather than rural areas and would take the form of new links in the network, product differentiation (especially paratransit), and competition against the railways.

Although not all innovation will be an a priori benefit, it can be reasonably expected that competition will cause innovation in the industry. Indeed, in Britain, NBC is introducing high-frequency minibus services in many towns in the run up to competition. In the section "Optimal Innovation" (elsewhere in this paper), the author discusses whether unfettered competition actually leads to the optimal amount of innovation.

Sustainability

It is frequently argued that there is no a priori reason why the local bus industry should be a monopoly. Research indicates that first, the industry is not a classic natural monopoly, and second, competition is likely to be sustainable. A study of the publicly owned bus industry by Lee and Steedman (14) found few economies of scale relative to company size. It is now commonly accepted that the bus industry displays constant returns to scale in terms of bus miles produced. In terms of the classical definition, the bus industry is therefore not a natural monopoly.

In addition, where there are incentives to enter the market, competition appears likely to be sustainable, especially if traffic is heavy or if the capacity offered is small in relation to the existing operation. This is due to the nature of local bus competition with low entry and exit costs, free access to the market, and no prebooking. Qualifications are that there appears to be a need to regulate terminals to avoid monopoly returns to their owners, and also that competition needs to occur on enough fronts to stop predatory action against entrants.

The system of statutory monopoly with priority for (what became) large network operators is alleged to have led to inefficiency, stifled innovation, and cross-subsidy. There would thus appear to be strong and undeniable arguments (based on X-efficiency gains, the introduction of low-cost operators' greater control over the level of provision on unremunerative services, and encouraging innovation) for the introduction of a competitive market structure into the stage bus industry.

SHOULD THERE BE UNFETTERED COMPETITION?

The solution adopted in Britain to deal with the disadvantages of monopoly has been to encourage direct competition on the road. The author concludes that the unfettered competition has several serious disadvantages:

- Wasteful competition in the short run,
- Nonoptimum long-run price/frequency outcomes,
- Erosion of demand- and supply-side links,
- The existence of artificial monopolies,
- Uncertainty,
- Nonoptimal innovation, and
- Reduced levels of safety.

Wasteful Competition

In the 1920s, it was frequently argued that competition on the road was unnecessary and wasteful. This implied that the competitive benefits to consumers on the competed route--from reduced fares and waiting times and the consequent generated traffic--are outweighed by the additional resource costs involved in competition. The author undertook an analysis, using economic models, to determine under what conditions this argument holds.

To do this, a model was developed to help understand competitive market decisions. It was clear that actual competition in the bus industry will tend toward oligopoly (competition among few) rather than perfect competition (competition among many). In the case of oligopoly, the inappropriateness of existing theory meant that the author had to develop a game theoretical approach to the policy decisions made by the competitors.

Using this model, an analysis of possible decisions by operators indicated that two tactics would generally be favored in competitive situations. First, each operator would wish to time his bus to "headrun" the opposition, whereby an operator locates close in front of the opposition and takes all the traffic. This is a version of the well-known Hotelling (15) principle whereby competitors locate spatially close to each other. Second, there is strong pressure, when competition is based on a homogeneous product, not to let price differentials persist and, thus, matching of fares is noted. Bearing these points in mind, it is possible to analyze whether the move to oligopoly from a base monopoly fare and frequency combination will produce increased or decreased social welfare.

An analytical device was developed from an underlying bus route cost-and-benefit model [described in detail in Savage (16, Chapter 5)] in order to do this. A diagram can show the relationship between frequency offered (per period of time) and the social welfare level resulting for a given fare level. This is shown in Figures 1 and 2, in which fare level F2

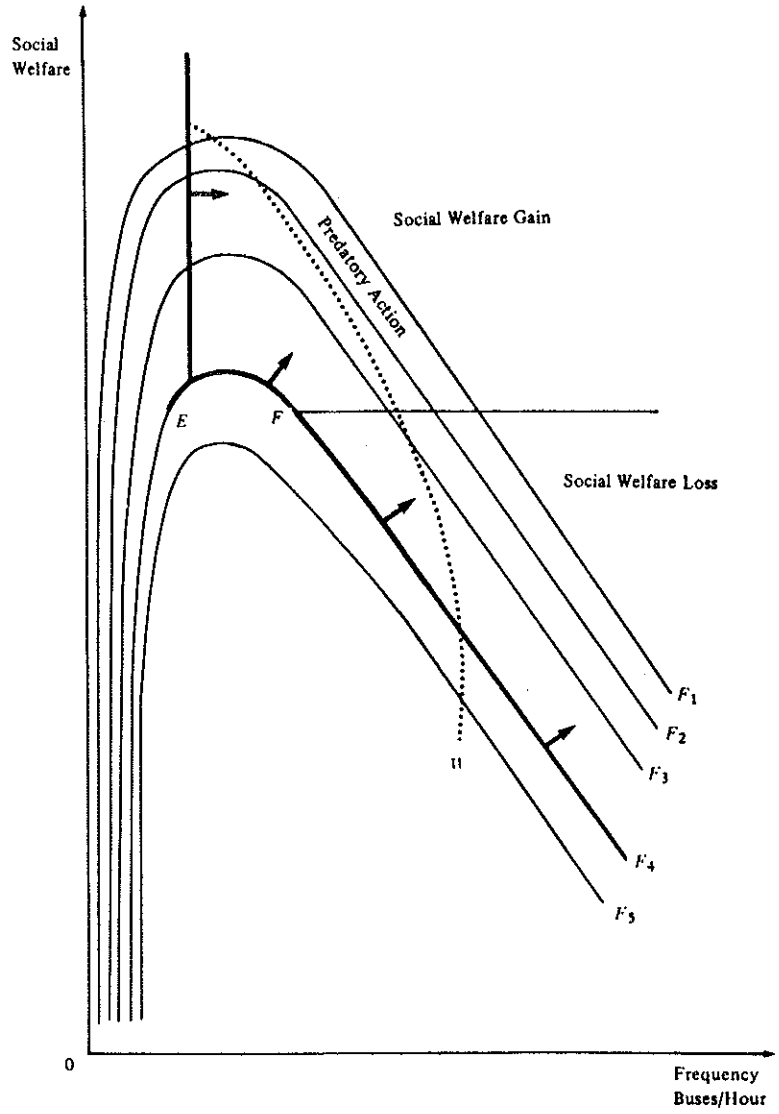

FIGURE 1 Wasteful competition—under-optimal provision.

is greater than fare level F1, and so forth. For a given fare level, additional buses at low frequencies produce an increase in social welfare as waiting times are significantly reduced and considerable traffic generated. An optimal level is then reached and, after that, social welfare declines as additional buses are put on. This is because the benefits of reduced waiting times are now much smaller (and the amount of generated traffic much less) and these are outweighed by the additional resource cost of the additional capacity provided.

The level of producer surplus (or profit) can also be represented in the diagram. This is shown by the broken contours. The most important of these is labeled Π_0 and represents the break-even position. All fare and frequency combinations outside of this contour represent a loss on the bus route. If the fare and frequency pair on a route is on the break-even contour (or, because of the indivisibilities, up to one bus per unit of time inside it), it would not be possible to expand capacity without incurring a financial loss on the route. Unless it would be taking predatory action, no bus company would be willing to move the route (and hence itself) into a loss-making position. The most favorable routes for entrants are those that generate a surplus. Thus, it can be expected that the routes on which competition is likely to occur are those on which the present fare and frequency combination is well within the break-even contour.

Oligopolistic competition is now introduced into the model. In the succeeding analysis, the following initial assumptions have been made:

1. Fare matching occurs;
2. The competitors have similar costs; and
3. Except when buses are full, the greatest advantage to he consumer accrues when buses are inserted equally between existing departures.

(Assumptions 2 and 3 will later be relaxed, however.)

To observe whether competition will bring a social welfare gain or not, it is necessary to look at two general cases. The first of these is where the monopoly frequency was originally less than the optimum, as it may be, particularly in some peak periods. This is shown in Figure 1. The monopoly fare and frequency combination is at point E. A feasible region for competition can be defined by applying the criteria that (a) fares cannot increase, and (b) frequency must increase by at least one bus per unit of time, as the competitor has to introduce some capacity. The representation of this in Figures 1

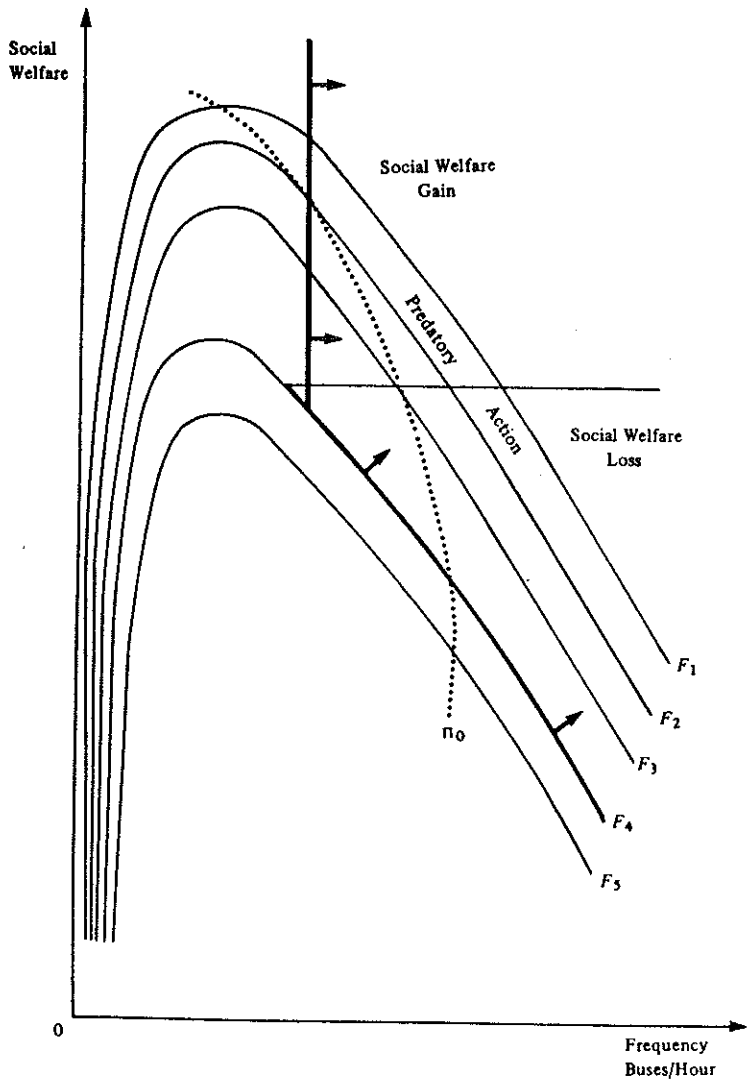

FIGURE 2 Wasteful competition—over-optimal provision.

and 2 will depend crucially on the horizontal scale adopted.

This is the area above and to the right of the bold line. The part of the area beyond the break-even contour represents fare and frequency combinations that would make the route unprofitable. Thus, fare cuts or frequency increases, which move the route into this region, depict predatory action on behalf of one of the bus companies. The area inside the break-even contour, however, represents fare and frequency combinations in which all firms are making a profit and, thus, oligopoly is more stable.

If a horizontal line is drawn through the feasible region at the same level of social welfare as point E, it is observed that all points above this line represent a welfare gain and all points below, a loss. In this particular case, it is noted that on the frequency and welfare function between points E and F, social welfare can be increased by introducing new capacity alone, without the need for reductions in fare. It is only in the case where monopoly fare and frequency are suboptimal, and competition takes the route to the optimal point, that oligopoly has been successful in moving a suboptimal monopoly resource allocation toward the welfare optimum.

However, in an industry with declining demand, a dynamic version of the model would have the frequency and welfare functions moving down and to the left. Attempts to maintain capacity in the face of declining demand would lead to the monopoly frequency being greater than the optimum (Figure 2). It is observed that the fare and frequency combinations in which a social welfare benefit, without losses (depicted by the shaded area), occurs is now much smaller. For a welfare gain, any increased frequency must be matched by a cut in average fare levels. However, for any given increase in competitive capacity, the entrant will maximize his constrained profit by pricing close to the existing fare. This is not compatible with moving to the shaded area. This rule remains valid regardless of how far point E may be from the optimum frequency.

When the assumptions on cost and timings are relaxed, it is observed, in the case of the entry of a lower-cost operator, that the area where a welfare gain can be experienced without financial loss increases marginally but does not alter the overall conclusion of the analysis. However, if, as has been observed, entrants have located themselves close to existing timings (known as "headrunning"), then society will gain little consumer benefit at the expense of additional resource costs. In this case, it is extremely unlikely that there would be any scope for social welfare gain, even if massive fare reductions were offered.

In conclusion, unless peak inadequacy is relieved or substantial traffic is generated, which, in practice, is unlikely, it would appear that in the short

run the oligopolistic market structure will not cause a previously suboptimal monopoly resource allocation to converge on a welfare maximum. Furthermore, it is probable that an oligopolistic regime will lead to reduced social welfare and a waste of resources, particularly if the favored competitive tactic of headrunning is employed.

Nonoptimum Prices and Frequencies

In the preceding section, it has been concluded that the on-the-road competitive phase of the oligopolistic game will generally be wasteful. However, this wasteful interlude is likely to result in a return to monopoly, either by some of the competitors dropping out of the market, or by collusive agreements being reached. It is therefore appropriate to ask whether the long-run fares and frequencies resulting from competition will be optimal.

An analysis of which fare and frequency combinations will be chosen on the return to monopoly is difficult as, in practice, a monopolist can select one of many combinations to offer on a route. Nash (17) identified four likely areas for maximization management objectives as follows:

- Social welfare,
- Profit,
- Passenger mile, and
- Bus mile.

Apart from the specific welfare-maximizing policy, only passenger mile maximization--with passenger miles weighted according to their social function (18)--is a proxy for social welfare optimization. A profit-maximizing monopolist will not therefore select a fare and frequency combination consistent with an optimum allocation of resources. Indeed, it would appear that unless a welfare-maximizing management objective, subject to budget constraint, is adopted, there is no a priori reason why a monopolist will select an optimum allocation of resources in preference to any other fare and frequency combination.

Two conclusions can be drawn at this point. First, left to their own devices, monopolists are unlikely to provide socially optimal fare and frequency combinations. Second, it does not appear a prior that competitive interludes will necessarily improve matters as there would appear to be no reason why the competitive phase will necessarily influence the final fare and frequency choices.

In economic terms, where the final outcome is not welfare-superior to the precompetitive resource allocation, the intervening oligopolistic period--on the basis of the analysis of the section on Wasteful Competition will probably have been wasteful. Even if the intervening competitive phase does lead to a welfare-superior final outcome, there is likely to be a "pay-back" period in which the benefits of the new monopoly solution compared with the original one are cancelled out by the wastes of the competition.

Overall, different market structures can be judged according to whether they will converge on a social welfare-maximizing solution. However, the difference between the units of demand and supply in bus operation (meaning that operators can choose both the fare they charge and the output they produce) results in there being many possible fare and frequency combinations that satisfy any particular budget constraint. In neither of the market forms studied (monopoly and oligopoly) was there any reason why the social welfare-maximizing combination, rather than any other combination, would necessarily be chosen. In addition, the introduction of competition is not likely to make a previously inefficient monopoly allocation converge on the social optimum. In conclusion, it would therefore appear that to obtain the optimal allocation on a route, it is better to use a policy that would encourage a monopolist to act in a socially efficient way rather than a policy of unfettered competition on the road.

Demand and Supply-Side Links

Competition will be expected to occur only on the remunerative parts of existing networks. It is therefore quite likely that networks will be broken up. This may have undesirable consequences if there are linkages, either on the demand or supply side, between routes. The author undertook an analysis to try to identify whether any such links exist.

On the supply side, some linkages are inevitable in an industry producing multiproducts (i.e., routes). These links--described as "economies of scope"--occur when advantages can be made from complementarity in production. In the bus industry, this occurs not only when these are joint costs (i.e., management) but also when vehicles are interworked between services. Where this occurs, there may be localized natural monopolies arising from the economies of scope (19,20). If price is divergent from costs (i.e., for the purpose of cross-subsidy), then a regime of indiscriminate competition can result in breaking of the natural monopoly and a loss of the cost-saving complementarities.

On the demand side, there are often complementarities of revenue. This classically occurs in the case of feeder routes. The feeder route may make a loss by itself, but it may generate a more-than-compensating increase in revenue on a trunk route. This may also be the case when a bus company provides some services unprofitably in, for example, the evenings because it knows this will have a positive overall effect by making the service more attractive to the rider. In both cases, these unprofitable but commercially viable (in a network context) services can only exist by a monopoly operator being able to realize jointness in demand by making financial transfers between services. In an era of uncontrolled competition, these financial links will be severed--as profits are competed away--and services only provided commercially on the basis that revenues they generate elsewhere might become unviable and, therefore, endangered.

A similar argument also applies to the increasing trend toward prepurchased system- or zone-wide tickets. Although these ticketing systems are not a priori necessarily a benefit, the fragmentation of networks in a competitive regime is likely to reduce the ability to continue to offer these schemes. The author was unable to undertake any analysis on this point.

Artificial Monopoly

The recent work in identifying cross-subsidy in bus operations (discussed previously) has indicated that the profit incentive does not exist in many parts of the bus industry. Therefore, even if entrants have relatively low costs, competition will not be seen on much of the current network (i.e., artificial monopolies exist). The United Kingdom government is proposing to overcome this problem by instigating a system of specific operating subsidies for individual routes, allocated between operators by competitive tender. Therefore, on the unremunerative services, competition will be encouraged for the market rather than in it.

However, the cross-subsidy analysis also reveals that, of the profitable services, many are financially marginal in nature. With the prospect of increased competitive capacity leading to reduced load factors, which, in turn, leads to operating losses, some currently commercial services will also not witness competitive activity. With the absence of incentives to enter the market in a proportion of the local bus industry, it can be assumed that unfettered competition will not allow the effects of competitive stimuli to be fully felt.

Uncertainty

An international collaborative study (21) highlighted the importance of service reliability in determining public transport demand. A concern raised with unfettered competition is that the short-run, intensely competitive phase will feature relatively frequent changes in operator timetables and fare scales. This will lead to uncertainty and could have a damaging effect on the overall level of patronage. The author, while concurring with this view, cannot personally bring any concrete evidence for debate.

Optimal Innovation

The preceding discussion (see section on Innovation) concludes that moving away from the existing controlled license system would encourage innovation in the industry. It is clear that innovation that produces increased social welfare is desirable; however, it is not clear whether unfettered competition will necessarily result in only optimal innovation. The author investigated this point.

Whatever form innovation will take, it is likely to impinge on existing services in one form or another. Therefore, the proper way of evaluating innovation is to compare the original service with the innovated service running exclusively. The analysis splits innovation into two types. The first is where the innovation is welfare-inferior to optimal provision by the existing service, but can compete because the existing service is currently inefficient. Entry of this type is likely to not only cause short-run losses of on-the-road competition, but could, if successful, lead to a nonoptimal method of provision. It would have been preferable if the existing operator had been initially encouraged to adopt a more socially desirable output and price combination.

The second case is where the innovation is commercially viable, and operating exclusively would be welfare-superior to the optimal provision by the existing service. In these circumstances, it is desirable that the innovated service, at least partially, replace the existing one. However, competition on the road might lead to the innovation not coming to fruition (because of the financial dominance of the existing operators), or, even if successful, the competition during the innovation's introduction is likely to be wasteful in social welfare terms.

In conclusion, it would appear that unfettered competition is not an effective sorting device for use in selecting the most beneficial innovations in the bus industry.

Safety

In the 1920s, unruly competitive driving practices and suspect maintenance initiated public interest in regulation. Although vehicle engineering and general road safety have improved considerably in the intervening period, the prospect of renewed competition has provoked many safety concerns.

Safety concerns can be divided into two aspects. The first is road safety, about which the author concludes that there is a possibility of unruly driving practices as a result of competition on the road. This arises from the polarizing of timings attributed to headrunning, which leads to racing and blocking of stops.

The second aspect is the quality of operators. A comparison of small operators, who might constitute the entrants to stage operation, and large network operators, indicates that there are no grounds for believing that there is any difference in accident rates (22).

However, a survey by the author (23) indicated that the smaller firms tend to have a much higher number of faults on their vehicles. The survey related to the Yorkshire area for 1983. The number of faults (officially graded as "prohibitions" and "notices of defects") detected by government examiners was tabulated by operator fleet size. The analysis is given in Table 1.

TABLE 1 Prohibitions and Defects per Million Vehicle Kilometers Tabulated by Operator Fleet Size

Fleet Size	Number of Operators	Faults
1	131	6.5
2	63	5.6
3	61	6.4
4	54	3.4
5	29	1.4
6-9	71	2.1
10-14	35	2.5
15-19	16	1.7
20-49	7	3.1
50+	11	0.7

The figures indicate that a typical 1-vehicle firm has more than 9 times as many faults per vehicle-kilometer as compared with a large operator, while a comparable figure for a 10- to 14-vehicle fleet operator is about 3.5 times as many as the large operator. What becomes clear is that there is a continual (and statistically significant) decline in the number of faults as fleet size increases.

Because the public cannot readily determine the quality of operators, drivers, and vehicles, there would appear to be no case for lessening the quality regulatory controls. Indeed, if a change in market regime leads to smaller operators undertaking stage work, there would be a case for more vigilance on the part of regulators. This would particularly be the case when fierce competition reduces financial returns to operators, who may then be forced to make economies in their maintenance.

The United Kingdom solution, which inherently encouraged direct competition on the road, does not appear to be the most optimal way of dealing with the disadvantages of monopoly. Thus, liberalization, or total removal, of licensing does not provide the answer. Unfettered competition has the following serious disadvantages:

- Direct competition on the road is likely to lead to a short-run social welfare loss on the route, as consumer benefits are outweighed by the additional resource costs; in addition, oligopolistic competition does not necessarily produce a long-run optimum resource allocation;

- Some jointness of demand may be broken and thus endanger services (i.e., feeder routes) commercially justified as a result of contributory revenues;
- Financial dominance of existing operators may impede the introduction of beneficial innovation;
- Some local economies of scope may be lost;
- Some nonbeneficial innovation might be introduced and could, if successful, lead to a nonoptimal service provision;
- Chance of unruly driving practice is increased;
- Integration between services may be lost and public goodwill may be endangered by a bad operator; and
- Uncertainty may arise.

In addition, the existence of artificial monopolies means that competition is unlikely in some parts of the present system and, thus, the full competition stimulus may not be felt.

REQUIREMENTS FOR AN OPTIMAL MARKET STRUCTURE

Given the problems of unfettered competition, a more nearly optimal solution to the disadvantages of the existing monopoly has to be found. In this section, the features of an ideal market regime are identified.

Direct Competition to be Avoided

The disadvantages of competition on the road, particularly the short-run welfare losses, the dangers from unruly driving practices, and the possible introduction of nonbeneficial innovation, indicate that a route monopoly system would be preferable.

No Priority System

The problem with route monopolies is how to allow for a control of costs, and also ensure that the monopolist maintains socially efficient fares, frequencies, method of operation, and reliability. Recent work (24,25) has indicated that the threat of potential competition can be as effective as actual competition in achieving these objectives. The problem in this industry is how to make the threat of competition real, yet preserve route monopolies. The solution would appear to be that any route monopoly should not be for perpetuity, as has been the case since 1930, but should be renewable after a certain period of time.

A system would have to be devised to decide between rival operators when route monopolies come up for renewal. Some options are (a) where a controlling authority sets socially optimal fares and frequencies and invites tenders on the basis of cost (known as "contracting"), and (b) where firms tender a proposed cost-fare-frequency combination, from which the controlling authority chooses the most optimal (known as "franchising"). Mackie (26) describes both of these systems. The optimal length of the contract-franchise would have to be determined with regard to the depreciation of capital (the most important being vehicles) to make bus operation attractive to operators.

This system will have the desired effects in that the competing tenders for the franchise and the determination of the contract terms will influence operators to act in a socially efficient way. This may include innovative routes and methods of operation, and the introduction of low-cost operators attributed to the implicit cost competition in the tendering process. In addition, a short-period, contract-franchise system will mean that the threat of potential competition, when the routes are next put up for tender, will encourage monopoly incumbents to maintain efficient management objectives, be reliable in operation, and also control X-efficiency. However, it may be necessary to word the contract-franchise in such a way (i.e., inflation-linked cost allowances) so as to maintain pressure on costs during its currency.

Recognition of Demand- and Supply-Side Links

Peacock and Rowley (27) present a solution to the problem of service tendering while preserving the benefits of natural monopolies or demand-side links, or both. They argue that localized groups of services, rather than individual services, should be the unit by which bus operations are put out for tender.

Unremunerative Services

It would be possible to put both profitable and unprofitable activities out to tender. In the latter case, routes would be tendered and evaluated on the basis of fares, frequencies, and the amount of revenue support required. This would mitigate against artificial monopolies, which would otherwise preclude competition on much of the present network.

Controlling Authority

There would need to be a controlling authority which, in addition to unbiasedly administering the contracting and franchising system, could also maintain goodwill and request through-fares and other integration policies. As a result of the need to make revenue support available for unremunerative activities (e.g., integration or other policies), the body to undertake this work would preferably have to be directly publicly accountable and able to raise public finance.

An additional task for a controlling authority, especially if a competitive stage-carriage market leads to more smaller operators, is to monitor the quality of operators, vehicles, and drivers. This need not necessarily be conducted by the contracting and franchising authority previously described, although safety considerations must be input to the outcome of a tendering exercise. At present, the government-appointed regional traffic commissioners do undertake such duties in the bus and coach market. Because local services are a minority of total coaching operations, it might be sensible to leave quality regulation of operators in their hands.

CONCLUSIONS AND POLICY PRESCRIPTION

A market regime has to be found that would give the benefits of competitive stimuli without the disadvantages of direct competition. Baumol (25) and others have argued that the benefits of competition can accrue from potential and not actual competition. He stated, "The heroes are the (unidentified) potential entrants who exercise discipline over the incumbents."

The institutional problem is how to make the threat of potential entry effective (i.e., have low barriers to entry), but avoid direct competition. It

would thus appear that in this industry, the optimal solution is competition for the market rather than competition in it. This would suggest that a system of competitive contracting or franchising of services should result.

This will bring the benefits of competitive stimuli, while avoiding the problems of the wastes of direct competition and the danger to the public posed by unruly driving practices. In addition, the authorities can monitor goodwill and safety standards, and request through-fares or other integration policies. The benefits of demand-side links, or localized economies of scope, can be realized, if necessary, by the controlling authority putting out to tender groups of, rather than individual, services. A competitive atmosphere can also be encouraged across all the network, by the controlling authority offering unremunerative services on a "negative tender" system, whereby services are allocated to operators on the basis of who requires the least subsidy.

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REFERENCES

1. H. Leibenstein. Allocative Efficiency vs. "X-Efficiency." American Economic Review, Vol. 56, No. 3, Aug. 1969, pp. 392-415.
2. Productivity Agreements in the Bus Industry. Report 50, Command 3498. National Board for Prices and Incomes, Her Majesty's Stationery Office, London, England, 1967.
3. R.J. Tunbridge and R.L. Jackson. The Economics of Stage Carriage Bus Operation by Private Bus and Coach Companies. Laboratory Report 952. Transport and Road Research Laboratory, Crowthorne, Berkshire, England, 1980.
4. Guildford/Cranleigh Bus Study. MVA Consultancy, Plymouth, Devonshire, England, 1984.
5. G.J. Ponsonby. Transport Policy: Co-ordination through Competition. Hobart Paper 49. Institute for Economic Affairs, London, England, 1969.
6. J. Hibbs. Transport Without Politics. Hobart Paper 95. Institute for Economic Affairs, London, England, 1982.
7. Cross-Subsidy in Urban Bus Operation. Institute for Transport Studies, University of Leeds; National Bus Company, London, England, 1984.
8. The Impact of the "Buses" White Paper on Plymouth. MVA Consultancy, Plymouth, Devonshire, England, 1985.
9. The Budgetary Consequences for the [Surrey] County Council of the Transport Bill. Booz-Allen and Hamilton, London, England, 1985.
10. K.M. Gwilliam. Aims and Effects of Public Financial Support for Passenger Transport. 67th Round Table, European Conference of Ministers of Transport, Paris, France, 1984.
11. E.K. Browning. The Marginal Cost of Public Funds. Journal of Political Economy, Vol. 84, No. 2, pp. 283-298.
12. K.J. Arrow. Economic Welfare and the Allocation of Resources for Invention. In The Rate and Direction of Inventive Activity: Economic and Social Factors, National Bureau of Economic Research, Princeton University Press, Princeton, New Jersey, 1962, pp. 609-626.
13. H. Demsetz. Information and Efficiency: Another Viewpoint. Journal of Law and Economics, Vol. 12, No. 1, April 1969, pp. 1-22.
14. N. Lee and I. Steedman. Economics of Scale in Bus Transport. Journal of Transport Economics and Policy, Vol. 4, No. 1, Jan. 1970, pp. 15-28.
15. H. Hotelling. Stability in Competition. Economic Journal, Vol. 39, No. 1, pp. 41-57.
16. I.P. Savage. Deregulation of Bus Services. Gower Publishing Company, Limited, Aldershot, Hampshire, England, 1985.
17. C.A. Nash. Management Objectives, Fares and Service Levels in Bus Transport. Journal of Transport Economics and Policy, Vol. 12, No. 1, Jan. 1978, pp. 70-85.
18. S. Glaister and J.J. Collings. Maximisation of Passenger Miles in Theory and Practice. Journal of Transport Economics and Policy, Vol. 12, No. 3, Sept. 1978, pp. 304-321.
19. W.J. Baumol. On the Proper Cost Tests for Natural Monopoly in a Multiproduct Industry. American Economic Review, Vol. 67, No. 4, Dec. 1977, pp. 809-822.
20. J.C. Panzar and R.D. Willig. Economies of Scope. Papers and Proceedings, American Economic Review, Vol. 71, No. 2, March 1981, pp. 268-272.
21. F.V. Webster and P.H. Bly. The Demand for Public Transport--Report of the International Collaborative Study of the Factors Affecting Public Transport Patronage. Transport and Road Research Laboratory, Crowthorne, Berkshire, England, 1980.
22. Full Time/Part Time PSV Driver Accident Study: Complete Report. Department of Transport, Her Majesty's Stationery Office, London, England, 1984.
23. I.P. Savage. Safety in the Deregulated Bus Industry. Traffic Engineering and Control, Vol. 25, No. 11, Nov. 1984, pp. 564-565.
24. W.J. Baumol, E.E. Bailey, and R.D. Willig. Weak Invisible Hand Theorems on the Sustainability of Multiproduct Natural Monopolies. American Economic Review, Vol. 67, No. 3, Jan. 1977, pp. 350-365.
25. W.J. Baumol. Contestable Markets: An Uprising in the Theory of Industrial Structure. American Economic Review, Vol. 72, No. 1, March 1982, pp. 1-15.
26. P.J. Mackie. Competition in the Bus Industry. Public Money, Vol. 3, No. 1, pp. 45-48.
27. A.T. Peacock and C.K. Rowley. Welfare Economics and the Public Regulation of Natural Monopoly. Journal of Public Economics, Vol. 1, No. 2, Feb. 1973, pp. 227-244.

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